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

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ENCLOSURE 2

Report No.: 50-261/88-26

Licensee: Carolina Power and Light Company
P. O. Box 1551
Raleigh, NC 27602

Docket No.: 50-261 License No.: DPR-23

Facility Name: H. B. Robinson

Inspection Conducted: September 12-16, 1988

Team Leader: for C Bassett 1/11/89
T. R. Collins Date Signed

Team Members: C. H. Bassett
R. B. Shortridge

Accompanying Personnel: C. M. Hosey

Approved by: C M Hosey 1/11/89
C. M. Hosey, Section Chief Date Signed
Division of Radiation Safety and Safeguards

SUMMARY

Scope: This was a special, announced assessment in the area of the licensee's program to maintain occupational radiation exposures as low as reasonably achievable (ALARA).

Results: The licensee now has in place many of the elements of an adequate ALARA program. Program strengths noted during the inspection included source term reduction efforts, good general worker knowledge and awareness of ALARA concepts and responsibilities, and holding management accountable for achieving exposure goals. However, increased support and involvement of management is required if the program is to be fully successful. Several weaknesses were also identified in the ALARA program that should be addressed to ensure that collective annual personnel radiation dose is reduced to the maximum extent possible. These weaknesses were in the areas of:

- Exposure goal formulation, and management involvement in achieving established goals, Paragraphs 3.c and d.
- Total number of personnel onsite with measurable exposure, Paragraph 4.b.

- Audits of the ALARA program, Paragraph 8.
- ALARA Sub-Committee effectiveness, Paragraph 3.a.
- Man-hour estimation for each job, Paragraph 3.b.

Within the areas inspected, no violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

J. Adams, Daily Planning
R. Chambers, Performance Engineering, Supervisor
*G. Cheatham, Environmental and Radiological Control Manager (Brunswick)
R. Cox, Modification Engineering
C. Dietz, Project Manager
J. Epperly, Construction Coordinator
M. Failes, Mechanical Planner
B. Flanagan, Engineering Design
B. Hammond, ALARA Coordinator
J. Harrison, Environmental and Chemistry, Project Specialist
C. Lapp, Fuels Engineer
*R. Mayton, Principal Health Physicist
D. McCaskill, Operation, Shift Foreman
*B. Meyer, Principal Health Physics Specialist (Corporate)
D. Miller, Mechanical Maintenance Supervisor
*D. Morgan, Plant Manager
D. Nelson, Operations Supervisor
R. Pearce, Outage Planning, Senior Specialist
A. Poland, ALARA Specialist, (Shearon Harris)
D. Quick, Maintenance, Manager
J. Sheppard, Operations, Manager
*D. Smith, Environmental and Radiological Control Manager
B. Snipes, Training, Supervisor
*R. Starkey, Project Manager (Brunswick)
*B. Webster, Health Physics Manager (Corporate)

Other licensee employees contacted during this inspection included engineers, technicians, maintenance, and office personnel.

Nuclear Regulatory Commission

L. Garner, Senior Resident Inspector
*R. Latta, Resident Inspector

*Attended exit interview

2. Background (83528/83728)

Between 1974 and 1987, the annual collective radiation dose at the Robinson Plant exceeded the national average twelve out of the thirteen years. The average collective dose for all U.S. PWRs over this period was 499 person-rem per year, per reactor. Robinson had the second highest

cumulative average collective dose of this period with an average of 1,025 person-rem per year.

Since 1980, 83% of the station's collective dose resulted from 11 outages, 9 of which were caused by steam generator problems. The steam generators were replaced in 1984. The licensee formed a task force in 1985 to propose a Radiation Exposure Reduction Program. The goal of the program was to lower collective dose at CP&L facilities to within industry standards. The key elements of the program were to improve supervisor responsibility and accountability in radiation safety, personnel dose reduction, and radwaste volume reduction.

Increased emphasis was placed on exposure accountability in 1986, and in 1987, each unit (department) was charged with the responsibility for their dose goals. Unit goals for 1987 were approved by Unit Managers and submitted to the ALARA Coordination group in September. An annual collective dose goal for 1987 was established at 450 person-rem. Robinson experienced 5 outages in 1987, and exceeded the annual collective dose goal by 11 %, which was 36 % above the national average of 368 person-rem per reactor.

