U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-255/88021(DRSS)

Docket No. 50-255 License No. DPR-20

Licensee: Consumers Power Company
1945 West Parnall Road
Jackson, MI 49201

Facility Name: Palisades Nuclear Generating Plant

Inspection At: Palisades Site, Covert, Michigan

Inspection Conducted: September 6 through December 8, 1988

Inspectors: C. F. Gill — Date: 12/30/88

W. J. Slawinski — Date: 12/29/88

M. A. Kunowski — Date: 12/30/88

Approved By: L. Robert Greger, Chief
Emergency Preparedness and
Radiological Protection Branch — Date: 1/3/89

Inspection Summary

Inspection on September 6 through December 8, 1988 (Report No. 50-255/88021(DRSS))
Areas Inspected: Special, announced team inspection of the operational radiation protection program during an outage. Areas inspected included: organization and management controls (IP 83750, 83722); training and qualifications (IP 83750, 83723, 83729); external exposure controls (IP 83750, 83724); internal exposure controls (IP 83750, 83725); control of radioactive materials and contamination (IP 83750, 83726); facilities and equipment (IP 83750, 83727); ALARA (IP 83750, 83728); outage exposure controls (IP 83750, 83729); licensee actions on previous inspection findings; questions raised by members of a contractor work group; and licensee actions taken regarding several recent events.

Results: The organizational structure, management controls, staffing levels, and upper management support appear adequate to establish and maintain a quality radiation protection program. One violation was identified-failure to provide locked doors to prevent unauthorized entry into high radiation areas in which the radiation level is greater than 1000 mR/hour (Section 14). Also, programmatic weaknesses were identified in the personnel contamination control (Section 12) and ALARA programs (Section 13).

DETAILS

1. Persons Contacted

#*C. Axtell, Health Physics Superintendent
#*W. Beckman, Radiological Services Manager
#K. Berry, Director, Nuclear Licensing
*K. Block, Training Instructor
#*E. Bogue, ALARA Coordinator
*J. Brunet, Licensing Analyst
N. Campbell, Senior Health Physicist
A. Clark, General Health Physicist
J. Cole, Plant Facilities Manager
M. Dickson, Radiological Safety Supervisor
*G. Ellis, Radiological Safety Supervisor
*R. English, Corporate Health Physicist
*R. Fenech, Operations Superintendent
*J. Hadl, Quality Assurance Consultant
#G. Heins, Senior Vice President
*D. Henry, Radiological Safety Supervisor
C. Hillman, Plant Chemical Engineer
#D. Hoffman, Vice President, Nuclear Operations
*L. Kenaga, Staff Health Physicist
C. Kozup, Technical Engineer
*J. Lewis, Technical Director
G. List, Engineering Supervisor
*D. Malone, Licensing Analyst
M. Mennucci, Radiological Safety Supervisor
*R. McCaleb, Quality Assurance Director
E. Polk, Radiation Materials Control Supervisor
R. Rice, Operations Manager
P. Rigozzi, Supervisory Instructor, Training Department
*D. Rogers, Training Administrator
#G. Slade, Plant General Manager
H. Tawney, Mechanical Maintenance Superintendent

#A. Davis, NRC/Region III, Regional Administrator
#C. Norelius, NRC/Region III, Director, Division of Radiation Safety and Safeguards
#L. Robert Greger, NRC/Region III, Chief, Emergency Preparedness and Radiological Protection Branch
#B. Burgess, NRC/Region III, Chief, Reactor Projects Section 2A
*E. Swanson, NRC Senior Resident Inspector
*J. Heller, NRC Resident Inspector

The inspectors also contacted other licensee employees.

*Denotes those present at the onsite exit meeting on November 22, 1988
#Denotes those present at the meeting in the Region III Office on December 8, 1988.

2. General

This special team inspection was conducted to review the operational radiation protection program. One team member was onsite intermittently in September and October; the full team was onsite for a week and a half in November. Tours of licensee facilities were made to review postings, labeling, access and contamination controls, and to observe radiation protection aspects of work in progress. Programmatic weaknesses were noted in the personnel contamination control (Section 12), ALARA (Section 13), and very high radiation area access control (Section 14) programs.

3. Licensee Action on Previous Inspection Findings (IP 83750, 92701)

(Closed) Open Item (255/87032-01(DRP)): Review method for revising the ALARA plan and briefing workers about the revision. The licensee's review indicated that (for the job reviewed by the NRC inspector) the required ALARA briefing was conducted when a change in job scope occurred; however, because of a paper-work mixup, a copy of the briefing summary was not attached to the Radiation Work Permit (RWP). Instead, a copy of the briefing summary for the job as originally planned was still attached. The licensee has reemphasized to the radiation protection staff the necessity of maintaining current documentation. This matter is considered closed.

(Closed) Unresolved Item (255/87005-10(DRSS)): Review licensee's study showing that monitoring for whole-body dose is adequate to determine dose to the lens of eye, as required by 10 CFR 20, Form NRC-5. The study has been reviewed by NRC (RIII and NRR); the whole-body dose monitoring system is adequate.

(Closed) Open Item (255/87005-11(DRSS)): Licensee should reevaluate the feasibility of establishing additional friskers, with or without shielded booths, in more convenient locations. As a result of the licensee's reevaluation, several additional friskers have been located in the auxiliary building. However, because of high background and floor loading limitations, placing additional friskers and shielded booths on the stairwell leading from the East and West Safeguards Rooms is reportedly not feasible. The licensee plans to position one shielded booth on the spent fuel pool deck elevation, and one each in the north and south radioactive material storage buildings.

4. Organization and Management Controls (IP 83750, 83722)

The inspectors reviewed the licensee's organization and management controls for the Radiation Protection Program including the organizational structure and staffing, staff stability, effectiveness of procedures and other management techniques used to implement the program, and experience concerning self-identification and correction of program implementation weaknesses.

The HP Superintendent (HP Operations Group), the Staff HP (HP Support Services Group), the Radioactive Material Control (RMC) Administrator

(Radwaste Group), and a Senior Health Physicist (Industrial Hygiene) report directly to the Radiological Services Department (RSD) Manager. The Senior Health Physicist (Industrial Hygiene) is assisted by a Nuclear Operations Analyst. Two Radiation Safety Supervisors, the Senior Nuclear Plant Emergency Planning Coordinator, the General Nuclear Emergency Planner, the General Health Physicist, a Senior HP Clerk, an HP Specialist, and two Radiation Protection Technicians (RPTs) report to the Staff HP. The RMC Supervisor (shipping), the Rad/Chem Supervisor, a Senior Engineering Technician, a Nuclear Operations Analyst, five RPTs, five Radwaste Handlers, and six advanced unskilled workers report to the RMC Administrator. The HP Operations Group consists of the HP Superintendent, an HP Specialist, the ALARA Coordinator, a Senior HP, two Radiation Safety Supervisors, and 16 RPTs. The licensee is hiring three experienced, ANSI 18.1-1971 qualified RPTs to fill three recent openings due to internal transfers/promotions; with this addition, 22 of the 26 RPTs will be ANSI qualified. The inspectors selectively reviewed RPT qualification documentation; no problems were noted. Because of the low staff turnover rate and increased RPT qualification/experience level, the licensee does not plan to augment the staff with contract RPTs after the current outage.

