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Report No. 80-16 Health Physics Appraisal Program

Docket No. 50-285

License No. DPR-40

Licensee: Omaha Public Power District (OPPD)
1623 Harvey Street
Omaha, Nebraska 08102

Facility Name: Fort Calhoun Station (FCS)

Appraisal at: Fort Calhoun, Nebraska and OPPD Corporate Offices in Omaha, Nebraska

Appraisal Conducted: September 15-26, 1980

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Inspection Summary

Appraisal on September 15-26, 1980 (Report No. 50-285/80-16)

Areas Appraised: Announced appraisal of the Health Physics Program, including organization and management, personnel selection, qualification and training, external and internal exposure controls, radiation surveys, access and contamination controls, radioactive waste management, ALARA, facilities and equipment, and emergency response capabilities. The appraisal involved 312 appraiser - hours on-site by two NRC Radiation Specialists and two NRC Contract Health Physicists.

Results: Several significant weaknesses in the Health Physics Program were identified. These weaknesses are in the areas of organization and staffing (Section 1), personnel selection, qualifications and training (Section 2), external exposure controls (Section 3.1), internal exposure controls (Section 3.2), and radiation surveillance (Section 4.0). Three apparent items of noncompliance were identified: Qualifications of staff not in accordance with technical specifications (Section 1); Failure to label containers containing radioactive material (10 CFR 20.203(f)) (Section 5); Failure to provide the record of exposure to each worker who terminates work at the facility. (10 CFR 20.409) (Section 3.1).

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SUMMARY

The Special Health Physics Appraisal was conducted during the period September 15-26, 1980, to evaluate the adequacy and effectiveness of Fort Calhoun Station's (FCS) overall Health Physics Program. At the time of the appraisal, FCS was operating at 100% power and major work consisted of seismic support placement in the auxiliary building. One appraisal team member entered containment on September 18, 1980, to observe respirator use, sample collection and radiological work practices.

The Appraisal Team consisted of two inspectors from the NRC Region IV office and two contractor personnel; one from Texas A&M University and one from Battelle Pacific Northwest Laboratories. The appraisal effort included observation of work practices, interviews with OPPD and contract personnel, independent measurements, and a review of selected procedures and records. The scope of the appraisal included:

A. Radiation Protection Organization and Management

B. Personnel Selection, Qualification and Training

C. External and Internal Exposure Controls

D. Radiation Protection Surveillance

E. Access Controls/Contamination Controls

F. Radioactive Waste Management

G. ALARA Program

H. Facilities and Equipment

I. Emergency Response Capabilities

Weaknesses in the FCS Health Physics Program were identified in several areas. Items the appraisal team considered significant weaknesses are as follows:

1. The plant organizational structure is such that the radiation protection manager function is not independent of station divisions whose primary responsibility is operations. The number of qualified health physics technicians on the permanent HP staff is insufficient to meet the needs of the HP group.

2. The training program for health physics technicians does not contain all the elements specified in the training manual and in addition, systems training and staff re-training has not been conducted. Selection criteria has not been established for health physics technicians and at least one technician did not meet the experience requirement specified in ANSI N18.1-1971.

3. Full and current calibration of monitoring devices for beta, gamma and neutron radiations have not been conducted. Quality control measures such as TLD-pocket chamber comparisons and analysis of test and control badges used to measure the performance of the dosimetry program.

4. The internal dosimetry program does not have procedures which contain biological models and calculational techniques necessary to assess the results of direct and indirect bioassay measurements in terms of intake limits specified in 10 CFR 20.103. Procedures do not contain information on internal dosimetry equivalent to that found in ANSI N343-1978.

5. The radiation surveillance program was considered weak in that portable instrument calibrations and check sources response practices were not in accordance with ANSI N323-1978, procedures did not speak to instrument selection for non-routine surveys and surveillance activities for alpha in air and beta dose rate for certain jobs was limited. In addition, the exclusive use of high volume sampling brings into question the representativeness of measurements to actual worker exposure. The plant's inventory of portal monitors, friskers and hand and foot monitors, cannot, using present techniques, measure contamination levels on personnel, clothing and laundry at the limits established by plant procedures.

Additional weaknesses which are considered important but less significant than the above findings are identified in the conclusions to each report area.

In addition to the weaknesses described above, three items of noncompliance with NRC requirements were identified as follows:

1. One health physics technician did not meet the applied radiation protection work experience specified section 4.5.2 of ANSI N18.1-1971 and section 5.3.1 of the technical specifications.

2. Contrary to 10 CFR 20.203(f), containers of licensed material were not labeled with the radiation caution symbol and the contents identified.

3. Contrary to 10 CFR 20.409(b), a report of exposure for two individuals who terminated employment with OPPD were not sent to each individual.

1.0 Radiation Protection Organization and Management

Documents Reviewed

FCS Technical Specifications, Appendix A to Operating License No. DPR-40

FCS Standing Order No. T-1, "Radiation Protection Manual"

FCS Radiation Protection Manual

OPPD QA Manual

OPPD QA Procedures

QA Audit Reports

FCS Position Descriptions

FCS Standing Order No. G-5, "Plant Review Committee"

1.1 Description

The Fort Calhoun Station (FCS) organization in place at the time of the appraisal is depicted by the chart in Figure 1. The organizational structural depicted is the same as that specified in Figure 5-2 of the FCS Technical Specifications. The radiation protection organization, shown in Figure 2., is directed by the Supervisor-Chemistry and Radiation Protection (Supervisor-C/RP) who reports administratively to the Supervisor-Technical. The Supervisor-Technical and the Supervisors of Maintenance and Operations are on the same organizational level and individually report to the Manager-FCS. The Supervisor-C/RP functions as the "Radiation Protection Manager" (RPM) as defined in NRC Regulatory Guide 1.8; however, there is no "RPM" job description or position title in the official organizational structure of FCS. Reporting to the Supervisor-C/RP are a Plant Chemist and Plant Health Physicist who supervise the daily activities in chemistry and health physics, respectively. The chemistry and health physics staffs consist of permanently assigned personnel as well as a pool of C/RP shift technicians who rotate between chemistry and health physics assignments. Omaha Public Power District (OPPD) does not have a radiation protection organization or individual at the corporate level but provides some radiological engineering, environmental monitoring and personnel dosimetry support through the Technical Services Section of the Production Operations Division.

As previously stated, there is no corporate office radiation protection organization or health physicist. The Appraisal Team does not consider this to be a significant weakness in the overall radiation protection program but recommends that OPPD look into the feasibility of establishing such a staff function at the corporate office level. In order to be effective, the Team feels that an individual in this capacity should have RPM qualifications in accordance with NRC Regulatory Guide 1.8 and should devote a major part of his time to radiation protection programs. The individual should also be capable of providing a high level of technical assistance to the Station and serve as a backup RPM during periods of extended absence of the on-site RPM.

The organization described above places the supervisor assigned the RPM responsibilities at a reporting level below that of operations and maintenance, and although FCS procedures state that the Supervisor-C/RP is responsible to the Manager-FCS for radiological health and safety, it appears to the Appraisal Team that this places an unwarrented administrative burden on the Supervisor-Technical as well as generating concerns about the RPM's independence and authority to administer the radiation protection program. Guidance on the placement of RPM functions in station organizations is contained in NRC Regulatory Guide 8.8, which recommends, in Section C.1.b.c., that "The Radiation Protection Manager (RPM) (onsite) has a safety-related function and responsibility to both employees and management that can best be fulfilled if the individual is independent of station divisions, such as operations, maintenance or technical support, whose prime responsibility is continuity or improvement of station operability." Therefore, the Appraisal Team feels that the organizational structure at FCS should be modified so that the individual designated as RPM reports directly to the Manager-FCS. Discussion of the this matter with the Manager-FCS indicated that a revised Station organization has been proposed and is under review to elevate the Supervisor-C/RP (and RPM) position to the same reporting level as the Supervisors of Technical, Maintenance and Operations. The Appraisal Team considers this reorganization to be appropriate and supports this proposal.

1.2 Scope of Responsibilities

The scope of authority and responsibilities for the radiation protection program is set forth in Section 1.0 of the FCS Radiation Protection Manual and Standing Order No. T-1, "Radiation Protection Manual". The Radiation Protection Manual establishes the basic radiation protection requirements and procedures for control of exposures to Station personnel as well as to visitors and the general public. Standing Order No. T-1 requires all personnel to adhere to the provisions of the Manual, and describes the authority of the Plant Health Physicist and Supervisor-C/RP in identifying

and authorizing corrective action for radiological matters when necessary. The appraisers noted that neither the Manual nor the Standing Order establish the authority of C/RP technicians to stop work in the event that unexpected radiological conditions or violation of procedures are encountered. Discussions with Station personnel indicated that the C/RP technicians do have this authority and use it when necessary. Standing Order No. T-1 also designates program responsibility for day-to-day activities in the radiologically controlled area to the Plant Health Physicist. In addition, the general responsibilities of each supervisor and individual in complying with radiological protection procedures and keeping exposures as low as reasonably achievable are established.

An appraiser reviewed job descriptions for the functional positions within the radiation protection program to determine if the responsibilities and duties for each position were clearly defined. Job descriptions reviewed included Supervisor-C/RP, Plant Health Physicist and Plant Chemist. No job descriptions were available for the C/RP technicians but job duties and responsibilities statements for OPPD performance appraisals for bargaining unit C/RP Technician I and II positions were reviewed. The appraiser noted that the supervisory job position descriptions are primarily orientied to classification or position justification and the technician statements are too general to fully describe their job duties and responsibilities. The Appraisal Team recommends that attention be given to more clearly defining specific duties, responsibilities and authority for supervisors and technicians when the new organization is implemented.

The C/RP shift technicians are assigned either to health physics or chemistry duties on day shifts and specialize in these areas during their assignments. Technicians assigned to back shifts perform basic chemistry in support of operations in addition to providing health physics coverage. During the appraisal it was noted that C/RP personnel specific work assignments had been established and documented in a memorandum which was posted for reference by the staff. Within the C/RP group special assignments to technical specialties such as dosimetry, whole body counting, ALARA and respiratory protection were made but there were apparently no provisions to maintain a high degree of technical competence in these areas by supplemental training or instruction. The rotation of shift technicians between chemistry and health physics also brings up the potential problem of maintaining the quality of performance in these areas with the increasing technical requirements. Discussions with Station personnel indicated that separation of these functions where possible is being explored and the Appraisal Team concurs with developments in this direction.

1.3 Staffing

The Chemistry and Radiation Protection staff under the Supervisor-C/RP at the time of the appraisal consists of one Plant Health Physicist with two staff C/RP Technician positions, one Plant Chemist with one staff C/RP Specialist and one Chemist position, and seven shift C/RP Technician positions. One part time clerk position was also authorized. Health physics coverage is provided twenty four hours a day, seven days per week by rotating shift technicians during normal operations and special shift assignment during outages. The C/RP staffing is supplemented by approximately 12 to 14 contract HP technicians ("rent-a-techs") during outages as well as 2 to 4 assigned during normal operations. The normal Station staffing is approximately 135 personnel with about 700 personnel on-site during a typical refueling and maintenance outage. Additional supervision of OPPD technicians and rent-a-techs on the back shift during outages is obtained by appointment of senior OPPD technicians as "crew chiefs" to coordinate and oversee health physics activities.

