NUREG-0855

Health Physics Appraisal Program

U.S. Nuclear Regulatory Commission

Office of Inspection and Enforcement

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ABSTRACT

The accident at Three Mile Island in March 1979 and subsequent investigations identified, among other items, serious concerns involving several aspects of the radiation protection program. Significantly, some concerns involved areas not addressed by regulations or facility technical specifications. This in turn led to initiation of a major effort to evaluate the adequacy and effectiveness of radiation protection programs at all currently operating nuclear power facilities during calendar year 1980 by the Office of Inspection and Enforcement (IE), Nuclear Regulatory Commission. This inspection effort was termed an appraisal since it was structured to facilitate an integrated look at the total radiation protection program, delve into matters for which explicit regulatory requirements did not exist, and emphasized evaluation of capability and performance rather than compliance with regulations. This report discusses the results of the 48 appraisals and the anticipated regulatory actions that may be taken to further address the concerns.

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PREFACE

NUREG-0855 documents the results of the power reactor Health Physics Appraisal Program (HPAP) initiated by the NRC's Office of Inspection and Enforcement during 1980. The HPAP findings, both generic weaknesses and selected examples of above-standard performances, are presented. These findings reflect conditions that existed at the time of the appraisals. Current conditions are likely improved since most licensees initiated immediate corrective actions for weaknesses easily corrected and committed to positive actions for the correction of weaknesses requiring longer-term actions. Although it was not possible to cite each and every instance, the above-standard plant performers noted in the various health physics (HP) programmatic areas appraised should provide a useful source of information for other facilities interested in improving their HP programs.

Generally, NRC HPA personnel noted a cooperative licensee spirit and a positive attitude during the onsite appraisals and subsequent licensee followup actions taken to improve and upgrade HP programs. Such cooperative response from the licensees is and continues to be encouraging.

ABBREVIATIONS

ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
anti-c	anticontamination (clothing)
BWR	boiling-water reactor
CCTV	closed-circuit television
DOT	Department of Transportation
ECCS	emergency core cooling system
ECS	Emergency Control Station
FSAR	Final Safety Analysis Report
HEPA	high-efficiency particulate air
HP	health physics
HPAP	Health Physics Appriasal Program
ICRP	International Commission on Radiological Protection
ICRU	International Commission on Radiation Units and Measurements
IE	Office of Inspection and Enforcement
JSA	job safety analysis
MPC-hr	maximum permissible concentration-hours
NIOSH	National Institute for Occupational Safety and Health
NRC	Nuclear Regulatory Commission
NRRPT	National Registry of Radiation Protection Technologists
PWR	pressurized-water reactor
QA	quality assurance
RWP	radiation work permit
TLD	thermoluminescent dosimeter
TMI	Three Mile Island
TS	Technical Specifications

HEALTH PHYSICS APPRAISAL PROGRAM

INTRODUCTION

On March 28, 1979, Unit 2 of the Three Mile Island (TMI) Nuclear Power Plant experienced the most severe accident in the operating history of commercial nuclear power plants in the United States. Preparation for such an event by the station staff and the radiation protection group was deficient in several respects that led to a less-than-satisfactory response to a real radiological emergency situation (NUREG-0600).

At approximately 2 hours into the accident, a radition monitor responded to increased radiation levels caused by fuel-cladding failure. A flow of this highly contaminated reactor coolant was maintained through the makeup and purification system for several days and was the principal pathway of release of radioactivity to the auxiliary and fuel-handling buildings and the environment. Levels in the vicinity of some makeup and purification systems components exceeded 1000 R/hr, which was the limit of the existing measurement capability. Several effluent monitors went off scale because of the noble gas releases.

A number of actions and events indicated lack of adequate training and supervision. For example, early in the accident, dose rates were calculated to be 10 rem/hr at an offsite location whereas, in fact, the actual dose rates were less than 0.001 rem/hr. A sample of reactor coolant was collected without the knowledge of the Emergency Control Station (ECS) Director. When airborne radioactivity was released during the collection of this sample, the ECS had to be relocated. The high levels of radioactivity disabled a counting room that contained the only instrument on site capable of performing gamma isotopic analyses. Containers of coolant sample were handled directly without the use of remote tools or shielding, and extremity dosimeters were not used. Several entries into areas of high airborne activity and whole-body exposure rates in excess of 100 R/hr were made without the knowledge of the Supervisor, Radiation Protection and Chemistry. In at least one instance, survey instruments were not used. At least twice, individuals failed to leave the area when survey instruments failed or deflected full scale. During the collection of a second sample of coolant, remote valve operating and sample-handling tools were not used although the sample valve measured 400 R/hr at 1 ft. During the first few days after the accident, some technicians, against good industry practice, processed their own thermoluminescent dosimeter (TLD) badges. During another period, a technician who had not operated the TLD reader system in more than a year processed badges without observing established procedures.

PROGRAM PURPOSE

As a result of the Three Mile Island accident and the resultant problems identified in the radiation protection program, the Nuclear Regulatory Commission (NRC) undertook a major effort to analyze the radiation protection programs at 48 commercially operated nuclear power plants. This effort, called the Health Physics Appraisal Program (HPAP), was initiated to determine

whether the nuclear power plants had adequate radiation protection programs and whether they had incorporated the lessons learned from the TMI accident in the area of radiation protection. A second objective was to identify generic radiation protection problems in order to make improvements in NRC regulations, requirements, and guidance.

The concept in developing the Health Physics Appraisal Program was to institute a means for performing a comprehensive evaluation of the overall adequacy and effectiveness of power reactor licensees' total health physics programs. Whereas the previous inspection program was more compliance oriented and led to the inspection of health physics programs by discrete subject areas, the appraisal program was structured to facilitate an integrated look at the total program. The criteria for evaluating the licensees' program elements were taken from technical specifications, NRC rules and regulations, and NRC regulatory guides, as well as ANSI* standards and ICRP/ICRU** recommendations, and in some cases where no publisher guidance was available, the professional judgment of the appraisal team members.

PROGRAM METHODOLOGY

The HPAP was structured using a systematic methodology that consisted of analytical trees with applicable questions for each tree. The analytical trees provided a graphic depiction that aided in the deductive analysis of a total system and provided a logic display of interrelationships. The questions were designed to define the scope of the appraisal and to ensure consideration of the essential elements of a radiation protection program. The questions were not an all-inclusive listing of significant items Thus the HPAP teams were expected to use professional judgment and be flexible, as the need arose, in the application of the guidance and use of the analytical trees.

For purposes of the appraisal the seven major parts of the health physics program were considered to be:

- radiation protection organization, and management;
- personnel selection, qualification and training;
- exposure control, external and internal;
- surveillance;
- radioactive-waste management;
- ALARA program; and
- facilities and equipment.

One or more analytical trees with corresponding questions were developed for each of these major parts. Examples of analytical trees and corresponding

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*American National Standards Institute
**International Commission on Radiological Protection/International Commission on Radiation Units and Measurements

questions are provided in Appendix A, pp. A-10 through A-22 and A-23 through A-59, respectively.

The analytical trees start with a single desirable condition and systematically proceed through lower levels or tiers until all important factors, which produce the major conditions, are specified. The original program (which included emergency preparedness) consisted of 18 separate trees, 2 of which interfaced with each of the remaining 16 trees.

The interfaces between areas are important in the evaluation process. To properly evaluate areas where transfers are noted, data collected from one area must be "transferred" to another and considered in the evaluation of both areas. The result is that, in a systematic way, one can assess the true impact of a particular event, and provide greater assurance that a given area is, in fact, adequate or inadequate.

Two interface areas that had to be considered and "transferred" to each of the major areas of the program were Management Oversight and Procedure(s) Development. These two areas obviously are critical to the proper and effective implementation of each of the major areas.

One area not included in the HPAP, but which is definitely a part of a total health physics program, was environmental monitoring and surveillance. This area was not included in the HPAP because the scope of the program was already so broad that completion would be difficult and because it would have extended the inspections to offsite areas. Since a great deal of attention is directed to independent measurements by the NRC and State and local environmental monitoring, the plant environmental monitoring program was not included in the HPA.

Licensee's emergency response capability was examined during the HPAP. However, because of previous NRC regional inspection schedule variations in the emergency planning area, the breadth and depth of appraisals in the area varied considerably among the regions. In any case, the HPAP was structured to appraise existing emergency response capabilities, prior to the recent emergency preparedness rulemaking. In mid-1980, the NRC initiated and is currently conducting a separate, nationwide evaluation program examining licensees' proposals. In order to eliminate the possibility of duplication or confusion regarding emergency response capability findings between the HPAP and the ongoing emergency preparedness appraisal, the HPAP findings are not included in this document. However, these findings were provided as input for the ongoing emergency preparedness appraisals.

PROGRAM IMPLEMENTATION

To implement the HPAP, eight appraisal teams were formed. The basic team was composed of three to five professional health physicists, including a senior NRC health physics inspector as a team leader and two contractor health physicists. On some of the appraisals, other NRC health physicists served as additional members. The inclusion of a contractor health physicist added an extra dimension of perspective and proved beneficial.

A team approach was selected for several reasons. Because of the broad scope of the program, it would have taken too long for a single individual to perform

the inspection and complete the appraisal schedule. Furthermore, the interaction between members was particularly desirable because many evaluations were necessarily based on professional judgments. Also, the interchange of concerns among team members and discussion of apparent weaknesses often helped clarify the real problem area or cause of the symptomatic deficiency.

Each appraisal was scheduled to be conducted over a 6-week period. The first 2 weeks were spent reviewing the site's past inspection reports, radiation protection procedures, technical specifications, Final Safety Analysis Report (FSAR), and other pertinent information to help the team become familiar with the onsite inspections. The 2-week visit to the reactor site included discussions with plant personnel, review and observation of work practices, review of the licensee's radiation protection procedures, and review of records (exposure, incidents, and such).

In the appraisal process using the Management Oversight and Risk Tree described in Appendix A, it was necessary to determine whether each major part of the total plant program was adequate or inadequate. It was also important that the documentation of the appraisal specify these conclusions. To accomplish this, each team was directed to structure reports to specify for each of the seven major parts of the radiation protection program whether it was (1) acceptable, (2) acceptable but certain matters should be considered for improvement, or (3) not acceptable. Likewise, the total program was rated as acceptable, adequate for present operations but having significant weaknesses, or not acceptable.

Deficiencies or weaknesses were considered significant when the finding had a direct effect on the level of protection provided or was a critical element that was required for judging whether that portion of the program was acceptable. Isolated instances and minor items were not judged as representing a significant finding. However, if a number of deficiencies were found within a particular phase of the program, then a significant finding may have been warranted for that phase. In instances where the deficiency or weakness required immediate attention, the problem was discussed with licensee management, definitive corrective actions were agreed upon, and specific dates were committed for completing the actions. NRC then documented the corrective actions and dates in an Immediate Action Letter to the licensee. Problems of less immediate concern were documented in the official appraisal report which was issued some weeks later.

Implementation of the Health Physics Appraisal Program involved a contract with Battelle Pacific Northwest Laboratory for providing professional health physics personnel to support the establishment of eight appraisal teams. A total of 24 contractor health physicists, 36 regional inspectors, and 8 NRC Headquarters health physicists participated in one or more of the 48 team appraisals. In all, 68 professional health physicists were involved in the program and spent more than 20,000 hours of onsite inspection time at licensee facilities.

PROGRAM FINDINGS

The HPAP inspections indicated that a number of weaknesses in the radiation protection programs, similar to those identified at TMI, did exist at many of the currently operating nuclear power facilities. Summaries of the most

significant and most frequently identified weaknesses are discussed in the following sections along with examples of noteworthy performances. Each section heading is identical to the seven major program areas used in the appraisal program.

Radiation Protection Organization and Management

Significant weaknesses in the area of radiation protection organization and management were identified at approximately a third of the facilities inspected. The most significant of these weaknesses involved:

- lack of management support,
- inadequate staffing,
- poorly defined assignments and authority, and
- failure to audit performance.

Lack of Management Support

The lack of management support of radiation protection programs was reflected in several ways. At some facilities the Radiation Protection Manager's (RPMs) reporting chain was such that the RPM must compete with others within the same group to bring radiological problems and concerns before the station manager. At other facilities, the lack of management support was best exemplified by the small staff allowed for the radiation protection department.

At some facilities, the quality of radiation protection was found to be significantly less where the RPM was not reporting directly to the station manager. It was noted in these organizations that health physics was more of a routine, service organization than a radiation protection support function, integrated into the fabric of all plant operations. It was noted that personnel within these organizations generally lacked incentive and a depth of technical knowledge.

At some facilities, inadequate management support was demonstrated by a failure to take timely corrective actions upon notification of radiological problems. As one example, disciplinary action for serious violations of radiological procedures was very rare. Perhaps the most telling fact was the attitude of many managers, that the radiation protection department was solely responsible to ensure good radiological work practices of all station personnel. For these cases, a similar attitude tended to prevail throughout all levels of the organization. Upper management often failed to demonstrate its support by requiring and ensuring that radiological safety and good radiological work practices are the responsibility of all supervisors and expected of all employees. For example, past experiences have shown that some supervisory and other nonradiation protection staff personnel failed to give appropriate consideration to radiological concerns when entries were made into reactor cavities with in-core thimble chambers withdrawn. In such cases, the personnel making the entries apparently did not feel a responsibility to ensure that good radiological work practices were implemented. Such entries have resulted in several overexposures in the past few years at other plants.

Inadequate Staffing

The radiation protection group was inadequately staffed at about one out of every three facilities. There were personnel shortages in the technician, foreman, and supervisory groups. Many facilities rely rather heavily on contractor-HPs for their technician staffing. In some facilities up to 80% of the routine radiation protection technician staff are contractor personnel. This heavy reliance on contractor technicians was considered a weakness because the turnover rate was generally quite high, and therefore, the level of familiarity with station design, plant-specific characteristics, and local procedures was generally low. Even at those facilities that did not rely heavily on contractor personnel, only enough radiation protection staff had been hired to meet minimum needs for routine operations; little provision had been made for outages and other anomalous conditions that significantly increase the work load. Frequently, the technician staff was inadequate to accomplish all routine duties in a timely manner. Furthermore, many facilities did not have radiation protection technicians on all shifts. Instead, this coverage was often provided by other personnel on a part-time basis. Many plant technical specifications allow for backshift coverage by persons trained in radiation protection procedures. Commonly, however, these personnel were poorly trained and often unprepared to perform many of the routine functions required to evaluate radiological conditions.

Generally, there were only a minimal number of foremen and supervisors in the radiation protection department. These personnel, frequently overburdened with administrative and clerical duties, could not supervise the technicians adequately. Such inadequate supervision often meant that adverse inplant trends went unrecognized and nonroutine operations were incompletely evaluated. In addition, most of the facilities did not have a qualified backup for the RPM. The need for providing a qualified backup has been demonstrated in the past: when the RPM became ill or left the organization, the quality of the radiation protection program decreased substantially.

Poorly Defined Assignments and Authority

At many of the facilities assignment of responsibility and authority was not clear within the radiation protection department. At several facilities, personnel within the radiation protection department could not identify their immediate supervisor. Specific duties, such as feedback of analytical data and discovery analysis of anomalous conditions (trend analysis), were not clearly defined. At some facilities the authority to immediately stop work was not clearly established and in at least one case there were opposing opinions as to whether or not this action was authorized.

Failure To Audit Performance

Another weakness observed in the organization and management of radiation protection programs: performance of the radiation protection personnel was not audited. Although functional audits were performed, those audits determined only that specific functions were being performed, not the quality of that performance. Usually performance audits were seldom conducted because the audit personnel were not qualified to judge acceptable quality. Another

apparent reason was the shortage of qualified health physicists on the facility's staff that could provide technical program support such as performing audits and other assessments of the plant's radiation protection program.

Examples of Good Radiation Protection Management

At some facilities (for example Trojan which is operated by Portland General Electric Company (PGE)), the management has made a strong, well-documented commitment to radiation protection even though PGE has only a single nuclear unit. Concern for radiation protection at PGE is evidenced by the active participation at the vice-presidential level. A formal charter has established a corporate radiation protection committee whose members are four vice presidents and a certified health physicist. This committee meets regularly to consider policy matters and review or investigate unusual occurrences.