Management involvement in radiation protection is evident in that the weakness correction programs delineated in Inspection Report No. 50-255/87030 are still receiving strong management support and new proposed improvement programs are generally receiving appropriate management attention. One apparent exception is the program to improve radiation worker practices. This plant-wide effort involves corrective action to be taken by all plant departments with most of the primary actions to be taken by the Radiological Services and Training Departments. Many of the problems were identified by plant workers and first-line supervisors during worker group discussions with RSD representatives and radiation worker practice inspections conducted jointly by RSD representatives and other departments' first-line supervisors. Major actions taken/planned by the Training Department include upgrading the observation training program, elimination of NGET-requalification practical factors waivers, increasing RSD step-off-pad (SOP) coaching skills, improving OJT for plant workers and contractors, and improving RPT continuing training. The RSD plans to be more involved in supervisory work activity observations, increase decontamination/laundry efforts and the use of SOP coaches, and make facility changes. The licensee had planned to have this program well implemented before the current outage; however, the unexpected early start of the outage, the need to quickly obtain and train contract workers, and (perhaps) a shortage of contract RPTs resulted in radiation workers less well-qualified and RP supervised than desirable. This likely contributed to the large number of personnel contamination events (PCEs) during this outage. If the existing radiation worker practices improvement program is fully implemented as now scheduled during 1989, it is expected that the frequency of PCEs will be significantly reduced.

No violations or deviations were identified.

5. Changes (IP 83750, 83729)

The inspectors reviewed changes in organizational, personnel, facilities, equipment, programs, and procedures that could affect the outage radiation protection program.

During this outage, the station RPTs and crewleaders are providing continuous coverage, seven days per week, by working twelve-hour days, five days per week. Two Radiation Safety Supervisors during the weekdays and other RSD supervisory personnel during the weekend days split the Duty Health Physicist function to provide 24-hour continuous coverage. Evidence of contract RPT oversight is exhibited by the licensee's policy of appointing station RPTs as crewleaders, with contract RPTs as alternate crewleaders. This scheme, combined with tours by Radiological Safety Supervisors, health physicists, and the ALARA Coordinator, appears to provide adequate oversight of contract RPT activities.

No violations or deviations were identified.

6. Audits and Appraisals (IP 83750)

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

As noted in Section 12, the licensee's QA group has been conducting monthly personnel contamination and radiation worker practice surveillances since January 1987. These surveillances were initiated at the request of plant management and consist of personnel contamination report and data trending review and tours of radiologically controlled areas (RCAs) to observe radiation worker practices and housekeeping. The surveillances, which appear to be thorough and well documented, indicate the licensee continues to experience significant problems in these areas. Numerous specific examples of poor radiation worker and contamination control practices are repeatedly noted in the surveillance reports. Additionally, Radiological Incident Report (RIR) No. 88-024, generated during the outage, exemplifies what may be a plant-wide indifferent attitude toward proper work practices and contamination controls. To date, efforts to improve these problems appear to have lacked the aggressiveness and necessary plant and corporate management support to be fully successful. Similar concerns have been previously expressed (Inspection Reports No. 50-255/87030 and 50-255/88006). The licensee intends to continue these monthly surveillances.

The report of the last annual QA audit of the Health Physics and Packaging/Shipping of Radioactive Material programs, conducted on October 3-7, 1988, was reviewed by the inspectors. The audit resulted in

three observations that are all considered adverse to quality and require corrective actions; these actions are pending. The observations consisted of (1) failure to require nasal smears and whole body counts for individuals contaminated in excess of 1000 cpm above the neck; (2) the need to develop acceptance criteria for verifying waste classification and characteristics, and (3) the need to remove chipped and peeling paint inside containment and evaluate its effect on fouling sump strainers. The auditors also noted that twelve of twenty-nine RIRs generated during the first nine months of 1988 were attributable to poor radiation worker practices including worker disregard for health physics instructions and inattentiveness of RPTs. The audit report indicated that the level of corrective and disciplinary action for certain practices lacked the appropriate worker sanctions and was not commensurate with the gravity of the problem. Other auditor concerns included two RIRs involving unlocked 1R/hr doors (five similar examples were noted in the 1987 audit report (Inspection Report No. 50-255/88006)). Inspector concerns regarding access controls to > 1R/hr areas are described in Section 14.

The QA audit and appraisal program appears good; thorough radiation protection program area audits/surveillances were performed in 1988.

No violations or deviations were identified by the inspectors.

7. Planning Preparation (IP 83750, 83729)

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

During the outage, the plant's HP Operations Group has been augmented with up to approximately 80 contract RPTs, consisting of about 70 senior and 10 junior technicians. The original RSD request was for approximately 100 contract RPTs; reportedly, the reduction in staff was made by management for budgetary reasons. The inspectors conducted plant tours and interviewed utility and contract RPTs, as well as utility supervisory and management personnel, to determine if the reduction in requested contract RPT staff had a significant negative effect on the outage radiological safety program. It appears that, at times, the RPT staff was barely able to provide adequate job coverage to support scheduled outage activities; some personnel indicated that outage tasks were sometimes delayed until RPTs were available for job coverage. Some utility crewleaders/RPTs indicated that the reduced percentage of contract RPT returnees (30% this outage compared to 85% last outage) required more detailed oversight by plant personnel of contract RPTs because of lower contract RPT plant familiarity than during previous outages. However, overall it appears that the RPT job coverage was adequate. One highly visible aspect of the licensee's radiation protection program, personnel contamination, appears to have been negatively impacted by the strained outage resources and planning (see Section 12).

Overall the supplies of portable survey instruments, portable ventilation equipment, respiratory protection equipment, and protective clothing appeared adequate for the outage. Licensee representatives stated that on several occasions during the outage, the supply of telescoping high-range G-M meters and portable HEPA-equipped vacuum cleaners was insufficient.

No violations or deviations were identified.

8. Training and Qualifications of Personnel (IP 83750, 83723, 83729)

The inspectors reviewed the training and qualifications aspects of the licensee's radiation protection, radwaste, and transportation programs including: changes in responsibilities, policies, programs and methods; qualifications of newly-hired or promoted radiation protection personnel; and provisions for appropriate radiation protection, radwaste and transportation training for station personnel. Also reviewed were management techniques used to implement these programs and experience concerning self-identification and correction of program implementation weaknesses.

The inspectors reviewed the education and experience qualifications of contract radiation protection personnel and training provided to them. Observations and conclusions discussed in Section 7 of Inspection Report No. 50-255/87002 are still valid. No problems were noted.

The inspectors reviewed the training programs for RPT qualification and continuing training, NGET, basic radiation workers, and radioactive waste handler qualification; no significant problems were noted. The inspectors also reviewed the Advanced Radiation Worker Training Program which is part of the qualification requirements for members of the Operations Department to allow self-monitoring in designated high radiation areas (HRAs). Interviews with licensee representatives and review of lesson plans, qualification requirements, OJT, practical factors, and selected examination records indicate that this qualification program should be adequate to permit members of the operations department to provide sufficient self-monitoring in designated HRAs under proper RSD oversight. The inspectors discussed with RSD supervisory and managerial personnel the importance of maintaining adequate RSD oversight of this program and the desirability of taking appropriate action if the privilege of self-monitoring is abused.

As noted in Section 4 above, the Training Department has been assigned a major role in the licensee's program to improve radiation worker practices. However, the delays in implementing the program and the early outage resulted in radiation workers being less well trained than planned and appear to have contributed to the large number of PCEs which occurred during the outage.

No violations or deviations were identified.

9. External Exposure Control and Personal Dosimetry (IP 83750, 83724)

The inspectors reviewed the licensee's external exposure control and personal dosimetry programs, including: changes in facilities, equipment, personnel, and procedures; adequacy of the dosimetry program to meet routine and emergency needs; planning and preparation for maintenance and refueling tasks; required records, reports, and notifications; effectiveness of management techniques used to implement these programs and experience concerning self-identification and correction of program implementation weaknesses.

The inspectors reviewed the licensee's personal dosimetry programs for compliance with 10 CFR 20.202 concerning National Voluntary Laboratory Accreditation Program (NVLAP) requirements for dosimetry processors. The licensee's self-administerd dosimetry program employs a Teledyne TLD system that is NVLAP accredited for ANSI-N13.11 Test Categories II, IV, V, VII, and VIII. The licensee is not NVLAP accredited for Categories I, III, and VI, corresponding to low-energy photons and high/low energy photon mixtures. The low-energy photons are characteristic of x-ray emissions in the 20-70 keV energy range. According to preliminary results of a study performed at the station, characteristic x-rays produced from system radioactivity (primarily Fe-55 activation product contamination) do not contribute significantly to either deep or skin dose. Although the licensee is not NVLAP accredited for determining exposure for low-energy photons, they contend that any such exposures are conservatively determined due to the inherent overresponse of calcium-based TL materials to photon energies less than 100 keV. However, due to replacement part availability and other concerns, the licensee is considering discontinuance of their current TLD system and evaluating another vendor's equipment. The licensee plans to initiate NVLAP accreditation performance testing for a self-administered Panasonic system within the next few months.

