



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

May 12, 1995

Report No.: 50-400/95-06

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

Docket No.: 50-400

License No.: NPF-63

Facility Name: Shearon Harris

Inspection Conducted: April 10-13, 1995

Inspector:

B. A. Parker

05/12/95

Date Signed

Approved by:

W. H. Rankin

Facilities Radiation Protection Section
Radiological Protection and Emergency Preparedness Branch
Division of Radiation Safety and Safeguards

5/12/95

Date Signed

SUMMARY

Scope:

This was a special announced inspection of the licensee's program and practices for maintaining radiation exposures As Low As Reasonably Achievable (ALARA) and included an examination of: organization; audits and appraisals; worker awareness and involvement; ALARA goals and objectives; ALARA initiatives and results; and Spent Fuel Program activities. In addition, general facility tours were conducted.

Results:

Based on interviews with licensee personnel, records review, and observations of work activities in progress, the inspector found the licensee's ALARA program for occupational radiation safety to be effectively functioning to reduce personnel exposure and eliminate radioactive source term. The ALARA program was aggressive in its efforts to manage dose and continued to be effective in implementing dose reduction initiatives. The licensee's various means for self-assessment were noted to be thorough, in-depth and probing. External and internal exposures were maintained within regulatory and the licensee's administrative limits. Spent Fuel Program activities and issues were reviewed and no safety concerns were noted.

No violations or deviations were identified.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *A. Cornett, Supervisor, Radiation Control (RC)
- *J. Donahue, Plant General Manager
- C. Evans, Senior Specialist, RC
- J. Floyd, Senior ALARA Specialist, RC
- *W. Gurganious, Manager, Environmental/Chemistry
- *D. McCarthy, Manager, Regulatory Affairs
- *K. Neuschaefer, Manager, RC
- *B. Robinson, Vice-President, Harris Plant
- K. Rogers, ALARA Specialist, RC
- *B. Pruty, Manager, Licensing and Regulatory Programs (LRP)
- *D. Stih, Supervisor, RC
- *D. Tibbitts, Manager, Plant Operations Assessment
- *M. Wallace, Senior Specialist, LRP
- E. Wills, Manager, Environmental and Radiation Control (E&RC) Support

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

Nuclear Regulatory Commission

- *D. Roberts, Resident Inspector
- *W. Rankin, Section Chief, Region II

*Attended April 13, 1995 Exit Meeting

2. Organization and Staffing (83728)

The inspector reviewed and discussed with licensee representatives changes made to the RC organization since the last inspection of this area conducted July 25-29, 1994, and documented in Inspection Report (IR) 50-325/94-14 and 50-324/94-14. At the time of the inspection, the inspector noted that the licensee continued to maintain an E&RC staff of approximately 87, 45 of which constituted the RC portion of the organization. The RC staff included supervisors, specialists, technicians, dosimetry personnel, and clerical staff.

Overall, the inspector did not note any concerns regarding the RC organization and staffing. The RC organization and staffing levels continued to be appropriate, appeared stable and functioning adequately to support ongoing RC activities.

At the time of inspection, the plant's reactor was operating at 100 percent power. The next refueling outage (RFO 6) was scheduled to begin in September 1995. In addition, during the inspection, the licensee was conducting its annual inspection of the shipping casks used in the ongoing long-term Spent Fuel Program. The program was a utility

initiative undertaken in the late 1980s to assist the licensee in alleviating a spent fuel storage capacity problem facing the other Carolina Power and Light (CP&L) nuclear plants, H.B. Robinson and Brunswick.

No violations or deviations were identified.

3. Audits and Appraisals (83728)

10 CFR 20.1101(c) requires that the licensee periodically (at least annually) review the RP program content and implementation.

The inspector noted that since the last inspection in this area conducted July 25-29, 1994, an audit had been conducted by the licensee's Nuclear Assessment Department (NAD). NAD Audit H-ERC-95-01, entitled "HNP Environmental and Radiation Control (E&RC) Assessment," was conducted January 30 - February 10, 1995 to determine the effectiveness of the E&RC program at the plant. The inspector reviewed the audit report and noted its thoroughness and detail, with substantive comments, issues and concerns. The results of the audit included two strengths related to chemistry, and one weakness and one issue related to the RC program. Both of the RC items were previously identified through the E&RC self-assessment mechanism; however, the auditors chose to reemphasize the items in the findings mainly due to the breadth of the issue regarding contamination control practices. The audit enumerated a number of examples in which contamination was not adequately controlled. Most of the examples had been previously identified and documented in the licensee's Adverse Condition and Feedback Report (ACFR) system, and included items such as a large number of personnel contamination events (PCEs) in clean areas, slightly contaminated materials released into clean areas of the radiological control area (RCA), and poor decontamination practices.