PGE has a strong, well-qualified corporate radiation protection staff which attends to licensing functions and long-term plant concerns. This staff also supports plant activities with special expertise as the need arises. PGE management supports professional level training programs in the engineering disciplines by making university level courses available at PGE facilities.

Farley, which is operated by the Alabama Power Company, has a strong, well-managed radiation protection program with strong support and active involvement of senior corporate officials who are committed to an excellent program.

Personnel Selection, Qualification, and Training

Significant weaknesses in the area of personnel selection, qualification and training were identified at about half of the facilities. The most significant of these weaknesses involved

- lack of development and use of selection criteria,
- poorly defined qualification criteria, and
- inadequate training programs.

Inadequate Selection and Qualification Criteria

Selection criteria were seldom established for specific positions within the radiation protection programs. Positions were most frequently filled by seniority and availability rather than by seeking the most qualified person for the position. This often meant that personnel who were not best qualified and knowledgeable about the position got the job. It was also common practice to accept contractor technicians "on faith" and to perform only cursory reviews of their qualifications. In many cases where qualification criteria were identified, they were defined too poorly or too generally to ensure adequate competency. One frequent mistake was interpreting ANSI-18.1 criteria as requiring 2 years of experience for technicians without paying attention to the functions

performed and type of knowledge gained during those 2 years. Several years of experience in maintaining records of exposure or performing limited activities as a control point monitor do not provide the varied experience needed for evaluating radiological conditions for the broad spectrum of inplant work activities.

Inadequate Training Programs

The most frequently observed weakness was inadequate training programs for radiation protection technicians--company employees and contractor technicians in particular. Too often the training and retraining programs were informally conducted when it was convenient to do so, based on work loads. The "once trained, always trained" philosophy was prevalent at many facilities. Too few programs included an effective method to evaluate the effectiveness of training (that is, the proficiency rating was often omitted). Too few training/retraining programs adequately incorporated a demonstration phase (hands-on practical factors) where the technician demonstrates proficiency of a skill. Many of the training programs did not cover plant systems and operations as they relate to potential health physics problems and seldom did the training address those conditions that could develop during an accident situation or what radiation level might be expected during such an event. In general, the technical depth of training for technicians was inadequate.

Technical training of health physics foremen was generally badly neglected; these "first-line" supervisors frequently received less training and retraining than the technicians they supervised. The apparent shortage of experienced health physicists has resulted in greater responsibilities being placed on inexperienced, new graduates. Because of heavy job demands and other restraints, these young professionals are frequently denied the broadening experience of a technician assignment. They are often not provided the system training, extensive training in station procedures, nor other broadening plant familiarization experience that would help them perform well. Professional development training, to maintain state-of-the-art knowledge, was generally not available to plant HP foremen and professionals.

The appraisal team noted other elements that demonstrated the inadequacy of training programs. A heavy reliance on computer programs for obtaining analytical results meant that a computer failure or power loss would result in the inability to identify and quantify nuclides. Seldom was the staff trained to perform manual calculations or to use alternate methods to identify and quantify nuclides. It was frequently observed that technicians failed to recognize a potential problem involving alpha and beta radiation and consequently did not perform appropriate surveys to evaluate the conditions. Technicians did not recognize situations where extremity monitoring should have been performed. It was also noted that postoperation briefings were not routinely scheduled following major outages or on completion of unusual operations. This type of continuing training was omitted by many facilities.

The radiological control training for general employee/radiation workers was found to be deficient at many facilities. Many programs did not provide the trainee with hands-on training such as proper frisking techniques and donning/removing protective clothing, or handling, moving, and working with contaminated materials.

Examples of Good Selection and Qualification Criteria

Several plants were noted to have developed and implemented selection and qualification criteria. The Farley and Browns Ferry plants had documented selection and qualification criteria for each position in their radiation protection organizations. These criteria related to job descriptions, included formal training and experience factors, and were used as standards for hiring and promotions. The Brunswick plant used job descriptions for each position category within the radiation organization. These descriptions were detailed and comprehensive and provided an excellent basis for performance evaluation as well as guidelines for job requirements at each proficiency level.

Examples of Good Training

Since the most frequently observed weakness was failure to provide adequate training for radiation protection technicians, a number of examples of good approaches to training are given below.

A few utilities have made a substantial committment to training. Health physics technician training for Carolina Power and Light is highly formalized in conjunction with the utility's Nuclear Training Section located near Raleigh, N. C. Technicians are removed from the job pressures and provided an uninterrupted classroom and laboratory work environment, staffed by well-qualified professional educators. There appeared to be a close liaison between the corporate training center and the individual plant training group.

TVA's technical training center in Muscle Shoals, Alabama offers a well-planned 6-month training course for HP technicians at Browns Ferry. The course consists of laboratory training with equipment similar to that used at the plant, inplant instructors, plant systems identification, radiation biology, mathematics, problem solving, and general health physics instruction.

Although North Anna's formal retraining program was not implemented, and documentation problems were noted, the plant had an excellent program for developing well-trained and qualified health physics technicians. Established in January 1978, the program is designed to take an individual with little or no health physics training and develop through an eight-step, 4-year program, a well-qualified technician. Before the trainee can progress to the next higher step he must receive satisfactory written examination results and acceptable supervisor appraisals. Individuals are normally brought into the development program at step 1. However, technicians with sufficient experience to meet the ANSI 18.1-1971 requirements enter the development program at step 5.

Peach Bottom's extensive, formal training program, starts with its entry-level radiation protection technicians. High school graduates, with background in mathematics and sciences, were placed in a 4½-month training program. The program modules included mathematics and physical science, BWR (boiling-water reactor) technology, radiation protection, and chemistry. Some of the modules included approximately 50% inplant and 50% classroom time. At the completion of each module, the students were required to pass a comprehensive exam. The Peach Bottom on-the-job training program was implemented by a training manual; the manual had skill requirements and a qualifying exam. Plant systems training was also provided.

Plant systems training for HP technicians was being conducted at several other plants. The Ginna plant offers, on a one-time basis, a systems familiarization course of at least 3 weeks' duration. Rancho Seco provides systems training on a scheduled basis and of appropriate depth for the technicians. TMI-1 had initiated systems training in the form of "cubicle training" for its HP technicians and foremen. The cubicle training vehicle was modularized into specific plant areas (for example, refueling floor) where the student learned systems, operations, and so forth, as they affected job responsibilities for those plant areas.

Sacramento Municipal Utility District (SMUD), operator of Rancho Seco, supports a strong technician upgrade program leading to NRRPT* certification. SMUD has supplied course materials, and study facilities after normal work hours, and pays the technicians for time spent in preparing for the NPRPT examination. At the present time, 6 technicians out of a staff of 20 are certified and 3 are in the application process.

The general employee radiation worker training at Beaver Valley was an example of a good program designed to inform workers of the hazards associated with handling radioactive materials. In addition to lectures and video presentations, workers were required to physically demonstrate respirator usage, frisking, donning and removal of protective clothing, stepoff pad procedures, and so forth. Mockup and simulated contamination areas were used to effect realism. A written test was administered to evaluate performance and retention of important facts. Training was directed by well-qualified instructors.

External Exposure Control

Significant weaknesses in the area of external exposure control were identified at approximately one-fourth of the facilities. The most significant of these weaknesses include:

- inadequate dose verification,
- poor dissemination of current dose status,
- failure to provide extremity monitoring, and
- failure to follow established procedures.

Inadequate Dose Verification

At a number of facilities, it was observed that the system for dose verification was comparatively lax. Frequently film or TLD readings were not compared with pocket dosimeter readings. Even in those cases where comparisons were made routinely, there were often no acceptance criteria or a level at which followup action was required. In situations where unexpectedly high exposures occurred or where verification of large exposures was advisable,

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*National Registry of Radiation Protection Technologists

there was often a reluctance to "go to the trouble" of verifying the doses and, in some cases, the need to evaluate and document doses for other than whole body exposure was not recognized.

At a number of facilities, pocket dosimeters were sent offsite for calibration and put into service directly upon receipt without any acceptance tests. This blind acceptance of vendor work without any independent quality control check represents a failure of some licensees to recognize their responsibility to ensure that vendor services and supplies satisfactorily meet licensee's needs.

Poor Dissemination of Current Dose Status

Some of the facilities did not have a system in place to provide timely dissemination of current dose status on individuals who were approaching regulatory or administrative limits. Although current dose status was maintained at all facilities, the timeliness of feedback to appropriate groups for effective control of exposures was sometimes poor. In most cases, this was exhibited by systems that relied on manual processing of data. Those facilities using computer systems seldom had a problem, unless the computer broke down.

Failure To Provide Extremity Monitoring

The failure to provide adequate extremity monitoring has been identified in several other sections of this report but deserves further discussion. The problem appears to relate to the fact that at reactors whole-body exposures are by far the greatest concern for most of the operations performed. It becomes so routine that consideration of other types of exposure is forgotten. Typical situations where exposure to the head or hands may provide the limiting doses include steam generator repairs, where the head is closer to the tube sheet than the trunk of the whole body, and maintenance on incore detectors, where the hands may receive the limiting exposures. Consideration must also be given to beta exposure anytime the primary system is open for maintenance work. All too often radiation protection technicians failed to recognize the need for special monitoring.

Failure To Follow Established Procedures

Failure to follow established procedures was one of the most frequently observed faults of radiation protection technicians and workers. Most facilities had procedures which were adequate to prevent inadvertent and unnecessary exposures. However, most exposure events were caused, at least in part, by failure to follow the established procedures. This problem was observed at most facilities.

Examples of Good External Exposure Control

Effective use of computerized dose recordkeeping was noted at several stations. The computer was used extensively at Kewaunee. Daily updates, based on pocket dosimeter results, are made to personnel and radiation work permit (RWP)

accumulated dose files. When monthly TLD data become available, personnel files are updated to reflect TLD results, and a program calculating TLD/pocket dosimeter ratios is executed. An alert is signaled for each ratio outside a predetermined limit. Additionally, RWP dose records are adjusted based on each individual's TLD/dosimeter ratio. This system is used to generate daily dose status reports, alert lists, termination reports; to track RWP person-rem accumulations; and to generate the material for required annual reports. The system appeared to function well and to be relatively simple to use.

San Onofre has developed what appears to be the basis for a particularly effective, computer-based, personnel-exposure RWP system. Although not completely debugged and lacking flexibility in certain areas, the system permits live time entry of exposures, reporting by shifts of exposures for work groups, visual review of records by cathode-ray tube (CRT) terminal and preparation of hard copy personnel file records and termination letters. This system also provides the plant management a daily (or by shift) statistical report of exposures during the preceding 24 hours by various sorts, including work groups or task. The system includes a computer-based RWP system which permits multiple entry-exit point control, positive control of authorized individuals, and review of training and respiratory protection qualifications before entry. The system automatically rejects individuals proposing entry on an RWP who do not satisfy the training requirements for the specific conditions of work stated on the RWP.

Several plants position a security guard at the controlled area access point. The most efficient use of the guard was noted at Prairie Island where the guard monitors the redundant plant security television system, retains individual clock punch cards for persons entering the controlled area, ensures that the RWP and dosimeter dose is entered on the cards, ensures that individuals are wearing proper dosimetry, and oversees exit frisking.

Internal Exposure Control

Significant weaknesses in the area of internal exposure control were identified at approximately one-fourth of the facilities. The most significant of these weaknesses included

- poor personnel contamination control,
- inadequate calibration programs,
- inattention to surface contamination areas, and
- failure to fully implement respiratory protection programs.

Weaknesses in Personnel Contamination Control

At about one-fourth of the facilities, serious weaknesses in personnel contamination control were observed. This was one of the most common weaknesses identified across the industry. Very often the type of monitoring equipment provided at exits to surface contamination areas was inappropriate for detecting significant levels of contamination on personnel. The use of large-area "pancake" end-window Geiger-Muller detectors (the preferred instru-

mentation) was too infrequent. The placement of the frisker was frequently in high-background areas where only gross levels of contamination could be detected and calibrations were often inadequate. Shielding was not utilized to the best advantage. Personnel exiting surface contamination areas often monitored themselves too fast, too little, or not at all. Many programs did not include provisions for recording instances of significant contamination for evaluation and tracking as an indicator of improper work practices. In many instances, facilities did not realize the extent of their contamination control problems until they began employing sensitive detection techniques, such as whole-body frisking with a pancake probe.

Many facilities did not have a procedure for estimating maximum permissible concentration-hours (MPC-hr) exposures from whole-body-counting data. Because 10 CFR 20.103 expresses standards for internal emitters in term of time-integrated concentrations (MPC-hr) and intakes rather than permissible body burdens or doses (such as has been done by the International Commission on Radiological Protection), two areas become very important: (1) that all licensees maintain a comprehensive breathing-zone air-sampling program; and (2) that all licensees be in a position to compare whole-body or organ burden data with the data generated by the air-sampling program. To accomplish this, each licensee must have a method for interpreting whole-body-counting data in terms of MPC-hr of exposure needed to produce the measured burden. Another reason for relating the whole-body-counting data base to the air-sampling data base is to determine the effectiveness of the respiratory-protection program. Many licensees failed to established a procedure for estimating MPC-hr exposures from whole-body-counting data and were, therefore, not in an optimum position for determining the effectiveness of the air-sampling and respiratory-protection programs.

Contamination control appeared to be a good measure of health physics (HP) program effectiveness. Good programs did it well, poor programs not so well. Employees were more productive when they were able to move around the plant without being excessively burdened by protective clothing, and their attitudes toward the HP program were generally better. Good programs stressed worker training in proper contamination control work techniques and prompt correction and cleanup when contamination was found; poor programs provided minimal training in radiological work practices and merely delineated contaminated areas to prevent further spread. At the latter plants, decontamination was usually a collateral responsibility of a group other than HP, and the emphasis and skill applied to it was not as great as when controlled by HP. Good contamination control programs also reflected stability (low personnel turnover) in the decontamination group. An exception was at Point Beach where the non-professional entry level position is as "HP helper" (including decontamination work) for several months before selecting a permanent plant position.

Failure To Fully Implement Respiratory Protection Programs

Approximately 25% of the facilities had respiratory-protection programs which did not meet the requirements of 10 CFR 20.103 or Regulatory Guide 8.15 nor the guidance criteria of NUREG-0041. In some cases, it appeared that the total program was not implemented because of the effort and expense that would be required. In most instances, deficiencies were noted in the areas of fit testing, assuring breathing-air quality, and maintenance of equipment.

At those facilities that did not fully implement the program, there was serious concern for the adequacy of the protection provided because of the weak "links" in the program. Additionally, those facilities could not take advantage of authorized protection factors for the various respiratory protection devices and, therefore, workers would be significantly limited in the amount of time they could spend in airborne-radioactivity areas. This practice could lead to increased cumulative external exposures because of the necessity of using more people.

Inadequate Calibration Programs

The calibration of friskers and whole-body counters was noted as a weakness at a number of facilities. In some cases, calibration was not performed on friskers or the minimum level of detection had not been established. At several facilities it was found that calibration of whole-body counters was attempted using one or more sources of unknown activity and without a phantom to establish proper geometry.

Examples of Good Internal Exposure Control

The calibration and utilization of the whole-body/thyroid/lung counter at the Maine Yankee Nuclear Power Station was found to be exceptional. This finding is based on the following elements of the licensee's in vivo counting program: performance of daily background and radioisotopic source checks on the whole-body/thyroid/lung counter; performance of a semi-annual electronic/radioisotopic calibration on the counter; frequency of the routine in vivo counting program; competence of the health physics department staff member performing in vivo counting; and analysis of in vivo data by the Health Physics Department management.

As a result of previously identified contamination program weaknesses, and resultant positive, responsive improvements, the Brunswick Units 1 & 2 site's, program ensuring adequate personnel contamination surveys was found exceptional. Personal survey instruments (friskers) were calibrated both electronically and to a radiation source, and functionally checked at least daily and usually each shift. Frisker stations were located at exits from the radiation control areas and at selected places inside. Survey areas were shielded, if required, to reduce background radiation levels. Each frisker station was continuously manned by a "frisker watcher" who was instructed to observe each individual surveying to ensure that each one performed an adequate survey and that hand-carried objects were either surveyed or had a valid health physics survey release form. The frisker watchers were trained in appropriate survey techniques such as speed of probe movement and distance from surveyed surface to detector window. The portions of the body to be surveyed depended on the area being exited. Each station was prominently identified with the extent of survey required, such as hands and feet, whole body, and so forth.