As of November 1, 1988, the licensee instituted the use of a single-chip ring badge for hand exposure monitoring. The ring contains one $LiBO_4$ thermoluminescent chip, and replaces the 4-chip dosimeter (containing 2 $LiBO_4$ chips and 2 $CaSO_4$ chips) formerly used for hand monitoring. The licensee continues to use the 4-chip dosimeter as the secondary whole-body dosimeter. Both monitoring devices, the single chip ring and the 4-chip dosimeter, are provided to the licensee by the same vendor (Panasonic). While there is a reduction of dosimetry information as a result of switching from the 4-chip dosimeter to a 1-chip dosimeter, the omitted information is not required for regulatory purposes.

The inspectors reviewed selected dose records for 1988; no problems were noted.

As discussed in Section 12, contamination levels associated with the recent high number of personal contaminations have been low, and 10 CFR 20 limits for whole-body skin dose have not been approached as a result of contamination on any workers. While most of the contamination found on workers is low-level and dispersed over the body, the licensee has identified some contamination in the form of relatively high-activity,

localized particles (hot particles). Licensee representatives reported that 48 hot particles have been found on workers in 1988. Isotopic analyses of these particles typically have indicated the presence of only Co-60. Skin dose calculation for hot particles and for contaminations of at least 10,000 counts per minute as measured with a pancake probe is performed with a method also used at the Big Rock plant (see Inspection Report No. 50-155/88004 for a description of this method).

Skin dose calculations for several hot particle contamination events were reviewed by the inspectors. For one of these events, involving a hot particle found on the heel of a worker, the licensee calculated a dose of 6.9 rem to the foot of the worker (compared to the 10 CFR 20 dose limit of 18.75 rem). For another event, involving a hot particle found on the shoulder of a diver, the licensee determined that for the five minutes the particle was apparently on the diver's shoulder, 329 mrem dose accrued to the skin of the whole body. However, the licensee later determined that the particle probably was on the diver's right thumb for about one hour during the dive, and was transferred to the shoulder when the diver removed his diving suit and protective clothing after completing the dive. (The licensee found a pin-hole leak in the right thumb of the diver's diving suit.) Radiation protection personnel covering the dive reportedly observed the diver touch his shoulder with his right hand while removing his clothing after the dive. The licensee calculated that the diver's thumb received approximately 4 rem from the particle. In another contamination event (on October 7, 1988), a diver was contaminated over a large portion of the body with low-levels of radioactive material. Apparently the diver had informed his supervisor via a communication line early in the dive that the diving suit was leaking; however, contrary to station policy, the supervisor instructed the diver to stay in the water and complete the dive. Licensee representative stated to the inspectors that after learning of these facts, they revoked the dive supervisor's access to the plant and have modified the diving communication line to allow RP personnel to listen in. This matter will be reviewed further at a future inspection (Open Item 255/88021-09).

Inspector review of the licensee's skin, extremity, and whole-body dose determinations for these events identified no problems.

No violations or deviations were identified.

10. Internal Exposure Control (IP 83750, 83725)

The inspectors reviewed the licensee's internal exposure control and assessment programs, including: changes to facilities, equipment, and procedures affecting internal exposure control and personal exposure assessment; determination whether respiratory equipment, and assessment of individual intakes meet regulatory requirements; required records, reports, and notifications; effectiveness of management techniques used to implement these programs, and experience concerning self-identification and correction of program implementation weaknesses.

a. Respiratory Protection Program

Selected aspects of the licensee's respiratory protection program were reviewed, including respirator selection, issuance and accountability, cleaning and maintenance, fit testing, training, and provisions for MPC-hour determinations; results of the review are discussed below.

Implementation of the licensee's respiratory protection program is governed by 10 CFR 20 requirements, Station Procedure No. HP 7.0, and a corporate policy statement on respirator usage. Personnel whose duties may require the use of respiratory protection equipment are required to complete initial training and periodic retraining in the use of the equipment, a biennial fit test and an annual medical exam and/or pulmonary function test. Respiratory protection training is provided by the station's training department as a supplement to NGET and includes an annual requalification. The inspectors discussed the respiratory protection training program with a training instructor; no significant problems were noted. However, although respirator selection and usage is discussed in the training course and practiced to some extent during the fit testing process, it appears desirable for each trainee to physically demonstrate proper respirator usage (donning, removal, etc.) as part of the training class.

Respiratory fit testing is accomplished in the station's fit test booth employing a smoke or corn oil atmosphere. The fit test equipment is periodically checked, calibrated, and routine maintenance performed as necessary. No problems were noted.

To obtain a respirator, workers report to the access control desk where training, fit testing, medical qualifications and equipment approval data are maintained on computer. The inspectors reviewed respirator qualification/training documentation for several plant and contractor personnel; no problems were identified. The computer database appears to be properly maintained and includes relevant and current information. After approval is verified, the appropriate respirator is issued by the RPT manning the desk. After use, respirators are individually bagged and deposited in a 55-gallon drum located near access control. No method is inplace for worker-respirator accountability/traceability nor for smearing used and returned respirators prior to cleaning. According to the licensee, lack of a respirator survey and accountability program has not posed significant problems and does not appear necessary at this time. If accountability and/or respiratory equipment related contamination control problems arise in the future, such a program should be considered. This matter was discussed at the exit meeting.

During the outage, used respirators were machine washed by contract workers and inspected by RPTs. A check of respirators ready for issuance indicated that adequate attention is given to inspection and maintenance. No unattended respirators were observed in the plant.

b. MPC-Hour Accountability and Tracking

MPC-hour accountability methods, procedures, and documentation were reviewed. MPC-hours are tracked, at the discretion of the duty health physicist, when the possibility exists that a worker's uptake could approach 40 MPC-hours in seven days as indicated by air sample results, or if tracking is prerequired by the RWP. If required by RWP, job coverage RPTs are responsible for air sampling and recording worker area entry/exit times and other necessary information on MPC-hour log sheets.

Normally, MPC-hours are calculated and assigned at the discretion of the duty HP based on review of (computer-tracked) air sample results, area occupancy, and other relevant factors. The evaluation performed by the duty HP is based on available information, subjective health physics judgement, and is not dictated by procedure or specific mechanism, nor is the evaluation documented for further/future review. If MPC-hour tracking is deemed appropriate, pertinent information is recorded on the previously referenced "MPC-hour log" sheets. The desirability to standardize the MPC-hour evaluation methods and document the outcome was discussed with the licensee. The licensee is attempting to devise a generic evaluation form for this purpose.

No problems were noted with the methods and practices employed for job specific (RWP) air activity determination. Air samples are collected by RPTs and results reviewed by the duty HP at least shiftly.

c. Whole-Body Count Evaluation Methods

The inspectors reviewed the licensee's methods and practices for evaluating levels of internally deposited radioactivity (MPC-hours) based on investigation of whole-body count results. The licensee computes MPC-hours from acute and chronic intakes using whole-body count results and methods delineated in Station Procedure No. HP 8.2, Whole-Body Count Evaluation Procedure. The procedure, however, is based primarily on ICRP-2 methodology and consequently attempts to utilize biologic models derived for chronic intakes to estimate actual acute intakes. The use of ICRP-30 methodology would be more appropriate in most nuclear power plant intake incidents. Use of ICRP-2 derived values could result in MPC-hour under-estimation, particularly when the acute intake is from an isotope with a relatively short effective half-life (with little or no long-term component) and

sufficient whole-body count data is unavailable. This matter was discussed with radiation protection supervision during the inspection and by telephone on December 6, 1988. This matter will be reviewed further during a future inspection (Open Item 255/88021-01).

