U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

REGION III

Report No. 50-346/81-11

Docket No. 50-346 License No. NPF-3

Licensee: Toledo Edison Company
300 Madison Avenue
Toledo, OH 43652

Facility Name: Davis-Besse Nuclear Power Plant, Unit 1

Appraisal At: Davis-Besse Site, Oak Harbor, OH

Appraisal Conducted: January 12 to 23, 1981

Team Members: I. R. Greger, NRC — 8/26/81

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Division of Engineering and
Technical Inspection — 9/1/81

Appraisal Summary

Appraisal on January 12-23, 1981 (Report No. 50-346/81-11)
Areas Inspected: Nonroutine, announced appraisal of health physics program, including organization and management, qualifications, training, internal and external exposure controls, surveillance, access controls, instrumentation, ALARA, radioactive waste, facilities and equipment, and accident response. The appraisal involved approximately 400 man-hours onsite by five inspectors.
Results: Three significant weaknesses in the health physics program were identified. These weaknesses are in the area of: training (Section 4), effluent monitoring (Section 9), and ALARA (Section 10).

DETAILS

1. Persons Contacted

*B. Beyer, Assistant Station Superintendent
*L. Bonker, Health Physics Specialist
*D. Briden, Chemist and Health Physicist
*R. Crouse, Nuclear Vice President
D. Eldred, Maintenance Specialist
*W. Frazer, Health Physics Specialist
*B. Geddes, Quality Assurance Representative
D. Hennen, Chemistry and Health Physics Foreman
*M. Horne, Health Physics Supervisor
*D. Huffman, Senior Engineer
*W. Mills, Chemical and Radiation Protection Engineer
D. Morrison, Office Supervisor
*T. Murray, Station Superintendent
*R. Scott, Chemistry Supervisor
L. Simon, Operations Supervisor
T. Syrowski, Training Instructor
T. Szydlowski, Station Services Foreman
J. Tapley, Chemistry and Health Physics Foreman
*L. Keyes, NRC Senior Resident Inspector

The appraisers also contacted other licensee employees, including members of the technical and engineering staffs.

*Denotes those attending the exit meeting.

2. General

This special appraisal, which began at 8:00 a.m. on January 12, 1981, was conducted to evaluate the adequacy and effectiveness of the licensee's overall health physics program. The appraisal team consisted of three inspectors from the NRC Region III office and two contractor personnel. General tours and examinations of licensee facilities were conducted initially on January 12 and 13, 1981. Selected licensee facilities were examined in more detail during the remainder of the appraisal period. The scope of the appraisal included the health physics organization, management controls, qualifications and training of the health physics personnel, radiation worker training, the radiation protection program, radioactive waste processing, effluent controls, and the chemistry and counting laboratories. The licensee's past and anticipated future performance under both routine and abnormal conditions was examined.

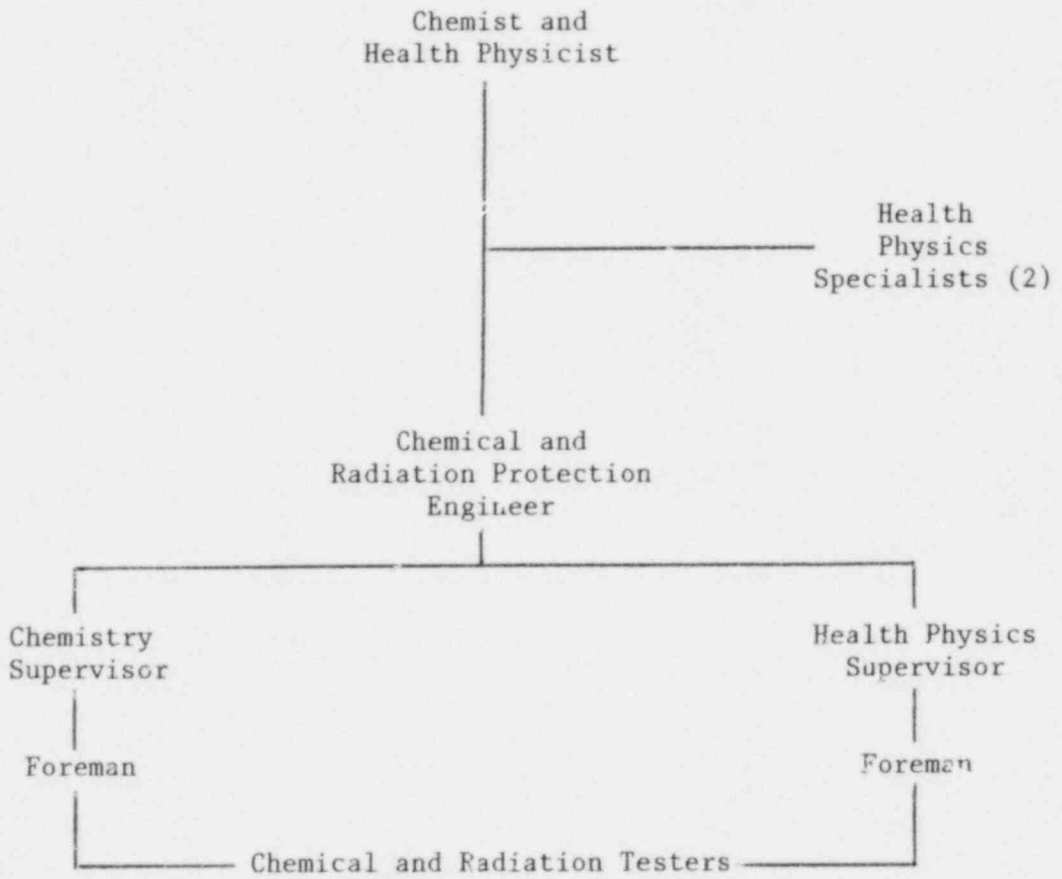
Significant weaknesses were identified in three areas of the licensee's health physics program. These areas are health physics technician (chemical and radiation tester) training, ALARA, and high range noble gas monitoring. Additional, less significant program weaknesses were identified in several areas; they are described in the respective report sections. The licensee's overall health physics program is considered above average by the Appraisal Team.

3. Organization, Management and Qualifications

The licensee's health physics organization is generally competently staffed and effectively managed. One apparent exception to this general observation is discussed below. Past licensee performance in health physics related activities has been good with the exception of a recent personal overexposure. Several areas of suggested improvement, noted below, were identified during the appraisal.

a. Organizational Structure

The licensee's health physics organization is directed by the Chemist and Health Physicist, who reports to the Station Superintendent through the Assistant Station Superintendent. No problems were noted regarding direct access to the Station Superintendent when necessary. The Chemistry and Health Physics (C&HP) Department structure is depicted below.



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The chemical and radiation testers are utilized interchangeably in the chemistry and health physics areas. Assignments may be short term or long term depending upon personnel availability. Coverage is provided for all shifts by a rotating schedule of approximately seven Chemical and Radiation Testers. The remaining testers had special assignments or were not considered qualified to provide offshift coverage without supervision.

The rotation between work assignments did not appear to adversely affect tester performance. This is attributed to the continuity provided by the two foremen, assignment of continuing responsibility in some areas to Senior Testers, and the relatively short rotation cycle (normally less than seven weeks). The flexibility gained through cross training may outweigh the disadvantages due to lack of specialization among the testers in these circumstances.

Based on the appraisal findings, this portion of the licensee's program appears to be acceptable.

b. Staffing and Qualifications

Technician (tester) staffing appeared adequate for the currently assigned responsibilities. Additional staff may be necessary to assume area decontamination responsibilities.

The chemical and radiation tester workforce has been relatively stable; this is an extremely valuable ingredient to an effective health physics organization in the Appraisal Team's opinion. The testers generally appeared well motivated and knowledgeable concerning their jobs.

A progression system based upon longevity and technical proficiency is used for advancement from the entry level health physics technician position, Assistant Chemical and Radiation Tester, through the senior position, Chemical and Radiation Tester Group Leader. Assistant testers are not considered "responsible technicians" per ANSI N18.1 and are not assigned to shift work unless supervised by a Chemical and Radiation Tester, Senior Tester, or Group Leader. As noted in the previous section, offshift health physics technician coverage is provided by Chemical and Radiation Testers. Qualification requirements for the various tester positions were adequately documented.

Management staffing appears good regarding numbers and competency. The Chemist and Health Physicist (RPM) was found to be very knowledgeable of health physics and plant activities and appeared dedicated to the conduct of a good health physics program. The motivation of the remaining department management personnel also appeared above average.

A possible exception to the general managerial competence within the Chemical and Health Physics (C&HP) Department appeared to exist with one supervisor. According to personnel both within and outside the C&HP Department, worker morale and productivity are adversely affected by this supervisor's apparent poor supervisory skills. This matter was discussed with the individual and licensee management, both of whom were aware that a problem existed. The licensee stated that attempts had been made, and would continue, to resolve the problem. The Appraisal Team is concerned that if this condition is allowed to continue, worker disallusionment and increased personnel turnover may have a significant adverse affect upon the conduct of the health physics program.