Oconee has established an excellent respiratory protection program. The plant has ensured that the program has good supervision, is adequately staffed, and is well equipped. The program's adequacy is analyzed in many varied ways--review of respirator issue records, records of body burden analysis, out-of-service time for respirators, parts usage and failure rates, and personnel-user complaints on design and construction of respirators.

Surveillance

Signi nt weaknesses in the area of radiation protection surveillance were identi.d at about one-third of the facilities. The most significant of these weaknesses included

- failure to perform adequate surveys,
- poor dissemination of survey data and plant conditions,
- marginal supply of instruments, and
- inadequate calibration.

Failure To Peform Adequate Surveys

The air-sampling programs at a number of the facilities did not provide accurate data for evaluating potential inhalation problems. This was due to a frequent failure to obtain air samples that were representative of the air being breathed by workers. Failure to consider air currents and dilution and turbulence caused by work activities were the most common reasons representative air samples were not obtained. Other common deficiencies noted in the air-sampling program were: assumption that all filter media are 100% efficient under all conditions; counting efficiencies based upon standards placed on metal backings (that is high backscatter); procedures which did not take into account the evaluation of short-lived particulate activity in the presence of natural radioactivity; filter paper being cut down in size before counting, without proper procedural controls to ensure the smaller sample is representative; inadequate sampling volumes and filter media for airborne alpha measurements; and inadequate quality control measures in he counting facility.

In many of the plants appraised, personnel exiting radiologically controlled areas used the portal monitor as the prime monitoring device for detection of contamination. These portal monitors measure gamma radiation only; they cannot detect personnel contamination with the sensitivity needed and contamination can be moved into unrestricted areas and offsite. Most of the portal monitors were found to alarm on`y when several microcuries were placed in close contact with each detector. More-sensitive frisker-type instrumentation was usually available but personnel were not required to use it.

Alpha and beta surveys were performed infrequently and, typically, with instruments designed only for detection and not for making quantitative measurements. Also, the procedures at many facilities did not specify what correction factors to use in quantifying alpha measurements or determining beta dose rates with gamma-calibrated survey instruments. Another concern was that the portable survey instruments used to conduct surveys were typically not calibrated against reference alpha and beta sources, but were used by applying the alpha and beta correction factor recommended by the manufacturer.

Another weakness was noted at a number of fac[illegible]--the determination of the neutron dose equivalent. Various neutron-monit[illegible]ices were observed in use. These included: TLD-100, TLD-600, Albed[illegible] film and neutron survey instruments, principally the Eberline PNR-4 [illegible]ly, the appraisers

noted that the facilities had not made a thorough enough evaluation of the neutron energy spectra in order to determine the suitability of the monitoring device to use and the appropriate factors to use for determining the neutron dose equivalent.

Poor Dissemination of Survey Data and Knowledge of Plant Conditions

In numerous instances, the dissemination and use of survey results were poorly coordinated, and there was a distinct lack of communications between operations and the radiation protection group concerning pertinent plant activities and radiological conditions. Often, current radiological safety data were not disseminated in a timely manner for inclusion on work permits or for updating radiological status boards. There was also a failure to maintain a good flow of information between operations and the radiation protection group concerning plant evolutions that could significantly change radiological conditions; for example, withdrawal of PWR incore detectors and associated equipment during refueling operations without timely notification of the radiation protection staff.

Marginal Supply of Instruments

The supply of health physics instrumentation at many facilities was judged to be marginally acceptable for routine operations and inadequate for an accident the magnitude of TMI or greater.

Inadequate Calibration

Calibration and maintenance problems were common. Calibration of beta and neutron instruments was particularly poor. Widespread use of national standards for calibration practices did not exist. The use of poor calibration techniques for personnel friskers and portal monitors often led facilities to the false assumption that these instruments were performing a function which they were actually incapable of doing. Not all facilities recognized the limitations of portal monitors and some improperly relied on these instruments for personnel contamination control. In general, it was noted that quality assurance programs for health physics instrumentation needed significant improvement.

Example of Good Surveillance

A high-quality instrumentation performance program was noted at Brunswick Units 1 and 2 in that a functional check of all portable instruments was done as recommended by ANSI N323-1979. Each normal working day and within 24 hours before use of portable instruments not routinely used, each instrument was returned to the calibration facility. It was visually inspected, a battery check was made, and it was response tested at points on each range using a Cs-137 well source. A checklist, used to record data, provided the acceptable response range. Those instruments not responding as required were removed from service until repaired and/or recalibrated.

Radioactive-Waste Management

Significant weaknesses in the area of radioactive-waste management were identified at about one-fourth of the facilities. The most significant of these weaknesses included:

- failure to perform adequate reveiws of modified liquid-waste-processing systems.
- failure to provide adequate facilities for storing packaged wastes,
- failure to meet burial ground and DOT requirements, and
- failure to provide adequate maintenance on ventilation exhaust filter systems.

Failure To Perform Adequate Reviews of Modified Liquid-Waste-Processing Systems

Several facilities did not perform adequate reviews of modified liquid-waste-processing systems, including the use of mobile process systems, to ensure the new systems provided the same degree of safety as installed systems. In particular, these new system interfaces with existing systems were frequently not tested before actual use. Operational procedures were not provided for these new systems.

Failure To Provide Adequate Facilities for Storing Packaged Wastes

Because fewer commercial burial grounds are available and because limitations are being placed on quantities of waste accepted from a facility, the volume of packaged wastes stored onsite has increased. Provisions have generally not been provided for the temporary storage of a great deal of waste, therefore, unforeseen problems have developed. In a number of cases, the increased volume of packaged waste has overcrowded areas and has resulted in an increased potential for unnecessary exposure.

Failure To Meet Burial Ground and DOT Requirements

The increased surveillance performed on materials arriving at burial grounds has highlighted failures on the part of reactor facilities to ensure that no free-standing liquid exists within packaged wastes and that contamination and radiation levels are within the DOT limits.

Failure To Provide Adequate Maintenance on Ventilation Exhaust Filter Systems

Several facilities had not established programs to routinely inspect, test, and maintain these various ventilation exhaust filter systems, not subject to technical specification requirements. Filter systems being operated without adequate surveillance programs included high-efficiency particulate air (HEPA) filter trains serving radwaste buildings, auxiliary buildings, BWR offgas systems, and chemistry laboratories. On one pressurized-water reactor (PWR),

field observations of the operating reactor containment building exhaust roughing filter system revealed that the large majority of filters had separated from their holding frames (because of overloading).

Examples of Good Radioactive-Waste Management

At many stations plans had been made to construct facilities for the interim storage of solidified radwaste. The Ginna plant had constructed a sheltered, fenced area onsite. The area contained a concrete bunker equipped with hatch covers, that allowed for below-grade storage. The bunker drained to a sump which could be sampled and pumped to the plant radioactive liquid waste system. No material had been stored in this area at the time of the appraisal.

A number of facilities had instituted programs to reduce the volume of solid radwaste generated. Efforts were being made to better identify and segregate trash, and minimize the amounts of materials (like packaging) taken into radiological controlled areas. New waste-solidification systems, more effective compactors, and awareness training about volume reduction were in place or planned. The Dresden facility had installed a new waste-solidification system in late 1979, with a resultant volume reduction savings ranging from half to a fourth Additionally, an estimated 75% reduction of associated exposure of radwaste personnel had resulted.

ALARA Program

Significant weaknesses in ALARA (as low as reasonably achievable) programs were identified at approximately one-fourth of the facilities. The more significant of these weaknesses included

- lack of formal ALARA program, and
- failure to integrate ALARA program stationwide.

Lack of Formal ALARA Program

At a number of facilities, no formal ALARA program had been developed and implementation of ALARA principles was minimal. The lack of written commitments and implementing procedures was a common deficiency. Written commitments and implementing procedures for an ALARA program help ensure uniform, continued program support. Substantive ALARA efforts (in the absence of commitments and procedures) were noted at plants that had strong, well-motivated individuals in key positions. The loss of these key individuals, however, could result in a significant loss of effectiveness of the ALARA efforts.

Failure To Integrate ALARA Program Stationwide

Because the program had not been formally instituted, no responsibilities had been defined, objectives were unclear, and the methodology to be used to implement the ALARA principles was not clearly understood. A common failure observed was the assignment of responsibility to a single group without the

emphasis that the entire station must actively implement the principles. Many radiation protection organizations were attempting to perform the principal ALARA functions with minimal input, feedback, and support from other organizational groups within the plant. It was generally noted that non-health-physics, first-line supervisors lacked specific commitments and responsibility for ALARA implementation.

Other ALARA Deficiencies

At many plants.

- There were no apparent measurable goals set for the ALARA effort; there was no management system developed that would indicate the degree of success of ALARA effort undertaken, that is, if the goal has been achieved

- There was no data base effectively derived from previous operational history nor did the current system (radiation surveys and dosimetry records) lend itself to being readily useful and meaningful for ascertaining the goals and direction of the ALARA effort.

- There was no engineering support; and appropriate ALARA involvement in maintenance and operations procedure reviews and prework planning were not adequate.

- At some facilities, even though adequate ALARA programs had been formulated, implementation efforts were seriously hampered by a lack of trained health physics professionals and technicians to supervise the program on a continuing basis.

Examples of Good ALARA Efforts

A basic element in an effective ALARA program is the capability to collect and sort radiation exposure data in order to evaluate the status of on-going jobs and provide a readily retrievable historical exposure file (by job function) for planning future work.

Several plants had developed effective, computer-based, exposure-tracking systems as was mentioned in the external exposure control section of this document

Some facilities successfully solicited worker input and practical suggestions for dose reductions through "worker suggestion boxes," "ALARA problem reports," and other plantwide participation schemes. The ALARA programs at Browns Ferry and Farley have directly benefited from such input, at the same time fostering employee involvement in the plant's ALARA efforts.

ALARA committees offered another effective mechanism for involving the various departments within the plant's organizations. In accordance with written procedures, the Ginna plant established an ALARA committee which was required to meet (at least quarterly, and more frequently during outages) in order to

- plan activities of personnel who must enter radiation areas,
- evaluate the actions and procedures of personnel working in such areas, and
- conduct postoperation debriefing on projects that resulted in substantial exposures

The chairman of the committee was the plant superintendent and the other members included representatives from health physics management, operations, maintenance, health physics technician staff, technical engineering, and quality control. Additionally, the Superintendent, Nuclear Operations was designated as a regular member of this committee.

Through effective ALARA outage planning, the Browns Ferry site has managed to provide a net decrease in total exposures over the course of seven outages. Other noteworthy ALARA dose-reduction schemes included sustained efforts to maintain fuel-cladding integrity and thoroughly reviewing maintenance procedures.

Although improvements should be made in documenting ALARA efforts, efforts at Indian Point 2 of adding shielding, decontaminating, and job-specific training have provided observable exposure reductions. Substantial person-rem savings were made during the 1979 refueling outage for job activities such as steam generator sludge lancing, refueling operations, and reactor coolant pump maintenance.

The Kewaunee plant's ALARA activities for inservice inspections deserve special note. A Quality Assurance Auditor and a health physics technician visited each job site to establish dose levels and to evaluate shielding and equipment requirements; they used this information for scheduling and improving job planning to minimize doses.

A postmonitoring job evaluation form is used routinely at Big Rock Point to document radiation protection review of jobs where direct HP technician coverage is provided. This form requests technicians to suggest methods to reduce exposure on future similar jobs. Although deficiencies in the implementation were noted, such feedback is a good ALARA tool.

Effective simulation training for radiation workers using realistic equipment mockups can provide for substantial personnel dose reductions. The Ginna plant had exceptional mockups of steam generators and reactor coolant pumps. The steam generator mockup included defective tubes for eddy-current testing, and a tube sheet for tube plugging and welding practice. Video taping was also used effectively in the mockup training.

Several plants' ALARA efforts have been enhanced by the effective use of audio-visual techniques. Closed-circuit television (CCTV) was used to maintain visual contact with workers, and aided in "dose-timekeeping" during sparger work in the drywell. CCTV was also used in remote radwaste areas to reduce the number of operator entries and, hence, exposure. Photographs have not only been used to document ALARA techniques, but also have been incorporated into training program materials and lesson plans for workers

Although improvements in formalizing of the ALARA efforts could be made, Prairie Island's ALARA program appeared effective. The plant's radiation doses have averaged approximately 250 person-rems a year over the last 3 years. The national PWR average was approximately 500 person-rems for the 1978-1980 period. There was a strong management commitment to the ALARA concept, and the attitudes of plant workers and HP staff toward minimizing exposures were excellent. Individual and job-specific exposure information was readily available and routinely used in planning the work activities.

A New ALARA Concept

NRC policy has recently shifted away from the concept of developing a separate ALARA program. There are steps under way to stop addressing ALARA as a separate program and rather to emphasize incorporating ALARA into the overall radiation protection program. Implementation at any operating facility requires that ALARA principles be incorporated into every daily activity as well as into special or unique activities. The principles of ALARA are inseparable from good health physics practices and their successful implementation depends primarily on the philosophy and attitude of management and workers.

Facilities and Equipment

Significant weaknesses in facilities and equipment were identified at about one-fourth of the facilities. The most significant of these weaknesses included

- marginally adequate facilities for offices, decontamination activities, respirator maintenance, and contaminated tool storage; and
- limited supplies of special equipment.

Marginally Adequate Facilities

Although weaknesses in facilities and equipment had less of an impact on worker safety than did most of the other categories, they contributed to the difficulty in providing a high-quality radiation protection program. Numerous programs were found to have very limited and marginally acceptable space and equipment for specialized activities. These included office space for the radiation protection technicians; space and equipment for decontamination activities; low-background, uncontaminated areas for respirator maintenance; and properly ventilated and controlled storage areas for contaminated hand tools.

Changing areas and rooms in the plants for putting on and taking off protective clothing were usually less than adequate. Access control of personnel through these changing areas (for example, the drywell area, the main HP control point, or the torus area) was usually chaotic and provided an easy opportunity for personnel to skip contamination surveys before donning street clothes.

The locker room and changing facility for women was inadequate at most plants. Separate dressing/undressing areas, decontamination sinks, showers, and so forth for women were usually not available.

The facilities for the decontamination of equipment and anti-c clothing at most plants were marginal at best. At many facilities decontamination of equipment was done at temporary controlled work areas. Although appropriate area restrictions and contamination controls were normally initially instituted by means of plastic sheets and rope barricades, after long use these controls had broken down, presenting increased opportunity for the spread of contamination and for unnecessary exposure. Also these temporary work areas usually had inadequate air-flow control and lacked adequate storage.

The amount of contaminated equipment present at many plants exceeded the storage designed for this purpose and consequently led to storage in areas not designed for contaminated equipment. This overflow storage compromised ALARA concepts on numerous occasions. This problem is caused by an apparent philosophy change which appeared since the plants were built. Health physics and engineering seem to concur that less waste is generated and less personnel exposure occurs if the routinely used equipment, which becomes contaminated in use, is just wrapped and stored in that condition pending future use. The logic is valid, but facilities must be provided to safely store this equipment without additional personnel exposure during normal operations. The equipment should also be protected from the elements to preclude spread of contamination.

In many plants the linear air-flow velocities at the face of the hoods in which radioactive materials were handled were below recommended values. This lack of concern for proper ventilation was evident as well in the decontamination work areas and in the waste compaction area.

Limited Supplies of Special Equipment

Shortages in supplies of special equipment were also noted. Types of special equipment in short supply were typically portable ventilation units equipped with high-efficiency filters, communication devices for use in contamination containment structures, and temporary shielding materials which are readily transportable and adaptable to various configurations.

Good Facilities and Equipment

From discussions with licensee personnel at many facilities NRC staff learned that plans are being made or are under way to improve the health physics facilities. In some plants major modifications were in progress. These included new or remodeled changing areas and rooms, decontamination facilities, and respiratory maintenance facilities. In addition to facility changes, funds for purchasing needed equipment were becoming available.