The E&RC organization responded to utility upper management regarding the audit findings as required in a letter dated March 24, 1995, outlining the causes and corrective actions associated with the contamination control issue. In general, corrective actions to the issue included procedure revisions, equipment upgrades, and personnel training enhancements. The inspector noted that the proposed corrective actions appeared appropriate and timely, although not all of the actions were fully implemented at the time of inspection.

As indicated, the inspector reviewed the licensee's program for self-identifying and correcting deficiencies and weaknesses related to the RC program. Since the last inspection, the licensee had initiated numerous ACFRs related to the E&RC program. Specifically, the inspector reviewed selected ACFRs related to the RC area and essentially reached the same conclusion as the licensee's NAD auditors. An adverse trend regarding contamination control practices was apparent, as discussed above. Also, during further review of selected ACFRs, the inspector noted another adverse trend involving locked high radiation area (HRA) doors and an incident in which an unauthorized attempt was made to move

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an incore drive. With regard to the HRA doors, the resident inspector had issued a non-cited violation for the most recent occurrence (NCV 50-400/94-24-01). No exposures occurred as a result of the unlocked HRA and the licensee made extensive programmatic and procedural changes in response to the event. With regard to the incore drive event, no violations were identified; however, the licensee identified a number of deficiencies that required attention, including procedure revisions to further diminish the possibility of personnel accessing the area in or around the incore drives during movement. The inspector reviewed the corrective actions and the actions taken to prevent recurrence of these types of events and noted no problems. The actions were prompt and comprehensive.

No violations or deviations were identified.

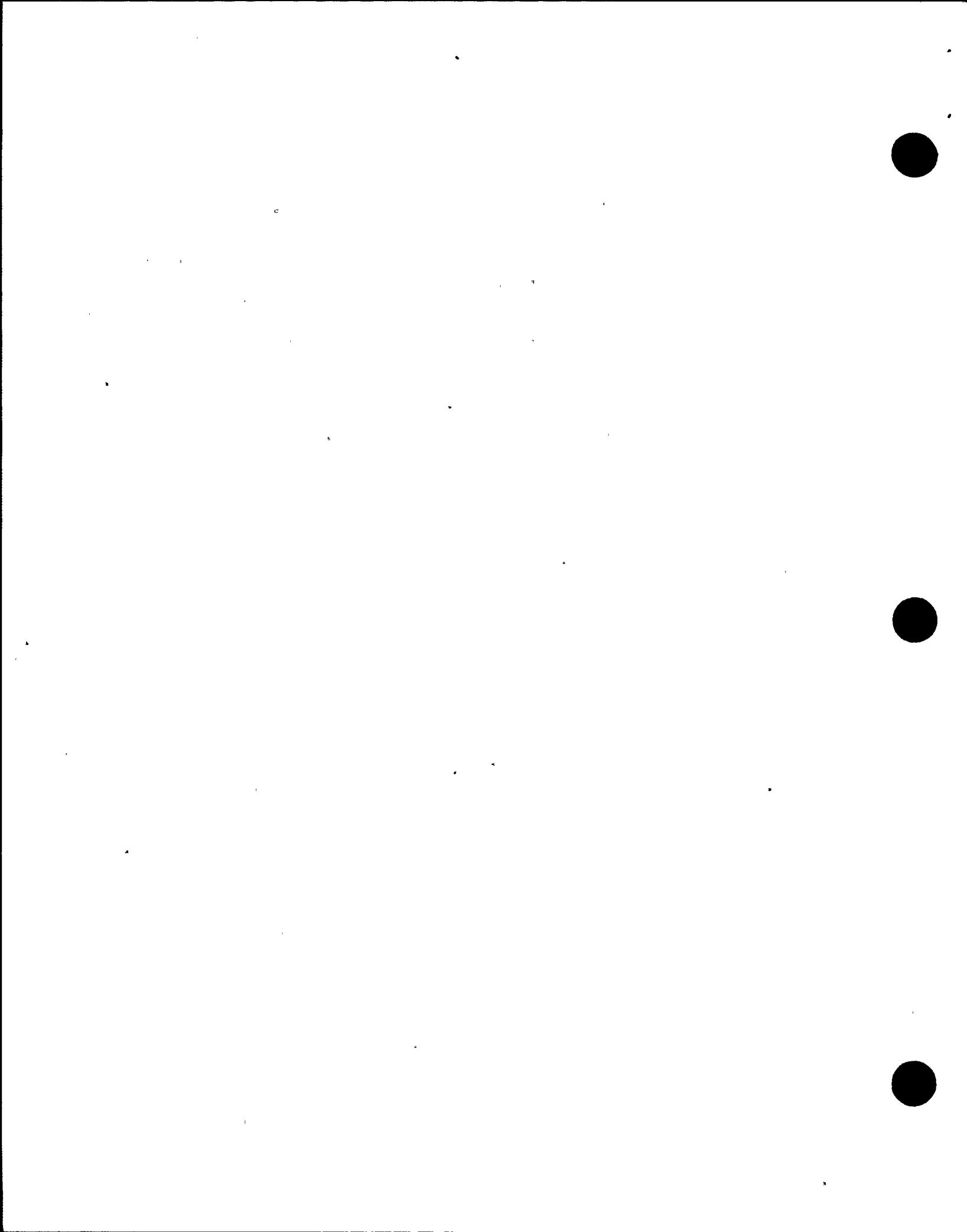
4. Worker Awareness and Involvement (83728)