Contract health physics technicians have been brought in to assist during refueling and major maintenance outages Resumes were on file for the contract technicians. The licensee reported that the resumes were reviewed for qualification per ANSI N18.1-1971. A needed improvement in contract technician training is discussed in Section 4.c. No further problems were noted. Contract technician control appeared adequate.

Area decontamination is performed by Station Services personnel under the direction of the Health Physics Foreman. This arrangement suffers due to the lack of permanent assignment of specific personnel to decontamination duties and to supervisory conflict between Chemistry and Health Physics and Station Services. The Appraisal Team recommends that assigned personnel be added to the Chemistry and Health Physics group to perform decontamination work or, less desirably, that specific Station Services personnel be permanently assigned to decontamination work to eliminate retraining problems and improve worker motivation.

Based on the appraisal findings, this portion of the licensee's program appears to be acceptable. However, the licensee should resolve the apparent supervisory problem noted above and review the method of personnel assignment to decontamination work.

c. Communications/Authority/Responsibility

The attitude of plant workers regarding radiation protection personnel and requirements appeared generally good, although a few individuals appeared to repeatedly violate plant health physics procedures. In these isolated instances, management had not always taken firm action to correct the situation. Such actions appear to have been taken more recently, but the technicians who identify the problems have not consistently been apprised of these management actions and therefore have tended to lose faith in the informal radiation protection infraction system. This system should be formalized to encourage more consistent reporting and resolution of radiation protection infractions. The system should provide feedback to the technicians to ensure that they are aware of the resolution of identified problems.

Improvement appears desirable regarding communications between health physics management and technician personnel. The formal communications necessary to perform work assignments was acceptable but technician complaints did not appear well known by department management, and several technicians indicated a general lack of information regarding department and plant activities which although not essential for conduct of their work, could affect them. An example, given previously, is the lack of feedback regarding resolution of radiation protection infractions. Another example is the lack of feedback on technician suggestions such as facility change requests. Feedback to the technicians in these situations encourages additional constructive efforts on their part.

Bimonthly meetings are held between health physics management and technician personnel. According to several licensee personnel, these meetings have been beneficial but could be improved by encouraging a more open forum for airing of problems. It appeared that some lower level supervisory personnel were impeding, perhaps unknowingly, the upward flow of information regarding technician perceived problems.

Based on the appraisal findings, this portion of the licensee's program, although acceptable, should be improved by formalizing the radiation protection infraction system, increasing feedback regarding technician identified problems, and encouraging informal communications between health physics management and technician personnel.

4. Training

The licensee's training program includes initial training and refresher training in radiation safety for workers per 10 CFR 19.12. This training appeared acceptable. The chemistry and radiation tester training program has recently undergone significant revision. The revised program appears adequate, but final judgement must await implementation of the program. A chemistry and radiation tester refresher training program is needed. Training programs are documented in the AD 1828 series procedures.

a. Chemistry and Radiation Tester Training

The recently revised chemistry and radiation tester training program includes general orientation training (GOT/RCT), health physics fundamentals, chemistry fundamentals, basic nuclear technology, administrative practices, and job specific qualifications. The major change from the previous training requirements is the inclusion of job specific qualifications which include discussion, system comprehension, and practical factor aspects, each of which requires checkout by a Senior Chemistry and Radiation Tester. The lack of job specific qualification requirements was the major shortcoming in the licensee's former chemistry and radiation tester training program. The revised training program appears acceptable;

final evaluation of its acceptablility, however, must await review of the fully implemented program. Licensee personnel indicated that completion of the training program was expected to take a new tester approximately two years. Although not yet formalized, promotion from Assistant Tester to Tester will require completion of the training program according to licensee personnel.

The continuing training program for chemistry and radiation testers has not been formalized to the extent of the initial training program. Additional efforts are needed in this area. At present, continuing training includes irregularly scheduled C&HP Department training sessions (six in 1980, fifteen in 1979, nine in 1978), annual refresher general orientation training, and periodic completion of chemistry proficiency tests.

Common tester complaints regarding training included: (1) excessive reliance on self training by routing new and revised procedures to the testers, (2) a lack of practical hands-on training in new equipment and new procedures, and (3) inadequate time available for self training and formal training sessions. The Appraisal Team generally agrees with these criticisms. The continuing training program needs better definition. It should include more formal training sessions, perhaps conducted by assigned technicians; additional hands-on training; expansion of the periodic proficiency testing to include pertinent radiation protection activities; and commitment of a specified portion of the tester's time to training activities (four hours per week would not be excessive in the opinion of the Appraisal Team). The Appraisal Team also believes that self-study can be an important part of the training program if sufficient guidance is provided to define and evaluate effectiveness of such training. This training method is particularly adaptable to the chemistry and radiation tester work schedule which has free time scattered over the work day.

Although the Chemist and Health Physicist is responsible by procedure for the training of the chemistry and radiation testers, the training department has responsibility for implementation of training programs. This arrangement appears to work fairly smoothly, due in part to the presence of a former chemistry and radiation tester on the training staff.

Based on the appraisal findings, an improved continuing training program is needed to achieve a fully acceptable program. Further improvement is desirable, as noted above, regarding formal training sessions, proficiency testing, and hands-on-training.

b. 10 CFR 19.12 Training

Initial indoctrination and annual retraining, provided by the training department in accordance with procedure AD 1828.03, consists of General Orientation Training (GOT) and Radiological

Controls Training (RCT). GOT training is required for unescorted access to the restricted area (radiation) or the protected area (security) and RCT training is required for unescorted access to the radiation access control area (RACA).

GOT consists of basic presentation of five topics: station security, industrial safety, quality assurance, station emergency plan, and radiation safety. Topics covered in RCT include a more detailed discussion of radiation safety rules and practices.

The training is presented mainly as a synchronous slide and tape presentation employing 12 slide projectors and a wide screen. The quality of the presentation was good with the presentation method especially good from the standpoint of viewer attention. The instructor giving the training emphasizes certain subjects, discusses changes, and answers questions. Testing is conducted at the end of each topical presentation. This training involves about five hours of presentation and testing.

The Appraisal Team found the training to be well presented, comprehensive in radiation protection matters, and inclusive of matters required by 10 CFR 19.12 and recommended by Regulatory Guide 8.13. Several minor errors and inconsistencies, were discussed with the Nuclear Training Manager who acknowledged the comments and stated that necessary changes would be made during anticipated program revisions.

Further training, provided for workers who may be required to wear respiratory protection equipment, was not specifically reviewed during the appraisal.

Based on the above, this portion of the licensee's program appears acceptable.

c. Other Training

In addition to initial general orientation training and annual retraining, plant radiation workers typically receive additional radiation protection training in their qualification programs. Except for licensed operators, refresher radiation protection training for these workers is limited to the annual GOT retraining and specific work group training sessions. Licensed operators receive additional radiation protection training in their requalification program.

Contract radiation protection technicians are used to supplement the chemistry and radiation tester staff during outages. Although these technicians receive general orientation training (GOT and RCT), no further training or testing program exists. The contract radiation protection technicians are generally assigned to specific jobs or plant areas under the supervision of a health physics foreman and have significant responsibilities for the protection of workers. The Appraisal Team believes that

the licensee should develop a training/testing program for contract radiation protection technicians to ensure they are familiar with licensee procedures and practices and to provide information regarding their radiation protection proficiency.

As noted in Section 9.e, additional training appeared needed to enable shift supervisors to quantify airborne radioactive releases using the interim high range plant vent noble gas monitors. The need for this training is somewhat dependent upon the quality of the licensee's procedures for quantifying these releases and the availability of chemistry and radiation protection personnel to assist in the quantification. Since only one chemistry and radiation tester is normally assigned to the offshifts, the shift supervisor may be required to perform the release quantification if the chemistry and radiation tester is involved in other required activities in response to an accident. The addition of a second qualified chemistry and radiation tester to the offshifts could alleviate the need for detailed quantification knowledge by the shift supervisors.

Based on the appraisal findings, improved contract health physics technician training and effluent quantification training for shift supervisors is needed to achieve a fully acceptable program.

5. Quality Assurance

Quality assurance is applied to the health physics program through: (1) management review of data and reports, (2) calibrations and testing to verify acceptable instrumentation performance, and (3) oversight activities by the Corporate Quality Assurance Division (QA) and the Company Nuclear Review Board. The first two areas are discussed in other sections of this report. The oversight activities, including desirable improvements, are described below.

Separate audits of radiation protection and radioactive waste management activities are conducted annually by QA. The 1980 audits were reviewed by the Appraisal Team. These audits, which were conducted in accordance with ANSI N18.7-1976 criteria, appeared adequate in scope and depth of review. Audit report issuance appeared timely, as did the Chemistry and Health Physics (C&HP) Department's responses. Some improvement in the QA review, followup, and closeout of these responses, however, appeared needed. Audit findings AFR 663-3 and 663-6 were responded to by C&HP on June 30, 1980, but QA did not advise C&HP that the responses were unacceptable until November 13, 1980 (significantly in excess of the "normal" 30 day QA review time). These audit findings have since been satisfactorily resolved. Additional audit findings (AFR657-2, 657-3, and 663-1) had been open for greater than six months at the time of this appraisal. Such delays can diminish the effectiveness of the audit program. Plant management committed to Corporate QA to close out these items by January 31, 1981.