No violations or deviations were identified.

11. Control of Radioactive Materials and Contamination (IP 83750, 83726)

The inspectors reviewed the licensee's program for control of radioactive materials and contamination, including: changes in instrumentation, equipment, and procedures; effectiveness of survey methods, practices, equipment, and procedures; effectiveness of methods of control of radioactive and contaminated materials; management techniques used to implement the program; and experience concerning self-identification and correction of program implementation weaknesses.

a. Personnel Monitoring Methods and Controls

The station's sole ingress/egress control point for the radiologically controlled area (RCA) is on the 607' level of the auxiliary building adjacent to the RPT access control desk. Three PCM-1B whole-body contamination monitors, which became operational in April 1988, are located at the egress point and can be readily observed by RPTs who continuously man the desk. Calibration and testing of these monitors is described in Section 15. The contamination monitors are physically positioned side-by-side and share a single common ingress and egress route which poses the potential for personnel cross contamination. Separate monitor egress routes would reduce the probability of cross contamination and tracking contamination into clean (non-RCA) areas. The desirability to reposition the monitors was discussed with the licensee during the inspection and at the exit meeting. This matter will be reviewed further during a future inspection (Open Item 255/88021-02).

Conventional (hand-held) friskers are stationed in various locations in the RCA and personnel are required to perform frisks at the nearest frisking station after removing protective clothing at step-off-pads or exiting a contaminated area. As noted in Section 6, previously identified worker frisking (Inspection Report No. 50-255/87005) and contamination control weaknesses continue. A final personal contamination survey is made prior to leaving the site with portal (walk-through) monitors located in the gatehouse.

b. Personnel Contamination Reports

Procedure No. HP 2.18, Personnel Decontamination, requires that personnel contamination reports (PCRs) be completed when personnel frisks yield greater than 100 cpm above background. PCRs are evaluated and findings summarized in reports issued to the Health Physics Superintendent. The reports address the number and type of

personnel contamination events, the plant location where the contamination is believed to have occurred, and the apparent cause as identified by the RPT completing the report.

In 1988, the licensee experienced a significant (four-fold) increase in personnel contamination events (PCEs). The new whole-body contamination monitors detected most of these events. Approximately 1360 PCEs have been reported in 1988 through November 8; the majority (about 88%) were identified during the three-month maintenance/ refueling outage, which commenced in early August 1988 and was nearing completion during this inspection. The station averaged about 345 PCEs annually from 1985 through 1987. An extensive evaluation of the outage contamination events was conducted by the licensee and is documented in a draft licensee report. Further licensee evaluation is continuing. Pertinent information noted by the inspectors and/or extracted from the licensee's study is delineated below:

- Contaminations were attributed primarily (77%) to discrete particles of low-to-moderate activity (100-2000 cpm); 5% involved activities greater than 10,000 cpm and triggered skin dose calculation if the contamination was on the skin.

- Approximately 27% of the contamination events were attributed to contaminated clean areas; 35% to contaminated protective clothing; and 33% to poor radiation worker practices.

- The contamination rate for certain jobs performed primarily by contractors was excessive and contributed a relatively high percentage to the overall totals.

- 75 individuals were contaminated four or more times and amounted to 32% of all the contaminations.

- 37% of the skin contaminations were to the head.

- The night shift contamination rate was nearly double the day shift rate.

- Laundry and related work accounted for 10% of all contaminations.

- As the outage progressed, the ratio of contaminations from Co-58 to contaminations from Co-60 increased. While contaminant particulate size appeared to range from two to 100 microns, other preliminary evidence suggests that contaminants may be colloidal crud in the sub-micron range.

These and related issues are further discussed in Section 12.

The licensee's policy on skin dose determination from hot particles is defined in Section VI of the corporate Radiation Safety Plan. The plan requires a skin dose determination if skin contamination levels greater than 10,000 cpm are observed regardless of the area over which the contamination is spread or the uniformity of contamination. To calculate skin dose, the licensee uses measured values from Eberline Model RO2/RO2A dose rate or count rate meters employing Model HP210/260 probes; the Radiation Safety Plan was recently revised to require that dose calculations from discrete particles be averaged over 1 cm^2 in keeping with NRC guidance. In 1988, to date, the licensee calculated 38 skin doses (to 36 individuals) resulting from personnel contamination events. The licensee's dose calculation methodology described in Station Procedure No. HP 2.42 was reviewed by the inspectors along with dose assessments for selected events (see Section 9); no significant problems were noted. Skin dose calculations performed by the licensee showed that no regulatory or licensee administrative dose limits were exceeded as a result of these contamination events. The skin doses for the vast majority of the contaminations were less than one percent of the NRC limits.

c. Area Survey Program

Routine area surveys are performed to assess general radiation and contamination levels and to evaluate the effectiveness of general radiological controls and housekeeping. Routine radiological survey requirements are described in Section Procedure No. HP 2.14 and include routine daily and monthly external radiation and smearable contamination surveys. Additionally, contractor personnel perform daily large area masslinn smears in various auxiliary building areas and in selected clean (non-RCA) areas. Masslinn smears exhibiting greater than 100 cpm warrant area cleanup. The inspectors selectively reviewed records of routine area surveys performed in 1988 to date; no significant problems were noted with the survey methods or frequency.

Efforts to reduce auxiliary building contamination continue (see Inspection Report No. 50-255/87005). The percentage of contaminated auxiliary building areas has remained fairly constant during non-outage periods in 1988 (about 40%) and increased to about 50% during peak outage activities in September 1988. Similar values were reported for 1987 (Inspection Report No. 50-255/87030). The station goal, initially established in 1987, is to maintain the percent of contaminated auxiliary building area to 22%; the contamination baseline is 11%. The continued failure to meet the auxiliary building contamination goal appears to represent a weakness and is undoubtedly a contributing factor to the recurrent personnel contamination problems. Staffing devoted to the decontamination program is described in Section 12.c.

d. Radioactive Material Container Marking and Labeling

During inspector tours of the RCA, numerous yellow plastic bags containing various equipment/parts (hoses, cables and metal components) were observed to be umarked/unlabeled as to the radiological conditions (dose rate and contamination levels) of their contents. The licensee uses such bags to store contaminated (or potentially contaminated) material. With limited exceptions, yellow bagged material (non-trash or laundry) observed during the inspection was not marked or labeled to indicate if removable contamination was present on the contents. Proper marking/labeling is desirable to inform personnel of the potential hazard associated with handling or unpackaging the material. While the bags appear to be exempt from regulatory labeling requirements because of the limited amount of radioactive material present, failure to properly mark/label the bags is considered a poor health physics practice. Station procedures do not prohibit this practice. This concern was previously identified by the NRC (Inspection Report No. 50-255/88006) and in numerous licensee monthly QA surveillances (Section 12.c). Other Region III plants with similar practices have experienced worker external and internal contamination problems when bagged equipment with unspecified radiological conditions was handled. The continued failure to properly label bags of contaminated items is a weakness in the contamination control program. This matter was discussed at the exit meeting and will be reviewed further during a future inspection (Open Item 255/88021-03).

No violations or deviations were identified by the inspectors.

12. Personnel Contamination Events (PCEs)

As previously noted (Section 11), the licensee experienced a significant (approximately four-fold) increase in PCEs in 1988. The majority occurring during the refueling/maintenance outage that began in early August. The thorough frisk capability and increased sensitivity of the new whole-body contamination monitor (alleviating individual frisking variances associated with conventional hand-held units) has dramatically improved the licensee's ability to identify low levels of personnel contamination. Although it is not uncommon for the number of identified PCEs to increase significantly when such state-of-the-art monitors are made operational, the magnitude of the increase and its continuance throughout the outage is unusual and appears indicative of weaknesses in the personnel contamination control program.