CONCLUSIONS

The redirected approach of the Health Physics Appraisal Program provided the opportunity to focus attention on areas not specifically covered by regulations and permitted inspectors to delve into the areas where weaknesses were known or suspected to exist. In general, the health physics personnel at the facilities welcomed the type of appraisals performed during this program because it constituted an evaluation of their total program and frequently the findings

supported concerns and requests the facility health physicists had already identified to upper management.

Based on the findings from the health physics appraisal of 48 operating nuclear power sites, several conclusions may be drawn.

- All of the radiation protection programs were judged to be at least acceptable for continued operations while significant findings were being corrected. Although there were no instances identified where the immediate health and safety of workers or the public were threatened, few of the programs were considred to meet the high standards of excellence expected of nuclear power facilities. There was particular concern that the introduction of great stress on the program, such as would be the case in the event of an accident, could lead to a real decrease in the level of protection afforded. In some instances, lesser events such as loss of key pesonnel could alsc result in a seriously degraded capability to provide adequate radiological protection.

- The single greatest cause for weaknesses in the radiation protection programs can probably be traced back to the general attitude toward radiological safety. Management often considered the radiation protection group more of a routine service organization than a radiation support function integrated into the fabric of overall plant operations. Consequently, funding, staffing, and management backing was frequently provided at the minimum level. Also, foremen and supervisors in other departments tended to have an attitude that the burden for assuring radiological safety rested almost entirely on the radiation protection group rather than understanding that such responsibility was properly that of all line management. Their failure to demonstrate a continuing concern for proper radiological work practices results in the workers adopting a similar attitude.

- The weakness most frequently observed at facilities was the inadequate qualification and training provided for radiation protection technicians. Within this area, the lack of depth of technical training and understanding was most common, along with a lack of knowledge and understanding of plant systems and operations. This weakness in qualification and training was particularly evident among contractor technicians. There was general concern that some routine monitoring duties were not being performed and a serious concern that offnormal and unusual conditions were not being recognized and evaluated thoroughly at some facilities.

- Although the list of specific weaknesses identified during the appraisal program included many that could jeopardize the adequacy of the radiation protection programs, it must be borne in mind that the acceptable performance standards were very stringent. The findings that areas were in need of improvement reflected concerns that programs and performance were not up to the standards of excellence expected and required of the nuclear industry. It must also be emphasized that many aspects of the radiation protection programs were excellent and a large number of knowledgeable and dedicated health physics personnel were performing their functions in an outstanding manner. Additionally, most licensees initiated immediate corrective actions for weaknesses easily corrected and committed to positive actions for correcting weaknesses that required longer term actions.

SUGGESTED ACTIONS FOR IMPROVING A HEALTH PHYSICS PROGRAM

Most of the weaknesses and deficiencies found during the HPAP involved aspects of the program that required management attention for correction. However, there are a number of actions the individual health physicist can take and policies he or she can actively support that could have a major impact on improving the most commonly identified areas of weakness in the radiation protection programs. Some suggested actions are discussed below.

Plant personnel should not be satisfied with a program that merely meets the formal regulatory requirements. Just meeting the regulatory requirements does not ensure that a program will be effective and efficient. The question to ask is, does the program provide a satisfactory level of protection and does it work when applied to real situation? One precaution, avoid overemphasis on paperwork and administrative details. A program that overemphasizes minute details tends to lose the respect of workers and consequently their cooperation. Additional time spent on explaining the bases and reasons for certain requirements often reaps generous payoffs in the attitude and cooperation of workers. Don't forget, this is just as true for personnel outside the radiation protection department.

When something goes wrong and a problem surfaces, be sure to search for the cause. It is remiss to just address the immediate act or event which may only be the visible sign of a more serious problem. A problem should not be disregarded as an inevitable slip or momentary loss of concentration on the part of a worker. For example, the problem may be a failure to follow radiation protection procedures. This deficiency could be caused by an inadequate training program, failure of the organization to stress adherence to procedures, or an unclear or poorly worded procedure. However, the inquiry and evaluation of what caused the problem should not stop there. The next line of inquiry should be to question why an adequate training program is not provided, why compliance with procedures is not stressed, or what caused the procedures to be written in an unclear manner. The goal should be to determine the basic cause of the problem and to correct the cause of the problem, not just to alleviate the more obvious signs.

Take the time and effort to ensure that radiation protection personnel are assigned specific duties for routine operations and during emergency situations. Furthermore, ensure that each individual knows his or her assignment and understands what is expected. Often the station procedures or Radiation Protection Plan will designate duties or functions to a generic class of personnel, for example, radiation protection technician. When this is the case, a procedure or formal assignment list should link names with the assigned duties. Assignment of duties to the Radiation Protection Manager presents another problem, one further aggravated by the requirements in the NRC's Regulatory Guide 8.8. Everyone appears to want the RPM to be both a program manager and the technical expert; however, adequate staff or support is not provided to the RPM so that all the assigned responsibilities can be accomplished.

In the area of training, it is important for the professional HP staff to development a depth of knowledge and understanding of radiological protection principles and practices. This depth of knowledge is needed to perform functions effectively, such as conducting performance appraisals and responding

to emergency situations. For the technician staff, training should include not only the technical and administrative aspects but also the application of the knowledge. Written and oral testing should be supplemented with hands-on performance. Although on-the-job training provides for necessary hands-on applications, it generally lacks the stress or pressure which is brought to bear by a test performance. Since most emergency situations would impose increased levels of stress, preconditioning personnel to this situation is often beneficial.

One of the most frequent omissions in audit programs is performance audits. Most programs include functional audits which determine whether selected activities are performed and whether they are performed at the proper frequency. Performance audits are more difficult to conduct and consequently, are often left out of the audit program. These audits are crucial, however, because they determine whether the activities being performed are done properly and are technically correct. When conducting any type of audit, records and paperwork generally must be reviewed. One tipoff to a potential problem is the recurring use of a value which should normally be a variable groundcount. For example, the consistent use of the same value for a background count should alert the auditor that further investigation is needed. Likewise, the inclusion of the same radiation levels on numerous radiation work permits even though they are for work in different areas of the plant should raise doubts in an auditor's mind as to the validity of the values. However, the auditor should not rely entirely on a paperwork review for conducting an audit. First-hand observation, independent measurements, and direct discussions with the people actually performing the activities are essential elements of a good audit program.

The last suggestion deals with the very critical element of communication. Effective communication is an absolute necessity for an efficient and effective organization. This need exists not only within the department but also outside the department. Too often the communications and relaying of pertinent information between the reactor operations group and the radiation protection group are less than satisfactory. Even within the radiation protection group, orders or instructions are often given to technicians without any explanation of the reasons or bases for the direction. Another common mistake made by many of the younger professionals is to treat the technicians as lowly subordinates. This attitude can be very costly for the young professional and can be disastrous to the program. Cooperation is built on trust and respect; it does not come automatically with academic degrees and positions.

BENEFITS AND FUTURE DIRECTION OF REGULATORY PROGRAMS

There have been several benefits from the Health Physics Appraisal Program. First, the radiation protection programs at all operating nuclear power facilities have been evaluated for their effectiveness in providing radiological safety. The weaknesses that were found have been identified to licensees and, in most cases, licensees responded with a very positive attitude and initiated aggressive actions to correct the deficiencies.

Additional benefit from the program was the attention received from upper management in the licensees' organizations. In the past, health physics inspection were performed by one or two inspectors and their scope of review was necessarily limited to only a few parts of the total radiation protection

program during each site visit. However, the Health Physics Appraisal Program involved a team of inspectors and their scope of review was the entire radiation protection program. This coupled with the new approach of extending the review beyond mere compliance created more attention from upper management. For example, findings from routine health physics inspections are discussed at an exit meeting with station management. For the Health Physics Appraisal Program exit meetings, a specific request was made that an appropriate corporate-level manager or vice president attend. In almost all cases, these representatives of upper management did attend the meetings. This provided the opportunity to bring radiation protection problems to the immediate attention of upper management who are in a position to ensure that funding and support will be provided to upgrade the radiation protection programs.

There are a number of followup actions under way to wind up the Health Physics Appraisal Program and to determine the future direction of the inspection program. One task was to conduct followup inspections to ensure that the major findings were being addressed and corrected by licensees. This effort was initiated after the inspections were completed, and most were completed by the end of calendar year 1981.

The future direction of the inspection program has been affected by both the TMI accident and the Health Physics Appraisal Program. One proposal which is currently being pursued is the imposition of a requirement on all power reactor licensees to develop and implement a radiation protection plan. Draft NUREG-0761 has been developed by the NRC to provide guidance for the development of radiation protection plans. The findings from the Health Physics Appraisal Program were considered in the development of this guidance document and many suggestions were incorporated which would correct deficiencies or upgrade areas of weakness that were identified.

Current thoughts within the Office of Inspection and Enforcement are that the nature and structure of the inspection program will change significantly over the next year or so. There will probably be an increased use of team inspections rather than one-man inspections. It is highly probable that the frequency of inspections and the scope of inspections will be adjusted on a case-by-case basis. Those facilities which do not appear to be operating effectively will be candidates for more frequent and broader scoped inspections. And finally, the areas of emphasis for inspections may be varied from year to year as opposed to the past practice of establishing set frequencies and standardized subject material for routine inspections.

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APPENDIX A

HEALTH PHYSICS APPRAISAL PROGRAM

CONTENTS OF APPENDIX A

I. INTRODUCTION

The program contained in this document, developed to satisfy the need for a clearly defined method of appraising licensee performance in the health physics program, will be subjected to further scrutiny and subsequent improvement.

II PROGRAM DESCRIPTION AND USE

General

This program consists of analytic trees (Section III), questions applicable to each tree (Section IV), and an Attachment. The analytic trees provide a graphical depiction that aids in the deductive analysis of a system The questions are designed as guidance to the appraiser for direction into areas pertinent to a comprehensive evaluation of the various aspects of a health physics program. The Attachment to this Appendix (pp. A-61 to A-70) provides a discussion of the functions of management and the manager and is provided as background information for the appraisers.

Although this methodology, i.e., analytic trees, is to be utilized by all teams, the team leaders are permitted a certain latitude in application Whether the analytic trees are presented and discussed with the licensee is optional. Also, the questions are not an all-inclusive listing of significant items. They are intended as an aid in providing an overview of the areas of interest and as directive guidance in conducting the appraisal.

The analytic trees provide both a clear picture of the basic elements of a system or program and a logic display of interrelationships. The trees start with a single desirable condition and systematically proceed through lower levels or tiers until all important factors which produce the major conditions are specified. The trees presented in this document provide a description of the ideal elements of a radiation protection program Their use can help in the prevention or detection and correction of oversights and omissions.

Each of the trees has some degree of interface with the others. Important interfaces are highlighted by transfer functions (triangles with arrows and a letter or number). Two of the trees (Management Oversight (p. A-21) and General Procedures Development (p A-22) interface with each of the remaining trees. The questions accompanying each tree (7.0, Management Oversight and 8 0, General Procedures Development, pp. A-53 and A-57, respectively) are carefully structured to avoid duplicative effort in the interface areas.

The interfaces between areas are important in the evaluation process To properly evaluate areas where transfers are noted, data collected from one area must be "transferred" to another and considered in the evaluation of both areas The end result is that, in a systematic way, we can assess the true impact of a particular event, and provide greater assurance that a given area is, in fact, adequate or inadequate

Emergency Operations

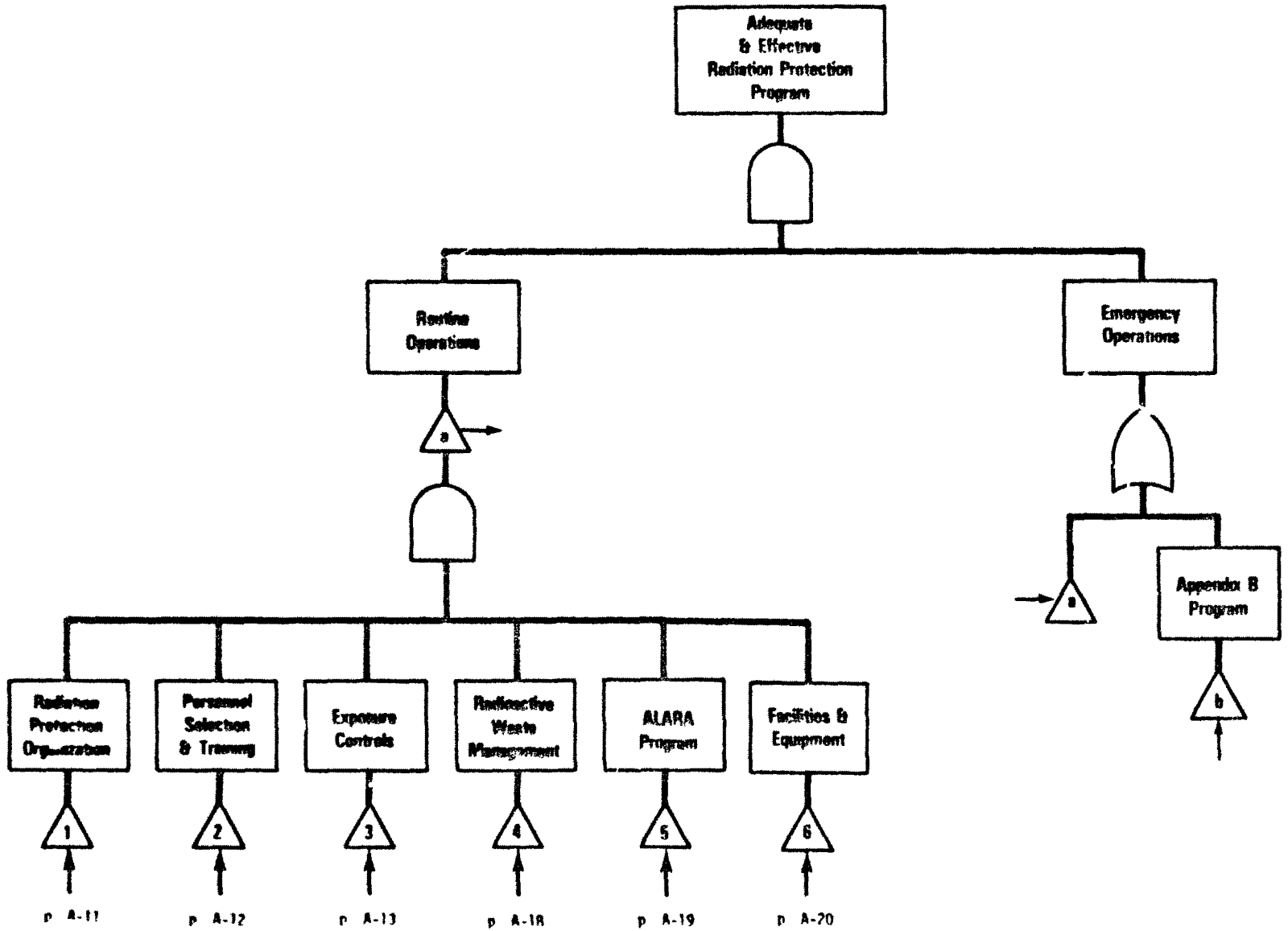
The basic program incorporates only those aspects of emergency response capabilities that relate directly to the health physics program If it is necessary or desirable to perform an in-depth review of all major aspects of a