Annual quality assurance audits have been performed of the contractors providing external dosimetry (TLD), environmental surveillance, and radioactive waste disposal services. Review of these audit reports for 1980 showed contractors to be in general compliance with their respective QA programs although some deficiencies were noted. The audits appeared to have been conducted adequately. Further details of these audits are provided in Section 7.

In addition to audits, quality control surveillances (inspections) of certain activities are performed. These surveillances have been conducted primarily for radioactive waste solidification, packaging, and shipping activities to provide independent verifications per 10 CFR 71.51. No problem was noted with the surveillances.

A technical audit of the health physics program was performed in 1980 by a team of outside consultants. This audit was performed for the Company Nuclear Review Board. The Appraisal Team reviewed this audit and discussed the findings with the licensee. No significant problems were noted by the Appraisal Team with regard to this audit.

A deviation report system exists to document review and followup of significant conditions adverse to quality. Administered by th Technical Engineer, and described in AD 1807.00.5, this system has been used primarily for operational problems which require reporting to the NRC. Only minimal emphasis appears to have been given to other problems. The Appraisal Team believes that expanded use of this system or creation of another system to report radiation protection problems would improve the licensee's radiation protection program.

Based on the above findings, the quality assurance aspects of the health physics program appeared generally acceptable. Two improvements appeared desirable: (1) timelier review and closeout of audit corrective actions, and (2) implementation of an internal reporting system for radiation protection problems.

6. Procedures

Radiation protection procedures appear in the Radiation Protection Manual, the C&HP Manual, administrative directives, the Emergency Plan and supporting procedures, and the quality assurance program. In addition, vendor manuals are used as reference procedures, and an internal memorandum system is used for communicating technical and administrative information. Procedures generally appeared to be technically accurate; however, some appeared excessively lengthy and detailed. Improvements could be made by emphasizing station unique applications, practices, and acceptance criteria and referencing appropriate sources for related background material. Instrumentation procedures were frequently noted to contain lengthy equipment descriptions quoted directly from vendor manuals (including vendor warranty statements). Deletion of such material by referencing the vendor's manual appears desirable. Procedure conciseness is particularly important in procedures which are performed infrequently but which require rapid execution. Individual procedures were reviewed

by the Appraisal Team as they pertained to areas examined during the appraisal; comments on specific procedures are included in other sections of this report.

The licensee's review, approval, and control system for procedure issue and revision was examined. Procedures are reviewed by the responsible section head and the Safety Review Board (SRB) before being approved by the Station Superintendent. Quality assurance (QA) review and approval are required for those procedures considered nuclear safety related to assure QA Manual requirements are met. For non-nuclear safety related procedures (including most C&HP procedures), QA performs an administrative review only if requested. Licensee procedures require that approved procedures be reviewed annually and revised if necessary. According to licensee records, over 90 percent of the approximately 300 C&HP section procedures were reviewed on schedule in 1980. No significant problems were noted with the procedure review, approval, or control system.

The licensee defines procedure modifications as either major or temporary. Major modifications require revision and reissuance of the entire procedure, while temporary modifications result in attachment of the change to the front of the procedure. A temporary modification requires approval by two members of management (including one licensed senior reactor operator); the approval is effective for 14 days to allow time for SRB review and Station Superintendent approval. After such approval, the temporary modification remains effective until a major modification of the procedure is made. Since there is no requirement that procedures be revised periodically to incorporate minor modifications, procedures can become difficult to use because of the existence of numerous temporary modifications. This can lead to disuse or misuse of procedures. The Appraisal Team believes that temporary modifications should have a limited lifetime (e.g., one month), and that timely revisions of procedures should be made when permanent change is necessary. The Appraisal Team noted that most C&HP procedures were revised on a timely basis. However, Procedure LI 4782.00 (Laboratory Instrument and Reagent Calibration) had six temporary modifications (each indicating a major modification was required) and had not been revised in four years. Another Procedure, SP 1104.30 (Miscellaneous Radioactive Waste Disposal), had 23 temporary modifications but had yet to be revised. The C&HP section does not have responsibility for revising the latter procedure.

Based on the above findings, this portion of the licensee's program appeared generally acceptable. Improvement is desirable, however, to minimize the long-term existence of temporary changes to procedures and to remove unnecessary detail from some procedures.

7. Exposure Control and Dosimetry

The licensee's external and internal exposure control programs appear to have functioned adequately except for an overexposure in April 1980 which appears to have resulted from a combination of inadequate

pre-job planning, personnel error, and possible equipment malfunction. No significant problems were identified with the licensee's controls during this appraisal. Several desirable improvements were identified and are described below.

a. External Exposure Controls and Dosimetry

External beta-gamma radiation exposure is monitored by a combination of thermoluminescent and self-reading pocket ion chamber dosimeters. A contractor provides the official dose determinations using a calcium sulfate thermoluminescent dosimeter (TLD) wafer for skin and whole body dose assessment. All personnel are assigned TLD's except infrequent visitors and escorted persons who do not enter the Radiation Access Controlled Area (RACA). Permanent plant personnel TLD's are stored at the security gatehouse; assigned temporary TLD's are stored at the RACA entrance. Control TLD's are kept at both locations. Spare TLD's are stored in shielded storage containers in the RACA health physics office. Extremity monitoring is performed by taping TLD wafers to the backs of the hands (or feet). This may be appropriate at times, but use of TLD finger rings appears needed also to enhance worker convenience (improved dexterity) and allow closer placement of the dosimeter to the source of exposure under certain conditions. Typical turnaround time for TLD processing has been about three weeks with much faster processing available when necessary. In addition, telephone notification is utilized for TLD results exceeding 800 millirems. Some problems have been experienced with erroneous contractor dosimetry results licensee evaluations in these cases appeared adequate. The licensee has an onsite TLD reader which is used for inplant (area) and environment measurements. Use of this system for supplemental or redundant personal dosimetry was discussed with the licensee; however, such use is not presently anticipated under normal circumstances.

Self-reading pocket dosimeters, used for monitoring dose on a short-term basis, are maintained at the RACA entrance and are required for all controlled area entries. Workers normally read and record their own dosimeter results. Review of these records indicated that personnel appeared to be logging the data properly. Licensee personnel indicated that during the recent refueling outage, loss of dosimeters by pilferage was initially significant; however, the subsequent assignment of a chemistry and radiation tester to read and log dosimeter results was effective in improving control. Similar controls are expected to be used routinely during future major outages. Quantities of both low range and high range dosimeters appeared adequate at the time of the appraisal.

Neutron exposures are determined using a Hankins neutron detector, operated in the integrate mode, which is carried by workers entering a neutron area. A site determined conversion factor is applied to give a direct millirem reading. Pocket gamma dosimeters have also been used for neutron dosimetry based on a neutron to gamma

ratio of 15 to 1. The neutron quality factor was recently increased by a factor of three to reflect an ICRP recommendation. Stay times for neutron areas are calculated based on dose rate surveys but are not normally used for dose assignment. A review of licensee records showed that neutron doses were less than ten percent of total whole body doses. Licensee personnel indicated this was due primarily to prohibiting containment entry at power levels exceeding five percent (due to a neutron streaming problem). Past neutron dosimetry methods have included neutron sensitive pocket dosimeters and albedo neutron TLD's, both of which were discontinued because of inconsistent results. Reconsideration is being given to albedo neutron TLD use due to reported satisfactory performance in the University of Michigan tests. No significant problems were noted with the present neutron dosimetry program.

Administrative limits (600, 1200, 2500 millirems) are used; an alert list system is used to inform management of individuals approaching the administrative limits. Increasingly higher levels of management review and approval are required (and documented) to exceed successive administrative limits. Females are limited to 200 millirems per month to implement NCRP 39, NCRP 53, and Regulatory Guide 8.13 recommendations. The overexposure in April 1980 was not attributable to failure of the dosimetry program. This overexposure was reviewed in NRC Inspection Report No. 50-346/80-12, dated June 27, 1980 Licensee exposure evaluations in response to the overexposure appeared acceptable.

Personnel dose records are maintained manually by a health physics specialist and a dosimetry records clerk. Work is in progress to computerize the personnel dose records. The Appraisal emphasized the need to maintain a manual backup record (perferably onsite) so that records would not be lost or rendered inaccessible due to computer failure. Random and selected personnel dose files were reviewed and appeared to be complete and current.

Quality assurance aspects of the external dosimetry program include (1) management reviews, (2) monthly blind spiking of vendors TLD's, (3) semiannual testing of pocket dosimeters (consistent with ANSI N13.3-1972 and Regulatory Guide 8.4 recommendations), (4) pocket dosimeter/TLD comparisons, and (5) annual audit of the TLD contractor. Pocket dosimeter/TLD comparisons are performed by the Health Physics Supervisor when TLD results exceed 50 millirems. These comparisons typically show pocket dosimeter results to be higher than TLD results due, principally, to conservative rounding off of the 0-500 mR dosimeter reading. These differences could be reduced by using 0-200 mR dosimeters which would provide more precise data. A licensee audit of the TLD contractor identified one TLD reader which had not been calibrated at the proper frequency and several deficiencies in material procurement. This audit appeared to be

worthwhile and is a step beyond what most external dosimetry programs include. Adequate quality assurance appeared to be applied to the program.