Based on licensee, INPO, and NRC evaluations, causal factors contributing to the contamination problem include protective clothing and laundry, radiation worker practices, and contamination in clean areas. Primary system particulate radioactivity buildup and accumulation over several cycles, coupled with its release and possible unique chemical and physical properties, appear to be the source of the problem. The underlying source and contributing factors are detailed below:

a. Protective Clothing and Laundry

The licensee attributes approximately 35% of the outage contamination events to cross-contamination and leaching from protective clothing (PC). During the outage, PCs were laundered using an in-plant wet wash system and a vendor-supplied dry cleaner. Highly contaminated PCs were dry cleaned during ~~initial outage stages but later~~ wet washed when the licensee discovered it was more effective in particulate removal. Early in the outage, contamination was identified on numerous workers exiting the RCA and in the PC dress area (The PC storage and dress area is located in the service building (clean area) along with offices and lunch rooms). The source was determined to be perspiration induced leaching of contamination from PCs and contamination on laundered PCs stored in the dress area. According to the licensee, contamination was not adequately controlled in the fuel pool tilt-pit drain line replacement job and highly contaminated PCs (particularly duck feet) on that job were not segregated and consequently cross contaminated other PCs during the laundering process. (The licensee was not able to monitor all laundered items in their automated laundry frisker (ALF) early in the outage due to the increase in PC processing requirements). Failure to segregate and specially launder PCs used in high contamination jobs, and the establishment of the PC dress and storage area in a "clean" non-RCA are considered poor practices, the latter increasing the probability of spreading contamination into offices and eating/drinking areas. The inspectors also noted that PC dress requirements and donning methods were not clearly delineated, changed throughout the outage, and varied from worker to worker.

The licensee's wet-wash system is somewhat antiquated in that it has only two water changes per wash cycle compared to about seven in newer units. Additionally, the wash water is hard and the station's NPDES permit severely limits the amount of detergent and additives in the water discharged from the wash system. Colloidal corrosion products (see Section 12.d) could apparently further hamper the effectiveness of the existing laundry facility. During mid and later stages of the outage, a degreaser and acid solution were added to improve wash capability; the latter was discontinued as ineffective.

To correct laundry and related problems, the licensee tentatively plans to contract the services of an offsite laundry vendor and is considering the purchase of new polyester/cotton blend PCs. This blend reportedly facilitates contaminant removal during laundering. The use of hospital scrubs will continue (as a PC undergarment) and their effectiveness further evaluated.

b. Radiation Worker Practices

The licensee attributes about 33% of the outage contamination events to poor radiation worker practices. Approximately 37% (roughly 160 events) of outage skin contaminations were to the head, which

typically result from improper worker practices. The station's QA group continues to conduct monthly PCE and radiation worker/ contamination control surveillances. These surveillances, which began in January 1987, have continually identified instances of poor radiation worker practices exhibited by plant and contract workers, including members of the radiation protection group. The problems escalate during outages. Similar problems have been noted during INPO visits and by NRC inspectors (Inspection Reports No. 50-255/87030 and 50-255/88006). Inspection Report No. 50-255/87030 describes a poor worker practice that contributed to an apparent radioactive material ingestion/inhalation incident. Although station management involvement to improve worker practices exists, a radiation worker practice task force was formed in early 1988, it dose not appear to have been very aggressive or effective to date (see Section 4).

Personnel contamination rates have generally reflected the area contamination levels except for steam generator platform workers. These workers have relatively lower personnel contamination rates apparently because their activities are closely scrutinized and they are assisted in PC removal by RPTs. Experience levels and qualifications of these workers also tends to be somewhat greater than other radiation workers. Monitors (or coaches) stationed at the fuel pool area SOPs to instruct/assist worker in PC removal proved to be beneficial. On the night shift, which reportedly did not utilize SOP monitors to the same extent as the day shift, nearly a double contamination incident rate was experienced. This information appears to imply radiation worker training deficiencies; however, the INPO and station QA auditors noted improved practices when workers knew they were being observed and degraded practices when unaware they were under observation. As previously noted (Section 11.b), about 75 workers were contaminated four or more times and accounted for 32% of all outage PCEs. If management continues to tolerate apparent worker indifference towards proper work practices and contamination controls, the excessive number of contamination incidents due to poor radiation worker practices may remain a significant programmatic weakness. A disciplinary action program for personnel that continue to demonstrate improper practices may be necessary. Enhanced radiation worker training, continued SOP coaching, and a program for expanded management oversight of radiation work may also be appropriate.

Corrective actions taken or under consideration by the licensee to improve worker practices include the following (also see Section 4):

- Periodic supervisory/management RCA tours.
- Evaluate revising contracts (as necessary) to penalize contractors for poor work practices.
- Evaluate the necessity for added training of contractor personnel or the increased use of technicians to monitor work practices.

- For future outages, use dedicated control-point monitors at high traffic SOPs.
- Evaluate the use of video monitors at multiple SOPs.
- Provide technicians to assist personnel in undressing at high contamination boundaries.
- Improve contamination area boundary demarcation.

c. Contamination in Clean Areas

The licensee attributes about 27% of the outage PCEs to contaminated clean areas. Several sources appear to contribute to this problem and include lack of sufficient decontamination resources, contamination spread caused by improper radiation worker and plant contamination control practices, lack of a formal leak identification and reduction program, and inadequate ventilation flows.

Previously referenced monthly QA surveillances repeatedly identified examples of poor worker practices and improper plant contamination controls contributing to contamination in clean areas. Similar examples were noted by INPO during an October 1988 visit and by NRC inspectors during this inspection, including:

- Lack of sufficient marking/posting of contamination area boundaries resulting in inadvertent entry into such areas.
- Unsleeved and unmarked cords/hoses across contamination boundaries.
- Material/equipment partially inside contamination areas.
- Worker congestion (due to space limitation) in certain SOP change areas.
- Unlabeled/unmarked yellow bagged material and equipment.

The licensee continues to experience numerous shoe contaminations involving individuals who enter the RCA but do not enter any posted contaminated area. Although the rate of shoe (to other) contaminations dropped in mid-1988, the data could be misleading because of the substantial increase in skin and clothing contaminations. The PCM-1Bs are presumably identifying low-level skin and clothing contaminations that previously were not detected using the conventional hand-held friskers; this may be less true for shoe contaminations because shoes are typically thoroughly surveyed with hand-held friskers. Although the station has devoted additional efforts to auxiliary building survey and cleanup (Inspection Report No. 50-255/87030), the station has not met area contamination goals

(during both outage and non-outage periods-Section 11.d). While the surface contamination levels were reportedly not greater during the 1988 refueling outage than in past outages, RSD management was generally dissatisfied with decontamination progress early in the outage. The outage commenced earlier and was more extensive than anticipated and the licensee was not adequately staffed with a qualified decontamination crew. Additional deconners and laundry workers were added at various times during the outage. Because known contaminated areas, laundry operations, and other emergent work received priority attention, clean areas of the auxiliary building may not have received appropriate attention. Budgetary constraints also limited decontamination staff overtime and weekend coverage.

Ventilation flow could be a contributor, spreading contamination from potentially contaminated to clean areas. During inspector plant tours, strong air currents from the open laundry area into the adjacent clean hallway were evident. According to a licensee representative, a similar situation exists in the spent fuel pool heat exchanger room to the hallway outside that room.

The lack of a formal leak identification, control, and reduction program may also contribute to the problem. The inspectors noted numerous plant areas with leakage directed into floor drains by tygon tubing or leaking directly onto floor areas. No formal mechanism currently exists to identify plant leaks and track their status.

Correction actions planned and/or under licensee consideration to reduce contamination in clear areas are described below:

- Increase decontamination efforts to quickly restore contaminated work areas to clean status, and increase frequency of cleaning in high traffic areas.

- Increase the use of vacuum cleaners to remove debris/dust throughout the RCA.