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

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The corrective actions taken in response to the licensee-identified contamination control issues noted above included enhancement of the training of RC personnel as well as other plant radworkers. Training of RC personnel during fourth quarter 1994 and first quarter 1995 reiterated proper contamination control and handling PCEs. Contamination related performance data and recent related ACFRs were also discussed during weekly RC Technician meetings.

The inspector also reviewed new Contaminated Area Training (CAT) developed and implemented for plant personnel that enter contaminated areas. The training was scheduled every three years and included classroom training as well as mock-up training. After the classroom training, which consisted of lectures, instructions and videos, classes were broken into groups of approximately five for mock-up. The mock-up portion of the training consisted of logging into an "RCA", donning protective clothing (PCs), setting up a work area, and removing PCs. The exercise was graded by instructors, a five-question oral quiz was administered to each individual, and a grade of pass or fail was given based on performance. Deficiencies were discussed on a case-by-case basis and failures were allowed to retake the entire training. The inspector noted that the CAT training was a significant enhancement to the licensee's program, providing a valuable training opportunity through demonstration and realistic mock-up.



The licensee's ALARA Committee expanded its membership in 1994 to incorporate evolving portions of the overall maintenance organization. Facilities Maintenance personnel were added to the Committee as well as an Online Maintenance Planner. These additions should enhance to effectiveness of the licensee's ALARA function by allowing more input from a wider variety of groups.

The ALARA Committee also reviewed and submitted dose reduction suggestions in preparation for RFO 6. The suggestions came from a variety of sources and were documented and tracked as part of the ACFR system. The inspector noted that the suggestions were substantive and demonstrated that workers were taking an active interest in dose reduction and thinking "ALARA."

The inspector noted that the ALARA Committee recognized personnel through the plant-wide Key Performer and PACE Awards programs. The awards were granted for excellent work on a significant project and/or long term sustained performance in a certain area. The awards were given in the form of cash with recognition during a luncheon or dinner.

The inspector interviewed a number of workers over the course of the inspection regarding their dose and ALARA in general. Workers were aware and knowledgeable of individual dose, dose rates, radiation work permits (RWPs), and other pertinent information.

No violations or deviations were identified.

5. ALARA Goals, Objectives, and Results (83728)

10 CFR 20.1101(a) requires that each licensee develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of 10 CFR Part 20.

10 CFR 20.1101(b) requires that the licensee use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA.

a. ALARA Goals

The 1994 site dose goal was 223 person-rem, and the actual dose for the year was 222 person-rem. Of that total, approximately 195 person-rem was incurred during RFO 5 versus an outage goal of 198 person-rem. The outage lasted for 55 days. A significant portion of the outage dose was due to a one-time project to eliminate the resistance temperature detector (RTD) bypass system, coming in slightly under the project goal of 65 person-rem.

Also in 1994, 95 skin and 131 clothing PCEs occurred, exceeding the total PCE goal for the year of 185. Twenty-one of the PCEs involved discrete ("hot") particles. The inspector selectively reviewed the documented PCEs and noted no problems. No significant doses were incurred as a result of a PCE. The licensee fully evaluated all PCEs and tracked them as an indicator of contamination control. This was one of the indicators used by licensee self-assessment and auditing staff in evaluating the E&RC program, as previously mentioned. Ninety-two of the 1994 PCEs occurred in "clean" areas of the RCA; however, not all of those were due to poor contamination control practices. Over the year, the licensee maintained a monthly average of only 1,742 square feet (recoverable) as contaminated versus a goal of 1,900 square feet. The total RCA had approximately 460,000 square feet of floor space.

The inspector reviewed and discussed the licensee's development of goals for 1995. The site dose goal was set at 218 person-rem, allowing approximately 15 person-rem for operational dose, six person-rem for the Spent Fuel Program, 38 person-rem for material upgrades to the plant (painting, etc.), and 159 person-rem for RFO 6 activities. At the time of inspection, the licensee had expended approximately 5.1 person-rem on operational dose, 2.3 person-rem on the Spent Fuel Program, and 0.2 person-rem on material upgrades and RFO 6 related activities, for a year-to-date total of 7.8 person-rem. No problems were noted with the licensee's dose to date.

Other 1995 goals consisted of 135 PCEs, 100 of which were budgeted to RFO 6. To date, 16 PCEs had occurred, none of which were significant as noted above. Also, the contaminated square footage goal was reevaluated and set at 6,000 square feet. On the surface, this looked significantly higher than the 1994 goal; however, in essence it was lower than 1994 goal due to the fact that the licensee planned to account for recoverable and unrecoverable floor space, excluding containment. In so doing, much of the previously "unrecoverable" RCA was being reclaimed, and at the time of inspection, contaminated square footage totaled approximately 7,200 square feet, excluding containment.