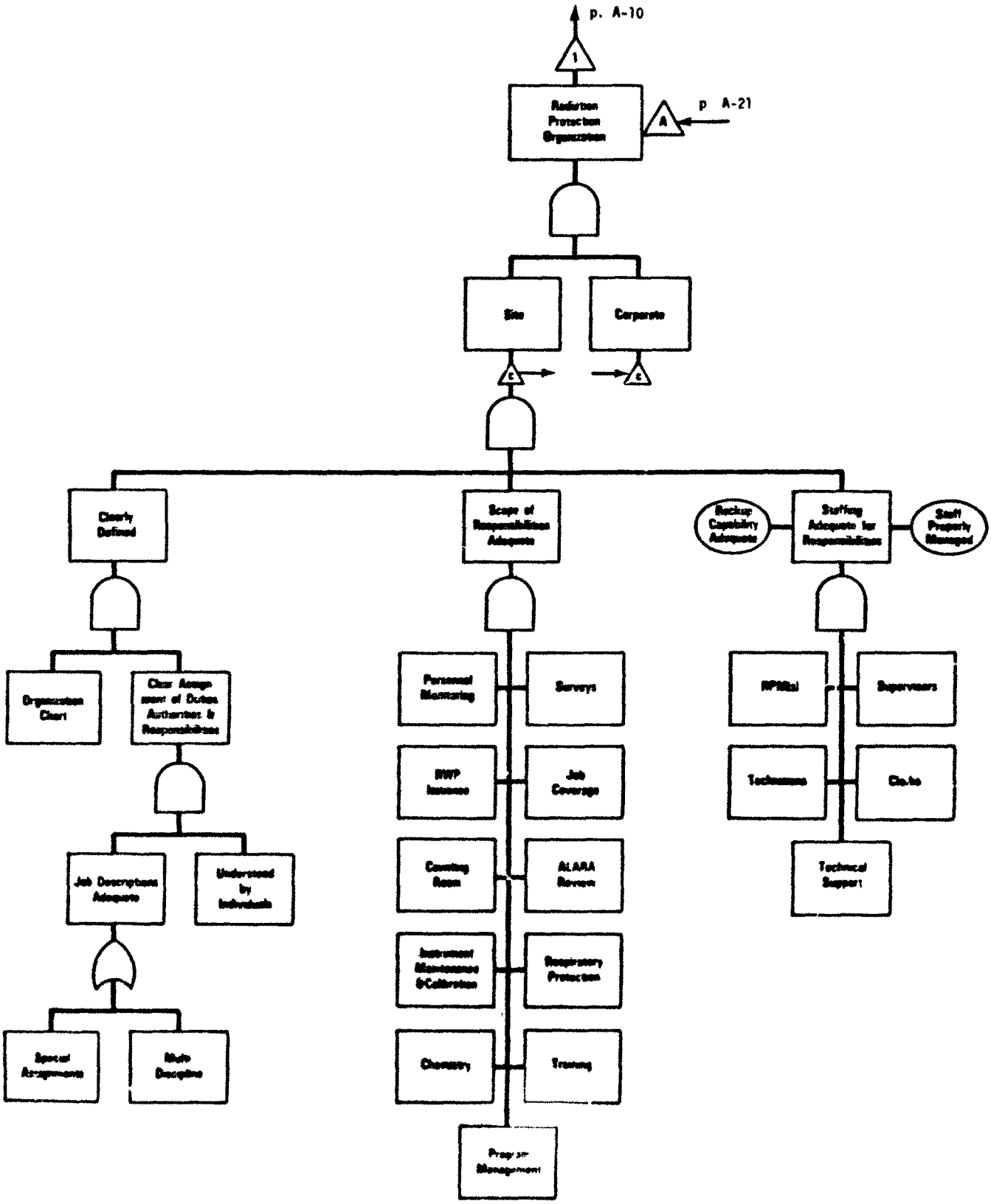
licensee's emergency planning program, the trees and questions contained in "Emergency Operations," a subpart of the program provided for optional use by the NRC Regions, should be used. When that program is used, the questions in the basic program which are denoted with an asterisk (*) should be omitted since they are covered in the "Emergency Operations" package. (NOTE: The "Emergency Operations "subprogram was omitted for purposes of this NUREG, since it provided inspection guidance developed prior to recent rulemaking in emergency preparedness.)

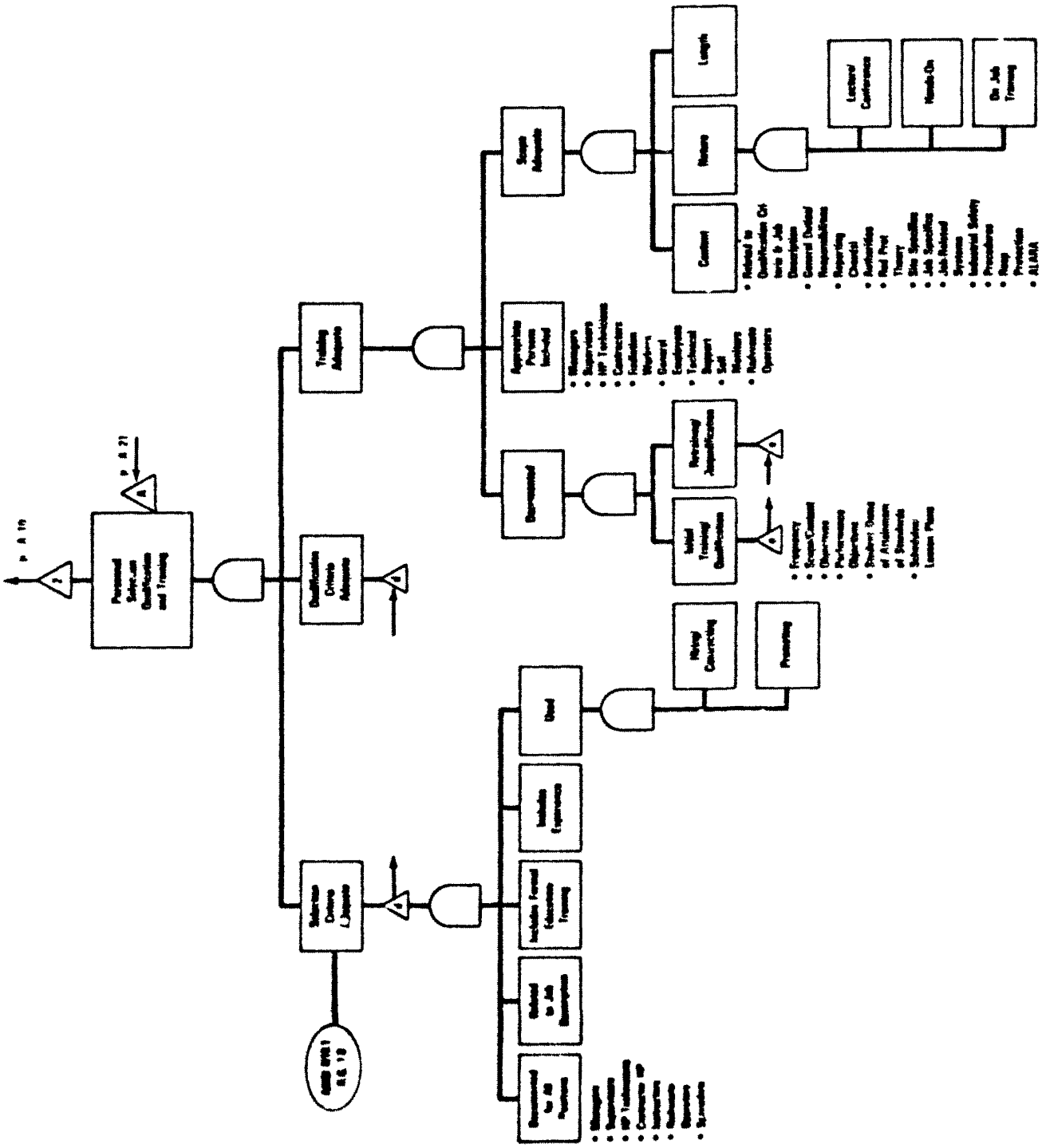
Management Oversight

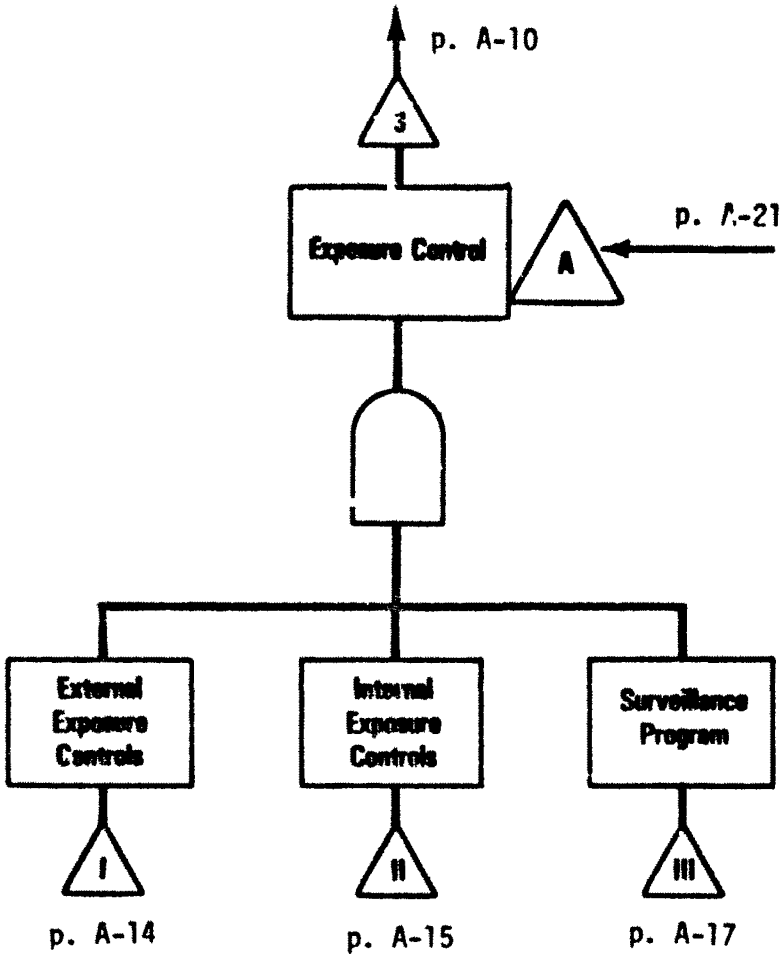
In reviewing the adequacy of any of the elements of the health physics program, an informed evaluation of management's oversight is critical. Frequently the cause of problems in a program is attributed to a "lack of management control." This view fails to recognize the control is only one of several management functions which, if performed ineffectively, can result in program deficiencies. It also fails to recognize that an individual manager or worker may be the causal agent. Therefore, to fully evaluate a program, the degree to which the management team, the individual managers, and individual workers fulfill their functions must be considered. The attachment, "Functions of Management and the Manager" (pp. A-61 to A-70), is provided as information and guidance.

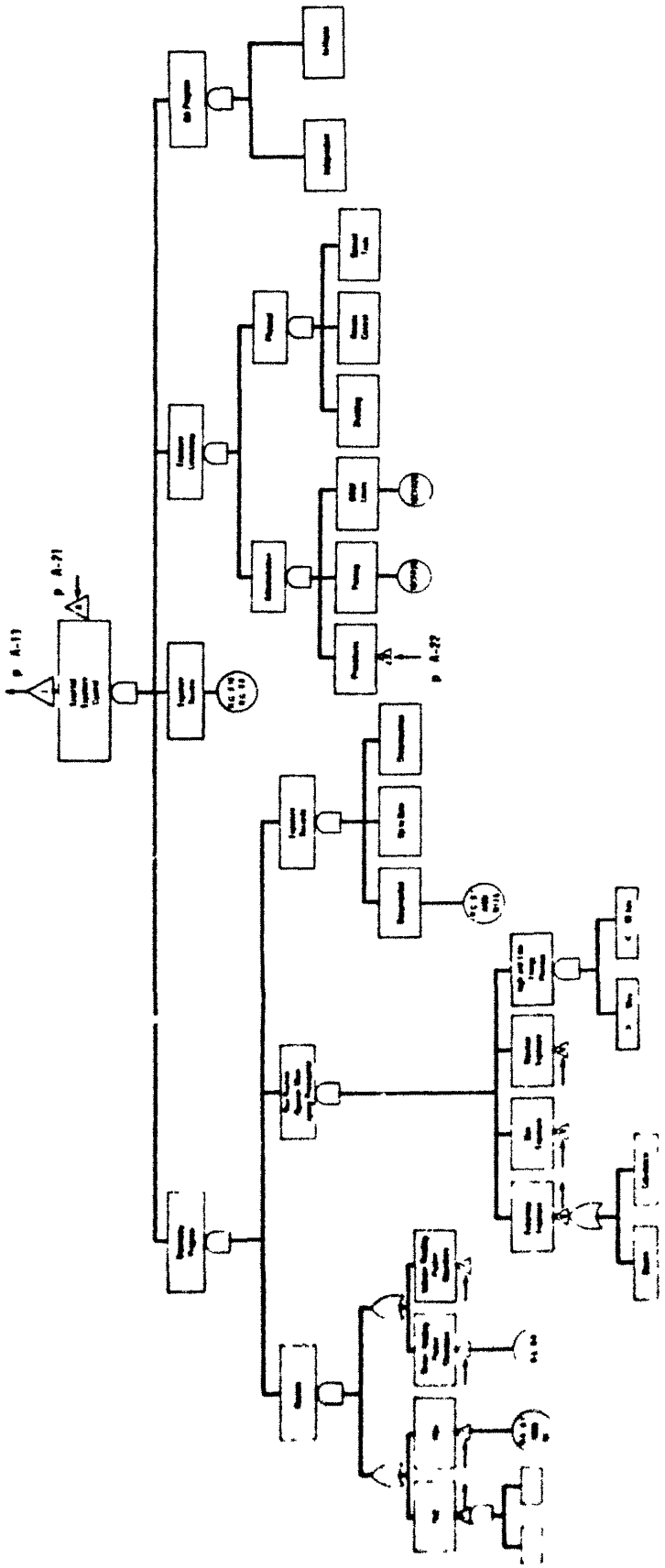
III. ANALYTICAL TREES

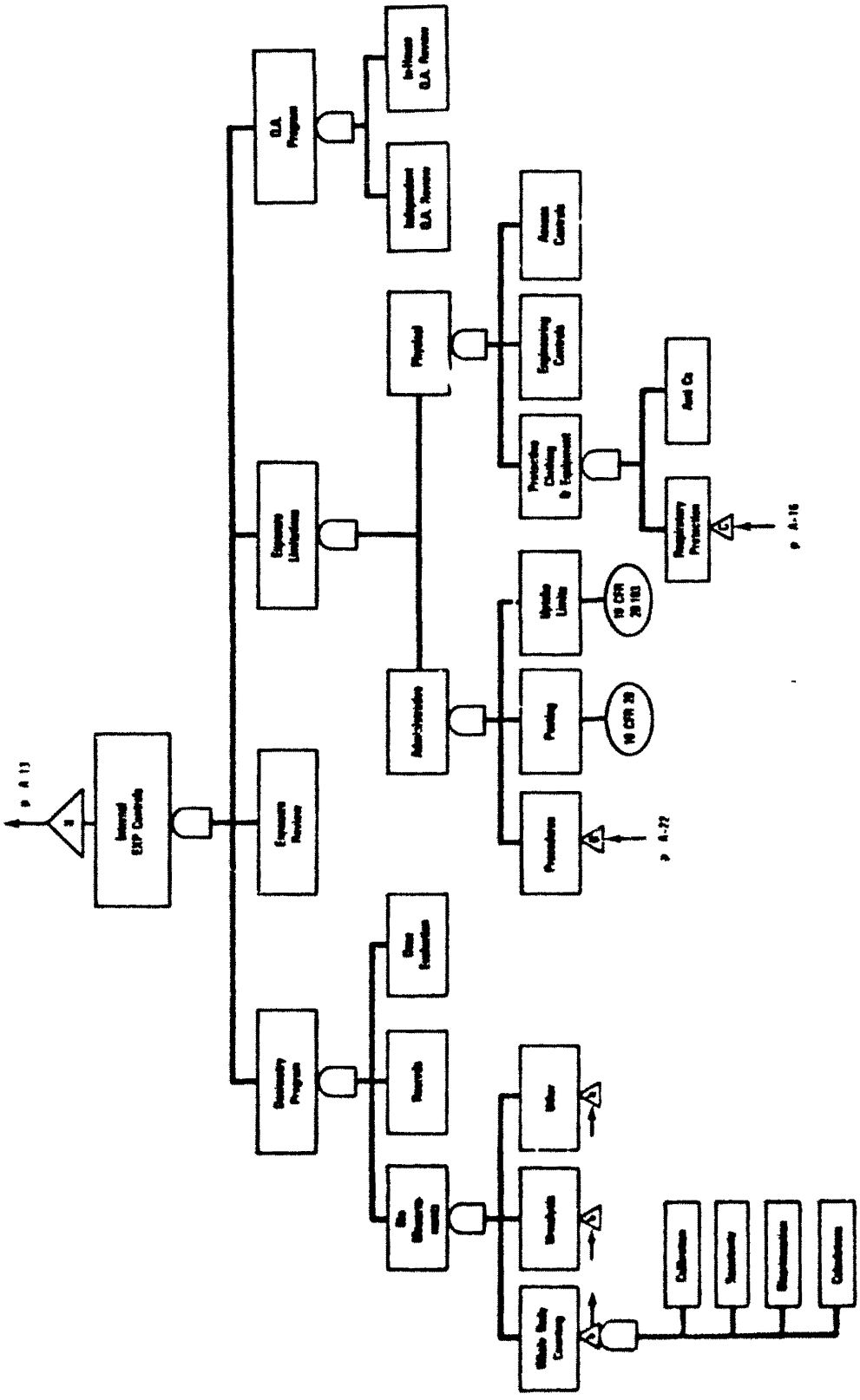

Adequate
& Effective
Radiation Protection
Program
Routine
Operations
Emergency
Operations
a
a
Appendix B
Program
b
Radiation
Protection
Organization
Personnel
Selection
& Training
Exposure
Controls
Radioactive
Waste
Management
ALARA
Program
Facilities &
Equipment
1
2
3
4
5
6
p A-11
p A-12
p A-13
p A-18
p A-19
p A-20