Based on the above findings, the licensee's external exposure controls and dosimetry program appeared acceptable. Improvement is desirable, however, in use of TLD finger rings for extremity monitoring.

b. Internal Exposure Controls and Dosimetry

Internal exposure controls include engineering controls, such as ventilation and area and equipment decontamination; an air sampling program; and use of approved respiratory protection equipment. Whole body counting and a limited tritium urinalysis program are used to monitor the effectiveness of these controls. No significant problems were noted with either the control or the monitoring methods. Desirable improvements to the program are discussed below.

Engineered controls and air sampling/monitoring practices are discussed elsewhere in this report (Section 8 and 9). Administrative controls used to minimize internal exposure include postings, a radiation exposure permit (REP) system, protective clothing requirements (discussed in Section 8), and a respiratory protection permit (RPP) system which is used in conjunction with the REP for work in airborne radioactivity areas (levels greater or potentially greater than 25 percent MPC). The RPP, written by C&HP, defines respiratory protection equipment requirements and stay times, documents airborne activity concentrations, and provides entry and exit records. MPC-hours are calculated and recorded if greater than 40 MPC-hours per seven consecutive days are anticipated. Licensee personnel indicated that no such accumulations have yet occurred; review of RPP's, air sample results, and whole body counts confirmed this.

The licensee conducts a respiratory protection program based on Regulatory Guide 8.15. Licensee procedures require respirator use if seven-day accumulated exposure is expected to exceed ten MPC-hours, if the exposure environment exceeds one MPC, or if certain processes (grinding, welding, etc.) are to be performed on contaminated equipment. Respirators available for use include approximately 50 full-face air purifying masks, 40 full-face supplied air masks, 25 supplied air hoods, and 34 pressure demand self-contained breathing apparatus (SCBA). The supply of respirators, spare parts, and filter cartridges appeared adequate to meet normal and initial emergency response requirements. Replenish capability for SCBA is provided by two spare charged bottles available for each SCBA and a cascade bottle recharge system. This capacity appears adequate for initial radiation protection purposes. Additional cascade bottle recharge capacity and a compressor recharge system are scheduled for installation to meet fire protection requirements.

Respirators are inspected, inventoried, and maintained in accordance with approved procedures. A respirator issue tag provides documentation of the condition of each respirator when packaged after cleaning. This tag, bagged with the respirator, is completed by C&HP with the user's name, date, REP number, and certification of qualitative fit test when the respirator is issued for use. The completed tags are retained by C&HP for approximately one year. This system appeared to function well to provide equipment and personnel traceability. Breathing air for hoods and airline respirators is provided by the station breathing air compressor system. Air is filtered by particulate and charcoal filters, sampled, and analyzed prior to use. Personnel are qualified for respirator use by an initial physical examination, training, and quantitative fit test. Annual requalification consists of retraining and a spirometer test. A quantitative fit test requalification is performed every five years. In addition, qualitative fit checks are performed prior to each use.

Verification of the effectiveness of internal exposure controls is provided primarily through whole body counting; a limited tritium urinalysis program is also used. Permanent plant personnel receive entry and exit whole body counts and annual counts if routine RACA entries are made. All temporary personnel receive entry counts; exit counts are required for respirator users. Whole body counts are also performed following suspected internal exposures. The licensee utilizes a contract whole body counting service. A moving 4 x 8 inch sodium iodide detector scans a supine subject and transmits raw data to the offsite contractor for analysis. Immediate printout of background and gross counts for selected nuclides is provided, and the vendor provides immediate telephone notification for results greater than five percent maximum permissible body burden (MPBB). Final results are typically reported to the licensee within two weeks.

Procedures for whole body counting appeared adequate, although inclusion of gross count action levels appears desirable. Licensee procedures require that individuals be showered and recounted if the WBC indicates a body burden greater than five percent MPBB. This determination is dependent upon telephone notification from the contractor or subjective comparison of gross count printouts with preceding printouts by a C&HP tester. Although several testers indicated recounts would be made if significant activity was identified, further guidance appears desirable to define gross count action levels which correspond to five percent MPBB for nuclides of interest. An acceptable method for back calculating MPC-hours exposure from measured organ burdens is defined in the licensee's procedures; this evaluation is performed when action levels corresponding to 40 MPC-hours are exceeded.

Full calibration is performed by the contractor; an energy calibration check is performed with each count. The contractor's calibration report was not available for Appraisal Team review.

Before the most recent (late 1980) calibration, the licensee had not requested copies of the calibration reports. These reports will be received and reviewed in the future. The Appraisal Team believes that the licensee must review vendor calibrations. In Regulatory Guide 8.26, the NRC endorsed ANSI N343-1978 as an acceptable standard for bioassay; the licensee agreed to review its program and vendor practices with regard to this standard. Further improvement in the quality assurance of the WBC program could be made by occasionally checking contractor response to a simulated high body burden. This check would verify notification capabilities and serve as a training exercise for C&HP testers. Contaminated coveralls could provide both realistic energies and contamination levels.

A limited tritium urinalysis program, utilizing contractor analyses, is conducted for selected station personnel. Results and scope of this program were reviewed; no problems were noted.

Based on the above findings, the licensee's internal exposure controls and dosimetry program appeared generally acceptable. The following desirable improvements were identified: (1) review of the contractor whole body counter calibration practices with regard to ANSI N343-1978 criteria, (2) conduct of an occasional spiked whole body count to assure adequate contractor response, and (3) establishment of gross count action levels for the whole body counter.

8. Surveillance and Access Control

The licensee's radiological control program was examined, including: access controls, radiation exposure permits, and routine and job specific radiation/contamination surveys. The access control review included: restricted areas, controlled areas, radiation areas, high radiation areas, contamination areas, and radioactive material areas. Based on the appraisal findings, this portion of the licensee's program appears acceptable; however, several matters which should be considered for program improvement are noted below.

a. Access Control

The radiologically restricted portion of the site is identical to the protected area defined for security purposes. Unescorted access to the restricted area requires a security badge and General Orientation Training, Part I (GOT-1). When leaving the restricted area at the guardhouse, personnel must pass through a portal monitor and surrender their security badge. Regularly assigned plant personnel receive and deposit their TLD badges at the guardhouse. TLD badges for others are maintained at the entrance to the main Radiation Access Control Area (RACA). The RACA is defined as any area of the station where the radiation levels are 0.25 mR/hr or greater or contamination levels are

220 dpm/100 cm^2 beta-gamma, or 22 dpm/100 cm^2 alpha, or greater. (Further mention of RACA in this section refers to the main RACA which consists of the area inside the auxiliary and reactor buildings.)

The primary access point into RACA is adjacent to the health physics monitor room. For all entries into RACA, a radiation exposure permit (REP) is required. Personnel requiring unescorted access into RACA must successfully complete Radiation Control Training. All personnel are required to pick up a dosimeter and log in on the appropriate REP before entering RACA. Surveillance, to ensure that personnel entering RACA have proper dosimetry and have signed the appropriate REP, normally is not performed. Access into various rooms within RACA is controlled through the use of key-card coding. Individuals leaving RACA are expected to pass through a portal monitor, use a hand and foot monitor, and record their pocket dosimeter reading in the REP log and on their radiation exposure record card. Surveillance of personnel leaving RACA is not routinely performed. The licensee reported that the lack of such surveillance during a recent refueling outage resulted in the loss of many pocket dosimeters (about 700 during a nine month outage). Direct surveillance of personnel exiting RACA, especially during peak traffic periods, could assist workers checking out and may reduce pocket dosimeter loss.

In addition to the main RACA, an outside area on the west side of the containment building has been designated a RACA. This area includes a temporary waste storage area and four trailers used to store radioactive materials. To enter this RACA, which is delineated by radiation rope, individuals must check in at the main RACA before entry.

Radiation area control is provided through area postings and REP issuance. A map of the most recent radiation survey is posted near the entrance to each radiation area. Control of radiation areas appeared to be generally adequate.

High radiation area access is controlled through area postings, issuance of special REPs and normally unlocked barricades when the intensity of radiation is greater than 100 mR/hr but less than 1000 mR/hr. Entry into these areas requires the use of a radiation monitoring device which continuously indicates the radiation dose rate in the area. Occupancy time limits, set by C&HP to ensure that personnel exposure limits are not exceeded, are specified on the special REP issued for the entry.

High radiation areas which exceed 1000 mR/hr are controlled by locked doors. Entry requires approval by C&HP management personnel. In an emergency, permission can be obtained from the Shift Supervisor. Keys are controlled through the use of a locked key cabinet and log book. Locked high radiation areas

require a two-person entry, one being a C&HP staff member. Since the personal overexposure incident in April 1980, two different types of high range survey instruments must be used when making entries. In addition to conventional posting practices, the licensee places a tag on each locked door stating that C&HP must be contacted for the key. In addition, the licensee has defined areas where an individual could receive a high dose in a short time as extremely high radiation areas. Only C&HP management personnel and the Shift Supervisor have keys to these areas (two areas were so designated at the time of the appraisal) and a member of the C&HP management staff must accompany all entries into these areas. Control of high radiation areas appeared adequate.