The inspector reviewed the licensee's methods for budgeting dose to individual work groups. ALARA Job Evaluations were performed for high dose jobs expected to accumulate between one and 10 person-rem total. ALARA Work Plans were performed for jobs expected to accumulate greater than 10 person-rem. These involved developing plans to coordinate effort and reduce dose. Historical information concerning dose rates and man-hours was combined with work requests to develop the plans and evaluate the overall work. The ALARA Evaluations and Plans were all-inclusive, accounting for all aspects of the work, including support functions such as scaffolding, shielding, etc. The inspector reviewed portions of selected ALARA Job Evaluations and Work Plans and found them to be

detailed and comprehensive. Dose estimates were developed for each of the associated work groups and tracked as the work commenced. Work that deviated significantly from the plan due to poor planning and/or emergent work was reevaluated and the dose scrutinized. Post-job ALARA briefings were noted to be an integral part of the process, enabling the workers involved to provide input to improve similar work activities in the future. Lessons learned were tracked and used as additional historical reference.

No violations or deviations were identified.

b. ALARA Objectives

The inspector reviewed and discussed the licensee's long range objectives to reduce dose. At the end of 1994, the licensee's three-year dose average was 156 person-rem per year. In late 1994, an objective was set by utility upper management that by the year 2000, the site three-year dose average would be down to 100 person-rem per year. In response, the licensee developed a five-year dose reduction plan evaluating current doses and dose rates, and outlining in general the steps that will be necessary to achieve the 100 person-rem objective. Review of the plan by the inspector indicated that with current practice extrapolated over the 1995-1999 time period, significant portions of dose will be required to be eliminated each year in order to reach the objective, ranging from five to 64 person-rem each year. Based on discussions with licensee ALARA personnel, the inspector concluded that although the objective was very aggressive, it did appear achievable with increased focus on and support for the ALARA principle. The inspector noted that the licensee's ALARA personnel were researching and evaluating a large number of initiatives to save dose, many of which would produce quantifiable results.

One of the areas noted to be worthy of increased focus by the licensee was operational dose. In response to a plant management inquiry, the licensee performed an analysis of operational dose, comparing themselves to a number of other "new vintage, low dose" pressurized water reactor (PWR) plants. The inspector reviewed the analysis and noted that the Harris plant incurred more operational dose in part due to the Spent Fuel Program as well as ongoing plant material upgrades. However, the licensee learned of a number of dose reduction techniques practiced at plants such as Seabrook and Waterford that if implemented, even in part, could significantly reduce normal operational dose. This, in turn, could play a vital role in the licensee reaching the 100 person-rem objective by the year 2000.

No violations or deviations were identified.

6. ALARA Results (83728)

Based on the review of the licensee's ALARA program, the inspector noted a number of items of interest, including the following:

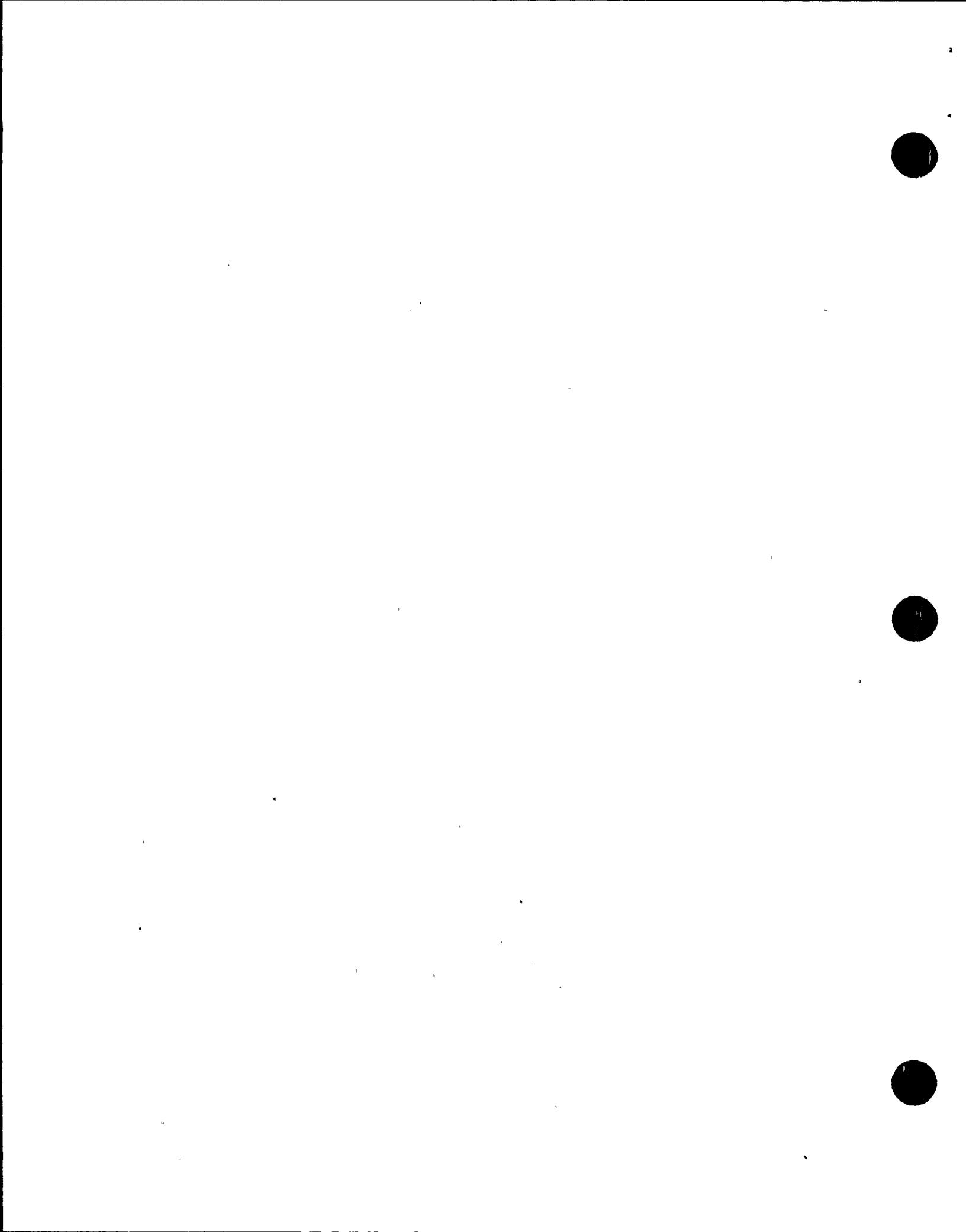
The licensee's ALARA Committee was very active in 1994 and continued to play an active role into 1995. The Committee met monthly and reviewed such issues as the RTD bypass project and the Surrogate Tour project, among others. Three ALARA Work Plans were reviewed and approved by the Committee during the year, as were a number of ALARA Job Evaluations. ALARA Work Plans for steam generator maintenance and refueling were being developed for RFO 6, and the Committee was preparing to begin review of them. The Committee also played an integral role in setting the dose goals and objectives for 1994 and 1995. The inspector reviewed the ALARA Committee meeting minutes for February 1995 and noted that attendance was excellent and that the Committee continued to closely monitor site dose and ongoing dose reduction activities. No concerns were noted.

In September 1994, the licensee began utilizing a Surrogate Tour system that could be used for training and informational purposes, as well as providing valuable pre-job knowledge and insight. The inspector agreed with the licensee's assumption that extensive use of the system could save significant amounts of dose.

The licensee experienced very low internal dose during 1994, with the maximum committed effective dose equivalent (CEDE) assigned being 23 millirem. Although the licensee had performed an evaluation when adopting the revised 10 CFR Part 20, and determined that internal dose need not be monitored, the licensee chose to conservatively track and assign all internal doses received, as opposed to assigning only at some arbitrary trigger level.

The inspector reviewed and discussed issues related to respiratory protection and noted that since 1992, the licensee has significantly decreased the numbers of respirators used during outages. The licensee reportedly used 1529 respirators during RFO 4 in the Fall of 1992, whereas only 560 were used during RFO 5 in the Spring of 1994. However, the inspector noted that respirator usage during non-outage periods had steadily increased since 1992. This was mainly due to the evolution of the Spent Fuel Program and the need for respirators related to it during certain portions of the process. At the time of inspection, the licensee was utilizing 30-50 respirators per month (non-outage). The licensee indicated that the "goal" for respirator reduction was not zero, but rather to use good, yet cautious judgment when evaluating the overall need for respiratory protection.

Another noteworthy aspect of the respiratory protection program was a breathing air cart developed by the licensee to assist and better protect the worker while working with supplied airlines. The cart was custom made and allowed for four individuals to use at once. The system was equipped with a series of filters and various monitors, and alarmed



on low air pressure or oxygen concentration and high concentrations of carbon monoxide and other gases such as hydrogen. The system was also equipped with backup "emergency" air supplied by two self-contained breathing apparatus (SCBA) bottles. The cart was connected to plant service air and, in the event of an emergency, the cart would automatically switch over to the SCBA air for "escape" purposes.

The inspector noted that the licensee had aggressively pursued the elimination of hotspots throughout the plant. By coordinating efforts with Operations, E&RC had reduced the total number of hotspots in the plant to 10. This was mainly accomplished through flushing of systems until the hotspot was removed or adequately reduced, but in some cases physical removal of valves or other components was needed in order to eliminate the hotspot source. This was another example of the licensee's aggressive efforts to maintain dose ALARA.