A goal of 450 person-rem was set for 1988, which included an outage scheduled to begin in the last quarter of the year. However, a justification for an additional 100 person-rem was submitted to the Plant Nuclear Safety Committee (PNSC) to cover two major modifications, Resistance Thermocouple Detector (RTD) removal and Service Water System work, to be included in the fall outage. The licensee expected that the collective dose at Robinson would again be above the industry norm.

Table 1 shows a comparison of the Robinson collective annual dose with that of the average PWR collective annual dose.

TABLE 1

Comparison of Robinson Annual Collective Dose with Average Collective Dose from Commercial Pressurized Water Reactors

Year	PWR Average Dose Per Reactor (Rem)	Robinson Dose (Rem)
1974	331	672
1975	318	1,142
1976	460	715
1977	396	455
1978	429	963
1979	516	1,188
1980	578	1,852
1981	652	733
1982	578	1,426
1983	592	923

1984	552	2,880
1985	416	311
1986	397	539
1987	368	499

3. Program To Maintain Radiation Exposures ALARA (83528/83728)

The following procedures, which implement the station ALARA program, were reviewed by the inspectors:

AP-016	Radiation Work Permit (RWP) Administration
ERC-003	Temporary Shielding Procedure
ERC-006	ALARA Program
ERC-007	ALARA Goals
HPP-006	Radiation Work Permits (RWPs)
PLP-001	Plant Nuclear Safety Committee and Safety Review Programs
PLP-016	Radiation Work Permit (RWP) Program

a. Organization

The licensee ALARA organization consisted of a permanent staff with an ALARA Coordinator and two health physics (HP) technicians. An additional HP technician was assigned as a HP/maintenance coordinator to plan mechanical maintenance tasks.

The licensee established an ALARA subcommittee in 1981 as a standing subcommittee of the PNSC. The primary function of the ALARA subcommittee was to act as an advisory group to the PNSC on plant ALARA related topics. The ALARA subcommittee membership evolved from 6 members in 1983, to 18 primary members in 1988, which included a chairman, vice chairman, secretary, and members from operations and from the other major station departments. Ten alternate members were also selected. The committee routinely meets monthly to review and discuss plant ALARA related topics. The inspectors noted that with the exception of the chairman, vice chairman, and secretary, new subcommittee members and alternates are appointed annually.

The inspectors reviewed the minutes of the ALARA subcommittee meetings held for the period of February 1983 through August 1988. The minutes indicated that ALARA Followup Items (recommendations to reduce dose), once approved by the subcommittee, were frequently not assigned to anyone for action. This resulted in inadequate or incomplete resolution of the followup items. The subcommittee, dissatisfied with the progress being made on resolving the ALARA Followup Items, developed ALARA Problems Reports (APRs). Management endorsed the program for opening up the suggestion program to all plant personnel. In 1987, 19 APRs were submitted, 11 of which were completed.

In 1986, during an inspection, the NRC expressed a concern to plant management about the poor attendance at ALARA subcommittee meetings; maintenance and instrumentation/control representatives missed 50% of the subcommittee meetings. In 1987, subcommittee meeting attendance did not improve.

An inspector attended the September 1988 ALARA subcommittee meeting and noted that outstanding ALARA Followup Log items were discussed in detail, with the responsible person for the action providing a current status. A brief status of annual collective dose for 1988 was given but there was no disscussion of methods to manage the dose, or how to reduce the rate of collective dose accumulation to get back to the projected dose goal. The projected dose for September was 63.975 person-rem and the actual dose was 98.780 person-rem. At the close of the meeting, the new Vice President of H. B. Robinson Nuclear Project challenged the subcommittee to uphold its responsibility and stated that historically the annual collective dose had been unacceptably high and that he was prepared to make tough decisions to reduce collective dose.

In discussions with licensee representatives after the meeting, the inspectors learned that supervision and management were not members of the subcommittee and that subcommittee members typically could not make commitments for their departments. The inspectors discussed with licensee management the need to improve the efficiency of the ALARA subcommittee by improving attendance and management participation and support for the ALARA subcommittee.

b. Work Reviews

Licensee procedure, PLP-016, Radiation Work Permit Program, Revision 6, dated July 1, 1988, required a pre-job review when the initial exposure for the work requiring a Special RWP was projected to be one person-rem but less than ten person-rem. The review was required to be conducted by the ALARA staff, a member of the ALARA subcommittee, the entire ALARA subcommittee or the job coordinator. All non-routine tasks with a projected exposure of ten person-rem but less than twenty-five person-rem was required to be reviewed by cognizant supervision. A review by the station ALARA subcommittee was required for all non-routine work estimated to exceed 25 person-rem.