Contaminated area control is provided through postings, REP's, and protective clothing requirements. The licensee has defined contamination areas as those areas where the contamination levels are greater than 2200 dpm/100cm^2 but less than 22,000 dpm/100 cm^2 beta-gamma. Entry into these areas may be made under a general REP with adherence to the posted Protection and Clothing Requirement (P&CR) Sheets required. The licensee has designated areas exceeding 22,000 dpm/100 cm^2 beta-gamma or 2,200 dpm/100 cm^2 alpha as high contamination areas. Entry into these areas requires issuance of a special REP as well as adherence to the requirements specified on the P&CR sheet.

Plant procedures require the P&CR sheet to be posted at the entrance to all contamination areas. Its purpose is to define protective clothing requirements and any special requirements or limitations specified by C&HP for entry into the area. These sheets apply for a maximum of one year; all sheets must be updated during the month of January. Additionally the licensee requires updating any time conditions change in the area. It is the Appraisal Team's opinion that the P&CR sheets should be reviewed for adequacy on a monthly basis rather than annually. The initials of the individual performing the review as well as the review date should be recorded on the sheet. It was noted that the C&HP staff does not use consistent wording when identifying the type of protective equipment required to enter an area. It is the Appraisal Team's opinion that the licensee should adopt a standard terminology for protective clothing and utilize a check-off box system on the P&CR sheet to designate the protective equipment requirements.

While the licensee's method for identifying the boundary of contaminated areas was acceptable, it was the Appraisal Team's opinion that the use of radiation tape between the contaminated area and the step-off pad would serve as a reminder to workers that they are crossing a contamination boundary. At the time of the appraisal there were approximately 40 posted contamination areas. The licensee's staff concurred with the Appraisal Team's observation that with a little extra decontamination effort the number of posted areas could be reduced by 20-30 percent. The need to paint floor surfaces to improve contamination control is discussed in Section 8.c.

Radioactive material areas are controlled through procedures and postings. Health Physics Procedure HP 1607.04, Storage of Radioactive Materials, does not address requirements for the storage of radioactive materials in areas or rooms (10 CFR 20.203(e)), but does cover containers or packages of radioactive material (10 CFR 20.203(f)). The licensee uses four semi-trailers on the west side of the containment building for the storage of radioactive materials. Containers of radioactive material appeared to be packaged and tagged in accordance with plant procedures. The Appraisal Team noted that the doors to two of the trailers were posted as containing radioactive material but that the other two were not. The licensee stated, and evidence indicated, that these trailers had been properly posted but that wind had caused the signs to wear through the holding straps. Although equipped to be locked, none of the trailers were. Locking would help to ensure that HP Procedure HP 1607.03 governing the transfer of radioactive material was followed. When these problems were described by the Appraisal Team, the licensee promptly posted and locked all four trailers.

Based on the appraisal findings, this portion of the licensee's program appears generally acceptable; however, the following matters should be considered for improvement of the program: (1) provide direct surveillance by C&HP staff of the exit to the main RACA during peak working hours; (2) use radiation tape to identify the boundary between contamination areas and step-off pads; (3) reduce the number of posted contamination areas by decontamination; (4) prepare procedures for posting of areas or rooms storing radioactive material; (5) post the four trailers and the outside RACA with signs that will withstand adverse climatic conditions; (6) provide monthly review of P&CR sheets; and (7) revise the P&CR sheets to permit use of standardized terminology.

b. Radiation Exposure Permits

The licensee's radiation exposure permit (REP) program, documented in Health Physics Procedure HP 1601.03.04, functions to control entries into RACA. Two types of REP's exist, general and special. General REP's are used for daily routine work, tours, and data taking within RACA. A special REP is required for activities involving high radiation and contamination areas, airborne activity levels exceeding 25 percent of MPC, opening primary system boundaries, and maintenance activities such as grinding and cutting in contaminated areas. At the time of the appraisal, there were 12 general and 23 special REP's in effect. In 1980 a total of 220 REP's were issued. REP's are routinely reviewed by a member of C&HP management before issuance.

During review of current REP's, it was noted that two, I&C-6 and M-4, although general REP's, gave permission to open system boundaries. Eighty-five individuals (nearly everyone in the

Maintenance Department) had been listed on REP M-4. According to the licensee's staff, any of these individuals authorized by C&HP to work under the REP could enter RACA during 1981 and work under a maintenance work order on systems, even to the extent that radioactive system boundaries might be opened. There was a division of opinion among the C&HP staff about the type and extent of systems that could be opened under REP M-4 and I&C-6. It appears that if confusion exists at this level, it would exist among the individuals authorized to perform the work. As noted above, Procedure HP 1601.03.4, Section 6.1.2 states that a special REP is required when breaking a primary system boundary. Since many non-primary systems contain or potentially contain radioactive materials or gases, it is the Appraisal Team's opinion that opening of any radioactive or potentially radioactive system, not only primary system boundaries, should require issuance of a special REP.

All REP's were terminated on December 31, 1980, in accordance with procedures and new REP's issued. The Appraisal Team noted that several workers had not obtained C&HP approval before entering RACA on the newly issued REP's. When informed of this problem, the licensee placed a notice on the Radiation Exposure Record Card of the involved individuals and quickly resolved the problem. It is the Appraisal Team's opinion that the licensee's procedures should be revised to also require Radiation Exposure Record Cards to terminate on the last day of the year to preclude recurrence of this problem.

The licensee reported that plans to include the REP program in a computerized radiation exposure monitoring (REM) program are nearly complete. When implemented, the REM program will provide the total dose for each REP and the total dose for each individual on an REP. The licensee reported that this information will be used in their ALARA program.

Based on the appraisal findings, this portion of the licensee's program appears generally acceptable; however, the following matters should be considered for program improvement: (1) revise the REP procedure to clearly establish which systems may be opened under a general REP and which systems will require a special REP and (2) terminate all Radiation Exposure Record Cards on the last day of each year.

c. Routine and Job Specific Surveys

Routine radiation and contamination surveys are conducted at scheduled intervals in accordance with approved procedures. In early 1981, the licensee revised his routine contamination survey program. The previous program required collection of about 50 smears daily, the new program requires about 160 smears daily. The C&HP staff reported that it takes about ten hours to smear the 160 locations and count the samples. The smear survey is performed during the day shift. It appears that the time consumed in conducting the present contamination survey program

may defeat some of the benefits gained in collecting a larger number of smears. Because of the time delay between sample collection and counting, the contaminated areas may not be detected promptly. The Appraisal Team agrees with the licensee's premise that one of the first areas to survey for contamination is the step-off pads (SOP). While the previous program concentrated on smearing SOP's, the current program includes many locations inside of posted contamination areas, other locations within RACA, and portions of the office building as well as SOP's. The SOP portion of the survey program may be more effectively performed on back shifts so that contamination problems are identified and corrected before the main work force begins work. The remainder of the survey program could continue to be conducted on the day shift.

The Appraisal Team conducted a smear survey of the auxiliary building. Of the 22 smears collected outside of posted contamination areas, two were found to range between 220 dpm/100 cm^2 and 2200 dpm/100 cm^2 beta-gamma, just below the level at which the area would be required to be posted. Both of these smears were collected just outside a SOP on unpainted cement surfaces. As expected, the licensee reported difficulty in decontaminating these surfaces. The Appraisal Team encourages the licensee to paint all floor surfaces in areas with significant potential for contamination since painted surfaces are much easier to decontaminate than unpainted cement surfaces.

Job specific surveys (radiation, contamination, and airborne) are conducted as needed in accordance with approved procedures. These special surveys are generally performed in conjunction with the issuance of special REP's. The licensee's procedures and practices for job specific surveys appeared to be acceptable.

Based on the appraisal findings, this portion of the licensee's program appeared to be acceptable; however, the following matters should be considered for program improvement: (1) perform SOP smear surveys on back shifts and (2) paint those cement floor surfaces that have a high potential to become contaminated.

9. Instrumentation

The licensee's supply, use, maintenance, and calibration of fixed and portable health physics instrumentation were reviewed, No significant problems were noted. Desirable improvements to the program are discussed below.

a. Portable Survey Instruments

The licensee's portable survey instrument inventory includes (approximate numbers) 65 beta-gamma dose rate instruments (including ion chamber detectors, GM detectors, and ten extendible probe instruments), five neutron dose rate instruments, and 35 contamination survey instruments. These quantities appear

adequate for routine operations, outages, and emergency response. Although about one third of these instruments were out of service for calibration or maintenance at the start of the appraisal, this number was reduced significantly over the two week appraisal. The instrument backlog had apparently developed during the recent reassignment of C&HP tester responsibilities and was reduced as the newly assigned tester's proficiency improved.