Observations during the appraisal and discussions with Station personnel in regard to staffing indicated problems in maintaining staff to fill responsible positions and authorized staffing levels. Both the Plant Chemist and Plant Health Physicist positions had been vacant prior to the appraisal and were filled with appointees to be effective October 1, 1980. During the appraisal one C/RP technician terminated and the possibility of at least one additional experienced C/RP technician departure was identified. These staffing and turnover problems appear to be very important to the continuity and effectiveness of the radiation protection program. The appraiser noted that this had been recognized as a significant problem by Station management and identified in an audit of the radiation protection program performed by a consultant at FCS in July 1980. It was also noted that this problem was being addressed by Station management and the proposed reorganization includes additional staffing of the C/RP department. The Appraisal Team considers improvements in staffing of the radiation protection group to be appropriate.

1.4 Review and Audit

OPPD quality assurance (QA) audit and review requirements related to radiation protection are set forth in the OPPD QA Manual, together with implementing procedures, and FCS Technical Specifications, Section 5.5.2. QA auditing of this area is primarily conducted by an QA-Operations group located at FCS. The QA-Operations group performs annual audits including radiation exposure control and documentation, radioactive waste activities, environmental monitoring, instrument calibration, and emergency planning. In addition this group conducts limited scope nonroutine audits ("mini-audits") on an unannounced basis approximately on a monthly basis. Necessary expertise in health physics related areas audited is provided by auditors who have had Navy nuclear experience. Corporate QA audits

in this area are primarily related to qualification of vendors of equipment or services. During the appraisal, selected audit reports of the types referred to above were reviewed for scope, depth and handling of items requiring responses and/or corrective actions. In general the audit program appeared to be well done within the scope of the QA program and responses to audit findings were, for the most part, timely and adequate.

Independent reviews and audits required by the Technical Specifications are conducted by the Safety Audit and Review Committee (SARC) on a frequency related to the safety significance of the item. SARC audits and reviews do not examine the radiation protection program as an entity but look at Station performance which overlaps in the areas of conformance to Technical Specifications, training and qualifications, emergency plan and implementing procedures, violations or deviations and corrective actions etc. Some knowledge of radiation protection is provided by consultants who are members of SARC, however, SARC does not have a member who is qualified in radiation protection. The Appraisal Team feels that OPPD should give consideration to instituting a comprehensive radiation protection program review or audit by the SARC on a biennial basis to evaluate the overall management and performance of the program.

In addition to QA audits and SARC reviews, the Production Operations Division has implemented a weekly review of acceptability of corrective actions to various requirements generated in operations incidents, QA audit reports, licensee event reports (LER) and NRC inspection reports. Follow-up actions are identified if appropriate and assigned for tracking. A review of selected minutes of these meetings was performed by an appraiser and it was noted that radiation protection matters are addressed. This appears to be a good vehicle for maintaining management cognizance of Station performance.

1.5 Communications

Communications within the C/RP staff and with other Station departments appeared to be adequate. The relatively small staff facilitates communications between the Plant Health Physicist and the technician staff as well as between the technicians on shift. Daily shift turnover meetings during outages are held and a health physics log is maintained which serves to document routine as well as nonroutine activities during the shifts. The Supervisor-C/RP meets with the Plant Health Physicist and Chemist roughly on a weekly basis as well as the Supervisor-Technical on the same basis. A staff meeting with all available C/RP staff is also routinely held at the end of the week to discuss program requirements and changes. Cognizance of significant maintenance and operations is maintained through the Plant Review Committee (PRC) meetings and reviews which the Supervisor-C/RP participates in as a member. Radiation protection representation is also present at maintenance meetings and outage planning meetings.

During discussions with health physics personnel it was stated that there is no routine review and sign-off by health physics personnel on maintenance orders. Maintenance that would appear to require a RWP is sent to C/RP. However, the personnel making this decision are not necessarily qualified in radiation protection or ALARA practices and also this does not appear to provide adequate review of maintenance procedures necessary to insure that appropriate consideration is given to incorporatiing health physics and ALARA provisions in procedures prior to issuance. During planning for outages, health physics staff are involved in the overall planning efforts.

1.6 Conclusions

Based upon the above findings, improvements in the following areas are required to have an acceptable program:

1. The Station organization should place the Radiation Protection Manager function at the same reporting level as Operations, Maintenance and Technical.

2. The necessary steps should be taken to stabilize radiation protection staff turnover and increase the C/RP staffing level consistent with current plans under consideration.

Other areas of the organizational and management aspects of the health physics function appear acceptable, however the following items should be considered for improvement:

1. Establish a biennial review or audit by the SARC for a comprehensive evaluation of the radiation protection program management and performance.

2. Establish an off-site radiation protection function at the corporate level with a minimum of one individual RPM qualified in accordance with NRC Regulatory Guide 1.8.

2.0 Personnel Selection, Qualifications, and Training

Documents Reviewed

FCS, Health Physics Personnel Training Records

FCS, C/RP Qualifications Records

FCS, Training Manual

ANSI-N18.1-1971, Selection of Personnel for Nuclear Power Plants.

Regulatory Guide 1.8, Personnel Selection and Training

2.1 Personnel Selection

FCS Technical Specifications requires that each member of the plant staff will meet or exceed the qualifications set forth in ANSI N18.1-1971. The C/RP Supervisor stated that ANSI N18.1 provides the selection criteria for new employees. There is no further documentation of personnel selection criteria. Contractor health physics technicians are selected after the C/RP Supervisor reviews a qualifications sheet submitted by the contractor company. Selection is presumably based upon ANSI N18.1 requirements.

2.2 Personnel Qualifications

FCS Technical Specifications requires that the C/RP Supervisor will meet Regulatory Guide 1.8 (1975) requirements. The incumbent presently meets the RPM qualifications listed in the Regulatory Guide.

The remainder of the C/RP department consists of a plant health physicist, plant chemist, chemist, C/RP specialist (Chemistry), eight C/RP technicians, a part-time clerk, and four IRM contractor C/RP technicians. However, of the eight regular C/RP Techs one left during appraisal period, one was planning to leave, one does not work shifts, and two were very new and not ANSI N18.1 qualified. All but one of the four contractor techs appeared to be ANSI qualified but that one was placed on a back-shift with one of the new FCS technicians who was also not ANSI qualified. There did not appear to be a well defined written program for seeing that the new technicians became qualified in a timely manner.

The Quality Control Department at FCS certifies the C/RP personnel for qualifications, but this is based on ANSI/ASME N45.2.6, "Qualifications for Examination, Inspection, and Testing Personnel," rather than ANSI N18.1. In reviewing the QC listings for qualifications they used all experience as applying to radiation protection rather than restricting it to experience "in their specialty" as stated in ANSI N18.1 section 4.5.2.

The failure to provide a ANSI N18.1-1971 qualified health physics technician for the backshifts of September 24, 1980 constituted non-compliance with section 5.3.1 of the FCS technical specifications.

2.3 Training

Health Physics training at FCS consists of three categories; general employee training (GET), special training, and health physics technician training. The training coordinator schedules training in the first two categories but he does very little of the actual health physics training. The plant training manual lists all training done at the plant including health physics but the training coordinator's records reflect only the information provided by the C/RP department on each individual technician's training progress.

2.3.1 General Employee Training (GET)

The length and content of training received by FCS personnel is determined by the color of badge they will wear and thus by the access limits to be imposed on them. Full unescorted access or Red Badge, is only attained by progression through "Blue Badge" status with additional training required at each step. Blue Badge training includes the general health physics material as well as requirements for demonstration of ability to read and recharge pencil dosimeters, demonstrate familiarity with the facility including area monitors and emergency access and equipment, use of protective clothing and contamination control procedures. A test is given at the end requiring at least 70% to pass. The red badge training is in addition to blue badge training and includes further demonstration of abilities in radiation safety, decontamination, ALARA, and plant access and contamination procedures. Total training for the red badge is two to three days and requires approval by the HP instructor, plant health physicist, and the C/RP Supervisor. The training coordinator stated that portions of the GET are given to all employees each year so that all the material is covered in a two year period as retraining. The training coordinator schedules each employee for this retraining, including offsite personnel who are badged, and pulls their badge if they do not show up.

2.3.2 Specialized Training

There are two types of specialized training at FCS; respiratory and emergency plan. Respiratory training is conducted at the time of the GET if an employee is to be a radiation worker. Records of the training are maintained in the personnel training record file.

Emergency response teams have been established at FCS with specific functions to be carried out during an emergency. Each team has a list of its specific functions and is trained and retrained annually for those functions. No specialized training is conducted at FCS for individual department personnel directed at the health physics aspects of their particular job functions.

2.3.3 Health Physics Technician Training

Each C/RP Technician at FCS has a personal training record folder consisting of several sections of training topics and areas related to his job functions. The total folder is called the Health Physics Study Guide and Record and consists of: I. General Employee Training; II. Health Physics Monitor Study Guide and Record; III. Health Physics Senior Monitor Study Guide and Record; and IV. Health Physics Technician Study Guide and Record.

The C/RP Supervisor stated that sections I and II must be completed and signed off before a technician can become a shift technician. Review of the individual records, however, showed that this policy was not being followed since only one or two of the technicians on shift had both sections completed and totally signed off. Topics listed in the four sections of the training guide cover job functions, instruments and procedures but there is no plant systems training listed nor any evidence that systems training is given. Informal conversations with the shift technicians indicated that they felt they had not been adequately trained, especially in plant specific areas.

The contractor health physics technicians on site appeared to have adequate experience, except for one technician assigned to a back-shift who did not meet ANSI N18.1 experience requirements. The experienced contractor techicians had been issued Health Physics Study Guide and Record folders but only the "Practical Factors" portions had been considered necessary. They also had received no plant systems training.

Each individual technician was responsible to have his training record signed off and the result was that only one folder was complete; that of a technician who had been on site for approximately five years.

There was no evidence of a retraining program in health physics except for the GET retraining required by the training coordinator. Training sessions for health physics technicians were being scheduled and held during the appraisal visit but their relationship to the formal training program and job qualifications was not clear.

2.4 Conclusions

Based upon the above findings, improvements in the following areas are required to have an acceptable program:

1. Establish written selection criteria for the qualifications of health physics technicians.

2. Establish a program or system that will certify and document health physics technician qualifications as specified in ANSI N18.1-1971.

3. Improvements in the health physics training program to include all elements specified in the training manual, plant systems training and periodic re-training.

3.0 Exposure Control

3.1 External Exposure Control

Documents Reviewed

FCS, Dosimetry Reports

FCS, Personnel Exposure Records

OPPD Technical Services, Procedure PO-TSOP-1

RCS, Results of Interlaboratory Comparisons

FCS, Radiation Protection Manual

3.1.1 Dosimetry Program

FCS has its own personnel radiation dosimetry program and does its own processing of badges. Dosimeters are two-chip TLD badges for beta-gamma dosimetry and albedo-type TLD neutron dosimetry consisting of Li-6 and Li-7 chips sandwiched between cadmium filters. The basic system is a Harshaw badge with automatic reader and computer processing and printout.

No full calibration is done on the TLD badges. Badge sensitivity factors are determined by exposing each to one dose (132 mR) and linearity is assumed. Neutron sensitivity factors were determined at the plant one time several years ago and no other calibration has been done. A review of exposure records showed that neutron doses of up to several hundred mrem have been reported from badge data but no analysis of that data versus instrument reading and exposure time has been done.

Day to day control of personnel gamma exposure is accomplished using pocket ionization chambers, usually one 0-200 mR and one 0-500 mR chamber, worn together. Neutron doses are recorded on a daily log based upon survey meter readings and time of stay. Beta skin doses from exposure to Xe-133 and other noble gases in the containment atmosphere are done by isotopic analysis of an air sample and computer calculation of total skin dose.

Extremity doses are monitored on special occasions by attaching TLD's to the extremities. These doses are read and recorded but are not on the regular monthly report.