The licensee continued to increase to overall use of cameras for monitoring certain activities throughout the plant. The licensee planned to use even more cameras during RFO 6 in order to further reduce the dose mainly to Operations and E&RC personnel.

The inspector verified during tours of the RCA that radiation, high radiation, and locked high radiation areas were properly posted and controlled. Barricades were utilized where necessary and locked doors were properly secured. No problems were noted in this area except that discussed in Paragraph 3 above.

The inspector noted the licensee's final preparations for implementation of a number of small article monitors (SAMs) to assist the licensee in more easily detecting contamination on tools and other hand carried items in the RCA. The acquisition of the SAMs was part of the corrective actions taken by E&RC in response to the contamination control issues identified by the licensee, as discussed in Paragraph 3 above.

Overall, the licensee's ALARA program was functioning effectively with results that significant dose was being saved due to aggressive and conscientious efforts.

No violations or deviations were identified.

7. Spent Fuel Program Review

During plant tours, the inspector noted that the amount of "crud" at the bottom of the spent fuel pool (SFP) was distinct and extensive. According to the licensee, the crud was mainly a product of the differences in PWR and boiling water reactor (BWR) water chemistries. The licensee's sister plant Brunswick had spent fuel being brought to Harris as part of the ongoing Spent Fuel Program. Thus, most of the crud came from the Brunswick fuel due in part to a chemical reaction that resulted when the BWR fuel was placed into borated PWR SFP water.

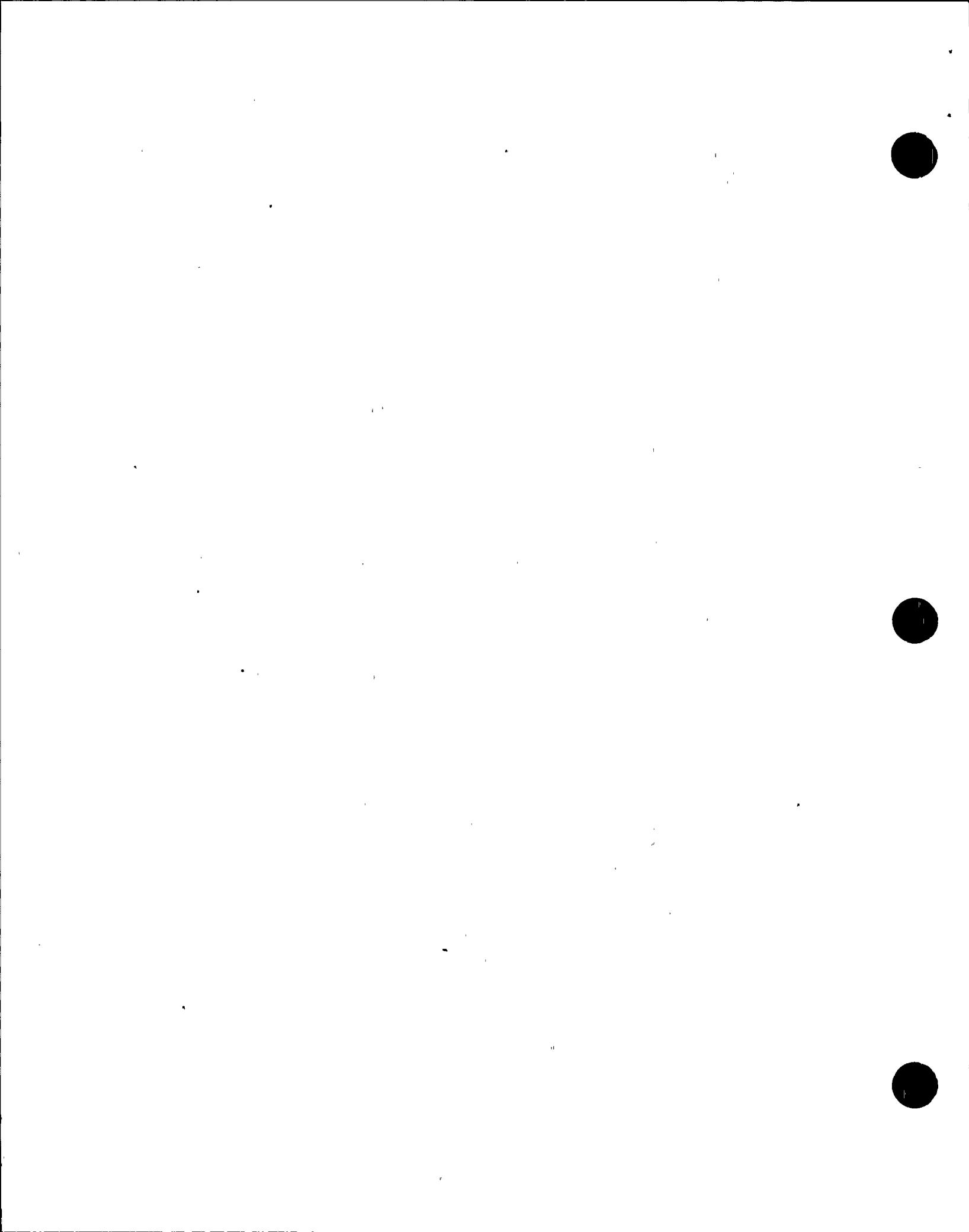
At the time of inspection, the licensee was in the midst of the annual spent fuel shipping cask inspection. The inspector reviewed a videotape following one of the highest dose aspects of the evolution and noted what unique health physics challenges the licensee faced with the ongoing Spent Fuel Program. In the video, the inner basket was removed from the shipping cask so both could be inspected. Prior to removal, the basket had contact readings of up to 2,500 Roentgen per hour (R/hr) and the process required it to be completely lifted out of the unloading pool for several minutes before it was relowered into the 2/3 transfer canal. A large mass of crud was in the bottom of the basket and as it was lifted completely out of the pool, the clear SFP water turned to the color of coffee. As it was lifted over to the other pool, large gravel-size crud chunks could be seen falling off/out of the basket. The water clarity returned shortly as the crud was essentially insoluble and settled out quickly. After "cleaning", the basket read 200 R/hr. In general, good health physics controls were exercised throughout the evolution, only costing the licensee approximately 0.07 person-rem in dose.