Procedures for instrument use and calibration appeared consistent with ANSI N323-1978 recommendations. The licensee utilizes a commercially manufactured multi-source gamma calibrator; periodic decay corrections appeared acceptable. Calibrations and simple maintenance (e.g., circuit board replacement) are performed by C&HP testers; instrumentation technicians perform more detailed maintenance and trouble shooting. A check source located in the RACA instrument storage cabinet is utilized for performing functional checks (single point) before instrument use. Although not presently done, it is desirable to check each instrument scale or range typically used, as recommended by ANSI N323-1978. This could be accomplished by using a high activity beta source with several shield windows of varying thicknesses, or, less desirably, by procedurally requiring scale overlap checks in increasing plant radiation fields. A second check source located inside the reactor containment building appears needed to allow instruments kept inside containment during outages to be more conveniently (and probably more frequently) checked. Present licensee practice is to return instruments to the RACA storage cabinet at the end of the shift, although this is not consistently done.

Based on the appraisal findings, this portion of the licensee's program appeared generally acceptable; however, improvement in instrument source checks appeared desirable as noted above.

b. Personal Contamination Detection Instruments

The licensee utilizes a combination of friskers (thin window pancake type GM instruments), portal monitors, and hand and foot counters for detection of personal contamination. Numerous friskers are located throughout the plant near step-off pads and at the RACA exit. Portal monitors are located at the RACA and guardhouse exits. A hand, foot, and hard hat counter is located at the RACA exit also. Licensee practice is to frisk if step-off pad boundaries have been crossed, use the portal monitor and the hand, foot, and hard hat counter when exiting from RACA, and perform a final contamination check at the guardhouse portal monitor before exiting the plant site. No significant discrepancies from these practices were observed.

Increased awareness by plant personnel of the sensitivity limitations of the various contamination detection devices appeared desirable. Based on checks performed by the Appraisal Team using licensee sources, the plant portal monitors were the

least sensitive detection devices, alarming somewhere between 3.3E4 dpm and 1E7 dpm on contact. Lack of adequate check source ranges prevented closer bracketing of the alarm capability; however, Appraisal Team experience indicates an approximate detection limit of 2E5 dpm for this type monitor. Overreliance on portal monitors for contamination control should be avoided. The licensee's hand and foot counter appeared capable of detecting and alarming at about 1E4 dpm. The licensee had modified this unit, replacing the 30 mg/cm^2 GM tubes with 2 mg/cm^2 pancake probes, thereby increasing detection capability by a factor of about two. Additional improvement appeared possible by elevating the foot detectors to closer proximity to the foot screen. The decreased sensitive area resulting from this repositioning may necessitate additional detectors. Friskers were the most sensitive personal contamination detection instruments and appeared to be capable of detecting 200-500 dpm. Although these instrument detection sensitivities are typical, several C&HP testers questioned were unaware of portal monitor and hand and foot counter sensitivities.

Procedures for calibration and checking of personal contamination instruments appeared adequate, although the following improvements appeared desirable: (1) determine frisker probe efficiencies and label probes to facilitate cpm to dpm conversion, (2) perform quantitative source calibrations (instead of pulse generator calibration and qualitative source checks), and (3) perform routine quantitative functional checks of friskers and hand and foot monitors with defined acceptance criteria consistent with ANSI N323-1978 recommendations.

Based on the appraisal findings, this portion of the licensee's instrumentation program appeared generally acceptable. However, desirable improvements include: (1) determination of instrument detection capabilities and education of C&HP personnel and plant workers regarding these capabilities, (2) performance of quantitative rather than qualitative instrument source checks and calibrations, (3) determination and labeling of frisker probes with their efficiencies, and (4) relocation of the hand and foot monitor foot detectors.

c. Continuous Air Monitors (CAMs)

The licensee has three continuous air monitors (CAMs) which are used for relative airborne radioactivity information rather than quantification. These units include iodine and particulate monitoring capabilities. They are operated and calibrated per vendor manual recommendations rather than by licensee procedures. Before the 1980 outage, a vendor service group performed onsite calibration and maintenance of the units. However, at the time of the appraisal only one unit was functional; the licensee indicated recurring problems with operability and availability had been experienced. Resolution of these problems should continue to be pursued to maintain these units in operable condition.

Based on the appraisal findings, this portion of the licensee's program appears generally acceptable. However, improvement in CAM maintenance appears desirable, and calibration practices and documentation should be verified to be consistent with instrument applications.

d. Area Monitor

The plant's area radiation monitoring system consists of 38 channels. Two types of detectors are used, GM tubes with a range of 0.1 mR/hr to 10,000 mR/hr and ion chambers with a range of 0.1 mR/hr to 10,000 R/hr. All detectors include installed check sources and downscale, alert, and high alarms. Monitors are read each shift. Quarterly source checks are performed on a rotating basis, one third of the monitors each month. The monitors are calibrated by instrument and control technicians every 18 months. The licensee indicated that some problems with meter movements had been experienced in the past but that these have been resolved, with the monitors functioning adequately now. Installation of two high range monitors inside containment is planned to implement NUREG-0578 (NUREG-0737) requirements.

Based on the appraisal findings, this portion of the licensee's program appears acceptable.

e. Effluent Monitors

The licensee's installed radioactive effluent monitoring system appears effective to warn of excessive releases, to initiate actions to reduce excessive releases, and to quantify nonroutine releases. Monitor readout and alarm (reflash capability) information is available to control room personnel. Potential airborne release sources are monitored by redundant offline monitors at the common release point, the station vent. Liquid release pathways are monitored by several individual monitors. These monitors appear to have operated satisfactorily after resolution of some initial equipment problems. Interim high range noble gas monitoring is available but requires improvement to ensure its useability under accident conditions.

Calibrations of the station vent gaseous monitor and the liquid radwaste monitor meet technical specification requirements, but a licensee commitment to calibrate the effluent monitors with fluids instead of using factory cross calibrated sealed sources had not been met for the station vent monitors, RE2024 and RE2025. The clean and miscellaneous liquid radwaste monitor (RE1770 and RE1878) had been fluid calibrated. According to license personnel, the station vent monitors were inadvertently omitted when the fluid calibrations were performed. The station vent monitors are scheduled to be replaced during the next refueling outage. Fluid calibrations should be performed on the new monitors at the time of installation.

Linearity checks are performed in conjunction with the sealed source cross calibrations. The linearity checks now include all monitor scales and have been included in the calibration procedures. The lack of these items had been identified during previous inspections. Although monitor operability problems have been resolved for RE5029 and RE5030 (overheating and inadequate monitor range) and RE2004, RE2005, RE2006, and RE2007 (inaccessibility during reactor operation), problems remain with RE744, RE8442, and RE1003A. The licensee appears to be steadily resolving the monitoring problems.

Interim methods for monitoring high level airborne releases per NUREG-0578 had been implemented. These modifications address releases from the plant vent and releases via the main steam system. The plant vent emergency monitoring system is located in the non-radwaste ventilation room, which is accessible from either the turbine building or the auxiliary building. The turbine building entrance would be used in an emergency due to potential radiation fields in the auxiliary building (near the emergency ventilation system filters). Approximately 75 feet of tygon tubing connects the emergency monitoring station with the normal monitors. The emergency monitoring system consists of a noble gas monitor and recorder, particulate filter and iodine absorber (silver zeolite) samplers, and grab gas sample capability.

The following potential problems were noted regarding the emergency vent monitor. (1) To assure overlap between the normal and emergency vent monitors, the emergency monitor must be capable of discerning 0.1 mR/hr above background. The licensee had not conducted an evaluation to determine if this is possible. Maximum expected radiation levels in the vicinity of the emergency monitor are 0.1 R/hr to 5 R/hr. The detector is shielded by a lead brick enclosure. If a background problem does exist at the low end of the emergency monitor's range, it would not affect the monitor's usefulness at higher release rates. (2) The monitor's calibration factor (conversion from detector response to release rate) was calculated for a reference isotopic mixture but no variable for isotopic changes with time is included in the determination. Licensee personnel stated that periodic grab sampling and isotopic analyses may be used to determine calibration factors. This approach appears satisfactory but requires modification of existing procedures to ensure consistent application. (3) The emergency monitoring system has not been tested to verify its operability. Particulate, iodine, and grab gas samples should be collected with the emergency system for comparison with samples collected from the normal system. This is particularly important to ensure the long tygon tubing does not have an appreciable effect on sampling efficiency. (4) Procedure AD 1850.04 "Post Accident Radiological Sampling and Counting" does not contain sufficient precautions regarding personal exposure minimization while making required valve lineups. The valve locations are near the emergency ventilation system (EVS) filters. Entry to this area must be

completed shortly after initiation of ventilation flow through the EVS filters under certain accident conditions due to rapid radioactivity buildup on the filters. Occupancy time must be minimized to maintain personal doses within regulatory limits.