In determining whether or not a job met the guidelines for an ALARA review, a Pre-Submittal RWP Request Form was submitted by a coordinator for the work, to the Radiation Control (RC) group. The Pre-Submittal RWP form specified the estimated number of man-hours to be worked as well as the work location and a description of the work to be performed. A HP technician from the RC group then made an estimate of the person-rem which was likely to be expended performing the job. Following the exposure estimate, the form was forwarded to

the ALARA section for action and the appropriate review if the estimate exceeded the one person-rem limit.

The licensee's procedure, PLP-016, required a post-job ALARA review for all tasks controlled by a Special RWP that resulted in radiation exposure of three person-rem or more or at the ALARA Specialist's or the Job Coordinator's discretion. However, the ALARA specialist stated that, as a good practice, post-job reviews were performed for all work requiring a pre-job review, if possible, and as time permitted. The post-job ALARA review was performed to document the success or failure of any special exposure reduction techniques employed, problems encountered that had an effect of exposure, and any other reason for deviations. From the post-job reviews, the ALARA specialist compiled job history files to be used for future reference for major or unusual jobs.

The inspectors reviewed selected pre-job and post-job reviews performed during 1987 and 1988, and verified that the required information concerning man-hours, person-rem, and problems noted with the job were documented and that lessons learned from prior jobs were considered during reviews involving work of a similar nature. During 1987, the licensee indicated that 97% of the station's dose had undergone review and was expended during work that had been preplanned.

During the review of the selected pre- and post-job reviews, the inspectors noted that, in over half of these reviews, the man-hour estimates and the person-rem estimates varied by 60% or more from the actual man-hours worked or 49% or more from the actual person-rem received or both. The inspectors discussed these discrepancies with representatives from the ALARA group because it was not apparent from the post-job reviews why the totals were so different. The licensee indicated that some of these instances involved jobs in which the scope of the work changed. However, the estimates had not been changed or revised but had been left as originally stated. Licensee representatives also indicated that, even though the procedure did not require another job review when the scope of the work changed, another ALARA review was usually performed.

The inspectors indicated that, due to the many discrepancies of greater than 60-49% between the estimated and the actual man-hours and person-rem, respectively, the licensee's method of estimation needed to be improved and some method developed to allow revision of their estimates once established. The licensee indicated that the main problem with the process was the man-hour estimates submitted for each job. The man-hour estimates were typically too high and often included hours not required to be spent by the workers in a radiation area. In reviewing the man-hour estimates and other information used to determine the person-rem estimates such as area dose rates, the inspectors concluded that the man-hour estimates were the major cause of the discrepancies between the estimates and the

actual man-hours worked and person-rem received. More accurate person-rem estimates may allow management to focus attention on problem jobs sooner.

c. Radiation Dose Goals

1. Licensee procedure, ERC-007, ALARA Goals, Revision 2, dated July 1, 1988, described the process used to establish the plant's unit's and subunit's goals. It was the ALARA subunit's responsibility to implement the procedure and the ALARA Specialist's responsibility to establish annual goals for the plant, units and subunits. The goals were derived from the work scheduled for the year as projected by each unit. Other factors were also taken into consideration such as: duration of jobs, manpower, survey information, and previous histories, if available. Once all the units' and subunits' goals were calculated, the station's goal was obtained from the total.

2. For 1988, the station's collective radiation dose goal was 450 person-rem based on normal operation and a fall outage. This goal had been established before it was known that the outage schedule was to include RTD bypass elimination work which would require the expenditure of approximately 87 person-rem and service water piping work in the pump bays which would require approximately 25 person-rem. The licensee indicated that the total projected collective dose for 1988 would probably be 550 person-rem.

d. Management of Collective Dose

1. The inspectors reviewed the methods used by the licensee to manage dose in achieving the annual collective dose goal. Licensee proceudres ERC-006, ALARA Program and ERC-001, ALARA Goals, defined how the ALARA program functions and how goals are established but did not specifically state who was responsible for achieving established goals.