Health Physics personnel enter the daily exposure data into the computer system and can call up an exposure up-date at any time.

These updated reports are posted at the control point for entry into the controlled access areas. Since each worker reads and records his own chambers, agreement between monthly TLD, which is the official record, and summaries of daily readings is not very good.

3.1.2 Exposure Review

The exposure update printout is posted outside the health physics office and the controlled access entry point. It consists of TLD badge data to the last available reading plus daily log data since that date. Anyone may review the printout and it serves as the guide for exposure limitations.

The monthly TLDs are sent to OPPD Technical Services in Omaha for processing. A preliminary report is prepared and sent to FCS for review and reconciliation with any discrepancies. This in-plant review is done by C/RP technicians and the supervisor. After reconciliation a final, official report is issued by Technical Services. The final report is reviewed and signed-off by the C/RP Supervisor. He also makes an annual report to the ALARA Committee for their review. The monthly report includes TLD reading plus any calculated doses such as beta skin dose due to exposure to noble gases.

3.1.3 Exposure Limitations

Personnel exposure limits at FCS are based on 10 CFR 20 with daily and weekly limits listed in section 2.3 of the Radiation Protection Manual. Normal working limits are 100 mrem per day, 300 mrem per week, 1250 mrem per calendar quarter and 5000 mrem per year. During major maintenance and refueling, the limits become 300 mrem per day, 900 mrem per week, and 2400 mrem per quarter. Plant policy is to maintain the 5000 mrem per year limit at all times if possible. The higher limits require exposure history forms to be filled out. There is a plant procedure for exceeding the daily and weekly exposure limits requiring approval of the Plant Manager and the C/RP Supervisor.

3.1.4 Quality Assurance/Quality Control

The TLD program uses irradiated standards at periodic intervals in the reading of badges. All (TLD standard) cards are exposed to approximately 132 mR and one is placed at the start of each loading of the automatic reader and one following each 60 personnel cards.

Each month Technical Services (Omaha) sends beta-gamma badges to Battelle at Hanford for exposure and compares their results with Battelle's reported doses. Neutron exposures are also done periodically. OPPD reports consistent agreement with Battelle but they have adjusted their sensitivity factors so that they do get agreement. Different sensitivity factors are used for the FCS personnel badges. OPPD also has participated in the University of Michigan Program for evaluating the quality of personnel dosimetry systems.

FCS C/RP technicians expose test badges each month to their calibration source. They expose each of 3 badges to a different gamma dose and record the results in a log book. There was no summary of past data and no analysis of the results. Review of the raw data indicated that agreement between exposure and reported doses was not very good.

The computer dosimetry update has provisions for listing those pocket chamber totals which vary widely from the TLD reported doses. Plant Standing Order T-10 Section 4.2 says an investigation will be conducted for all exposures over 100 mrem in which pencil and TLD disagree by greater than 25 percent. There were many cases where the limits of disagreement had been exceeded but only one investigation was documented.

There are no performance requirements established at the Station concerning the quality and performance of TLD and pencil dosimeter programs. The performance testing of the pencils does not meet the ANSI N13.5-1972 "Performance Specifications for Direct-Reading and Indirect-Reading Pocket Dosimeters for X and Gamma Radiation," and Regulatory Guide 8.4 "Direct Reading and Indirect Pocket Dosimeters." Pocket dosimeters are checked twice a year for 24 hour drift (limit 4 mR) and checked at two exposures, 75 mR (-11) and 150 mR (+22), or approximately ±15% which is less restrictive than the ANSI Standard N13.5, "Performance Specifications for Direct Reading and Indirect Reading of Pocket Dosimeters for X and Gamma Radiation." None of the other tests identified in this standard are performed. Health Physics personnel have noted a recent increase in the rejection rate of the pocket dosimeters. This rate would be even greater if the ±10% rejection requirement were followed. The calibration of the pencils is performed using a commercial instrument calibrator. The exposure time and exposure geometry is not precise. No test has been performed to determine beam uniformity nor to determine the impact of scatter on the dose rate at the calibration point.

3.1.5 Exposure Records

The basis of a good occupational exposure record system exists because of a C/RP technician's effort to develop individual folders for each plant worker. However, there are no written requirements for the records that are to be placed in each individual's folder. ANSI N13.6, "Practices for Occupational Radiation Exposure Records System," should be reviewed to identify all elements of an occupational exposure records system including the historical records necessary to establish the quality of the health physics program at the station.

On October 22, 1979 an OPPD QA Deficiency Report was written citing the failure to identify in a timely manner the OPPD personnel who were badged at FCS but exposed at another facility and then terminated. The QA inspectors noted two cases of terminated employees not being issued an exposure report. They recommended a mechanism be devised to notify Health Physics of people leaving OPPD so final exposure reports could be sent. During the appraisal period, no response had been made to the QA Deficiency Report and no action had been taken. Review of the inactive exposure files revealed that the problem still existed and some termination exposure reports were not being made in accordance with 10 CFR 20.409. The failure to provide a record of exposure for two individuals who terminated work at FCS in December 22, 1979 and August 15, 1979 constituted noncompliance with 10 CFR 20.409(b).

3.1.6 Conclusions

Based upon the above findings, improvements in the following areas are required to have an acceptable program:

1. Perform full calibrations for beta, gamma and neutron dosimeters using sources and energies typical of plant activities.

2. Improvements in quality control measures such as TLD-Pocket chamber comparisons, and analysis of test and control badges used to evaluate dosimetry system performance.

Other areas of the external dosimetry program appears acceptable, however, the following items should be considered for improvement:

1. Establish a calibration and performance testing program for pocket dosimeters consistent with guidance in ANSI-N13.5-1972 and Regulatory Guide 8.4.

2. Establish a worker exposure record system that would contain all the information specified in ANSI N13.6.

3.2 Internal Exposure Control

Documents Reviewed

FCS, Standing Order No. T-11, "Respiratory Protection Program"

FCS, Radiation Protection Manual

FCS, Radiation Protection Procedure RPP-4, "Radiation Protection Procedure for Possible Inhalation or Ingestion Hazards"

FCS, Radiation Protection Procedure RPP-6, "Radiation Protection Procedure for Protective Clothing and Respiratory Equipment Cleaning"

FCS, Radiation Protection Procedure RPP-13, "Recharging SCBA Cylinders"

FCS, Health Physics Procedure HP-1, "Whole Body Counting Procedure"

FCS, Health Physics Procedure HP-2, "Respirator Fit Test Quantitative Man Sodium Chloride Aerosol Method and shutdown of unit"

FCS, Health Physics Procedure HP-6, "Respirator Canister Testing"

FCS, Health Physics Procedure HP-7, "Annual Review of Personnel Authorized to wear respirators"

FCS, Standing Order No. T-8, "Routine Health Physics Surveys and Reports"

Memorandum - Installation of Air Line Respirators.

Helgeson Nuclear Services, Inc. Whole Body Count Reports.

3.2.1 Dosimetry Program

The licensee's internal exposure assessment and dosimetry program is detailed in the Radiation Protection Manual, primarily in Radiation Protection Procedures RPP-4, "Radiation Protection Procedure for Possible Inhalation or Ingestion Hazards" and Health Physics Procedure HP-1, "Whole Body Counting Procedure". These procedures identify the circumstances of possible internal exposure and describe the operation of the Helgeson Nuclear Services "do-it-yourself" body counter. There is no indirect bioassay program so all intake assessment is performed by use of the body counter which is located in the environmental laboratory building outside of the security gate. C/RP technicians operate the counter and the counting data is transmitted to Helgeson by dedicated telephone data link for

analysis. Significant results are reported back immediately by telephone and a written report is generated covering a one to two week period of counting. All non-visitor personnel are required to have a whole body count on an annual basis and contract personnel receive counts prior to working in the controlled area and prior to departure from the Station. Special body counts are authorized by the Supervisor-C/RP for exposure incidents or suspected intakes of radionuclides. The whole body counter was initially calibrated by Helgeson when the unit was installed and a calibration by a C/RP technician using a sugar phantom with small sealed sources is performed annually. Calibration records are maintained by Instruments and Controls (I&C). In the future, calibration responsibility will be transfered to them. A check on calibration source traceability by the appraiser showed that the cobalt-60 and cesium-137 button sources used for calibration had no record of certification of activity. It is recommended that standardized sources traceable to the National Bureau of Standards be obtained for this purpose. A Cobalt-60 check source is used in conjuction with an internal americium-241 source to determine if the peak channels are within specifications prior to counting subjects and this is documented in the counting log. An appraiser observed the use of the counter and noted that there was a significant gain shift during the course of a day. This appears to be due to the lack of temperature control for the room in which the unit is located. The appraiser recommended that the licensee consider taking steps to control the temperature in this room when the unit is in operation.

The calibration of the Helgeson counter for measuring iodine in the thyroid is not known by FCS and no procedures for thyroid counting have been generated. The Appraisal Team recommends that FCS establish a thyroid burden counting procedure and use a suitable NBS traceable iodine burden and neck phantom, if necessary, to properly calibrate the response of the counter.

3.2.2 Exposure Review

All whole body counting data in the Helgeson Nuclear Services reports are reviewed by the Supervisor-C/RP prior to filing. Reports of incident investigations and associated whole body counting data are filed in the individual exposure file. Discussion with C/RP personnel indicated that assessment of suspected or actual intakes of radioactive materials would be made by the Plant Health Physicist or outside consultants if necessary using suitable references. The appraiser noted that although certain Station personnel are familiar with biological models and calculational techniques, there are no approved Station procedures which give guidance in the application

and use of these methods of internal dosimetry. The foregoing is not in accordance with the guidance contained in ANSI N343-1978, "Internal Dosimetry for Mixed Fission and Activation Products" which recommends that in addition to an appropriate measuring program (bioassay), an internal dosimetry program should include the necessary biological models and calculational techniques. In addition, there are no Station procedures developed for obtaining urine, fecal, or other indirect bioassay media for assessment of intakes of radionuclides which cannot be quantitated in the body by gamma ray whole body counting, and interpreting the results of such samples. Also it was noted that there were no action levels established for the initiation, continuation, or termination of direct or indirect bioassay procedures, or guidance in converting bioassay results to MPC-hours of intake. Because of these observations the Team finds that an internal dosimetry program has not been fully implemented at FCS.

3.2.3 Exposure Limitations

The FCS administrative controls for exposure to airborne radioactive materials and designation of airborne radioactivity areas are established in the Radiation Protection Manual. Airborne radioactivity areas are established when the airborne concentrations exceed 25% of the amounts listed in Appendix B, Table I, Column I of 10 CFR 20. Each airborne radioactivity area entry has an "Airborne radioactivity area entry log" which gives activity concentration information, time of exposure and type of respiratory device used. C/RP technicians calculate the MPC-hours of exposure which are limited to 40 MPC-hours in a week. Notification of exceeding this administrative limit to the Plant Health Physicist and Supervisor-C/RP is required with appropriate follow-up action to be taken. However, it was noted that there was no Station procedure for evaluating exposures which exceed the 40 MPC-hour control measure, taking action to assure against recurrence of a similar exposure and documentating the evaluation and action as required by 10 CFR 20.103(b)(2). The appraiser noted no instances where the 40 MPC-hour control measure had been exceeded.