- Continue to explore alternative locations for PC dress-out areas so that clean area transit by personnel wearing PCs is minimized. A modification has been requested to move the change area into the RCA space vacated by the laundry. (The budget authorization for this request is pending.) When laundry processing is moved off-site, additional support should be available to address decontamination needs.

- Additional contract deconners will be planned for future outages as necessary to ensure that surface area contamination is maintained at acceptable levels.

d. Source Term Considerations

The unit's primary system particulate activity source term has apparently built-up and accumulated over several cycles; its subsequent release into the primary coolant system may have been triggered by a crud burst or other as yet unknown event. Additionally, preliminary licensee studies suggest that a possible chemical and/or physical reaction prior to shutdown may have caused primary system contaminants to be in a chemical and physical form that compounded problems with effectively controlling the contamination after its release from process systems. These matters are explored below:

Following shutdown, the plant experienced an unexpected increase (about two orders of magnitude) in coolant activity after flooding of the reactor cavity. This produced elevated radiation levels particularly in the safeguards equipment and piping, reactor cavity, and spent fuel pool tilt pit. This increase was initially thought to be caused by corrosion product suspension possibly produced by a crud burst. Although not totally discounted by the licensee, the curd burst theory has not held up after coolant sample filtration and chemical analysis. Subsequent coolant chemical analyses revealed that contaminants were in a dissolved ionic state presumably created by an unknown oxidizing environment. Other licensee analyses appear to indicate that the contaminants may be colloidal crud (sub-micron particles). Since the PCs used by the licensee are permeable to sub-micron particulates, many of the PCEs may have resulted from this sub-micron contamination. The licensee is continuing to investigate the possibility of a crud burst and to characterize the contamination.

The licensee's past maintenance/operational practices may have introduced undesirable quantities of base metal into the primary coolant system and allowed them to accumulate over numerous cycles. This practice would negatively impact the ALARA and contamination control programs. Primary coolant system filtration and/or other primary system decontamination/cleanup techniques have apparently not been extensively employed by the licensee until recently (Section 13). It appears desirable to consider the various options available for additional primary coolant system decon/cleanup and source term reduction.

The contamination control programmatic weaknesses delineated in the subsections above were discussed at the onsite exit meeting, at the December 8, 1988 meeting in the NRC/Region III office, and will be reviewed further during a future inspection (Open Item 255/88021-04).

No violations or deviations were identified; however, a significant programmatic weakness was identified.

13. Maintaining Occupational Exposures ALARA (IP 83750, 83728)

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

NRC inspections since 1986 (Inspection Reports No. 50-255/86012, 50-255/87002, 50-255/87005, 50-255/87030, 50-255/88006, and 50-255/88020) have determined that the licensee has apparently learned well from past outage and operating experiences and has realized significant dose savings through a strong and continually developing ALARA program. A review of the ALARA program during the current inspection corroborated these earlier observations. Temporary shielding is used liberally; work orders, proposed modifications, and work group procedures receive generally good review by the ALARA group; job coverage by the radiation protection (RP) group appears adequate; and plant upper management in the operations, maintenance, and engineering groups appear to be sincerely involved in ALARA efforts.

As of mid-November 1988, final dose totals for approximately 72% of the 330 currently inactive radiation work permits (RWPs) written for calendar year 1988 job activities were within the projected dose totals. For the approximately 105 currently active RWPs, dose totals for 65% were within the projected totals. A review of selected RWPs indicated that overall, the initial dose estimates were reasonable and not inflated. Although the initial estimate of 404 person-rem for the current refueling outage and the estimate of 550 person-rem for the calendar year 1988 will be exceeded, the licensee appears to have made a good effort to limit dose. The licensee incurred much of the dose on unanticipated outage work and on unusually extensive or first-time modification or maintenance activities. (However, some dose appears to have been incurred because of poor planning or poor maintenance.) Licensee representatives stated that several jobs in containment and the East and West Safeguards Rooms had higher than expected dose totals because of the relatively high radiation field created by the apparent crud burst (see Section 12.d). This apparent crud burst resulted in exposure rate readings of 250 mR/hr at the surface of the refueling cavity pool (with readings in the pool as high as 1 R/hr) and general area readings of 70 mR/hr in the East and West Safeguards Rooms. Several of the jobs that had relatively high final dose totals were reviewed by the inspectors and are discussed below.

Unanticipated outage activities that incurred significant dose included steam generator work (approximately 90 person-rem incurred on eddy current testing, plugging 34 tubes, reinstalling plugs in 11 other tubes, and support activities for the work); examination of all (45 total) control rod drive seal housings (Inspection Report No. 50-255/88025); and repairs to the fuel transfer cart. Anticipated outage activities

that resulted in a significant dose total increment included the complete core offload, the extensive valve work in the East and West Safeguards Rooms and in the "rat's nest" area of containment, preparation for and conducting of reactor head work, installation of excore dosimetry, the extensive work on the safety injection and refueling water tank (SIRW tank), and the hydrolasing of the reactor cavity, spent fuel pool tilt pit, and selected auxiliary building drain lines. According to licensee representatives, during the current outage a dose-total reduction program for reactor head work was initially implemented. This program culminated the two-year efforts of an engineer hired by the licensee to develop the program to increase reactor head work efficiency and save dose. This program reportedly resulted in dose-savings of 40 person-rem this outage. In addition, licensee representatives stated that the work on the SIRW tank included cleaning of the inside of the tank, which had not been done since initial plant startup. This cleaning is expected to reduce the plant source term.

Apparently poorly planned or performed job activities that resulted in increased dose included scaffold erection in containment (twice the projected person-hours and four times the projected 10 person-rem dose), and insulation removal and replacement in support of acoustic monitoring in containment (seven times the projected person-hours and five times the projected 2.8 person-rem dose). In addition to these two examples, the inspectors noted that the licensee incurred unnecessary dose because the maintenance performed on valve SFP-126 on September 20, 1988, was inadequate and the valve required extensive rework. In addition, valve position verification performed on this valve for red tagging purpose after the initial repair was inadequate and resulted in the unintentional pumping of 5400 gallons of spent fuel pool water out through disassembled valves in the Safeguards Rooms (Inspection Report No. 50-255/88023(DRP)). The spill required several days of cleanup efforts and resulted in unnecessary exposure of deconners.

Because of initial poor plant system design and previous poor operational and maintenance activities, the plant has been plagued with hot spots and relatively high general area radiation fields. In the past two years, the licensee has developed and been implementing a plan for radioactive source term reduction. Licensee representatives estimated that the recent removal of five hot spots, including a 900 R/hr hot spot in a shutdown heat exchanger and a 2000 R/hr hot spot in the spent fuel pool tilt pit drain line, will reduce annual dose totals by 6.5 person-rem. (However, during the present outage, a 500 R/hr hot spot developed in the reactor cavity drain line, a 25 R/hr hot spot developed in a shutdown heat exchanger, and a 200 R/hr hot spot developed in the spent fuel pool drain line.) Other hot spots have been catalogued and are slated to be removed in the future. Licensee representatives indicated that preliminary consideration has been given to periodically flush and/or hydrolaze systems and components with recurrent hot spots, such as the tilt pits, the shutdown heat exchangers, and the low-pressure safety injection pumps. For the heat exchangers, the flushing would require a formal jumper, link, and bypass review and could be done during each refueling outage. For the injection

pumps, the flushing could be done during one of the monthly operational surveillances of these pumps. Licensee representatives also indicated that preliminary discussion had been held on formally requiring system engineers to institute maintenance, modification, or operational activities to reduce the source terms of their assigned systems.

In addition to the hot spot reduction efforts, the licensee instituted this outage, for the first time, extensive use of temporary filtering systems to improve water clarity and reduce the activity of the refueling cavity and spent fuel pool water. Three submerged filter/pump systems were installed in the cavity and provided for filtering of the cavity pool water in 6-8 hours. Two other systems, equipped with a skimmer, have also been purchased: one system was used during the refueling outage in the spent fuel pool. In addition to the in-pool filtering systems, modifications have been made to allow inline filtering of the spent fuel pool tilt pit and the reactor cavity drain lines.