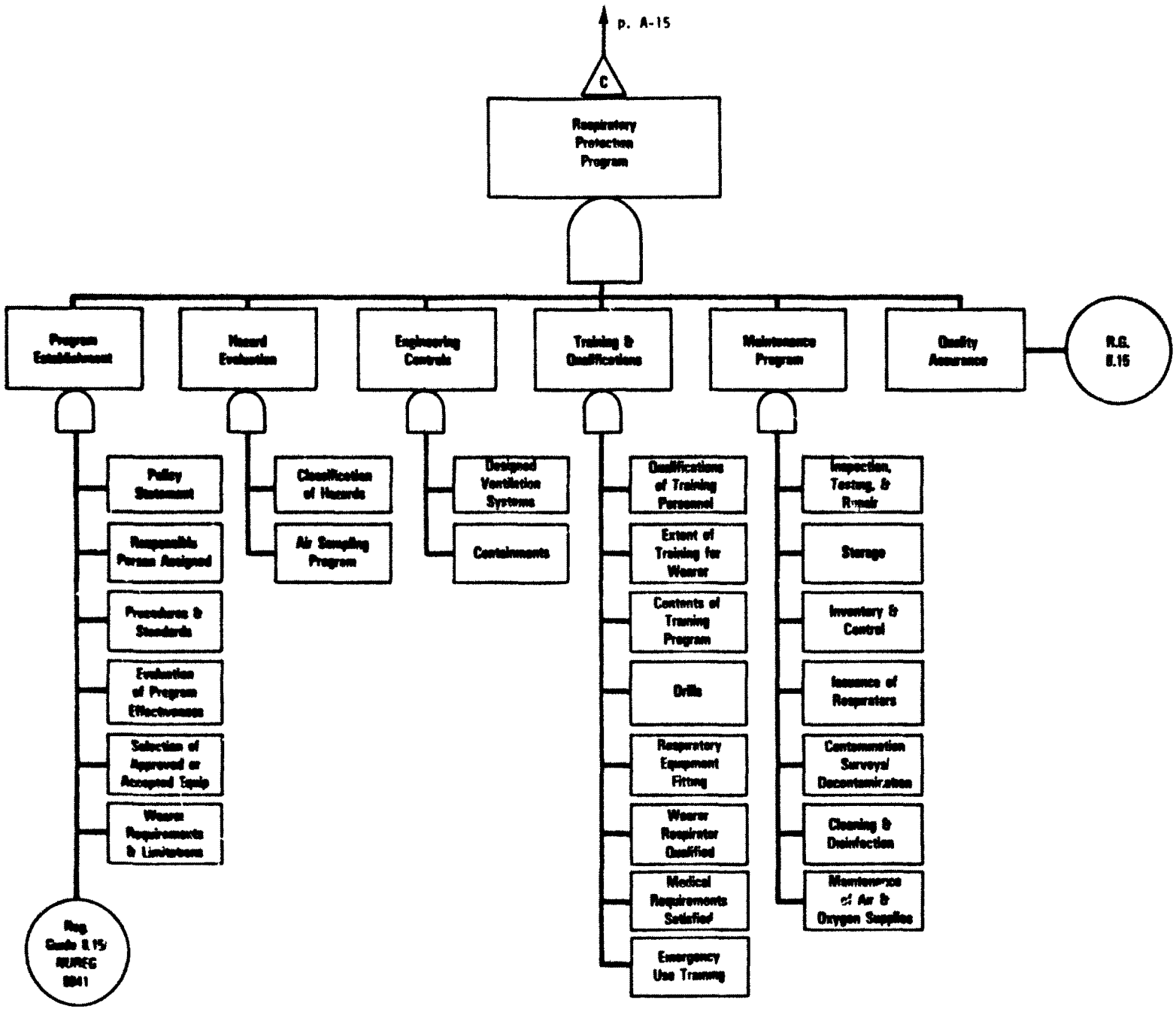

p. A-10
1
Radiation Protection Organization
A
p A-21
Site
Corporate
C
C
Clearly Defined
Scope of Responsibilities Adequate
Backup Capability Adequate
Staffing Adequate for Responsibilities
Staff Properly Managed
Organization Chart
Clear Assignment of Duties, Authorities & Responsibilities
Personnel Monitoring
Surveys
RWPs
Supervisors
RWP Issuance
Job Coverage
Technicians
Counting Room
ALARA Review
Technical Support
Instrument Maintenance & Calibration
Respiratory Protection
Chemistry
Training
Job Descriptions Adequate
Understood by Individuals
Special Assignments
Multi Discipline

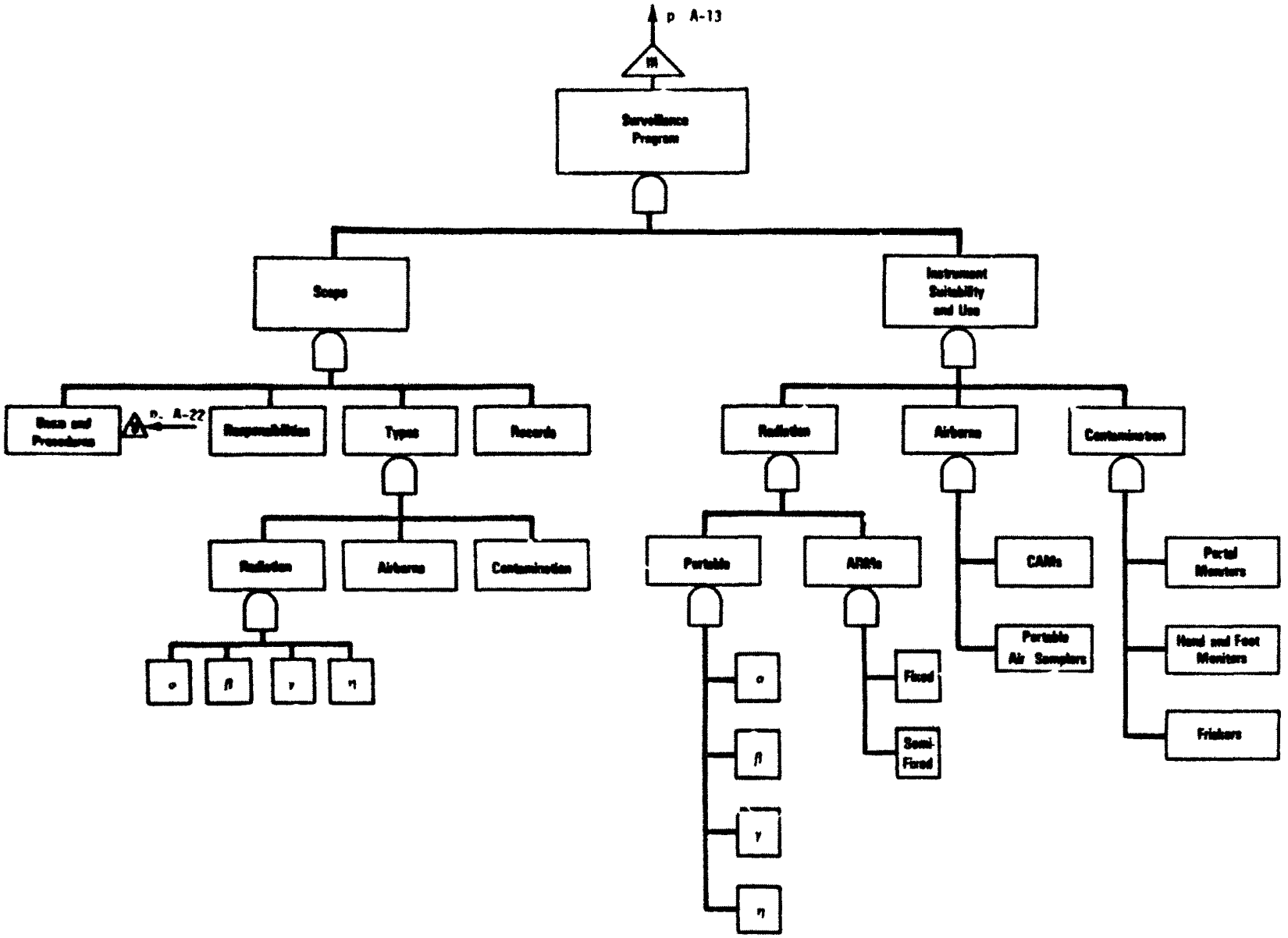


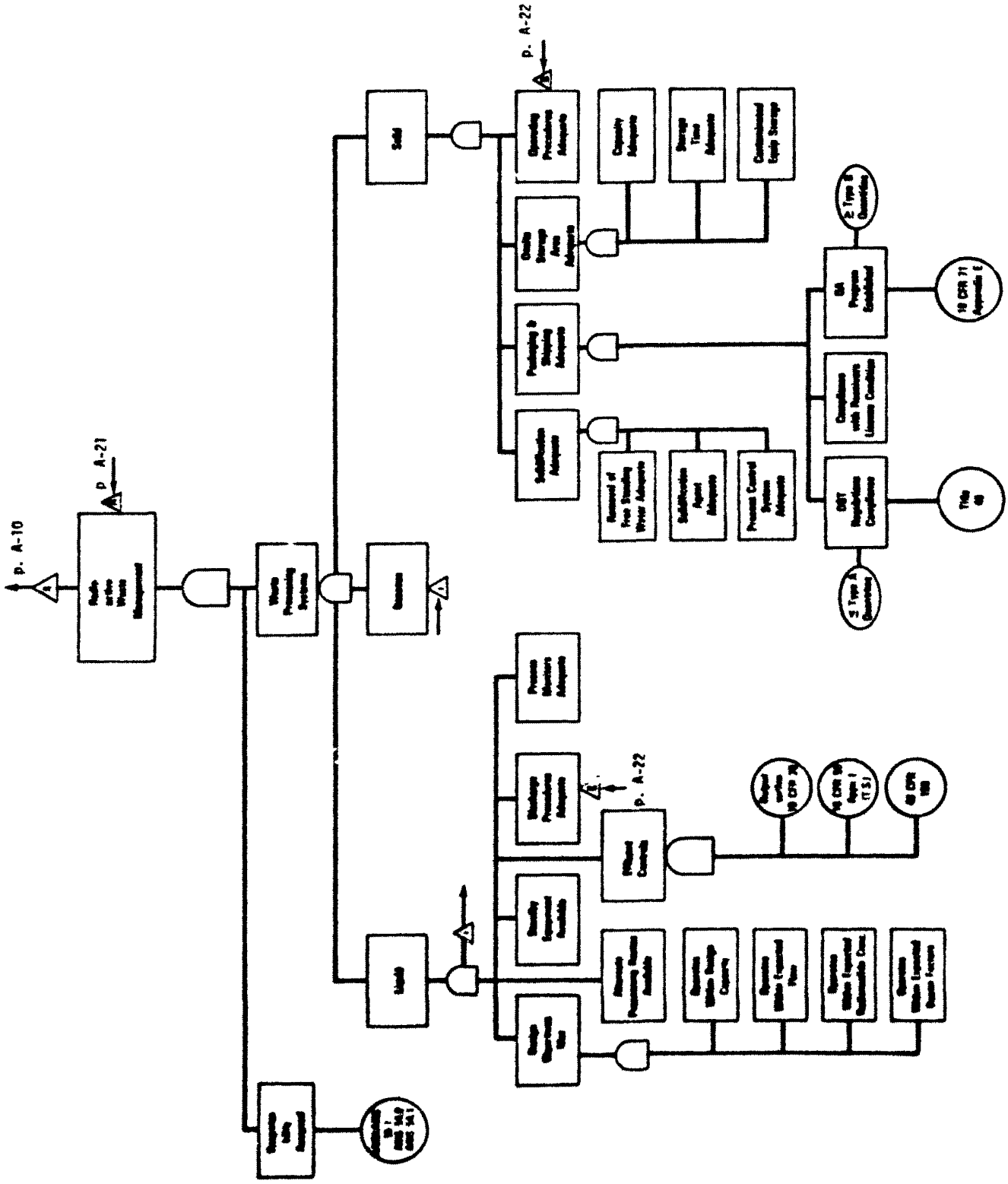

p. A-10
3
Exposure Control
A
p. A-21
External Exposure Controls
Internal Exposure Controls
Surveillance Program
I
II
III
p. A-14
p. A-15
p. A-17