   Licensee representatives stated that, in reviewing the intended work scope of their proposed five-year plan, they did not believe it was possible to bring the station's annual collective dose within the industry norm for PWRs until 1992.

2. The inspectors discussed with licensee management representatives whether or not contractors were held accountable for achieving established dose goals. The inspectors were informed that specific contractors were not held accountable for person-rem expended on assigned tasks. The inspectors stated that contractors should be held accountable for doses received since it is a major contributing factor toward the annual dose projection. If this program were approved and successful, it would be beneficial in reducing the station's annual doses.

3. On August 31, 1988, the collective station dose was 98.780 person-rem measured against a projection for the end of August of 63.975 person-rem. During the program review, the inspectors did not observe any management initiatives or directions to recover from this situation of being over the dose projection. Based on the attendance at ALARA Subcommittee meetings, interviews with managers, supervisors, and ALARA coordinators, the inspectors determined that station management and unit/subunit mangers were not involved with dose management on a frequency necessary to ensure that the station's annual collective dose goal was met. Licensee management representatives indicated that they were in a reactive mode rather than a proactive mode to keep collective dose within established goals.

e. Job Histories and Post Outage Reports

Through discussions with licensee representatives, the inspectors reviewed historical job exposure data that was available for review when preplanning radiological work. The Radiological Information Management System (RIMS) computer data base contained data covering all RWPs and was cross referenced to the ALARA review control number for the job. This control number could be used to access the hard copy files of the documents associated with that RWP. The most current data, typically for 1986 through 1988, were maintained by the ALARA staff. This data consisted of the Pre-Submittal request, the pre-job review, the RWP used to perform the work, the post-job review, if required, and other related documentation such as survey data and notes made during the course of the job. Records for work which occurred prior to 1986 were available on microfiche.

The inspectors reviewed selected job history files that were being maintained in the ALARA group's work area. The inspectors noted that the files contained useful information for the planning of similar tasks.

The inspectors also reviewed the licensee's post outage reports that had been written and issued following the past five outages. These, too, were used to document various jobs, the suggestions for improvements, and other historical data. It was noted, however, that the post outage reports did not fully or adequately describe the problems that had been encountered. The solutions to the problems were frequently discussed but the source of problems encountered and the root causes were not identified so specific problem areas could be resolved prior to the next outage. The inspectors indicated that this was a weakness and that the post outage report could be a better resource document for future planning if the problems noted during a specific job and groups responsible for the difficulties were identified in detail. In addition, a formal method for incorporating

lessons learned should be established and incorporated into planning for future outages. The licensee acknowledged this and indicated that the matter would be investigated.

f. Hold Program

After reviewing the procedures dealing with the RWP program, HPP-006, Radiation Work Permits, Revision 15, dated July 1, 1988, and PLP-016, Radiation Work Permit Program, Revision 6, dated July 1, 1988, the inspectors noted that there was no mention of any type of a hold that could be placed on jobs covered by RWPs that were approaching or that had actually exceeded the estimated dose projections for those jobs. The licensee indicated that, although there was no formal hold point for such jobs when they exceeded the person-rem estimate, the HP technicians covering the work were cognizant of the exposure status and would inform the ALARA group when such problems occurred. At that point a review of the work would take place to evaluate the reasons for the problems and what corrective actions could be employed to counter the trend. The licensee indicated that this was not always a formal review but usually involved a review by a member of the ALARA group. The inspectors informed the licensee that other stations had found an automatic "hold" placed on the RWP when the exposure estimate was about to be exceeded to be beneficial. This allowed everyone involved to reassess the work and reconsider the dose minimization techniques used to that point. Licensee representatives stated that they would consider incorporating hold points in their RWP program.