While the above described actions of the licensee, and other actions reviewed during this inspection and previous inspections indicate that the licensee is putting forth effort to control worker exposure, the fact that the plant's dose total for 1988 will probably be twice the national PWR average, and the fact that the plant has almost consistently exceeded the national average over the past 11 years, indicate a weakness in the ALARA program that should be aggressively and expeditiously corrected. Much additional effort appears needed to remove radioactive material from the primary system. The licensee's proposed actions to correct this weakness were discussed at the onsite exit meeting, at the December 8, 1988 meeting at the NRC/Region III office, and will be reviewed further during a future inspection (Open Item 255/88021-05).

No violations or deviations were identified; however, a significant program weakness was identified.

14. Access Control for Areas with Radiation Levels >1 R/hr

The inspectors reviewed the licensee's actions to satisfy Technical Specification (tech spec) 6.12.2, which in addition to requiring the use of a radiation monitoring device for entries into areas with radiation intensity greater than 1000 mrem/hr (>1 R/hr areas), requires that locked doors be provided to prevent unauthorized entries into these areas. Keys to these locks are to be maintained under the administrative control of the Shift Supervisor on duty and/or the Plant Health Physicist. Station Procedure No. HP 2.5, Entry Control for High Radiation Areas Over 1R/hr, establishes requirements for entries into >1 R/hr areas. In addition to reiterating the requirements of the tech spec, the procedure lists additional constraints. For example, entries into areas with extremely high radiation levels or the potential for such levels must be made by at least two persons, one of which must be an RPT. These areas include containment with the reactor critical, under the reactor vessel, the purification and fuel pool demineralizer rooms, the

purification filter room, and the spent resin storage tank areas. Entries into other >1 R/hr areas can be made by one individual, if that individual is an RPT, or an operator trained in the use of a dose rate meter (a list of operators qualified to make these entries is maintained at the HP desk at access control). The licensee maintains at the HP desk at access control five copies of the key to the locks for one-person >1 R/hr areas and two copies of the key to the locks for two-person >1 R/hr areas. The keys are distributed by the HP crewleader assigned to the desk and the names of individuals who are given the keys are entered in a log. When the keys are returned to the desk, a notation is made in the log. The shift supervisor also maintains two copies of the one-person >1 R/hr key and one copy of the two-person >1 R/hr key, for emergency use.

At a previous inspection (NRC Inspection Report No. 50-255/87005), the inspector reported a weakness in the licensee's controls over access/egress from >1 R/hr areas. The inspection report described two instances in 1986 where individuals were locked in areas controlled as >1 R/hr areas, and one instance in 1986 where two individuals worked without RP coverage in a >1 R/hr area, contrary to procedure. The licensee's corrective actions for these events have apparently been adequate.

However, discussions with personnel during the current inspection and a review of RIRs indicated that in 1987 and 1988, the licensee has continued to have problems with tech spec-required controls over >1 R/hr areas. On June 10, 1987, as described in RIR 87-021, the door to a >1 R/hr area (around tank T-60) was found by the licensee to be unlocked. On September 30, 1987, as described in RIR 87-029, the NRC Senior Resident Inspector found a door to a >1 R/hr area (602' pipeway) that was open. On December 17, 1987, as described in RIR 87-037, the door to the spent fuel pool heat exchanger room, a 1> R/hr area, was found to be open. Similarly, on September 5, 1988 as described in RIR 88-028, and on September 7, 1988 as described in RIR 88-027, the door to the spent fuel pool heat exchanger room was found to be unlocked. (The inspectors note that the last three instances, all involving the spent fuel pool heat exchanger room occurred during successive outages.)

While the three instances in 1987 apparently can be partially attributed to hardware problems with the doors or locks, the root cause of these events, as well as the two events in 1988, is the failure of plant personnel to lock or close the doors to these areas. Apparently, after each event, the licensee has reemphasized to workers the requirements for entering and leaving these areas; however, this action and other procedural changes made have not been adequate to preclude recurrence. The failures on June 10, September 30, and December 17, 1987, and on September 5 and 7, 1988, to maintain locked doors to prevent unauthorized access to areas >1 R/hr is a violation of Technical Specification 6.12.2 (Violation 255/88021-06). Although these violations were predominantly licensee-identified, licensee corrective measures to date have not been adequate to preclude recurrence.

One violation and no deviations were identified.

15. Facilities/Equipment and Equipment Calibration

The inspectors toured radiation protection facilities, observed equipment in use, and discussed future plans for program improvements. Laundry facility weaknesses and the desirability to relocate the PC storage and dress area and reposition the PCM-1Bs were previously discussed (Sections 12.a and 11.a).

The inspectors reviewed records and relevant procedures for operation and calibration of the Eberline Model PCM-1B whole-body friskers. The station maintains three such friskers at access control and plans to calibrate each monitor on a semiannual basis. Initial calibrations were performed in April 1988 and repeated in August using nominal 100 nCi cesium-137 plate sources (100 cm^2 area). Detector efficiencies for the cesium-137 standard are typically about 12%; frisker alarms are set at 95 dps (about 2.5 nCi). Daily monitor operational checks are performed using a 2 nCi cesium check source. The inspectors reviewed calibration records for the monitors; no problems were noted.

The licensee purchased an automated laundry monitor utilizing gas flow proportional detectors (of about 345 cm^2 area) located above and below and traversing the width of a moving conveyor mesh. In July 1988, the monitor was installed, voltage plateaus determined, and detectors calibrated using the cesium-137 (100 cm^2) plate sources; detector efficiencies are about 12%. Monitor alarms were initially set at 120 cps, corresponding to about 30 nCi over the detector surface area (8 E-5 uCi/cm^2). After the initial surge in PCEs in early August, the monitor alarm setpoint was reduced to 60 cps. An additional similar monitor was leased, calibrated, and put into service in early September. Procedures have been developed for monitor operation/calibration and include daily operational checks using a licensee fabricated cobalt-60 point source. The procedure and calibration records for the leased monitor were reviewed; no problems were noted.

The licensee's whole-body counting program remains as previously described (Inspection Report No. 50-255/87030). During the inspection, the procedure for operating the whole body counter (WBC) was available at the counting facility. The WBC operator was interviewed and was aware of the procedural requirements for whole body counting and reporting criteria. The inspectors reviewed the operation of the WBCs including calibration, functional check, and maintenance activities. Station Procedure No. HP 8.5 outlines operations of the units. Calibrations, functional/operational checks, and maintenance activities are performed by or dictated by the vendor. The licensee does not perform routine functional or operational checks on the WBC and relies on the equipment vendor to inform them of any problems. (Shortly after a count is performed, the data obtained during the count is transmitted to the vendor for further evaluation and refinement.) The licensee is notified if problems are noted and minor adjustments are necessary. To better evaluate counter operation and performance, the licensee should consider

implementing a routine operational check program including the maintenance of related logs and operational trending information. This matter was discussed at the exit meeting and will be reviewed further during a future inspection (Open Item 255/88021-07).

The inspectors reviewed the latest annual calibrations of the WBCs. The calibration methods remain as previously described (Inspection Report 50-255/87030); no problems were identified by the inspectors.

The licensee has budgeted for a new WBC system and intends to purchase a standup Fastscan counter and related hardware and have it operational in early-mid 1989. One of the existing lay-down counters will be maintained as a backup and for its locational detection capabilities. A vendor will continue to analyze WBC results until alternate methods are developed.

No violations or deviations were identified.

16. Tours and Observations (IP 83750, 83729)

The inspectors conducted several auxiliary and fuel building tours and a guided tour of containment. Although auxiliary and fuel building housekeeping was generally good, contamination control and containment housekeeping concerns were noted and include the following:

- Graffiti-laden surfaces in numerous areas of containment. The graffiti was in areas exhibiting radiation levels up to 20 mR/hr.
- Plant process system leaks (Section 12.c).
- Unmarked/unlabeled yellow bagged material (Section 11.d).
- Unsleeved/unmarked cords and hoses across contamination boundaries and other material partially inside contamination control boundaries.
- Lack of sufficient space to properly doff PCs at the containment manway SOP.
- Lack of sufficient contamination control boundary demarcation- to reduce inadvertent entry.
- One of two ingress points to a "clean" area in the auxiliary building posted as a contamination area.