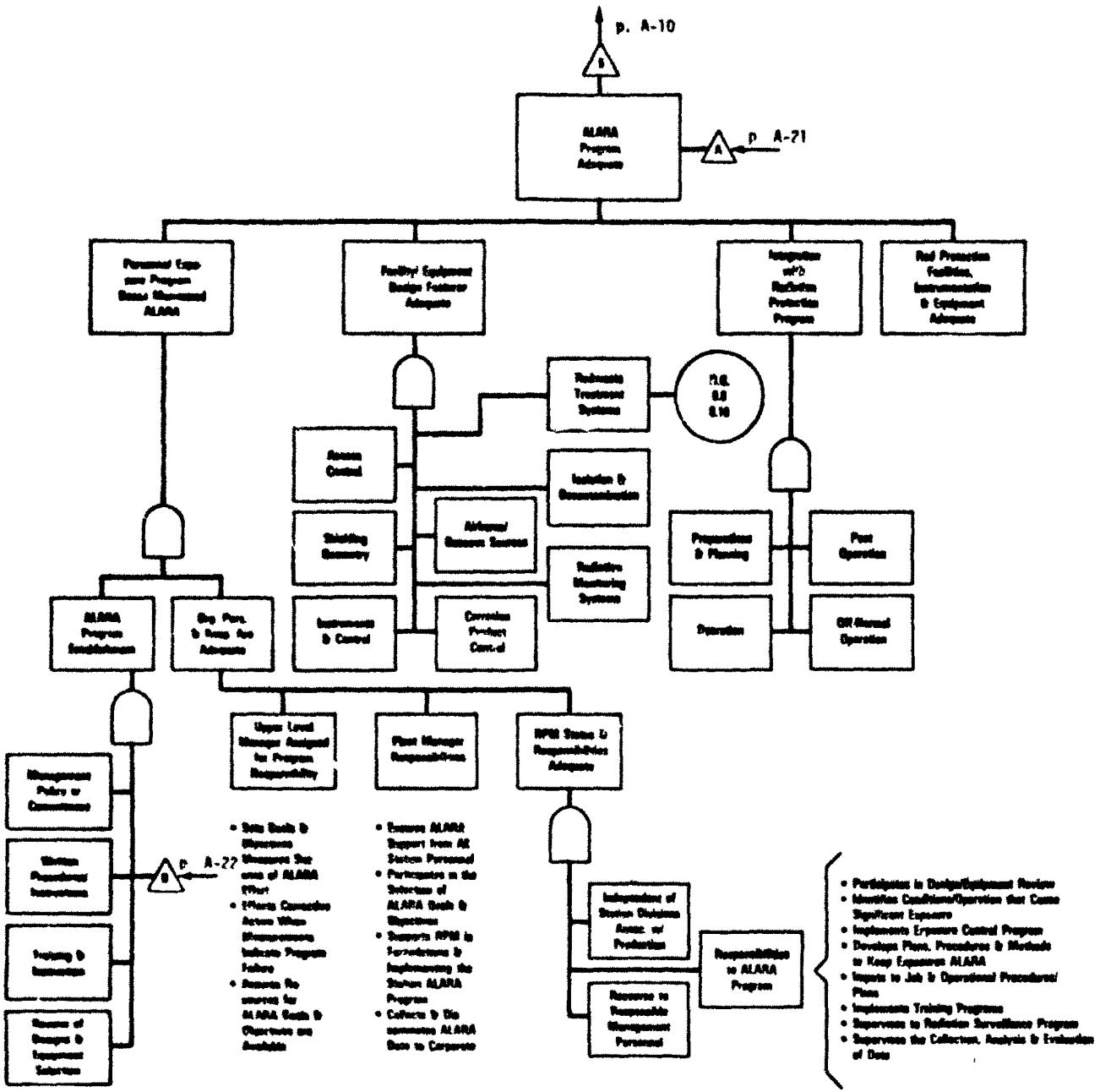


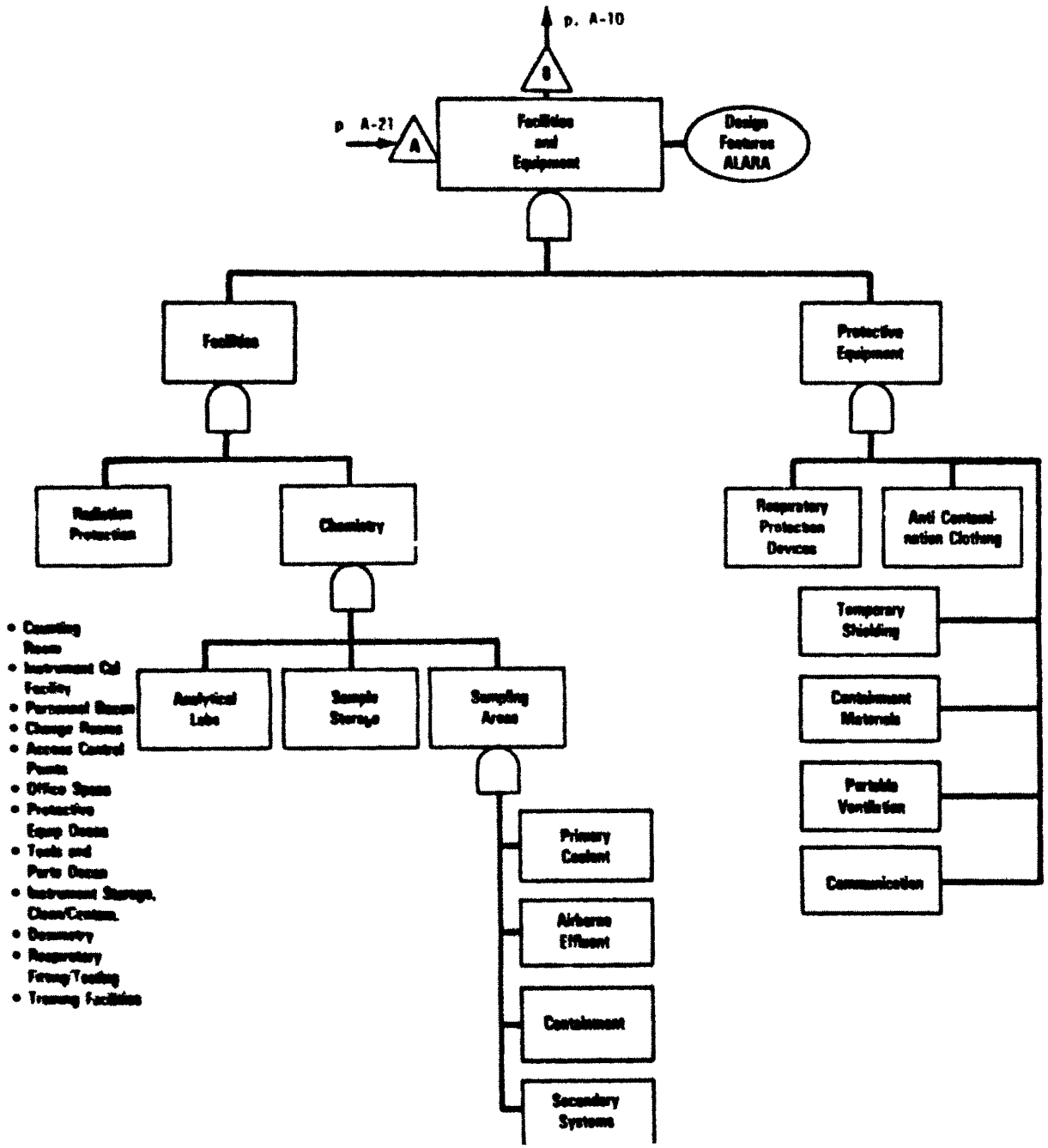


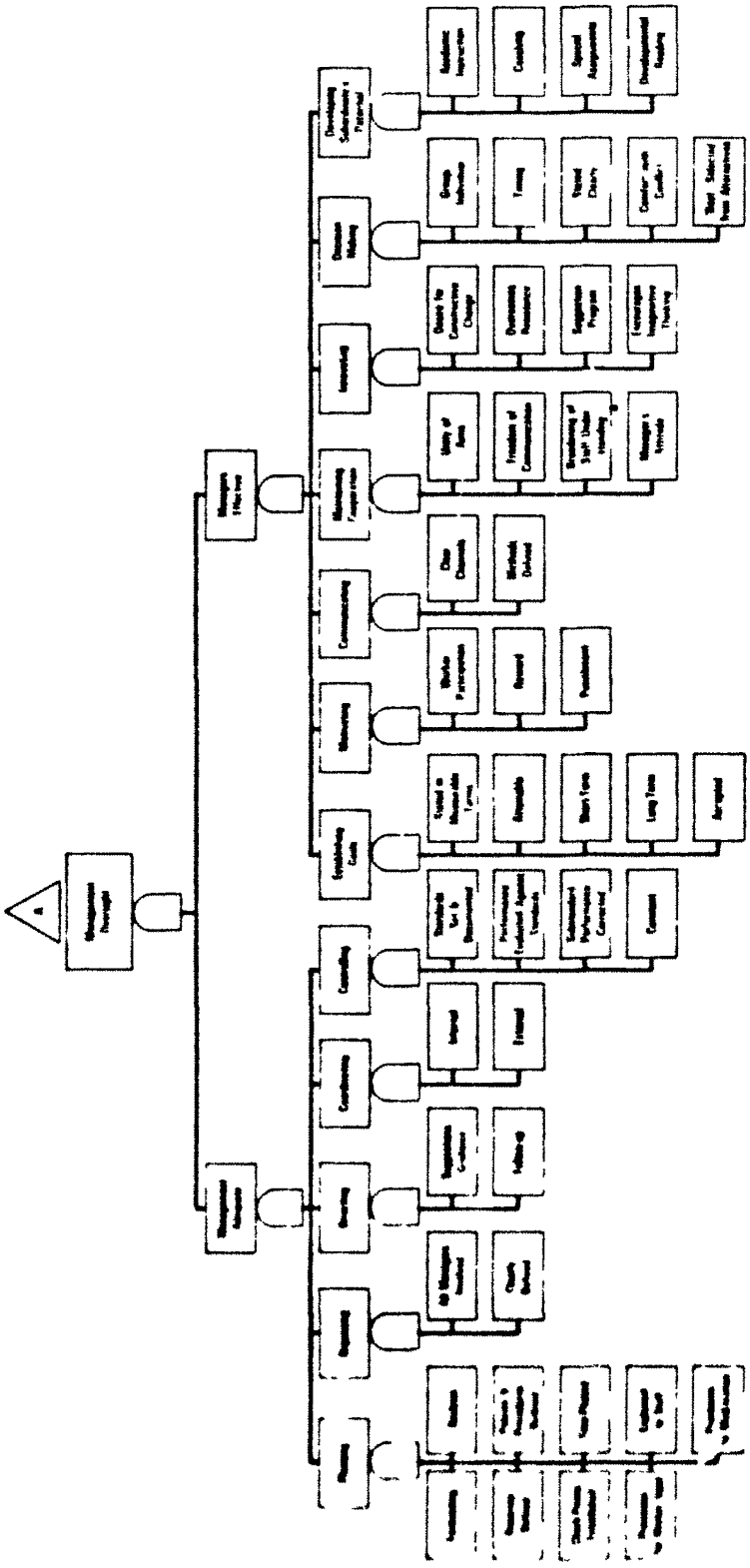

p. A-15
C
Respiratory Protection Program
Program Establishment
Hazard Evaluation
Engineering Controls
Training & Qualifications
Maintenance Program
Quality Assurance
R.G. 8.15
Policy Statement
Responsible Person Assigned
Procedures & Standards
Evaluation of Program Effectiveness
Selection of Approved or Accepted Equip
Wearer Requirements & Limitations
Reg Guide 8.15/ NUREG 0041
Classification of Hazards
Air Sampling Program
Designed Ventilation Systems
Containments
Qualifications of Training Personnel
Extent of Training for Wearer
Contents of Training Program
Drills
Respiratory Equipment Fitting
Wearer Respirator Qualified
Medical Requirements Satisfied
Emergency Use Training
Inspection, Testing, & Repair
Storage
Inventory & Control
Issuance of Respirators
Contamination Surveyal Decontamination
Cleaning & Disinfection
Maintenance of Air & Oxygen Supplies

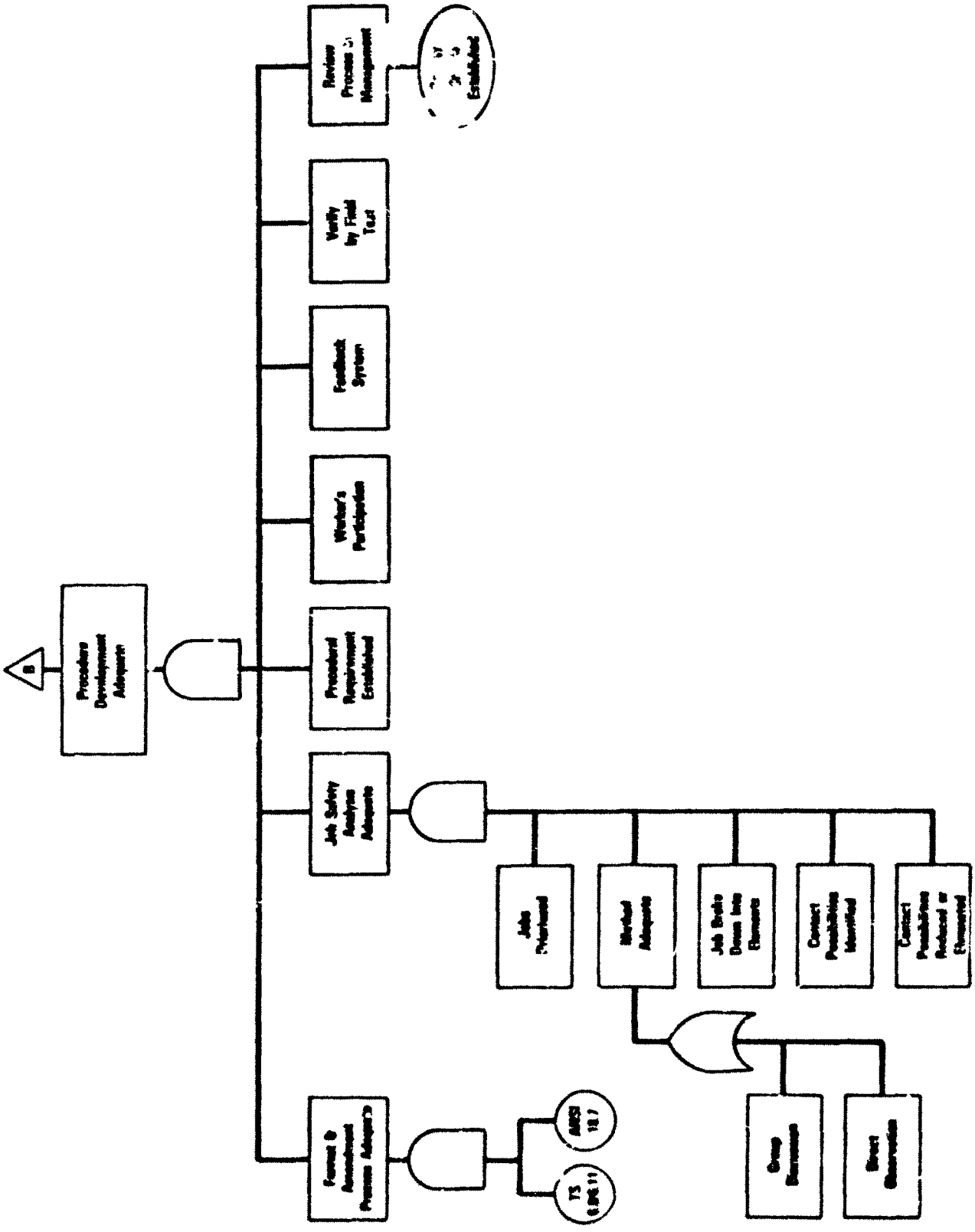

p. A-13
Surveillance Program
Scope
Instrument Suitability and Use
Basis and Procedures
p. A-22
Responsibilities
Types
Records
Radiation
Airborne
Contamination
Radiation
Airborne
Contamination
α
β
γ
η
Portable
ARMs
CAMs
Portable Air Samplers
Portal Monitors
Hand and Foot Monitors
Friskers
Fixed
Semi-Fixed
α
β
γ
η


p. A-10
p. A-21
p. A-22
p. A-22
p. A-22


p. A-10
ALARA Program Adequate
p A-21
Access Control
Isolation & Decontamination
Shielding Geometry
Airborne/ Release Control
Radiation Monitoring Systems
Preparation & Planning
Post Operation
Operation
Corrective Action Control
Upper Level Manager Assigned for Program Responsibility
Plant Manager Responsibilities
RPM Status & Responsibilities Adequate
Independence of Station Divisions Assoc. w/ Protection
Resource to Responsible Management Personnel
Responsibilities re ALARA Program
p A-22
• Participates in Design/Equipment Review
• Implements Exposure Control Program
• Develops Plans, Procedures & Methods to Keep Exposures ALARA
• Inputs to Job & Operational Procedures/ Plans
• Implements Training Programs
• Supervises the Collection, Analysis & Evaluation of Data


p. A-10
B
p. A-21
A
Facilities and Equipment
Design Features ALARA
Facilities
Protective Equipment
Radiation Protection
Chemistry
Respiratory Protection Devices
Anti Contamination Clothing
Temporary Shielding
Containment Materials
Portable Ventilation
Communication
• Counting Room
• Instrument Cal Facility
• Personnel Room
• Change Rooms
• Access Control Points
• Office Space
• Protective Equip Decon
• Tools and Parts Decon
• Instrument Storage, Clean/Contam.
• Dosimetry
• Respiratory Fitting/Testing
• Training Facilities
Analytical Labs
Sample Storage
Sampling Areas
Primary Coolant
Airborne Effluent
Containment
Secondary Systems




Procedure Development Adequate
Procedural Requirement Established
Worker's Participation
Feedback System
Verify by Field Test
Review Process of Management
Job Safety Analysis Adequate
Job Performed
Worker Adequate
Job Broken Down into Elements
Correct Positions Identified
Correct Positions Reduced or Prevented
Direct Observation
Group Discussion
Format & Assessment Process Adequate

IV. QUESTIONS

1.0 RADIATION PROTECTION ORGANIZATION

1.1 Description

a. Is there an organizational chart depicting the site and corporate radiation protection organization?

b. Does the chart clearly show that the Radiation Protection Manager (RPM) had a direct reporting chain to the Plant Manager?