3.2.4 Respiratory Protection

The licensee's respiratory protection program is implemented through Section 2.0 of the Radiation Protection Manual and the following procedures: RPP-6, "Radiation Protection Procedure for Protection Clothing and Respiratory Equipment Cleaning" which describes the cleaning, monitoring for contamination and contamination limits; RPP13, "Recharging SCBA Cylinders" which describes the charging of SCBA bottles from the compressed air bottles cascade system; HP-2,

"Respirator Fit Test Quantitative Man Sodium Chloride Aerosol Method" which describes the operation of the NaCl aerosol test system and fit booth; HP-6; "Respirator Canister Testing" which describes the pressure drop testing of new and used respirator canisters; and HP-7, "Annual Review of Personnel Authorized to Wear Respirators" which describes the respiratory function testing for the use of respirators.

Prior to receiving authorization to use respiratory protective devices each worker is required to have a medical evaluation by a qualified physician. Requalification is accomplished by a review of the workers medical history and a pulmonary function test administered by a C/RP technician. The medical record and pulmonary function evaluations are maintained in the worker's permanent file. Each worker also receives a quantitative respiratory device fit test in a sealed booth with NaCl aerosol test equipment. During the appraisal, an appraiser observed the fit testing, which is conducted by a C/RP technician, and noted that there was no Station procedure for the different test elements during the actual fit evaluation, also it was noted that the strip chart recorder on the unit was not being used to generate a record of the degree of the fit during the test. The C/RP technician simply writes down a penetration value on a form. The appraiser also noted that the time allowed for each phase of the test was not long enough for adequate evaluation. FCS should establish a fit procedure based on the manufacturer's recommendations and document each fit conducted by use of the strip chart recorder. Upon satisfactory completion of the medical evaluation, respirator fit and training the worker is authorized to wear respirators at FCS. The status of all of these requirements is entered into a computer which prints out a current status report. The worker also receives an identifying mark on the security badge to indicate approval to wear respirators.

Respirators are stored for issue on shelves in the protective clothing change room. The health physics group does not control the issuance of each respirator and there is no specific verification that the individual is currently qualified to wear respiratory equipment. This is left up to the individual and his supervisor to know if the qualification is current. The individual is also responsible for field testing the respiratory prior to use by a negative pressure test or irritant smoke in the case of half-masks. During the first part of the appraisal it was noted that used masks were allowed to remain in various locations in the radiologically controlled area and reused without going through the cleaning, monitoring and inspection phases of the program. This was brought to the Station Managers attention and the masks were subsequently removed from the areas.

The respirator cleaning, decontamination and drying is done in the laundry area. The respirators are inspected, checked for contamination,

and bagged for issue in the health physics counting room area. Spare parts are stored partially in the health physics office area and in the auxiliary building corridor in the controlled area. A routine maintenance and inspection program is carried out by trained C/RP technicians for the SCBA units and a monthly inspection record is maintained. Filters for respirators are given a pressure drop test on a sampling basis when received and after use prior to reuse. Masks are given a negative pressure test after cleaning and inspection.

The supply of respirators and inventory control procedures were reviewed by an appraiser. It was noted that FCS has an inventory control system with restocking criteria so that a minimum level of supply is assured. The supply of half-masks, full-face masks, air supplied hoods and airline respirators and equipment on hand during the appraisal was found to be adequate for normal and outage conditions if the cleaning, inspection, etc. function performs well, with the exception of SCBA units available. For radiation protection use there are only three SCBAs each for the control room, emergency control center and health physics change area. The appraisers feel that this is not enough to support the needs during significant accident situations. The appraiser noted that only NIOSH approved respiratory equipment was in use and C/RP personnel stated that such approval for all devices ordered is made a part of the order specifications.

The appraiser noted that breathing air for SCBA units is obtained as bottled air from a commerical vendor. No records of certification of air quality were available but this was checked by FCS during the appraisal and found to be in accordance with air quality requirements. It is recommended that certification records be obtained from the vendor and maintained at the Station. Breathing air for the airline respirators used in containment is supplied by oiless, filtered compressors located on the lower level of the auxiliary building outside the radiologically controlled area. There is no testing of the air supply to show that the air quality meets grade D specifications. It is recommended that a routine surveillance of the air quality be initiated and record of the air quality be maintained at the Station.

3.2.5 Conclusions

Based on the above findings, internal dosimetry procedures have not been developed that would contain the biological models and calculational techniques necessary to assess the results of direct and indirect bioassay measurements in terms of the amounts and dosimetry of radioactive materials taken into the body. These procedures need to be developed and implemented to achieve a fully acceptable program.

Other areas of the internal dosimetry program appear acceptable, however, the following items should be considered for improvement:

1. Improve the whole body counting facility temperature control and provide traceable calibration sources for proper calibration of the whole body counter.

2. Develop and implement procedures for conducting quantitative respirator fits and use the units recorder for generating a record of the fit parameters.

3. Provide documentation of air quality for SCBA and airline respirators showing that the minimum specification of Grade D breathing air is being supplied.

4. Consider increasing the inventory of SCBA devices which are available for radiation protection purposes.

4.0 Radiation Protection Surveillance

Documents Reviewed

FCS, Health Physics Manual, Section 4.0, Radiation Monitoring

FCS, Health Physics Manual, Section 4.1, Radiation Schedule

FCS, Health Physics Manual, Section 4.2, Contamination Surveys

FCS, Health Physics Manual Section 4.3, Air Surveys

FCS, Health Physics Manual, Section 4.4, Water Surveys

FCS, Health Physics Manual, Section 4.5, Survey Schedule

FCS, Procedure HP-5, Collection and Analysis of Air Samples

FCS, Standing Order T-8, Routine Health Physics Surveys and Reports

FCS, Procedure FCP-HP-1, Response Checks

FCS, Procedure CMP-3.10, Determination of Radioactive Particulates and Radioactive Iodine in Air Samples

FCS, Procedure CP-RM-070, Area Radiation Monitor Calibration

FCS, Procedure CP-RM-059, Waste Disposal, Auxillary Steam, Waste Condensate Monitor

FCS, Procedure CP-RM-050, Particulate Monitor RM-050

FCS, Procedure ECP-RM-051, Stack Containment Gas Monitor

FCS, Procedure ECP-052, Stack Gas Monitor

FCS, Procedure ECP-RM-053, Component Cooling Water Monitor

FSC, Procedure ECP-RM-054A, Steam Generator Blowdown Sample Monitor A

FCS, Procedure ECP-RM-055, Monitor Tank, Discharge Monitor

FCS, Procedure ECP-RM-055A, Overboard Waste Discharge

FCS, Procedure ECP-RM-056A, Raw Water, Effluent Monitor

FCS, Procedure ECP-RM-056B, Raw Water, Effluent Monitor

FCS, Procedure ECP-RM-057, Condenser off-gas Monitor

FCS, Procedure ECP-RM-060, Stack Iodine Monitor

FCS, Procedure ECP-RM-061, Installed Particulate Monitor

FCS, ECP-RM-062, Stack Gas Monitor

ANSI N13.12 - 1978, Control of Radioactive Surface Contamination on Materials, equipment, and facilities to be released for uncontrolled use (draft).

ANSI N323 - 1978, Radiation Protection Instrumentation Test and Calibration.

ANSI N320 - 1979, Performance Specifications for Reactor Emergency Radiological Instrumentation.

ANSI N13.10 - 1974, Specifications and performance of on-site Instrumentation for Continuously Monitoring Radioactive Effluents.

ANSI N13.1 - 1969, Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities.

4.1 Procedures and Basis

Fort Calhoun Station's routine surveillance program is described in Section 4.0 of the radiation protection manual. The routine survey program consists of daily, weekly and monthly surveys in specified locations within the controlled and uncontrolled areas. The present routine survey schedule is documented in Standing Order No. T-8. The survey schedule is comprehensive and covers most areas of interest, including

monthly surveys of the security fence area. Routine surveys consists of direct radiation measurements (gamma) and indirect contamination measurements (beta and gamma) using smears. Non-routine surveys are conducted for each containment entry and other areas as directed by the Plant Health Physicist. Other than the continuous air monitors (CAM), a routine air sampling schedule is not conducted. High volume air samplers are used to survey work areas as the need arises. Plant survey procedures do not adequately cover instrument selection and use. The licensee stated that these topics are covered in technician training. Surveys by personnel outside the health physics group are generally not performed. The licensee stated that general employee training emphasises that any changes in work conditions under a Radiation Work Permit (RWP) must be reported to health physics for their further evaluation.

During the appraisal, radiation and contamination surveys made by the health physics staff and personnel contamination surveys using portal monitors and the hand and foot monitor were observed by the appraisal team. It was clear that a surveillance program had been implemented in accordance with plant procedures.

4.2 Responsibility

Radiation protection surveillance is under the director of the Supervisor-Chemistry and Radiation Protection (C/RP). Each survey report is reviewed by the Plant Health Physicist (PHP). The C/RP and PHP review the routine surveillance program periodically and make changes as required by plant conditions. The survey program is conducted entirely by the health physics staff.

4.3 Types

Routine surveys for alpha activity in air and on surfaces are not conducted. The licensee conducts smear surveys for alpha during receipt and handling of new fuel and conducts weekly gross alpha measurements on the primary coolant. Gross alpha values have been on the order of 10^{-9} uCi/ml, a value near the MDA. The licensee uses the gross alpha coolant activity as the prime indicator of no significant alpha in the plant. The appraiser stated that periodic surveys for alpha activity in air would further demonstrate the absence of alpha activity in the plant. Plant procedures covering collection of air samples were not adequate to cover the collection and measurement of alpha activity in air. Discrepancies are as follows: Typically, three (3) cubic meters of air are sampled using a high volume sampler and the particulate activity collected on a four (4) inch cellulose filter (BM-2133). The collection efficiency is assumed to be 100 percent.

A two (2) inch diameter circle is cut from the filter in order to accomodate the counter. Samples are counted for beta/gamma activity on a gas flow proportional counter. The counter efficiency is based upon the response to an Tl-204 standard. Typical efficiencies are about 30%. The appraiser calculated the MDA to be about 7E-12 uCi/ml which is greater than the Part 20 value for gross alpha activity in air. The appraiser stated that the cutting of filter media and the assumption of 100% efficiency could lead to considerable error. In addition, the use of Tl-204 standard with its energetic beta and evaporated on a metal base will yield a higher efficiency than a standard composed of activities similar to plant activity and placed on a media similar to the media being counted. The net result is a underestimation of activity concentrations. The appraiser stated that the exclusive use of high volume sampling brings into question how representative the air samples are to actual worker exposure.

The majority of routine and special gamma radiation surveys are conducted using the teletector instrument. The appraiser stated that the teletector was not the instrument of choice in all cases, specifically, beta dose rate surveys when workers are in close contact with exposed activity. The teletector detects energetic betas when using the low range detector. The licensee does not use ionization chamber instruments except in emergency kits. The number of portable instruments of various types and their adequacy to make routine and specialized surveys is covered in section 4.5.2.

Discussions with the HP technicians revealed the lack of practical training in the use of portable instruments under unusual situations, such as non-uniform fields and high beta fields which may occur during a unusual occurrence or severe emergency. One of the ex-Navy techs reported receiving training in the use of correction factors to account for nonuniform fields. However, this training has not been continued at the station. Refresher training for the C/RP technicians should include realistic testing of their capability to handle and interpret portable instruments in unusual field situations.

Surveys conducted during entries into containment are performed by chemistry personnel. Noble gas concentrations are determined by purging a sample of gas through a flask and measurement using a Ge (Li) detector/ spectrometer system. These concentrations are used in calculating worker exposure and respiratory protection requirements. In addition, particulates and iodines are collected using a vacuum pump and suitable filtering media. Calculations of isotopic content and concentrations are performed by computer. Removal of noble gas adsorbed on the charcoal cartridge is affected by use of a heated vacuum dessicator. Exhaust from the vacuum dumps into the hot lab at a location near the exhaust hood. The hood does not have a separate blower and appears marginal in its ability to remove noble gas activities from the hot lab and adjacent counting facilities. Radiation surveys are also conducted during containment entries. Gamma surveys are conducted using a teletector and neutron surveys using a PRN-4 rem ball.