4. Performance (83528/83728)

In discussions with the inspectors, licensee representatives stated that, in the past, equipment problems such as steam generator tube leakage and unplanned or emergent work have been the biggest contributors to the collective dose exceeding the national average. The following sections discuss the station's performance on reducing collective dose for repetitive tasks.

a. Exposure Expended on Rework

The inspectors discussed with licensee management representatives whether a program had been established to identify exposures received resulting from rework. Licensee management representatives stated that they had a system to identify repetitive work or system failure. However, no program was established to track jobs that were considered rework due to personnel error, lack of the proper qualifications of personnel or failure to identify the cause rather than the symptom. Also, no method or system existed to track exposure resulting from such rework. Establishment of a program to track repetitive work/rework and the doses expended due to such work may result in a more comprehensive analysis of the causes of the

problem, more rapid solution to the problem, and an overall reduction in the station's annual collective dose.

b. Number of Personnel With Measurable Exposure

The number of workers with measurable exposures was discussed with licensee representatives. The data in Table 3 were taken from statistical summary reports required by 10 CFR 20.407. Measurable dose was defined as dose large enough to be detected by personnel monitoring devices (greater than 100 mrem). As can be seen for the years 1983 through 1987, H. B. Robinson had approximately 201 percent more workers with measurable dose than the industry norm for a typical PWR. Licensee representatives stated that they were aware that the reduction in the number of workers with measurable exposure would result in a reduction of collective dose at the station and placed a limit of 1500 total personnel onsite for the 1988 Unit 2 refueling outage.

Table 3

Comparison of H.B. Robinson with Industry Norms for Average Number of Personnel with Measurable Dose Per Reactor

	83*	84**	85***	86***	87****
Number of Personnel With Measurable Dose	2,244	4,127	1,378	1,571	1,397
PWR Industry Average of Personnel With Measurable Dose	1,065	1,117	1,012	1,086	978
Percent of Industry Norm	210	369	136	145	143

*Steam Generator Repair Outage
**Steam Generator Replacement Outage
***Seismic Support Repair Outage
****Refueling Outage

c. NUREG/CR-4254

The inspectors reviewed NUREG/CR-4254, Occupational Dose Reduction and ALARA at Nuclear Power Plants: Study on High-Dose Jobs, Radwaste Handling, and ALARA Incentives, dated April 1985, with licensee personnel. NUREG/CR-4254 contains data on doses experienced throughout the industry for typical high dose jobs. The inspectors compared the licensee's exposure history for several jobs described in the NUREG as indicated in Table 4.

Table 4

H. B. Robinson Dose Summary for High Dose Jobs (Person-Rem)

Job	'83	'84	'86	'87	NUREG/ CR-4254 Avg.
Snubber, Hanger Anchor, Boch Inspection/Repair	—	242	33	--	110
Reactor Disassembly/ Assembly-Fuel Sipping	--	137	51	48	48
Plant Decontamination	15	156	19	28	45
Primary Valve Maint./repair	--	41	7	24	30
Insulation Removal/Re- placement	4	41	15	5	18
S/G Secondary Side Repair/Maint.	33	164	18	6	11
Fuel Shuffle/ Sipping/Insp.	---	34	3	11	9
Operations- Surv, Routines/ Valve Lineups	---	150	52	14	7

The inspectors determined that for most jobs reviewed, the licensee's dose performance was higher than the industry average indicated in NUREG/CR-4254 (1974-1984 data).

5. Dose Reduction Initiatives

a. Chemistry Control

(1) Reactor Coolant pH Control

In a letter to the licensee's fuel vendor dated November 6, 1986, the licensee requested that the fuel vendor consider approval to operate the Robinson 2 plant with an increased reactor coolant system pH of 7.0 - 7.4. The licensee made the request based on data obtained from evaluations at the Ringhals site in Sweden. Licensee representatives stated that they were

convinced that a reduction in out of core radiation levels could be achieved by increasing the reactor coolant pH.

On December 3, 1986, the licensee received approval from their fuel vendor to increase Lithium at the beginning of Fuel Cycle 12 from 2.0 ppm up to 2.2 ppm while maintaining a pH of 7.0 - 7.4 throughout the cycle. The licensee subsequently implemented this program at the beginning of Fuel Cycle 12 and has seen Radiation level reductions of approximately 30% in various areas inside containment. However, at the time of the inspection, no entries had been made inside the steam generators. Thus the actual reduction of radiation levels in this area has not been determined.

This program appears to be successful and should reduce station personnel doses.