Further review and discussion of the issue revealed the following: In 1991, a violation was identified by the resident inspector for failure on the part of the licensee to characterize the crud build-up. In response, the licensee performed an engineering evaluation (EE) per 10 CFR 50.59 to analyze the effect of crud on the SFP from spent fuel received from Brunswick. The EE concluded that the introduction of crud into the pool was well within the bounds of the SFP design bases and the Final Safety Analysis Report (FSAR).

The inspector noted that the crud issue was revisited a number of times since the 1990-1991 timeframe. Most recently, Inspector Followup Item (IFI) 94-13-06 addressed the issue of crud quantification and controls. In response to that item, the licensee performed an evaluation of the crud itself. They also took steps to require that this type of evaluation be performed at least annually. The inspector reviewed the recent evaluation during the inspection. By using a computer program (MicroShield 4.2), and applying numbers obtained from actual crud and SFP water samples, actual SFP surveys, and some very conservative assumptions, the evaluation's conclusion indicated that currently the crud load in the pool was only roughly one-tenth (1/10) of the maximum crud loading calculated in the initial EE.

In summary, the inspector's review of the crud evaluation indicated:

- (A) based on the mass calculated in the EE, approximately $1.1E+11$ microcuries, or 110,000 curies (Ci), would be present on the bottom of the SFP at maximum crud loading (i.e., when the SFP is filled to capacity with spent fuel);
- (B) the 110,000 Ci equated to an average contact dose rate at the SFP bottom of 585 R/hr/ft²;



- (C) based on actual SFP bottom surveys, the average contact dose rate was presently 67 R/hr/ft², which equated to approximately 12,500 Ci of crud.
- (D) Isotopic analysis of the crud indicated that it consisted mainly of iron-55 and -59, cobalt-58 and -60, cesium-134 and -137, chromium-51, manganese-54, and iodine-131 (roughly in that order from most to least abundant); and
- (E) 99.8 percent of the crud was settled out on the SFP bottom, leaving only 0.2 percent in solution.