The inspectors performed direct radiation and smear surveys of selected "clean" equipment and areas in the auxiliary building; no significant problems were identified.

17. Contractor Worker's Information Requests

On September 16, 1988, a contractor employee contacted the NRC Resident's Office requesting confirmation of certain statements made to the employee and others in his work group by members of the licensee's radiation

protection staff. Subsequently, an NRC Radiation Specialist and the Senior Resident Inspector met with a group of approximately 20 contractor employees to listen to their concerns. Two questions from the workers, one involving asbestos removal requirements and the other involving verification of proper scaffold construction, were referred to the licensee because they concerned industrial safety matters not within the NRC jurisdiction. Four other questions or concerns about the validity of statements made by the radiation protection staff, were reviewed by NRC Radiation Specialists. The questions/concerns and the results of the review are discussed below.

- RP staff have stated orally and in memoranda that the designation of "dedicated" RPT coverage on an RWP does not mean that the RPT assigned to a job must remain in "line-of-sight" of the workers on that job; however, several contractor workers remember being told in General Employee Training (GET) that "dedicated" coverage meant that the RPT must remain in "line-of-sight" of the workers.

  During a previous inspection (Inspection Report No. 50-255/87005), the inspector expressed a concern about the definition of "dedicated" radiation protection coverage. In response, the licensee clarified the definition, as stated in Administrative Procedure No. 7.03, Radiation Work Permit. The definition does not require RPTs to remain in "line-of-sight" of workers unless there is a good potential for a sudden increase in radiological hazards. However, discussions with licensee personnel, in response to the contractor concerns, indicated that some individuals need to be apprised of the definition. The lead GET instructor and several RPTs stated that "dedicated" coverage did require RPTs to remain in line-of-sight of workers. Whereas this interpretation is conservative, it may not be in keeping with good ALARA practices and may confuse workers on what is actually required by dedicated RP job coverage. The inspectors informed RP management of the discrepancy and the need to correct it. The licensee agreed to resolve the situation. The success of the resolution will be reviewed during a future inspection (Open Item 50-255/88021-10).

- There are not enough deconners. RP staff stated there were enough.

  The NRC inspectors discussed deconner staffing levels with RP management (see Section 12.d). They conceded that staffing level was less than desirable early in the refuel outage because of the sudden, unanticipated onset of the outage; however, after several weeks, staffing was increased up to the desired level.

- Respirator requirements appear inconsistent, e.g., on one shift for a particular job respirators may be required, yet on a subsequent shift, for the same job, and with no apparent change in radiological conditions, respirators may not be required.

A review of WBC records indicated that the licensee's internal exposure control program has been successful to limit uptake of radioactive material. A review of air sample records indicated that typically airborne radioactivity is less than 1-2 MPC. As with most other utilities, Palisades guidelines for requiring the use of respirators are conservative. Discussion with RP staff indicated that early in the outage, respirator requirements, as well as protective clothing requirements, did change more often than usual for some jobs, as the RP staff tried to compensate for the relatively high air temperature and humidity, lower than desirable deconner staffing level, and the relatively high number of personal contaminations. Based on the results of the WBCs, the NRC inspectors identified no problems with the licensee's establishment of respirator requirements; however, it is noted that the licensee needs to take stronger informational action to resolve the inevitable confusion that will arise in workers because of changing radiological protection requirements.

- Protective clothing is responsible for contaminating workers.

  RP management readily concedes that so-called "clean" protective clothing has been the cause of a fair number of personal contaminations. Apparently the licensee has been trying to correct this problem throughout the outage. The licensee's corrective actions for this concern are discussed in Section 12.

During the initial review of these issues by the NRC, the licensee's RP management met with the contractor group to discuss these issues and others. Discussions with licensee representatives after the meeting and a review of a written summary of the discussions at that meeting indicated that the meeting was a worthwhile airing of concerns for both groups and a good exchange of information. The inspectors noted that similar meetings might be considered for future outages to ensure a better working relationship.

No violations or deviations were identified.

18. Review of Radiological Protection Considerations Taken During Recent Events

The inspectors reviewed radiological protection considerations taken during several recent events. These events, involving potentially high radiation and/or contamination levels, were (1) the freeing of a stuck fuel assembly from the upper guide structure, (see Inspection Report No. 50-255/88018); (2) repair of the fuel transfer cart prior to core offloading; (3) cleanup and decontamination of the East and West Safeguards Rooms after 5400 gallons of water from the spent fuel pool were pumped into the rooms (see Inspection Report No. 50-255/88023); and (4) removal of a 2000 R/hr hot spot in the spent fuel pool heat exchanger room.

Radiological protection considerations taken by the licensee during events 1 through 3 appeared adequate. Overall, doses received by workers appeared to have been kept as low as practicably. One exception to this involved a diver who was assisting in the repair of the fuel transfer cart. Because of a leak in the diving suit, the diver became contaminated with a hot particle, which resulted in a dose to his thumb of approximately 4 rem. The dose to the diver from the contamination is discussed further in Section 9.

Regarding Event (4), as discussed in Inspection Report No. 255/88006(DRSS), and in Section 13 of this report, a 2000 R/hr hot spot developed in and was eventually removed from the drain line for the spent fuel pool tilt pit. A review of the completed work packages for removal of the hot spot indicated that, overall, job activities were well planned and executed. In view of this, Open Item No. 255/88006-01 is closed. Notwithstanding the overall good effort, the inspectors did note that for the initial entry, on January 6, 1988, an RPT received a whole-body dose of approximately 650 mrem, a radiation protection supervisor accompanying the RPT received approximately 300 mrem,and an auxiliary operator received approximately 170 mrem. The workers entered the area to open several valves on the drain line, to attach a high-range radiation probe to the drain line, and to hang temporary shielding around the hot spot. The workers were in the area for approximately 25 minutes. The dose received by the RPT was the highest dose incurred by any individual during the hot spot removal. Considering that another entry was made on the next shift to perform a survey (partially to provide information for a shielding evaluation), the dose received by the RPT appears excessive. Doses received by workers during subsequent evolutions were reasonable. The inspectors' review of the job also included a review of selected engineering evaluations conducted for temporary shielding hung around the hot spot. Licensee representatives stated that no evaluation was done for the shielding that was hung during the initial entry. Station Procedure No. HP 1.6, Revision 1, Control and Use of Shielding and Associated Equipment, the procedure on shielding that was in effect at the time of entry, required an engineering evaluation be conducted prior to installing any shielding equipment. This apparent discrepancy will be reviewed further at a future inspection (Unresolved Item 255/88021-08).

No violations or deviations were identified; however, one unresolved item was identified.

19. Exit Meeting

The inspectors met with the licensee representatives (denoted in Section 1) at the conclusion of the onsite inspection on November 22, 1988, and at the NRC/Region III office on December 8, 1988. Further discussions were conducted by telephone from November 23 through December 7, 1988. The inspectors summarized the scope and findings of the inspection. The inspectors also discussed the likely informational content of the inspection report with regard to documents and processes reviewed by the inspectors during the inspection. The licensee did not identify any such documents or processes as proprietary. The following matters were discussed specifically by the inspectors:

a. The violation of the tech spec requirement to provide adequate access controls for high radiation areas greater than 1000 mR/hr. (Section 14)

b. The weaknesses in the personnel contamination control and ALARA programs. (Section 12 and 13)

c. The apparent need to improve marking/labeling of RAM bags, MPC-hr methodology, and the PCM-1B locations. (Sections 10 and 11)

d. Inspector concerns regarding the apparent lack of an adequate engineering evaluation before shielding installation. (Section 18)