(2) Reactor Coolant Filters

The licensee was evaluating the use of sub-micron filters for reactor coolant on-line cleanup. The sub-micron filters were to be installed on the Spent Fuel Pit (SFP) and Reactor Coolant System (RCS) filtration systems in 1989. Initially a 25 micrometer (um) filter would be installed and thereafter the filter sizes would be progressively decreased to the sub-micron range.

This program, if approved and successful, should be effective in reducing crud activity levels in the RCS and enhance the licensee's success in achieving its ALARA goals.

(3) Hydrogen Peroxide Shock

The licensee was evaluating the use of hydrogen peroxide to shock (i.e., controlled crud burst by chemical addition) the reactor coolant primary chemistry system which would oxygenate the RCS and help remove Co-58 and Co-60 at Mode 5 operation, with the RCS at less than or equal to 200°F.

The procedure, used by the licensee during RCS cooldown prior to refueling outages, calls for the addition of hydrogen peroxide while the system is solid to promote a controlled crud burst. In the past, the hydrogen peroxide addition had been performed after the RCS had been drained to mid-nozzle. Current data available has indicated there has been a substantial decrease in the amount of soluble activity available for purification after the crud burst occurs when the hydrogen peroxide addition is performed in this manner. The licensee is planning to implement this program during the November 1988 refueling outage. If approved and successful, this program should further enhance the licensee's success in achieving its ALARA goals.

b. Fuel Integrity

During the period of 1983 to 1987, the licensee had not experienced fuel failure to the degree that could be directly related to the increase of personnel doses inside the RCA.

The licensee has implemented a fuel integrity monitoring and chemistry measurement evaluation program which includes allowable levels of dose equivalent Iodine-131 (DEI) in the Primary Coolant System. The DEI is monitored on a daily basis, under equilibrium and transient conditions, with respect to the technical specification limit of one microcurie per gram (1 uCi/gm).

During refueling outages, the licensee has a program for analysis of each fuel assembly that is suspected of fuel degradation. If these tests are required to be performed (ultrasonic test) and the fuel assembly has been determined to be defective, the entire fuel assembly would be replaced by a new fuel assembly known not to be defective. All of the fuel assemblies determined to be defective would later be reconstituted by replacement of individual fuel pins.

6. Interviews (83528/83728)

a. Employee Interviews

Licensee employees were interviewed to assess their knowledge, involvement, and perspective of the utility's ALARA program. An ALARA questionnaire was prepared prior to the inspection and was utilized during each interview to ensure that each employee's ALARA awareness and involvement was evaluated uniformly. The employee questionnaire was also prepared to evaluate the employee's knowledge of ALARA goals, concepts, policies and procedure documents; individual responsibilities, personal doses, and personal dose limits; the employee's involvement in special ALARA training, communication with co-workers and supervision, and participation in the ALARA suggestion program; and the employees perspective on how to improve the ALARA program, what events or conditions have caused increased personnel doses, and what events or conditions have helped reduce personnel doses.

(1) Employees

All employees interviewed entered the radiological controlled area (RCA) on a daily to weekly basis depending on plant conditions.

(2) Knowledge of ALARA Program

Each of the employees interviewed was familiar with the basic ALARA concepts taught in the General Employee Training (GET) program and knew that they had a basic responsibility for

implementing the utility's ALARA program by performing tasks in a manner consistent with the utility's ALARA policy. In general the employees knew their current radiation exposure and their exposure limit. The employees generally were aware of where the ALARA requirements originated and what documents described the ALARA program objectives. Most of the employees interviewed knew that each of their sections had an ALARA goal, but generally were unaware of the goal that was established. However, the employees did know that they could find out their section's goals from the ALARA staff.

(3) ALARA Program Involvement

The majority of employees interviewed had not received any ALARA training other than that given in the GET course. A majority of those interviewed had received some informal ALARA training on jobs requiring ALARA pre-job planning and on-the-job training. The employees reported frequent discussions of ALARA objectives on major jobs during outages with co-workers and supervisors. The employees also reported good communications with the ALARA and HP staffs. Only a small fraction of employees interviewed had participated in the formal ALARA suggestion program. Other employees reported that they had made suggestions to supervisors informally and had not used the formal ALARA suggestion program believing it was only for "significant ALARA suggestions."