The range of gamma energies being measured is quite wide and the overall response of the teletector to this range of gamma energies is not known. The teletector is calibrated against a Cs-137 source. The neutron energy spectra in containment at power was measured about five years ago using activation foils. The average neutron energy reported was quite low, about 100 ev. Measurements of neutron levels using the PRN-4 are accepted as actual. The exact response of the instrument at 100 ev is not known although over response is expected.

The appraisal team observed the performance of surveys on several occasions and collected smear samples in and outside the controlled areas. These independent samples were in general agreement with the licensee's values.

4.4 Records

The results of surveys are recorded on survey sheets which serve as the permanent record. Survey data is also posted on large plant maps at the entrance to the controlled areas. These maps show radiation and contamination levels at each level of the auxiliary and reactor buildings. The appraiser noted that survey records were sufficiently clear and traceable to the instrument used and to the person performing the survey. It was difficult to match the survey results for a particular RWP, however, since the RWP number on the survey report is the RWP number assigned to the health physics group for performing surveys and not the RWP for the job in question.

4.5 Instrument Suitability and Use

4.5.1 Inventory

The instrument program, including portable, semi-fixed and fixed area monitors associated with the health physics program was reviewed and discussed in depth with the C/RP and Instrumentation and Control (I&C) staffs. The appraisal involved a review of procedures, training, records, and observation of calibration techniques and selected tests of some of the instruments. A review was performed of the training of the two departments in the use, maintenance and calibration of instruments. Discussions were held with members of both departments to clarify the recommendations contained in ANSI N323, "Radiation Protection Instrumentation Test and Calibration."

The inventory of health physics instrumentation was reviewed, together with maintenance and availability experience, including the number of instruments maintained for emergency use. The licensee would appear to have an adequate number of instruments for routine and emergency purposes. The current inventory consisted of: 11 teletectors; 4 high range instruments with extendable probes; 8 ionization chamber

instruments (rad guns); 14 radiation monitors (RM-14); 2 radiation detectors (RM-15); 3 radiation monitors (RM-19); 2 neutron survey (PNR-4); 1 neutron survey (PNC-4); 12 Geiger Counters (E120); 10 Geiger Counters (E520), and 3 ionization chambers (RO-2).

There appears to be an adequate supply of air sampling and monitoring equipment which include 5-air particulate monitors (AMS-2), 3-continuous air monitors (NMC) and 9-high volume air samplers. Some of the instruments above are located in emergency kits and are not available for routine use.

On September 17, 1980, the following were immediately available at the entry to the auxiliary building: 7 teletectors; 5 rad guns; 5 E530s; and 1 HRTP. The C/RP technicians are currently initiating a set of HP instrument records. It would appear that some of the instruments currently listed in the inventory may actually have been lost during recent outages. There is a need for a good set of inventory records, including location of the instruments and the dates of calibration and maintenance to provide an adequate history of the quality of the HP instrumentation.

4.5.2 Portable Survey Instruments

The capability of the portable instruments in use at FCS is marginal from several standpoints. 1) As a result of the response time of the rad guns and weight and calibration problems of the rad owls, there are no ionization chamber instruments routinely in use at the plant. Dose rate measurements are made using either E530s (a GM instrument with limited range), or teletectors, a dual GM probe instrument with an upper range of 10^3 R/hr. 2) They have no instruments that will achieve 10^4 R/hr as suggested by ANSI N320, 3) The beta response capability of a teletector would be marginal, thus, the station currently is limited in beta capabilities to those of the E530. 4) Currently, they have no operational alpha survey instruments, although the station does own an instrument.

The performance capability of all health physics instruments has been accepted without question. There is no acceptance testing on the part of the staff to determine whether the instrumentation meet applicable ANSI standards, including ANSI N13.10, and ANSI N323. The instruments are not tested to determine whether they meet the vendor's specifications. GM probes are accepted without testing the sensitivity or operating characteristics. This, coupled with calibration problems which will be discussed in the next section, can lead to variation of measurements between instruments.

4.5.3 Instrument Calibration and Check Procedures

The calibration and maintenance program is well established and documented by procedures. Recently, the responsibility for calibration of all portable health physics instruments was transferred to the I&C Department. Based on discussions with the HP and I&C staffs and reviewing all the instruments awaiting maintenance, it would appear that the station has an excellent maintenance program. One of the main problems with the instrument program, is the lack of a calibration program which meets ANSI N323 requirements. This standard should be carefully reviewed and efforts conducted to identify basic changes that are necessary in the program.

Calibration procedures indicate that instruments should be within ±15% to be released for use. A review of the before and after readings in the instrument maintenance and calibration records revealed that the response of many of them were not within the ±15%. This calibration frequency would appear to be too great based on the number of instruments not performing within ±15%. A good operational check program, which is discussed later, would help to better define their problems. The calibration program is deficient for the following reasons: (1) There is no beta calibration currently being performed on any of the portable or semi-fixed instruments. (2) Photon calibration is not performed at two points on each range or decade as required; in fact, photon calibration is not performed at one point on each range. Calibration procedures rely primarily on an electronic calibration coupled with a source check at one or two points. (3) The station is following the advice of the vendor in terms of providing no source correction for the neutron source. It is true that the decay of the neutron source creates a negligible change in the emission rate. However, in an article from Mound Laboratory (the major supplier of neutron sources), it was suggested that the ingrowth in a plutonium neutron source may be as high as 2% per year if there is .07% of ^{241}Pu present in the isotopic mix when the source is encapsulated. A similar plutonium source checked in 1962 had an overall ingrowth of approximately 20% through June 1980; thus, it can be seen that the calibration of neutron instruments could be significantly in error. The question of whether the PuBe source is an appropriate standard for calibration purposes will be discussed in another section. (4) Adequate check sources are not available for checking each range of an instrument as suggested in ANSI N323. ANSI N323 suggests that a check source should be available that would permit checking at least one point on each range of an instrument. The check source located at the entry to the auxiliary building permits checking only one point on each instrument, approximately in the 15 to 30 mR/hr range. Rejection criteria for the daily source check is not stated.

(5) The photon source calibrator has not been calibrated by the licensee. Two of the sources, IRL-165 and IRL-166 are improperly calibrated. The calibration curves provided by the vendor include two scales for each source, depending on whether a GM or an ion chamber is to be calibrated. A test of the calibrator using an instrument supplied by the appraiser, indicated reasonable agreement on all of the source calibrations with the exception of the two mentioned above. The station should undertake an effort to confirm all of the calibration points currently included on the calibration curves from the vendor. The calibrator is difficult to use when calibrating two points on each scale or decade as suggested by ANSI N323. It may be necessary to develop a different calibration facility if complete calibration is to be accomplished. It was noted that there is confusion on the positioning of detectors in the calibrator. The C/RP technician clearly understood the need for measuring the distance from the source to the effective center of the detector. This was not understood by the I&C technician. They were measuring the distance from the source to the surface of the detector. For some detectors it appears that a better jig would be beneficial to assure uniform positioning for each calibration. With the existing calibrator, it is impossible to calibrate the teletector above approximately 230 R/hr.

4.5.4 Friskers

FCS has an adequate supply of radiation monitors (RM-14, 15) for use at locations where contamination of personnel is likely. Currently an electronic calibration is performed followed by one point source check. The conversion factor of counts per minute to disintegrations per minute could not be verified using the station's ^{204}Tl source. The source was prepared by one of the C/RP technician and there appears to be some question as to the true activity. This problem was reported to the HP staff and was not resolved during the appraisal.

4.5.5 Portal Monitors

Portal monitors are located at several points in the station, including the exits from the security area, the auxiliary building, the health physics counting room and in the radiochemistry laboratory. Additionally, other units are available for specific use during jobs involving high contamination levels. The station also has one hand and shoe counter which is located at the exit from the auxiliary building. These instruments are not adequately calibrated. They are calibrated electronically in a manner similar to the friskers. The instrument response is checked with a large ^{137}Cs source, which

is placed in the vicinity of the detectors. The source activity is too intense to individually test detector sensitivities. The portal monitors will not alarm with a 0.5 uCi cesium source placed directly over each of the tubes. It would appear possible that personnel could exit radiologically controlled areas with up to a million dpm contamination on their body or clothing. The 0.5 uCi ^{137}Cs source, when used to check the hand and shoe counter, revealed two detectors on the left hand that would not respond. The licensee investigated and found that these two detectors had been unplugged. The other detectors in the hand and shoe counter responded to this source but not at uniform rates. One of the tubes in the right foot registered greater sensitivity than the rest of the tubes. The hand and shoe counter has no timing circuit. It was determined that up to 10 seconds were required using 0.5 uCi cesium source to obtain an alarm. It was suggested that a sign be placed on or near the hand and shoe counter to indicate the need for waiting 10 seconds before leaving the counter. Efforts should be made to introduce a timing circuit to assure that an adequate count time is used for each person exiting the controlled areas.

4.5.6 Constant Air Monitors

There appears to be an adequate number of constant air monitors for the station. However, the validity of monitoring results from these air monitors are questionable because of the absence of a complete performance test of the instruments when purchased from the vendor and an adequate calibration procedure. These instruments are not calibrated on each range. Additionally, adequate energy response tests to assure linearity of the instruments for varying energies have not been performed.

4.5.7 Area Radiation Monitors

There appears to be an adequate number of air monitors within the plant for normal operations. The range of these instruments also appears to be adequate for normal operations. Calibration, which is generally adequate, involved the use of a special calibrator provided by the vendor. This calibrator provides a reproducible geometry and a capability to check the instrument at three points (two on the lower amplifier and one on the upper amplifier). This calibration could be improved by adding another point on the upper amplifier.

4.5.8 Health Physics Counting Equipment

The health physics counters are not provided sufficient quality control measures. Weekly calibration and background control charts have not been developed. Additionally, there is not an adequate reference

source which is traceable directly to the National Bureau of Standards. The source is made from a standard ^{204}Tl solution by the HP technicians. The strength of this source should be verified.

4.6 Conclusions

Based upon the findings, improvements in the following areas are required to have an acceptable radiation surveillance program:

1. Develop a portable instrument calibration and response check program consistent with ANSI N323-1978, recommendations.

2. Increase plant surveillance for alpha activity in air using proper methods and equipment.

3. Increase surveillance of work areas with potential for high beta dose rates using a suitable calibrated instrument.

4. Use of lapel and other low volume air samplers to evaluate air concentrations more representative of actual worker exposure.

5. Review instrumentation and practices related to detection of contamination on personnel, clothing and laundry in light of present plant contamination limits and the recommendations of ANSI N13.12-1978.

Other areas of the surveillance program appear acceptable, but the following areas need to be improved.

1. Perform current evaluation of neutron energy spectra in containment and determine the response of portable neutron survey instrument to this energy spectra.

2. Determine photon energy spectra in containment and determine the response of portable gamma survey instruments to this energy spectra.

3. Develop a set of instrument records which would provide repair calibration and maintenance history for each instrument.