High level main steam system releases (air ejector, safety valves, atmospheric vent valves, and gland steam exhaust) are quantified using steam jet air ejector monitor readings and/or grab sampling results as described in procedure EP 1202.57. Procedure EP 1202.57 appeared adequate except for release quantification when the main steam isolation valves are shut. The procedure requires revision to reflect steam generator sampling instead of steam line sampling in this situation. Another technique for quantifying high level steam line releases, utilizing the main steam N-16 monitors, is under review by licensee personnel. This technique appears of limited usefulness due to the potential high background radiation levels (50 R/hr to 500 R/hr) in the vicinity of these monitors.

Four shift supervisors were questioned during the appraisal regarding quantification of high level airborne releases. This quantification is described in procedure AD 1827.10, "Emergency Offsite Dose Estimates." Two of the shift supervisors could not explain how to determine release rate or offsite dose rate from the high range effluent monitor results. They did not identify procedure AD 1827.10 as the pertinent procedure to be used to quantify the release. Such actions would delay the quantification process and may preclude it if radiation levels from the EVS filters become too great to safely allow making the valving changes necessary to lineup the high level monitoring and sampling system. Although a planned permanent installation of high level monitoring instrumentation should eliminate the need to enter high radiation fields in an accident, shift supervisor training appears necessary to ensure high range monitoring in the interim. In addition to the need for training, procedure AD 1827.10 should be more explicitly referenced in the licensee's accident response procedures. This would enable shift personnel to locate and implement the procedure more readily. Procedure AD 1827.10 should be reviewed in an attempt to simplify the actions required of shift personnel in an accident. The calculations necessary to quantify airborne releases using the high range monitor can be performed either by hand or programable calculator. Both methods are described in AD 1827.10. Although the programable calculator was used in a recent drill, the calculator was not readily available to control room personnel during the appraisal. Several individuals interviewed were unfamiliar with the hand calculations. The licensee should consider setting the calculator up permanently for use by shift personnel.

Based on the appraisal findings, the high range noble gas monitoring capability needs improvement to achieve a fully acceptable program. These improvements should include: low range and energy response determinations; system testing; shift supervisor training; and procedural revisions to improve radiation protection precautions

during valve lineups, to address steam system sampling with the main steam system isolated, and to direct operating personnel to the correct procedure for estimating offsite doses for high level releases.

10. ALARA

Although individual aspects of a good ALARA program were in place, a comprehensive plantwide ALARA program appears lacking. The radiological plant environment has not presented significant hazards to date due to the newness of the plant and licensee prophylactic actions. However, recent increases in primary coolant radioactivity levels dictate a growing urgency to implement an effective ALARA program. This program should include the considerations discussed in this section.

A management policy statement supporting the ALARA effort is desirable to indicate the support of upper plant/corporate management for the ALARA program. The ALARA program must be a plantwide effort, not just a health physics program. Such a statement is needed. Present ALARA promotion is by way of health physics procedures and an introductory statement to the radiation protection manual. Although a health physics procedure entitled "ALARA" (HP 1601.05) has existed since plant startup, it was a passive procedure until revised extensively during 1980. The revised procedure requires conduct of pre-job and post-job ALARA reviews for certain higher exposure jobs. This procedure, which was first used for the early 1981 outage for replacement of main coolant pump seals, appears beneficial but should be augmented by additional structured ALARA evaluations. These ALARA evaluations should include procedure revisions, facility changes (FCR's), and radiation jobs (REP's).

Although some ALARA review is currently incorporated in REP and procedure revision authorizations, a structured program including established selection and evaluation criteria and review documentation does not exist.

Input to the ALARA program from plant personnel is an essential ingredient of a successful ALARA program. Such input not only identifies potential areas for improvement but also helps to generate an awareness and concern for ALARA in the workers. Several workers interviewed during the appraisal indicated that input to ALARA on their part was not encouraged by plant management. This feeling is damaging to the ALARA effort whether true or just a result of poor communications. Worker input should be actively encouraged. This can be accomplished by generation of a formal system for submittal of ALARA suggestions and for feedback to the workers regarding disposition of their suggestions. An additional communication device, not currently used by the licensee, is the solicitation and documentation of ALARA suggestions as part of the REP termination process.

Other ALARA tools considered beneficial by the Appraisal Team but not currently incorporated in the licensee's program include: (1) and ALARA oversight group, (2) dose compilation by job type (REP), and (3) a structured radiation safety infraction report system. The oversight group is valuable not only because of its direct contributions to management and interdepartmental problem solving but also because of the attitude of commonality generated through selection of members from the various plant departments and the corporate organization. A consultant did provide some ALARA oversight during an onsite audit during 1980 as noted in Section 5. Dose compilation plans are underway according to licensee personnel. Radiation safety infraction reporting is discussed further in Section 5.

Health physics management personnel appeared interested and active in personal dose reduction. These personnel were familiar with exposure potentials of anticipated plant work and exposure reduction techniques. A substantial effort has been made to minimize primary coolant radioactivity levels through water chemistry control aimed at reducing corrosion products. Control of oxygen in primary coolant makeup water, an important aspect of corrosion control, is hampered by oxygen absorption problems in the primary water storage tank. This problem may be resolved with the anticipated installation of a degassifier in the future. A significant exposure contibutor is the reactor head when it is in the refueling laydown area. According to licensee personnel, shielding will be installed to limit this exposure potential. These and other dose reduction concerns by health physics management personnel appeared indicative of their interest and ability to pursue effective dose reduction actions.

Based on the appraisal findings, improvement in licensee's ALARA effort is needed to achieve a fully acceptable program. Improvement efforts should be directed at implementation of a more formal ALARA program which includes provisions for: (1) structured ALARA review of activities significantly affecting personal exposure, (2) radiation protection technician and plant worker input, and (3) interdepartmental management involvement, among others.

11. Radioactive Waste

Radioactive effluents have been generally acceptable since plant startup. Improvements, noted below, should be considered to upgrade the licensee's performance in this area.

a. Liquid and Airborne Effluents

Liquid and airborne radioactive effluents have been reasonably low since plant startup. Due to time restrictions, these systems were not reviewed comprehensively during this appraial.

Several selected events which occurred within the past 18 months involving effluent releases for which red phone notifications were made were reviewed. One of the events was further reported as a Licensee Event Report (LER). The

review was performed to evaluate the internal mechanism used to track event review and provide corrective actions for specific events. It appears from the review that if the magnitude of the event prompted an LER, event review and corrective action was timely and relatively complete. However, events that involve the same types of problems, such as failure to follow procedures, but the resulting event was of lesser magnitude, may be treated rather cursorily and may not even be reviewed under the deviation report system. One event that resulted in a red phone notification on July 3, 1980, resulted in the writing of a deviation report on July 7, 1980, but the report had not been closed out at the time of review on January 22, 1981. Another event was written up as a health physics procedure violation, with no deviation report, but appeared to initiate adequate corrective actions. There does not appear to be a standard method of tracking the review and corrective actions for nonroutine events to assure timely corrective actions or to assimilate information concerning such events to identify generic problems.

The licensee's actions in response to IE Bulletin 80-10 (nonradioactive system contamination) were reviewed. The licensee had previously identified two normally nonradioactive systems, the Component Cooling Water System (CCWS) and the Demineralized Water Transfer System (DWTS), which had become contaminated because of interconnection with the Primary Water Storage Tank (PWST). No significant additional interconnections were identified during the licensee's review in response to the bulletin. The licensee determined that contamination of the CCWS or DWTS likely occurred when changing operational conditions placed an interfacing contaminated system (PWST) at higher pressure than the CCWS or DWTS systems since only check valves (which do not function properly) provide system separation. The licensee had commenced periodic sampling of the CCWS and DWTS to detect contamination before issuance of IEB 80-10. Since the PWST contains only processed water, the principal radioactive contaminant is tritium. When tritium contamination was detected in significant concentrations, the involved system (CCWS or DWTS) was purged to a radioactive liquid hold tank and the system refilled with uncontaminated demineralized water.

As directed by Bulletin 80-10, the licensee conducted a 10 CFR 50.59 safety evaluation and concluded that small concentrations of radioactive materials present in the CCWS or DWTS do not constitute an unreviewed safety question. The licensee continues to perform periodic sampling to detect increases in activity in these systems. The safety evaluation states that detection of significant concentrations of radioactivity in these systems should trigger either an immediate decontamination of the system or the conduct of a 10 CFR 50.59 safety review to evaluate operation of the system as a contaminated system. The licensee has instituted procedural changes which require closed valves in

addition to the check valves during certain operational conditions, and work orders have been written to replace the improperly functioning check valves. No significant problems concerning the licensee's response to IE Bulletin 80-10 were noted.

Based on the appraisal findings, this portion of the licensee's program appears acceptable. However, the method of tracking corrective actions for nonroutine events concerning unplanned effluent releases should be improved.

b. Solid Radioactive Waste

Solid radioactive wastes consist primarily of evaporator bottoms, spent filters, and general plant wastes (paper, plastic, wood, piping, etc.). Historically, the licensee's solid radwaste volume and curie content has been relatively low. Only about 50 cubic feet of spent resins have been produced since startup. They are stored in an 800 cubic foot tank within the auxiliary building.