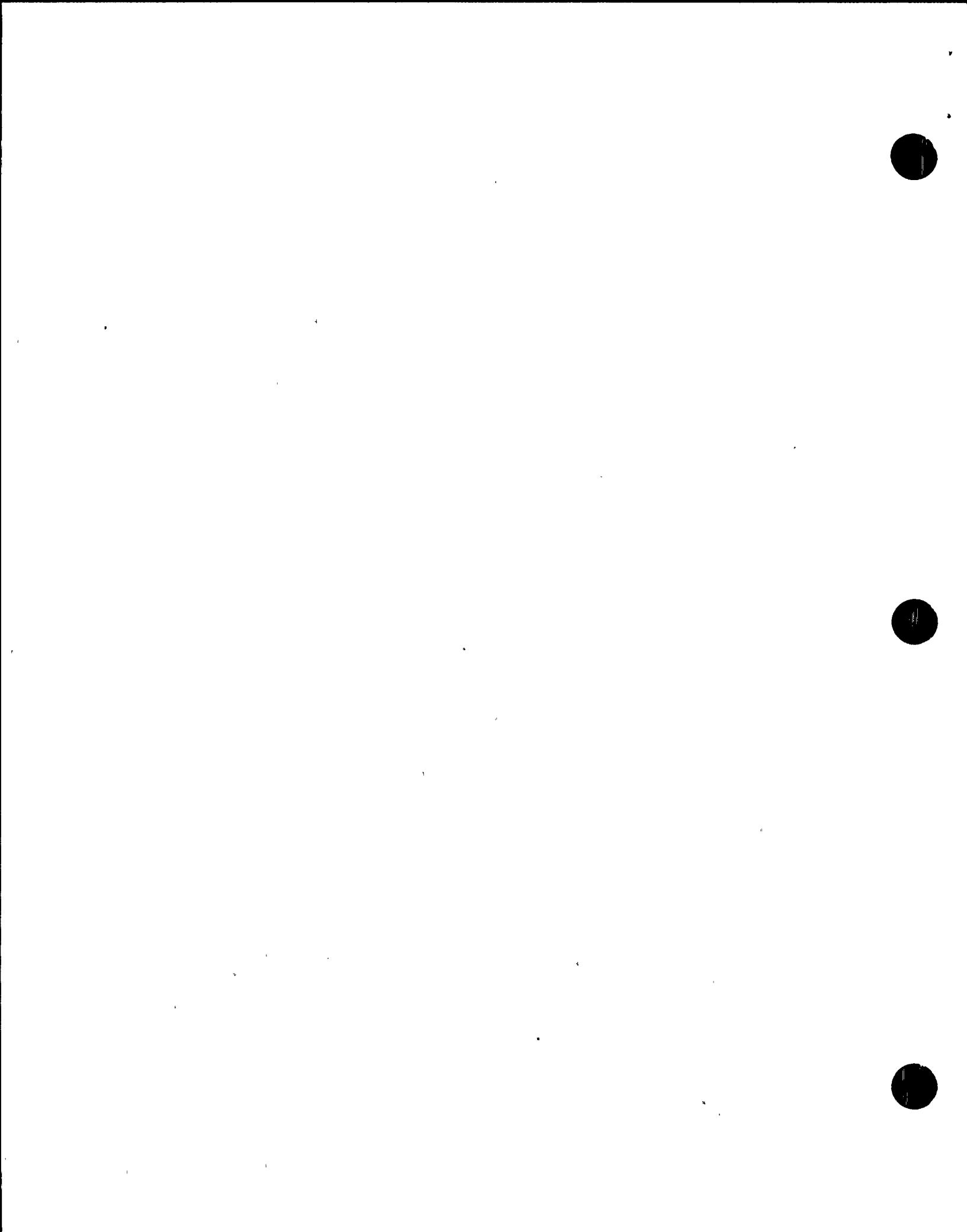
The inspector noted that the dose rates indicated above were only averages. According to the licensee, the deepest portions of the crud (six to 12 inches) were located in the "D" pool, where crud was actually pumped during certain portions of the cask offloading evolution. The SFP surveys in "D" pool ranged 9-21 R/hr and were fairly uniform. Dose rates in the 2/3 transfer canal were the highest and varied widely from point to point, ranging from 42 to 620 R/hr over a fairly small area. The highest readings were consistent as they occurred at the point within the pool over which all materials passed. The averages noted above were averaged over the entire square footage of the SFP system.

Based on discussions with the licensee, the inspector noted that the input of crud into the SFP should be leveling off. The Spent Fuel Program began with movement of the oldest Brunswick fuel and since Brunswick's operating chemistry has improved significantly over the year, less and less crud should come off as newer fuel arrive.

Overall, the inspector concluded that the crud and its radiological hazards were not a concern at the present time. Adequate controls were in place to limit the radiological impact associated with the crud issue. However, the licensee will have to address the crud issue if the Spent Fuel Program is to be completed as originally planned because the "C" and "D" pools will eventually have to be plumbed and racked in order to store spent fuel. The licensee indicated that issue would be addressed as the need approached.

In conclusion, overall, from a health physics standpoint, the inspector noted no safety concerns. The licensee was dealing well with the dose from the Spent Fuel Program, and the crud on the bottom of the pool would only become a radiological safety issue if it were moved/handled. At the time of inspection, there were only approximately 1,000 fuel assemblies in storage in the SFP, whereas, at full capacity, the SFP will hold approximately 7,500 spent fuel assemblies.

No violations or deviations were identified in this area.



8. Review of Previously Identified Inspection Findings

(Closed) VIO 50-400/93-11-01: Failure to properly label radioactive material.

The inspector reviewed the licensee's corrective actions to the identified violation as specified in response letter dated July 16, 1993, and verified that the actions were completed. No additional examples of labeling problems were identified during the inspection. Based on this followup, the inspector informed the licensee that the violation was considered closed.

9. Exit Meeting (83728)

At the conclusion of the inspection on April 13, 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 inspection and indicated that no apparent violations or deviations were identified. The licensee did not indicate any of the information provided to the inspector during the inspection as proprietary in nature and no dissenting comments were received from the licensee.

<u>Item Number</u>	<u>Status</u>	<u>Description/Reference</u>
50-400/93-11-01	Closed	VIO - Failure to properly label radioactive material (Paragraph 8).