4. Evaluate adequacy of the PuBe neutron source for use as a plant neutron standard.

5.0 Access Controls/Contamination Controls

Documents Reviewed

FCS, Radiation Protection Manual, Section 2.7, Radiation Work Permits

FCS, Radiation Protection Manual, Section 2.8, Contamination

FCS, Radiation Protection Manual, Section 2.9, Decontamination Procedures

FCS, Radiation Protection Manual, Section 2.11, Protective Clothing

FCS, Radiation Protection Manual, Section 3.0, Area Control

FCS, Radiation Protection Manual, Section 3.2, Contamination Limits

FCS, Radiation Protection Manual, Section 3.4, Access Control

5.1 Restricted Area Access

At FCS the restricted area is the OPPD property within the security fence. They designate their property outside the security fence as an exclusion area. Access to the restricted area is controlled by a guardhouse with security badges color coded to indicate extent of access.

5.2 Controlled Area Access

At FCS these areas are called Control Areas and defined as any area inside the restricted area where a radiological control point must be passed to gain access. Unescorted access to control areas requires completion of basic security and radiation protection training. All entries must be under a written Radiation Work Permit which lists dosimetry and protective clothing required. A TLD badge and one or two pencil dosimeters are required except that a visitor for less than 4 hours may be excused from this requirement if no high radiation areas are to be entered. No guard is present at the access control point.

Each person takes pencil dosimeters from a board on the wall, enters his name on the RWP log, and reads his dosimeter on the way out. The Health Physics office is at the access control point to the auxiliary building no one routinely checks that proper dosimeters are worn and that pencil dosimeters are read accurately.

5.3 Radiation Area Access

Radiation areas within the control area are identified as areas where radiation levels are present from 5 to 100 mrem per hour. These areas are required to be posted with "Caution-Radiation Area" signs. In practice these areas were posted and the area defined with rope or tape on the floor.

5.4 High Radiation Area Access

FCS divides those areas with greater than 100 mrem per hour into two classifications and has two sets of access requirements. A high radiation area is one with greater than 100 mrem per hour and less than 1000 mrem

per hour. These areas are barricaded and posted with "Caution - High Radiation Area" signs and require a dose rate meter, a dose integrating instrument with alarm, or a radiation protection qualified person with a dose rate meter as escort. Entry into high radiation areas also requires notification of health physics or plant operations and a RWP. Areas with dose rates greater than 1000 mrem per hour have the same access controls as the high radiation areas except that in addition access doors are kept locked or under continuous direct control by someone who is aware of the radiation status of the area. Keys to these areas are controlled by the Shift Supervisor or the Plant Health Physicist. These control measures appear to be adequate and the appraisal team found no problems in the plant in implementing these control measures. It was observed that workers generally overread their pocket dosimeters when exiting controlled areas and this could contribute to poor comparisons between these the pencils and the TLD badges.

5.5 Contaminated Area Control

FCS procedures define contamination limits for uncontrolled areas, control areas, and posting of contaminated areas. Further controls in contaminated areas were described in the Health Physics Indoctrination of General Employee Training. Uncontrolled areas are limited to 10 dpm/100 cm^2 alpha, 100 dpm/100 cm^2 beta-gamma, and 0.5 mR/hr fixed contamination. Control areas are limited to 100 dpm/100 cm^2 alpha and 1000 dpm/100 cm^2 beta-gamma or they must be posted as contaminated areas. Within contaminated areas greater than 20,000 dpm/100 cm^2 (removable) requires a half-face mask, greater than 100,000 dpm requires a full-face mask, and greater than 1,000,000 dpm requires supplied air. It was observed that these requirements caused possible over use of respiratory equipment and frequent reuse of masks in rooms where several entries a day must be made by the same person. Masks were found hanging on the door knobs and other handy places for apparent reuse. This situation was reported to the C/RP Supervisor who directed his staff to collect all masks that were not in their proper storage location. Workers were also allowed to hang up lab coats inside the control access to the auxilary building, to use the the same coats many times. This is considered poor contamination control since the lab coats are not checked for contamination before reuse.

FCS procedures require personnel to survey themselves on a hand and foot monitor and a portal monitor when leaving a controlled area. Several radioactive sources were used to check the sensitivity of the hand and foot monitor, the portal monitor, and the laundry monitor for fixed contamination. The hand and foot monitor had poor sensitivity (0.5 microcuries of Cs-137 would not cause an alarm when placed against the detectors) and the laundry monitor had poor sensitivity (250,000 dpm of Tl-204 in a planchet placed against the detectors would not cause an alarm). See Section 4 for further information and conclusions in this area.

On September 16, 1980, the appraisal team toured the auxiliary building to observe conditions and radiation control practices. On the 995'6" level, several 55 gallon drums of radioactive waste materials were stored. The drums were not labeled or information provided as to their radioactive contents. This constituted noncompliance with 10 CFR 20.203.

5.6 Conclusions

Based upon the findings reported above, this portion of the licensee's program appears acceptable; however, consideration should be given to improvements in the following areas.

1. Review of contamination control practices where lab coats and respirators are re-used in controlled areas.

2. Surveillance of workers exiting controlled areas as to proper frisking techniques and accurate logging of pocket dosimeter readings.

6.0 Radioactive Waste Management

Documents Reviewed

FCS, Section XI, FSAR

FCS, Technical Specifications

FCS, Standing Order T-2, Waste Liquid Release

FCS, Standing Order T-3, Waste Gas Release

FCS, Standing Order T-4, Waste Solids Release

FCS, Standing Order T-12, Containment Purge Release

FCS, Radiation Protection Manual, Sections 6.2, 6.3, 6.4, 6.5

FCS, ST-IR-1, Iodine Removal Efficiency

FCS, ST-VA-4, Auxiliary Building Air Filtration Units

FCS, ST-FIL-2, Charcoal/HEPA Filter Bank in-place testing

FCS, Waste Shipment Records

ANSI N13.10-1974, Specification and Performance of On-site Instrumentation For Continuously Monitoring Radioactivity in Effluents.

ANSI/ANS-55.1-1979, American National Standard for Solid Radioactive Waste Processing Systems for LW Cooled Reactor Plants.

ANSI/ANS-55.4-1979, American National Standard for Gaseous Radioactive Waste Processing Systems for LW reactor plants.

ANSI/ANS-55.6-1979, American National Standard for Liquid Radioactive Waste Processing Systems for LW reactor plants.

ANSI 101.1-1972, Efficiency Testing of air cleaning systems containing devices for removal of particulates.

ANSI/N510-1975, Testing of Nuclear Air-Cleaning Systems

6.1 Program Responsibility

The plant systems designed to store, process and dispose of gaseous, liquid and solid radioactive waste are described in Section XI of the FCS Safety Analysis Report. The radioactive systems were designed to limit radioactive releases to below 10 CFR 20 limits. Plant procedures have been developed and implemented to control the processing and disposal of radioactive waste. The proper operation of the rad waste systems is the responsibility of the Operations Supervisor. Routine operation of the rad waste systems is handled by station and licensed operators under the supervision of the Shift Supervisor. The appraiser reviewed the major components of each system, plant operating experience, design changes, 10 CFR 50.59 evaluations, effluent design objectives and reported releases from the plant. FCS surveillance and testing of HEPA/charcoal units in the plant was also reviewed and included in the section.

6.2 Waste Processing Systems

6.2.1 Liquid Waste Processing System

Liquid wastes are separated according to source and water quality. Hydrogen bearing reactor coolant liquids are collected in waste hold-up tanks. Processing of these wastes on a batch basis can utilize filtration, evaporation and demineralization. Demineralization is currently not being used. Treated wastes are held in monitor tanks and can be released into condenser cooling water or diverted for additional processing. A neutralization tank was part of the original design but no longer is used. Chemical additions for foam control and iodine reducing conditions are made manually prior to evaporation. Auxiliary building waste liquids are collected in spent regenerate tanks then processed using filtration and evaporation. Any liquid releases are from the monitor tanks. Laundry and other aerated liquids are collected into two (2) hotel waste tanks. These wastes are transferred to the monitor tanks after filtration using a add-on roughing filter (cloth). Releases are made from the monitor

tanks as above. Radiation Monitor RM-055 is in-line with discharges from the monitor tanks and alarm points are set to close an isolation value and terminiate flow in case of high effluent activity. Major sources of liquid waste that must be processed are: laundry and other hotel waste, floor drain system (auxilary building) and letdown flow during reactor heat up. Changes to the original design of the liquid waste system include non-use of the neutralizer tanks, a add-on filter for hotel waste, and non-use of the degasifier in the evaporator package. 10 CFR 50.59 evaluations for these changes were examined by the appraiser and found to be adequate. The licensee has experienced problems with the evaporator, due primarily to corrosion. Decontamination factors for the evaporator are measured by chemistry personnel periodically in order to evaluate performance. The capacity of the two hotel waste tanks to contain generated laundry waste, particularly at refueling time, appears small. In the past laundry operations had to be stopped since hotel wastes were full and could not be transferred to full monitor tanks.

Other pathways for liquids leaving the site were examined. Steam generator blowdown water is discharged without treatment into the plant raw water system. Monitor RM-056B monitors the raw water activity prior to release. Noncondensibles for the blowdown are vented to the environs in a separate non-monitored vent. ANSI N55.6 recommends that steam generator blowdown water be filtered and demineralized prior to discharge.

The location of the steam generator blowdown monitors (RM-054 A&B) was found to be poor. Radiation levels from the primary coolant sampling station and other sources contribute a high background level to the monitors which reduces the sensitivity of the monitor to detect activity levels in the blowdown. Portable lead sheets have been draped over the monitors in order to reduce their background.

Water from the turbine building sump is discharged into condenser cooling water. An oil separator is used to collect oils and other organics prior to discharge. This flow path is not monitored as recommended by ANSI/ANS-55.6.

The appraiser reviewed plant liquid effluent reports for the last half of 1979 and the first half of 1980. In the 1979 period, 188 batch releases were made and average effluent concentrations were less than 1% of applicable Technical Specification (TS) limits. Three hundred and Twelve (312) batch releases had been made in 1980 up to the time of the appraisal. Average effluent concentrations were a few percent of TS limits. The appraiser concluded that the design objectives of the liquid waste system had been met.

6.2.2 Gaseous Waste Processing System

Hydrogen bearing gaseous waste from reactor operations and from gas spaces in tanks containing reactor coolant are collected in the gas vent collection header. Compressors deliver the gas to one of four gas decay tanks. Gaseous wastes are released on a batch basis after storage in the decay tanks. Discharge is into the building exhaust ventilation system for dilution prior to final release via the plant stack. A radiation monitor monitors the ventilation system exhaust for gaseous and particulate activity and can close a control valve in the discharge header on a high activity signal.

The gas waste system is designed to met 10 CFR 20 limits on discharges. Another potential source of gaseous activity is the steam jet air ejector (SJAE) discharge via the turbine building vent. The discharge is monitored with monitoring element RM-057. Low level gaseous activity from normal auxiliary building ventilation discharge is released via the plant stack where monitors RM-060, 061, 062 measure iodine, particulate and gaseous activities, respectively. FCS has experienced some problems with leakage from the vent header. Valve replacements in the vent header may eliminate this leakage.

Samples of radioactive gas from the decay tanks, make-up tanks and other sources are taken at a central sampling station in the auxiliary building. Samples are taken using a glass container and plastic tubing. Leakage from the sampling apparatus or sample connections recently caused a gas release to the auxillary building sufficient to get an alarm on the stack monitor (LER 80-18). The appraiser considered this sampling location and sampling procedure to be a problem area with improvement needed. Samples should be taken in all metal containers and tubing and consideration should be given to locally exhausting the sampling station. Gaseous effluent releases were reviewed for the last half of 1979 and the first half of 1980. Gaseous and particulate releases were a few percent of TS limits. Design objectives of the gaseous waste system appear to have been met.

6.2.3 Solid Waste Processing and Shipment

Solid waste at FCS consists of compacted dry materials and solidified wet solids from the drumming station. The automatic drumming system has never worked so connections for filling must be done by hand. Cement and vermiculite are used for solidification and mixing is done by rolling each drum on the side.