(4) Perspective

Most of the employees had suggestions on how the ALARA Program could be improved. The suggestions included better planning and scheduling of work to ensure that appropriate equipment and tools were readily available to perform tasks expeditiously. The majority of employees had opinions on things that had contributed to decreases and increases in personnel exposures. Employees believed that the following actions had contributed to exposure reductions: use of temporary shielding, special tools, permanent shielding such as the reactor vessel head shielding, flushing of various system components and lines, and decontamination of contaminated areas within the RCA. Employees believed that the following actions had contributed to increases in personnel exposures: poor maintenance planning and scheduling in the past, replacement of steam generators in 1984, use of less experienced contract personnel, and too many personnel on site entering the RCA.

b. Management Interviews

Licensee managers and supervisors were interviewed to assess their knowledge of the utilities ALARA Program. An ALARA questionnaire for managers and supervisors was prepared prior to the inspection and was utilized during each interview to ensure that the ALARA awareness and

involvement of each manager and supervisor was evaluated uniformly. The questionnaire was prepared to evaluate the manager's or supervisor's knowledge of ALARA goals, concepts, policies, and procedure documents; individual responsibilities, personal exposure, and personal exposure limits; the manager's or supervisor's involvement in special ALARA training, communication with co-workers and supervision, and participation in the ALARA suggestion program; and the manager's or supervisor's perspective on how to improve the ALARA program, what events or conditions have caused increased personnel exposures, and what events or conditions have helped reduce personnel radiation exposures.

(1) Entry into the RCA

All individuals interviewed entered the RCA on a weekly to monthly basis depending on plant conditions.

(2) Knowledge of ALARA Program

Each of the individuals interviewed was familiar with the basic ALARA concepts taught in the GET program and knew that they had a basic responsibility for implementing the utilities' ALARA program by ensuring that each employee performed tasks in a manner consistent with the utility's ALARA policy. In general, the managers and supervisors interviewed knew what their current radiation exposure was and what the exposure limit was for their departments. The managers and supervisors had a good understanding on where the ALARA requirements originated and what corporate and plant documents described the ALARA program objectives. All of the managers and supervisors interviewed knew their departments ALARA goals.

(3) ALARA Program Involvement

The majority of the managers and supervisors interviewed had not received any ALARA training other than that given in the GET course. Each department had a dedicated individual to serve on the ALARA Committee, which met on a monthly basis or as appropriate. The ALARA Committee members represented their departments in discussions of ALARA objectives for major outage jobs. None of the managers or supervisors interviewed had participated in the formal ALARA suggestion program. However, most of the managers or supervisors interviewed were aware of the number of ALARA suggestions submitted by their departments in the past or current year. These ALARA suggestions were usually submitted by the departments' ALARA subcommittee members.

(4) Perspective

All managers and supervisors interviewed had suggestions on how the ALARA program could be improved. The suggestions included better scheduling and planning of work, ensuring that appropriate equipment and tools were readily available, and continuing to increase the awareness of the ALARA concept to all levels of plant staff. These methods could be accomplished through GET retraining, departmental training, non-licensed training or through the Advanced Radiation Worker Training (ARWT) Program. The ARWT Program, as discussed in Paragraph 7, is in the process of being revised and will be implemented as a pilot program during the first half of 1989.

The majority of managers and supervisors had opinions on things that had contributed to decreases and increases in personnel exposures. Individual managers and supervisors interviewed believed that the following actions had contributed to exposure reductions: use of temporary shielding, permanent shielding such as the reactor vessel head shielding, reduced work activities in high radiation areas, flushing of various systems components and lines, reduction of contaminated areas within the radiological controlled area, use of reach rods on specific systems, and the use of live load packing on valves inside containment to reduce unidentified leakage and the required frequency of repacking these valves.

Individual managers and supervisors interviewed believed that the following actions had contributed to increases in personnel exposures: poor planning and scheduling of maintenance in the past, forced outages, replacement of steam generators in 1984, repetitive work or rework of specific jobs, number of personnel on site entering the RCA, duration of outages, and failure to manage dose on a daily basis to stay within budgeted goals.

7. Training (83528/83728)

The inspectors reviewed the licensee's program for ensuring that all employees received training in ALARA beyond that given in basic GET. The inspectors reviewed selected lesson plans for non-licensed personnel including RC and Chemistry, Mechanical Maintenance, Instrumentation and Control, and Electrical training and verified that ALARA information and considerations were incorporated into the lesson plans.