The track alley area of the auxiliary building (585' level) is currently being used for radwaste processing. Evaporator bottoms are sluiced to disposable liners located in this area. At the time of the appraisal, the regular transfer line was plugged and a temporary system was being used. Work to unplug the transfer line was proceeding during the appraisal period. The radwaste processing is performed by a contractor with procedures which have been approved by the licensee and incorporated in licensee procedures. The contractor utilizes urea formaldehyde to solidify the evaporator bottoms prior to shipment to the disposal facility in South Carolina. Effective January 1, 1981, the disposal facility license required that no detectable free-standing liquids be present in radioactive wastes received for burial. This is further interpreted to mean one-half percent by waste volume or one gallon of non-corrosive liquids per container, whichever is less. The solidification contractor had received a 30-day waiver from this requirement from the State of South Carolina.

As the result of excessive leakage from the seals on the reactor coolant pumps in late 1980, five liners of evaporator bottom wastes were generated in about a seven-day period. Under normal conditions, one to one and one-half liners per month are generated. In accordance with plant Procedure SP 1104.28.3, every tenth liner is held for at least four days following solidification and initial dewatering (estimated to be twice the normal shipping time to the disposal facility) and the dewatering process is performed again. The licensee reported that since this practice was initiated in mid-1980, no liquids have been observed. However, during the week of January 9, 1981, one liner was found to contain 3.8 gallons of free liquid in the second draining. This amount would not

comply with the existing State of South Carolina regulations without the temporary waiver. A second liner was found to contain less than a quart of water. According to the solidification contractor, the licensee will be able to obtain an extension of the waiver until June 30, 1981. It is the Appraisal Team's opinion that as the result of these recent findings, the dewatering sample size should be increased to improve the assurance of proper solidification. Such an increase is particularly needed upon termination of the current waiver.

The equipment to transfer resins from the resin storage tank to the waste drumming area has never operated satisfactorily. Since the volume of resin generated to date has been relatively low (approximately 50 cubic feet), it appears that the licensee has not established a very high priority for the repair of this system. It is the Appraisal Team's opinion that the licensee should take immediate steps to make the resin transfer system operational.

General plant wastes are compacted in 55-gallon drums or placed in 4'x4'x7' plywood boxes. During 1980, the licensee developed maintenance instruction MI-98, detailing the construction requirements for the plywood box. As the result of an Appraisal Team's observation that two boxes partially filled with wastes did not meet the construction requirements of MI-98, it was determined that the department responsible for the construction (Station Services) was unaware of the existence of MI-98. The appraiser noted that the average spacing of nails was about 12 inches (maximum spacing about 24 inches) whereas MI-98 specified six inch spacing. The licensee stated that the maintenance instruction would be reviewed and future boxes built to specifications.

The licensee's procedures and practices for compacting wastes in new 55-gallon drums were reviewed. No problems were identified. The waste drums are stored outside pending shipment. At the request of the Appraisal Team, the licensee checked two drums for free liquids. None was found. The licensee's practice of storing filled 55-gallon drums outdoors poses potential corrosion and loss of package integrity problems. The licensee, having recognized this, stated at the exit interview that funds for a storage building were being budgeted for 1981.

Based on the appraisal findings, this portion of the licensee's program appears generally acceptable; however, the following matters should be considered for program improvement: (1) repair of the resin transfer system; (2) constructing waste boxes in accordance with plant procedures; (3) storing waste-filled drums inside pending construction of a new storage facility; and (4) dewatering a higher percentage of solidified liners

12. Facilities and Equipment

The health physics and chemistry facilities appear adequate for normal operations and initial accident conditions.

a. Chemistry and Counting Laboratory

The licensee's hot lab, cold lab, and counting rooms appear to be adequate in size for routine and emergency operations. The hot lab has two filtered hoods and a small lead brick shielded cave built on the floor under a lab bench. The cave appears adequate for routine hot samples but would not be adequate for post-accident sample storage.

The hot laboratory is the licensee's primary post-accident analytical lab. If the hot lab is not usable, the laboratory in the Water Treatment Building would be used. The licensee has a procedure for moving a portable multi-channel analyzer (MCA) and Ge(Li) detector to the Water Treatment Building for use in post-accident sample analyses. The portable MCA and Ge(Li) detector have been set up and calibrated but have not been transported to the Water Treatment Building to verify that such movement can be made if needed. The Appraisal Team recommends that this capability be tested by moving the portable MCA and Ge(Li) detector and testing its operation at the temporary laboratory location.

Analytical counting equipment includes two Canberra Multi channel Analyzers (MCA's) and Ge(Li) detectors and one Canberra (MCA) with a NaI detector mounted on wheels. Other counting room equipment include alpha and beta counters and a liquid scintillation detector. Daily backgrounds are run and counting statistics are plotted as a quality assurance check. The MCA units are checked for calibration daily using a europium-152 standard.

Based on the appraisal findings, this portion of the licensee's program is acceptable; however, the portable MCA should be transported to the backup laboratory location and tested for operability to ensure such movement is feasible.

b. Health Physics Facilities

Health physics facilities appear to be generally adequate for the needs of the department staff during normal and initial accident conditions.

The health physics monitor office, located adjacent to the primary access point to RACA, provides the focal point for all health physics activities. Conveniently located nearby are offices for the health physics foreman, the main protective equipment storage area, personnel decontamination shower, and respirator cleaning station. Also nearby is a wet laundry,

a medical station, radiochemistry and chemistry laboratories, counting room, and instrument calibration room. A dry cleaning machine is located in the auxiliary building track alley area.

During an extended outage in 1980, an additional RACA access point consisting of two trailers was established on the south side of the auxiliary building. This access point, which generally duplicates the primary access control point facilities, was established to accomodate large numbers of outage workers. According to licensee personnel, it could adequately handle about 300 persons per hour. This appears to be a good solution to the need to accomodate large numbers of additional personnel during outages.

Protective equipment lockers are located throughout the main RACA. They supplement the main protective equipment supplies at the RACA entrance. Several of the supplementary lockers were inadequately stocked and poorly maintained when examined during the appraisal. The Appraisal Team believes that these lockers should be inventoried and restocked more frequently, perhaps daily. Placement of trash cans nearby for deposit of wrappers, defective booties, etc. would assist in keeping the lockers tidy.

The licensee reported that the low radiation field created by the protective clothing storage area at the entrance to RACA occasionally interfers with the sensitivity of the nearby frisker, portal monitors, and hand and foot counter used by personnel exiting RACA. Temporary shielding has been erected to minimize this problem. A more permanent solution should be investigated.

Based on the appraisal findings, this portion of the licensee's program appeared to be generally acceptable. Improvement in protective equipment locker supplies is desirable.

13. Accident/Re-entry

The scope of the appraisal in this area was limited to the Chemistry and Health Physics Department's accident and re-entry preparedness capability. The appraisal primarily focused on six areas: instrumentation, analytical laboratory, re-entry, expanded support, training, and environmental monitoring. While some work in each of these areas has been undertaken as a result of TMI, additional improvement in certain areas, especially in training, appear warranted.

Survey and sampling equipment are available for initial response to an accident. The supply and type of survey instruments appear adequate. The emergency kits are appropriately located and appear to be adequately stocked and maintained.

Interim post-accident reactor coolant sampling equipment, consisting of a high pressure shielded sample container connected to the reactor pressurizer system with flexi-quick disconnect lines, is in place. The sampling system can be flushed, with the exception of the flexi-lines, to reduce radiation levels. Licensee representatives said they intend to change the location of the sample container slightly to provide better access and also to shield the flexi-lines to reduce personal exposure. Training in the sampling procedure, including a walk-thru, has been given to all chemistry and health physics personnel.

In-plant iodine sampling equipment is located in the emergency cabinets in RACA and on the 623' level of the turbine floor. Sampling systems include both AC and 12V battery operated air samplers, SAM-2 detectors, and silver zeolite cartridges. Procedures for the use of the equipment have been written and training and a walk-thru of the procedure has been given to all chemistry and health physics personnel.

The licensee has prepared an emergency plan. Thirteen implementing procedures and twenty-one station supporting procedures have been developed to implement the emergency plan. Emergency plan implementing Procedure EI 1300.10 outlines the course of action and protective measures required for re-entry. Procedure EI 1300.11 identifies the procedures for placing the plant in an anticipated long term shut-down condition following a site or general emergency. The licensee has contractually arranged for health physics support (equipment and personnel) with two other licensees and with two health physics service contractors.

A separate NRC evaluative effort is being conducted regarding reactor emergency planning activities. In light of this ongoing effort, the HP Appraisal Team has refrained from evaluating the licensee's overall emergency response capability.

14. Exit Interview

The Appraisal Team met with licensee representatives (denoted in Section 1) at the conclusion of the appraisal on January 23, 1981. The Appraisal Team summarized the scope and findings of the appraisal. The findings are grouped into two categories:

a. Significant appraisal findings are contained in Appendix A to the letter forwarding this report. The licensee's response to these findings, to be submitted in writing, will be reviewed upon receipt.

b. Findings of lesser significance, but which are considered instrumental to improvement of the licensee's health physics program, are summarized at the conclusion of the applicable sections or subsections of this report. The licensee's actions in response to these items will be reviewed during subsequent inspections.