Waste handling is done by several departments. Operations personnel fill the drums, general maintenance personnel decons the drums and moves them to the hot shop for weighing and storing. Health Physics

smears and surveys the drums and also checks for free water. Compacted waste goes to the hot shop for the same procedures. Storage space for drums in the hot shop is not adequate but a new rad waste storage building has been authorized. Health Physics is responsible for all labelling of drums and filling out the shipping papers. They have current requirements of the burial site and regulatory shipping requirements.

The curie content of each drum is determined by taking a surface radiation reading and multiplying the exposure rate times 0.3 to get mCi. Using a single conversion factor instead of one based on drum weight and nuclides present probably underestimates the curie content significantly.

Shipments observed during the appraisal appeared to be in conformance with requirements.

6.3 Process and Effluent Monitors

The calibration and maintenance program for process and effluent monitors is well established by plant procedures. There appears to be adequate requirements to perform needed calibration and maintenance at a frequency generally associated with refueling operations. The procedure requires a complete maintenance and electronic check followed by a detector check using small check sources. This is accomplished in a set geometry in the control room. If additional sources of varying strengths were available, the detector could be checked on all ranges or decades. A source calibration is required to be performed within 60 days of the electronic calibration. However, monitors RM050, 051, 052, 053, 054A, and 054B, exceeded the 60 days. Apparently the delay was due to the requirement to have contaminated air or liquid present in the effluent to conduct the required calibration. It would appear that the electronic calibration was performed too soon. The calibration, for the most part, consists of obtaining a sample of the effluent surrounding the monitor and counting it in the laboratory. If there is no significant change in the response of the instrument, then no other calibration is performed. There have been no complete energy or range calibrations since the initial one.

In at least two instrument systems, the quality of sample should be investigated to assure that a representative sample is being monitored. Monitors RM061 and 062 included a sample line estimated to be at least 100 feet long. This sample line contains many bends and joints. The line

has been heat traced in order to prevent sample loss from condensation; however, it would appear that due to the length of the line effort should be made to determine the amount of line loss that is occuring in particulate samples. A similar problem may also exist with monitors RM050 and 051. Both RM061/062 and RM050/051 use a Victoreen moving tape collector. These collectors experience air leakage into the chamber due to the nature of the seal on the rectangular box. Monitor RM050 has had the old box lid changed to a welded steel lid which appears to provide better sealing capabilities. The same modification has not been provided for RM061. Both of these should be checked to verify that in-leakage is not occurring.

It appears that there is a sufficient quantity of process monitors to provide necessary information for normal operations. Some effluent monitors will be replaced in order to meet NUREG 0578 requirements. The data from process monitors might be questioned due to deficiencies in the calibration program. Performance testing of all process monitors is not performed, and there is no program to provide performance testing for detectors that might be replaced in the process monitors.

6.4 High Efficiency Air Filtration Systems

High efficiency particulate air filters (HEPA) and charcoal adsorbers are installed as stand-by units for the control room, spent fuel storage area and the safety injection pump rooms. The surveillance of these units is covered by TS requirements. The licensee stated that in-place testing of HEPA and charcoal filter tanks is done in accordance with applicable sections of ANSI N510-1975. The appraiser reviewed surveillance procedures and tests results on the HEPA and charcoal and found no areas of concern. Auxiliary building ventilation exhaust is through banks of HEPA filters. These HEPA filters are not instrumented and are not on a routine inspection and testing program.

6.5 Conclusions

Based upon the above findings, this portion of the licensee's program appears to be acceptable, but the following matters should be considered for improvement.

1. The steam generator blowdown monitors are in a high radiation background area and should be relocated.

2. The gas sampling panel and gas sampling apparatus should be improved in order to prevent inadvertent releases.

3. The hotel waste holding tanks have limited capacity and considerations should be given to adding additional storage or obtaining approval for a separate release path for laundry waste.

4. Noncondensibles from the steam generator blowdown flow are a potential source of radioactivity and should be monitored prior to venting.

5. The turbine building sump is a source of potentially contaminated water that should be monitored prior to discharge.

6. The auxiliary building ventilation exhaust HEPA filters are not instrumented and are not on a routine inspection and testing program.

7. Perform complete calibrations of effluent and process monitors to verify full range, sensitivity and linearity response.

8. Develop a more complete method of determining the curie content of waste drums prior to shipment.

7.0 ALARA PROGRAM

Documents Reviewed

FCS, Radiation Protection Manual

FCS, Standing Order No. T-1, "Radiation Protection Manual"

FCS, Standing Order No. T-10, "Personnel Exposure Reports"

Summary of Outage Job Tasks

ALARA Task Status Sheet

An appraiser reviewed the licensee's administrative policies and implementation of measures for maintaining occupational radiation doses as low as reasonably achievable (ALARA) at FCS. It was noted that the FCS commitment to principles of ALARA is stated in Standing Order No. T-1 and the Radiation Protection Manual. Also a formal Station ALARA Committee is established in Standing Order No. T-10. The ALARA Committee consists of the Supervisor-C/RP, Plant Health Physicist, and representation from operations and maintenance. The Committee functions through meetings and reports which review and evaluate high exposure activities and make recommendations for dose reductions. The appraiser reviewed documentation of committee activities which showed a summary of outage job tasks and exposure summaries for 1979, together with recommendations and the status of review of major dose considerations. It was noted that this formal ALARA program was being applied only to outages due to limited resources with the objective of effecting the most significant man-rem dose reductions during these periods. Discussions with management at the corporate office also revealed that there is no formal ALARA management control at that level for either normal or outage Station operations although the importance of ALARA is recognized and supported. The Appraisal Team recommends that additional resources be allocated to the ALARA program to fully implement the program to normal operations as well as outages in accordance with guidance contained in NRC Regulatory Guide 8.8, "Information Relevant To Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will be as Low as is Reasonably Achievable."

From discussions with FCS personnel and observations it was noted that some other elements of ALARA as recommended in Regulatory Guide 8.8 are present at the Station although not in a formal program. These practices include Plant Health Physicist pre-work reviews of significant jobs, preplanning of work which includes consideration of temporary shielding or engineering controls for airborne radioactivity with portable air filtration units, dry runs for high exposure potential jobs such as removal of incore detectors, and the use of photographs of plant systems for training purposes. Also good communications, review of design changes and Station procedures by the Supervisor-C/RP and participation in maintenance and outage preplanning by C/RP all contribute to potential dose savings. The Appraisal Team feels that all of the above have contributed to relatively good performance in controlling individual doses and Station man-rem but the present program does not demonstrate that doses are, in fact, being maintained ALARA and could not be reasonably further reduced.

Based on the appraisal findings reported above, this portion of the licensee's program appears acceptable but consideration should be given to expanding the formal ALARA program to cover all Station operations using the recommendations contained in NRC Regulatory Guide 8.8 and establishing specific ALARA program management control at the corporate level.

8.0 Health Physics Facilities and Equipment

8.1 Facilities

The appraisers visited and reviewed the facilities used by the C/RP staff in carrying out their various health physics and radiochemistry functions. Since little guidance is available to determine the adequacy of these facilities, appraisal findings are based upon appraiser judgement and comparison with practices at other nuclear power plants. The following facilities were observed: health physics office and access control, health physics counting area, instrument calibration and storage, equipment and personnel decontamination, change rooms, C/RP office space, laundry, personnel dosimetry, respiratory protection, training, radiochemistry, sample storage and access to sampling areas.

8.1.1 Radiation Protection

The health physics office is located adjacent to the auxiliary building controlled access on the 1013 ft. elevation between the change area and health physics counting area. Both the office and counting space are very small and are considered to be inadequate to support current and future operations. The health physics office is located such that the RWP station can be observed but the actual access and exit points can not be observed. The personnel decontamination facilities inplant are small and separate facilities are not

provided for female workers although there is a separate area with locker space provided for female workers to change clothes. Adequate first aid facilities are provided in the main worker change room. Personnel decontamination facilities outside of the plant are very limited, consisting of a rest room and shower stall in the environmental laboratory building which also houses the Emergency Control Center (ECC).

The respiratory protection program facilities at FCS are located in several areas. The equipment for fitting respirators and evaluating pulmonary function is located in the environmental laboratory building as is the whole body counter. These facilities are considered to be adequate. Cleaning, drying and decontamination of respiratory equipment is done in the laundry, and inspection and maintenance in the HP counting area. Spare parts are stored in the health physics area as well as in the radiologically controlled area of the auxiliary building. These facilities are considered to be less adequate than facilities specifically dedicated to these functions.

The health physics counting area is in a radiologically controlled area adjacent to the health physics office. Small potentially contaminated items are passed from corridor 26 into this counting area and are surveyed and released. The space allocation for counting is small and with good potential for contamination and erroneous results. Equipment decon is accomplished in a room off corridor 26 in the auxiliary building. The space is small but appears adequate for routine operations. Laundry facilities are adjacent to the control point to the auxiliary building. The facility appears adequate for routine operations. Contaminated equipment storage is located in a caged area near the personnel hatch to the containment. This area was found to be orderly and well controlled.

The calibration room is a small area near the health physics counting area. The room is not shielded and open range calibrations are not performed. It may be necessary to develop a different calibration facility if complete calibrations, as recommended by ANSI N323, are to be performed. The appraisers also reviewed instrument storage and facilities for processing TLD in Omaha and considered these facilities to be adequate.

8.1.2 Radiochemistry

The radiochemistry laboratory is located at the 1013 ft. elevation just east of the calibration facility. Access to the lab is through cooridors 52 and 26. Corridor 26 is in the auxiliary building and radiologically controlled. A hand and foot portal monitor separates the hot lab from the other lab areas. Personnel in the hot lab wear protective clothing and have access to auxiliary building

via corridor 26. Access to sampling areas is through this corridor. The lab space is small and counting instruments are close to sources of high activity. Ventilation supply to the labs is by the auxiliary building supply fans. Small air conditioners have been added to cool counting equipment. The exhaust hood installed in the hot lab does not have separate blower and air movement appears quite low. The laboratory does have modern counting instruments and computer based spectrometers. The Appraisal Team feels that the radiochemistry facility is marginally adequate for normal operations and recommends that a separate blower be provided for the exhaust hood to increase air flow and consideration be given to moving the lab facility to a location with less potential for contamination and high radiation levels associated with an accident in the auxiliary or containment buildings.

8.2 Protective Equipment

8.2.1 Respiratory Protective Devices

The FCS supply of respirators, filter cartridges and related equipment appears to be adequate with the possible exception of the supply of SCBA devices. As reported in Section 3.2.4 of this report, there are only six or seven SCBA units, outside of the control room, available for radiological protection purposes in the plant. This appears to be too small a number to support the needs during accident conditions which might result in relatively unknown or high levels of airborne radioactivity in areas requiring access by several personnel at one time or multiple entries over a prolonged period of time. Because of this the Appraisal team recommends that more SCBA units be made available.

8.2.2 Anticontamination Clothing and Protective Equipment

Existing supplies and station control of anticontamination clothing and protective equipment was reviewed. The FCS Stores Department purchases and dispenses all clothing, equipment or supplies. Health Physics has a stores book from which they can order what is needed. Stores has been given a minimum and maximum number for inventory of each item and seem to have no problem keeping necessary items available. If Health Physics wants something on the list they send in a request specifying the inventory range to be maintained. This request must be approved by management. The health physics technicians felt that in most cases they have no problem getting what they need when they need it. They did indicate some problems in obtaining rope stanchions for use in defining controlled areas.