The inspectors also reviewed the status of the licensee's program for advanced GET which had been referred to as GET III. The licensee suspended the GET III training in September 1987, for evaluation of the program. The GET III course did not qualify personnel to provide their own job coverage but was designed as a one week course given to supervisors, lead technicians and planners to make them more aware of all aspects of radiation control and ALARA. Since suspending the former

course, the licensee had been developing a new program for advanced GET training entitled Advanced Radiation Worker Training (ARWT). Licensee representatives indicated that the new ARWT course would be designed to provide supervisors of radiation workers, radiation workers themselves and other personnel who plan, control, direct, and engineer work in the RCA, specific instruction on methods, practices, and procedures to reduce their occupational radiation dose and work more efficiently and safely in the RCA. A final portion of the course would provide additional on-the-job training for selected radiation workers in order to permit those, so trained, to perform limited additional radiation control activities, such as surveys, concurrent with their other responsibilities associated with completion of the job. The ARWT program was scheduled to be implemented as a pilot program during the first half of 1989 and, following revisions to the pilot program, to be implemented system-wide in early 1990.

The inspectors also toured the licensee's practical factor training areas. One area was equipped with various mockup training aides including a model of the steam generator lower channel head. Another area had a working containment structure with an associated airlock and undress area. The inspector determined that the licensee should be able to provide adequate mock-up training for several complicated work evolutions.

8. Internal Audits and Assessments

The inspectors reviewed annual audits performed by the corporate radiation protection group for the years 1983 through 1988. In addition, five internal audits, 026, 035, 060, 061 and 070, performed by site quality assurance were reviewed.

The purpose of the annual audit by corporate staff was to assess the adequacy and effectiveness of the Environmental and Radiological Control (E&RC) Program, through review, evaluation, and verification of implementation of the Plant Operating Manual, Technical Specifications, Final Safety Analysis Report and Corporate Quality Assurance Program. The inspectors found that the corporate audits, in general, were not comprehensive in evaluation of ALARA. Very few nonconformances or findings were identified. The inspectors determined that the audits did not result in identifying technical radiological issues, that when evaluated and corrected, would result in significant ALARA program improvements. The internal audits performed by site quality assurance were primarily compliance audits and did not identify ALARA programmatic problems. The inspectors discussed with licensee management the value of comprehensive self assessments that result in program improvements. Licensee management representatives acknowledged the inspectors concerns and stated that the audit and assessment program would be reviewed and evaluated to assess the effectiveness of ALARA programmatic problems.

9. Conclusions (83528/83728)

The inspection revealed that the licensee appears to have established an ALARA program including many of the elements required to effect dose

reduction however, they have not been totally effective. In the past, the lack of management support and involvement in ALARA, conflicting operational priorities, and unforeseen work items have contributed to less than total success for the ALARA program. Management support and involvement will be required to lower the licensee's person-rem dose to a level consistent with the PWR national average for collective dose to personnel.

The following significant issues were identified during the inspection and should be addressed by the licensee to increase the effectiveness of their ALARA program.

a. Management was not involved in managing collective dose on a frequency to achieve established dose goals (Paragraphs 3.c and d) (50-261/88-26-01).

b. The number of personnel accessing the RCA with measurable exposure is consistently higher than the industry norm (Paragraph 4.b) (50-261/88-26-02).

c. The licensee's audit program is not resulting in ALARA program improvements (Paragraph 8) (50-261/88-26-03).

d. ALARA Subcommittee meetings have not been well attended by members or management. (Paragraph 3.a) (50-261/88-26-04).

e. The process of estimating man-hours needed to perform a job are frequently overestimated and result in descrepancies between estimates and actual man-hours worked (Paragraph 3.b) (50-261/88-26-05).

f. Lessons learned from outages are not formally incorporated into planning for future outages (Paragraph 3.e) (50-261/88-26-06).

10. Exit Interview (30703)

The inspection scope and findings were summarized on October 5, 1988, with those persons indicated in Paragraph 1. The inspectors described the areas inspected and discussed in detail the inspection findings (see Paragraph 9). The licensee acknowledged the inspection findings and took no exceptions. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspectors during the inspection.