The Stores Department is located separate from the reactor and auxiliary buildings and so would probably not be lost in a nuclear incident. The appraiser considered present supplies and anti-contamination clothing to be adequate.

8.3 Conclusions

Based upon the findings; this portion of the licensee's program appears to be acceptable, however, the following matters should be considered for improvement.

1. Improvements in the health physics office, respiratory protection and calibration facilities.

2. Consider relocation of the health physics counting area and the radiochemistry laboratory to reduce potential for contamination and high background.

3. Supply a local exhaust blower for the radiochemistry fume hood to increase air flow.

4. Increase the supply of SCBA devices available for radiation protection.

9.0 Emergency Response/Re-entry

Documents Reviewed

FCS, licensee letters of 11/25/79, 11/27/79, 12/31/79 in response to NUREG-0578 requirements.

FCS, OI-PAP-1-9, Interim Post Accident Procedures.

9.1 NUREG-0578 Items

NUREG-0578 contains items that impact directly upon the health physics staff. These items are post accident sampling, high range monitors for effluents and in-plant iodine monitoring. The appraiser reviewed the licensee's letters of 11/25/79, 11/27/79 and 12/31/79 in response to NUREG-0578 requirements. Emergency plans and procedures were reviewed with the plant staff as well as present supplies, equipment and facilities.

The interim procedures for taking a primary coolant sample involves the use of a shielded container and taking the sample at the present primary coolant sampling station. A shielded container is now available. The handling and counting of the sample would be accomplished at the present radiochemistry laboratory. The appraiser noted that the expected radiation levels, based upon the design accident, would be about 30 R/hour in the primary

coolant sampling room and .1-1 R/hour in the radiochemistry laboratory. Handling tools and portable shielding have not been collected for possible use. The location, ventilation and shielding available in the laboratory presents considerable concern. The laboratory and auxiliary building uses the same supply air and the laboratory appears only slightly positive with respect to the auxiliary building due primarily to small air conditioners in the lab. The lab hood does not have a separate blower and air movement through the hood appears quite low. The amount of activity that could be brought into the lab and successfully counted has not been determined. Certainly additional shielding and sample dilution would be required to successfully analyze these samples. The appraiser concluded that using present procedures, equipment and facilities no assurance could be given that samples can be collected and handled and maintain personnel exposures within 10 CFR 20 limits. Additionally, the location, shielding and ventilation of the present radiochemistry lab are such that it is doubtful that samples could be handled and counted to obtain meaningful results.

Containment gas and particulate samples would be taken at the existing containment sampling location in the auxillary building, using the same sampling gear utilized in the routine program. It should be noted that this sampling location is not presently being used due to poor correlations with samples taken inside containment. The cause of these descrepancies has not been identified. These samples would be handled and counted in the existing radiochemistry laboratory. No protective equipment or portable shielding has been provided. Containment air brought to this location under accident conditions would certainly present personnel exposure problems. These problems appear not to have been addressed. The handling and counting of these samples in the laboratory would present problems similiar to those encountered in handling primary coolant samples.

In order to provide high range capability for monitoring gaseous effluent releases under accident conditions, the licensee proposes to use a portable survey instrument to be placed on the main steam safety relief line and thereby estimate release rates from this effluent path. Curves relating instrument reading and release rates have been developed. Stack air sample can also be collected at the RM-060, 061, and 062 monitor location in the auxiliary building and also using a sampling port on the main stack on the roof of the auxiliary building. This location is about 10 feet from the containment building. An outside consultant will provide FCS's final high range monitoring capability.

For in-plant iodine monitoring under accident conditions, a SAM-2 instrument has been purchased and calibrated. Charcoal adsorbers would be purged of noble gas activity using a vacuum desicator in the radiochemistry lab. The poor hood flow in the laboratory casts doubt on the ability of the hood to remove noble gases from the counting and laboratory areas.

9.2 Emergency Response

An appraiser reviewed the FCS health physics staff's preparedness for responding to an accident and preparations for extended radiation protection following an accident. The review in this area during the appraisal did not duplicate other NRC emergency planning program evaluations in progress. OPPD has established a corporate emergency planning task force, with representation from Licensing, Engineering, Technical Services, Communications, Public Relations and FCS C/RP, to coordinate and develop a revised emergency plan and implementing procedures to meet the requirements of 10 CFR 50 and NUREG 0654. The appraiser noted that the revised plan was under review by OPPD at the time of the appraisal and also the implementing procedures for re-entry and recovery in the event of an accident were under development. Discussion with a task force member indicated that a basic recovery organizational chart has been proposed and qualifications for job functions will be analyzed, job descriptions written and necessary training identified and provided in the near future. Discussion of arrangements for supplemental staff and technical support indicated that no firm provisions for augmenting the onsite radiation protection staff with properly qualified health physics assistance or additional technical support to support re-entry or recovery operations following an accident had been made.

9.3 Conclusions

The NRC is conducting a separate nuclear power reactor emergency planning evaluation program as well as a task group to evaluate NUREG 0578 items. Because of this, the Health Physics Appraisal Team will not make conclusions of adequacy in this area except to recommend that OPPD enter into suitable agreements with offsite organizations for supplemental health physics assistance and technical support and further evaluate the adequacy of protective equipment and the present radiochemistry laboratory to sample and analyze samples from designated sample points areas during a serious accident.

ANNEX A

EXIT INTERVIEW

The Appraisal Team and the Region IV Fuel Facility and Material Safety Branch Chief met with licensee representatives (identified in Annex B) at the OPPD corporate offices on September 26, 1980. The appraisal team leader summarized the scope and major findings of the appraisal. The findings were classified into three categories:

A. Significant appraisal findings are described in Appendix A of the transmittal letter forwarding this report and are summarized at the conclusion of each applicable section of this report. Written responses to these significant findings will be required to be submitted by the licensee. Actions taken on these findings will be reviewed during subsequent inspections.

B. Apparent items of noncompliance identified during the appraisal are described in Appendix B of the letter forwarding this report. Written responses to these items will be required to be submitted by the licensee. Actions taken on these items will be reviewed during subsequent inspections.

C. Findings of lesser significance but which are considered important by the appraisal team are summarized at the end of each report section. No written response to these findings will be required, however, it is expected that these findings will be used by the licensee in formulating a radiation protection plan. Requirements for the radiation protection plan will be specified by the NRC in the future. Progress and improvements in these areas will also be reviewed in subsequent inspections.

ANNEX B

PERSONS CONTACTED (OPPD)

*S. C. Stevens, Station Manager
*W. G. Gates, Supervisor of Operations
*F. F. Franco, Chemistry and Health Physics Supervisor
*B. J. Hickle, Plant Health Physicist
*R. L. Jaworski, Section Manager, Technical Services
*F. A. Thurtell, Manager, Quality Assurance
*W. C. Jones, Division Manager, Production Operations
*R. C. Andrews, Section Manager, Operations
*K. J. Morris, Manager, Administrative Services
J. Mattice, C/RP Technician
M. Core, I&C Electrical Engineer
J. Connolley, Supervisor, I&C and Electric Field Maintenance
J. Gass, Training Coordinator
T. Chapman, C/RP Specialist
R. Coleman, I&C Technician
W. Jewell, QC Inspector
C. Crawford, C/RP Technician
S. Rima, C/RP Technician
R. Hyde, Operations QA Engineer
J. Gasper, PhD, Supervisor of Technical Services
D. Bruening, PhD, Engineer, Technical Services
J. Gloshen, Corporate QA Engineer
D. Lorentz, Reactor Operator
C. Brunnert, QA Inspector

*Denotes those persent at the exit interview on September 26, 1980.

Other licensee employees contacted included technicians, operators, etc.

Figure 1
Ft. Calhoun Station Organization

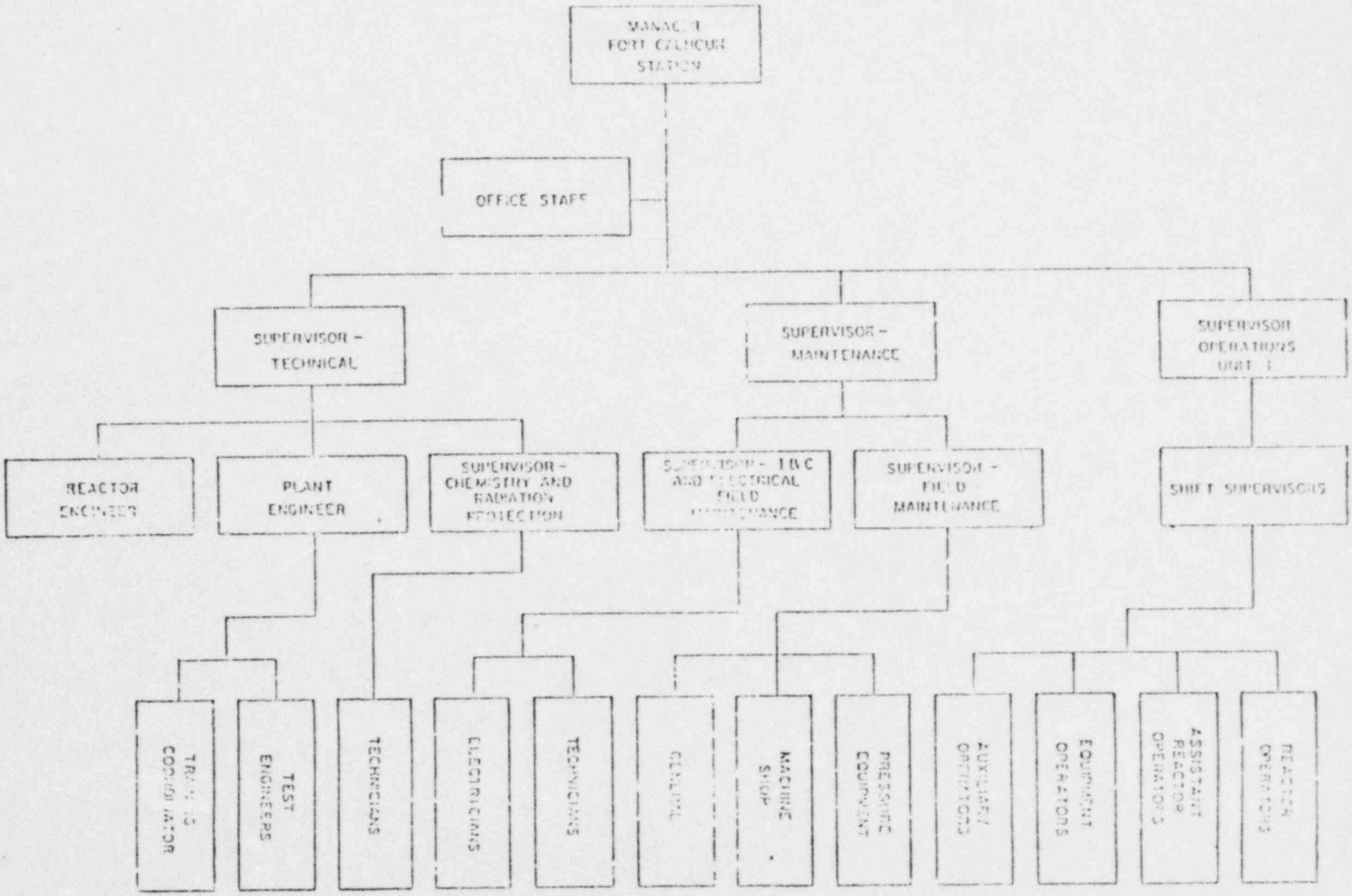

FIGURE 2

FCS - RADIATION PROTECTION ORGANIZATION