*c. Are the persons who may be assigned to the following functional areas of emergency activity specified by position or title:

- *- radiological environmental survey and monitoring,
- *- personnel monitoring,
- *- recordkeeping and retention,
- *- radiation protection, and,
- *- plant chemistry.

*d. Are there corporate personnel specified who will augment the plant emergency staff in the following areas?

- *- environs monitoring,
- *- logistics support (e.g., equipment and supplies procurement),

*e. Are there contractor and private organizations who may be requested to provide technical assistance to and augmentation of the emergency organization specified?

1.2 Scope of Responsiblities

a. Are the responsibilities assigned to the radiation protection organization described?

b. Are there collateral or supplementary responsibilities performed by the radiation protection organization that are not reflected in the formal assignment of responsibilities?

c. Is there a clear assignment of authorities and responsibility within the radiation protection organization?

d. Does the radiation protection organization have adequate authority to ensure that the radiation protection program is implemented (e.g., enforce adherence to procedures, stop work, etc.)?

e. Is there documentation of actual responsibilities, authorities and reporting chains in the job descriptions of radiation protection personnel?

f. Are job descriptions (e.g., responsibilities, authorities and reporting chains) understood by the individuals to whom they apply and by other personnel in the site organization (e.g., operations and maintenance)?

*g. Are there any other individuals in the radiation protection organization assigned responsibilities for maintaining an emergency response capability? If so, what are the responsibilities?

*h. Do the individuals in the radiation protection organization charged with responsibilities for maintaining emergency preparedness have adequate authority to ensure program implementation?

*i. Are the emergency authorities and responsibilities of key individuals in the radiation protection organization delineated?

*j. Are the interfaces between and among the onsite funcitonal areas of emergency activity clearly understood?

*k. Are there provisions for continuous (24-hour) operations for an indefinite period (e.g., are there provisions for manpower planning to permit such continuous operation with the individual in the emergency organization who will be responsible for implementing the manpower planning considerations specified)?

1.3 Staffing

a. Is there adequate staffing (numbers) of managers and supervisors for at-power operation and outages?

b. Is there adequate staffing of managers and supervisors (per site/per unit) for day and backshift operations?

c. Is there overall staffing level of radiation protection technicians adequate to perform assigned responsibilities with the workload existing during normal and outage conditions?

d. Does staffing level provide for adequate numbers of specialists for such jobs as dosimetry, respiratory protection, ALARA review, etc.)?

e. Is there adequate administrative support to relieve technical personnel from clerical duties?

f. Is there sufficient technical support at the corporate level?

*g. Are adequate radiation protection resources (e.g., time, manpower, and money) devoted to the emergency preparedness program?

*h. Does the licensee have plans for supplementing the HP staff beyond 24 hours under accident conditions?

*i. Are the interfaces between the onsite funcitonal areas of emergency activities and the augmentation groups clearly understood by both parties?

2.0 PERSONNEL SELECTION, QUALIFICATION, AND TRAINING

2.1 Selection Criteria

a. Are there formal selection criteria for all positions in the radiation protection organization (permanent personnel; technical and management/contractor staff)?

b. Do the criteria relate to the job (job description) which the individual is expected to perform?

c. Do the criteria include measurable formal education and experience factors?

d. Are the criteria actually used in the contracting, hiring, and promotion process?

e. Are personnel aware of the selection criteria, methods. and requirements for promotion?

2.2 Qualification Criteria

a. Are there qualification requirements for each position in the radiation protection organization?

b. Are there qualification requirements for persons not in the licensee's radiation protection organization, but who may provide contract support to it or who may require access to the site (e.g., general employees and radiation workers) to perform non-radiation-protection jobs?

c. Do individuals in the radiation protection program (licensee and contractor) meet qualification requirements?

2.3 Training Program

a. Are the qualification criteria used as a basis for the development of the qualification training program?

b. Do the training and retraining programs include:

- frequency?
- scope/content?
- student performance objective (qualification requirements)?
- schedules and lesson plans?
- student demonstration of attainment of standards?
- record maintenance?
- qualification of instructors?

c. Are appropriate personnel required to undertake training/qualification, such as:

- managers?
- supervisors?
- HP/chem techs (contractor and licensee)?
- radiation workers?
- general employees?
- technical support?
- self-monitoring personnel?
- radwaste operators?

d. Is the scope of the training provided to each category adequate in content, nature, and length?

e. Does the training include an appropriate level of knowledge of plant systems?

f. Are adequate instructions provided on procedures including reasons and bases for the procedures?

g. Is instruction provided on the capabilities and limitations of instrumentation (fixed and portable) (e.g., duct monitors and field gradients)?

h. Is training provided for special or unique activities (e.g., special maintenance)?

i. Does the training program encompass the minimum following content:

- general duties?
- responsibilities vs. job?
- reporting/communication chain?
- authorities, site, local and regional?
- theory and practicum?
- site specific or job specific?
- job-related systems?
- related industrial and rad safety?
- specific related procedures?
- special protection (i.e., respiratory, anti-c)?
- ALARA?

j. Are the operators of the various counting and analysis systems properly and adequately trained in their use, and qualified to operate them?

k. Is there an adequate operator training and qualification course for radioactive waste facility operators?

l. Is formal on-the-job training available at appropriate intervals for all individuals?

m. Is there a retraining, requalification, and training up to the state of the art for on-board personnel in new instrumentation and its full range of capabilities?

n. Are special surveys, unusual conditions, uncommonly encountered radiations, and non-routine survey locations adequately covered in training?

o. Is there a retraining program for all aspects of the use of fixed and semi-fixed instrumentation?

*p. Does the licensee have a documented emergency plan training program?

*q. Does the training include information on what might be expected under unusual plant conditions (e.g., components and areas with high radiation levels, magnitudes of radiation increases, changed nuclide composition, etc.)?

*r. Is there adequate training of personnel in surveillance under accident conditions, including use of equipment, interpretation of results, personnel access control, and special precautions?

*s. Are initial training and periodic retraining programs provided to each of the following categories of emergency personnel?

- *- personnel responsible for radiological assessment,
- *- radiological environmental survey and monitoring teams,
- *- radiation protection,
- *- chemistry (contamination and exposure control for "hot" samples),
- *- repair/corrective action teams.

*t. Does training of the onsite emergency organization include practical exercises and/or tests in which each individual demonstrates his ability to perform his assigned emergency function (e.g., meet the student performance objective set forth in the lesson plan), and where on-the-spot correction of erroneous performance is made through additional training and a demonstration of the proper performance by the instructor?

*u. Are there provisions to evaluate the ability of the individual to perform his emergency duties, including a description of the conditions, tasks, and standards of performance that will apply in making this evaluation?

*v. Are there approved, formal lesson plans for each category of training as a supplement to the procedure?

*w. Are the individual(s) who will be responsible for conducting each category of emergency training specified by position or title?

*x. Are the instructors qualified?

*y. Are there provisions to train members of the emergency organization in changes to procedures and equipment which occur in the period between the scheduled training sessions?

3.0 EXPOSURE CONTROL

3.1 External Exposure Control

3.1.1 Dosimetry Program

a. Is there an external radiation dosimetry system suitable for the radiation exposure types and levels

anticipated during routine or non-routine work operations?

b. Are there adequate facilities for reading, processing, storing, and calibrating all types of dosimeters in use?

c. Do the personnel available to perform the required dosimetry function have adequate knowledge to perform the normal duties as well as recognize unusual events that may require special interpretations or evaluations?

d. Are adequate equipment and facilities available to perform non-routine dosimetry and exposure control functions?

e. Are there suitable devices or exposure models and data base to measure or calculate extremity exposures?

f. Is there capability to determine skin exposure by measurement or modeling?

g. Are there suitable techniques to measure neutron exposures?

h. Are there suitable techniques to measure photon energies of greater than 3 Mev and less than 80 kev?

i. Is there a system as backup or are there alternate offsite facilities if needed?

j. Are devices of acceptable quality and sensitivity available for short-duration usage by personnel or visitors to areas requiring dosimetry?

k. Is there a dedicated exposure records clerk?

l. Are exposure records kept up to date?

m. Is information dissemination timely and accurate?

n. Is there a dedicated exposure records system?

3.1.2 Exposure Review

a. Are reviews of exposure data performed routinely by management?

b. Are exposure trends plotted and reviewed for feedback in exposure control?

c. Are exposure discrepancies reviewed by management (i.e., pocket chamber versus film badge or TLD)?

d. Are exposure rates and integrated exposures evaluated against 10 CFR 20 and ALARA as a routine review?

3.1.3 Exposure Limitations

3.1.3.1 Administrative

a. Are there procedures which clearly establish and convey required actions and action levels? (e.g., administrative exposure limits)?

b. Do procedures clearly reflect the existing regulations and recognize the ALARA concept?

c. Are procedures written and disseminated for use and application by appropriate personnel regarding posting of various hazardous or potentially hazardous areas in accordance with 10 CFR 20?

d. When access controls are employed, are they adequate to prevent unnecessary exposure, inadvertent contamination, or unauthorized entry?

e. Is there a surveillance program to demonstrate that the external exposure control program is effective?

f. Is there an effective program employing control/action levels?

g. Are well-defined procedures followed to ensure that all personnel are logged out, monitored, and equipment and tool inventories complete before leaving a worksite?

h. Are areas accurately identified, posted, and controlled?

3.1.3.2 Physical

a. For alarmed access areas, are periodic tests performed for assurance of operation and function?

b. Are remote-operating and remote-handling devices available and maintained?

c. Are physical barriers for exposure control reviewed on a regular basis?

3.1.4 Quality Assurance

a. Is an active quality assurance element present?

b. Is it managed and reviewed at an appropriate frequency and level?

c. Is onsite calibration of instruments, devices, and processes a part of or reviewed by the person charged with quality assurance?

d. Are calibration functions performed offsite reviewed by QA?

e. Is quality assurance extended to the review of procedures?

f. Are quality assurance reviews extended into work recently performed?

g. Are there suitable feedback procedures to suitable levels of management?

3.2 Internal Exposure Controls

3.2.1 Dosimetry Program

a. Are there sufficient types of biosurveillance techniques and counting facilities to make a reasonable assessment of internal bioburdens of radionuclides?

b. Are models or calibration capabilities available to ensure accuracy and reproducibility of measured findings?

c. What biosurveillance capabilities are on site? Off site?

- whole-body counting?
- thyroid counting?
- urinalysis?
- fecal analysis?
- blood activity?
- others?

d. What radiation types are detectable by each system?

e. Are sensitivities adequate to assess maximum permissible concentrations (MPC's)?

f. Does equipment have adequate energy or radiation-type discrimination capability?

g. Are procedures adequate to reduce or control against cross-contamination of samples or of counting facilities?

h. Are dose estimations or dose factor calculations maintained as a matter of record?

i. Are records maintained up to date and with suitable cross-reference?

3.2.2 Exposure Review

a. Are radiation exposure dose limits for routine and non-routine events maintained ALARA?

b. Are survey and internal exposure data on an individual adequately compared?

c. Are incidents of personnel contamination documented and followed up with a causal evaluation?

d. Are the records reviewed for possible exposure investigation?

e. Are the investigation records complete and maintained?

3.2.3 Exposure Limitations

3.2.3.1 Administrative

a. Are uptake limits considered in the establishment of administrative and physical barrier controls?

b. Are methods and calculations for results using uptake limits documented?

c. Are procedures well defined for determining need for protective clothing and equipment?

d. When need for respiratory protection is indicated, what procedures ensure that only qualified personnel employ respiratory equipment?

e. Are procedures well defined to control or prevent cross-contamination of both facilities and personnel?

f. Do adequate procedures exist to establish authorized personnel in a controlled area?

g. Are procedures defined for posting areas where controlled access, airborne, or other contamination are known to exist?

h. Do the procedures clearly specify the need for exposure review relative to the specification of dosimetry and/or barriers?

i. Are suitable and proper measures taken to minimize leakage, control local releases, and clean up contaminated areas in the controlled area?

j. Are tests of engineering controls conducted at reasonable intervals and documented?

*k. Are there adequate plans for expanding the respiratory protection program in the event of an accident (e.g., expanded supply of respirators, provisions for expanded decon facilities, provisions for promptly refilling air bottles)?

3.2.3.2 Physical

3.2.3.2.1 Protective Clothing and Equipment

A. Respiratory Protection Program

1. Program Establishment

a. Policy Statement

° Is there a written policy statement on respiratory usage issued from a high management level (beyond station management)?

° Does the policy discuss the program objectives?

° Does the policy discuss the application of engineering controls (i.e., containment, ventilation)?

° Are topics such as routine, non-routine, emergency situations

addressed? Are work periods discussed?

b. Responsible Person Assigned

- Is the responsibility for the program assigned to a responsible individual?
- Does that person have the ability, training, and experience to do the following?
  - Evaluate total hazard?
  - Recommend engineering controls?
  - Specify appropriate respiratory protection?
  - Forbid use of equipment when conditions warrant?

c. Procedures and Standards

- Are written procedures prepared for descriptions of equipment; issuance, maintenance, selection, use, return of equipment; and training and qualification of personnel?
- Are air-sampling and bioassay procedures included or referenced?

d. Evaluation of Program Effectiveness

- Are sufficient records maintained to evaluate program effectiveness?
- Is there a system to feed back information on program effectiveness?

- Are attributes such as comfort, visibility, ability to communicate, ability to perform tasks, confidence, and wearer acceptance evaluated?

- Is there an adequate method to correlate air-sampling results and bioassay results?

- Are positive indications of exposure while wearing equipment immediately investigated?

e. Selection of Approved or Accepted Equipment

- Is only NIOSH-approved equipment used?

- Is the filter equipment certified for protection against radionuclides, radon daughters?

- Are there provisions for using only the particular types of equipment specified by the certification (such as hose types, fittings, regulator types, etc.)?

- Is there a provision against the use of sorbent cartridges or canisters for protection against radioactive gases or vapors?

f. Wearer Requirements and Limitations

- Are visual and communication problems effectively handled?

- Are breathing resistance and air supply adequate?

- Are there provisions to ensure proper fit of the equipment?
- Are there provisions to prohibit facial hair that may interfere with the seal; for facial abnormalities?
- Are there provisions for routine medical evaluation of all potential users of the equipment to include a medical approval form?
- Are the medical provisions implemented by a certified medical practitioner?
- Is there adequate guidance given to the medical practitioner sufficient to adequately evaluate wearer's ability to use the equipment?

2. Hazards Evaluations

   a. Are there provisions to ensure that oxygen-deficient conditions are recognized and effectively controlled?

   b. Are there provisions for recognizing and effectively controlling toxic and nuisance atmospheres?

   c. Are there provisions that relate the MPC to the mode of exposure (i.e., submersion dose due to argon, krypton, xenon, and tritium)?

   d. Are there provisions to ensure that the air concentration does not exceed the multiple of the protection factors afforded by the equipment?

*e. During emergency conditions, is there a capability for filling self-contained breathing devices, and would this equipment be usable under conditions in which the internal areas of the plant have high airborne/direct levels of radiation?

3. Engineering Controls

a. Designated Ventilation System

- Are air flows from low to high airborne radioactivity areas?
- Are hood face velocities adequate?
- Are temporary ventilation systems used where practicable?

b. Containments

Are containment systems (gloveboxes, hoods, tents, etc.) used where practicable?

c. Alarm Systems

Are alarm systems employed at strategic locations?

4. Training and Qualifications

a. Qualification of Training Personnel

Do instructors have training and experience in the application of respiratory protection devices?

b. Contents of the Training Program

- Are there provisions in the training program for instructing both the worker and his supervisor

- Is there a retraining provision?
- Are the following elements covered?
  - airborne contaminants?
  - construction, operation and limitation of the device?
  - engineering controls; why respirators are used?
  - procedures?
  - fitting?
  - use and maintenance?
  - applications of cartridges and canisters?
  - emergency actions in the event of malfunction?
  - radiation and contamination hazards?
  - classroom and field training?
  - special training as needed?
  - use during emergencies?

c. Drills

Are there provisions for simulated use of equipment?

d. Respiratory Equipment Fitting

- Are there qualitative and quantitative testing requirements?

- Are simulated work conditions used during the fit test?
- Are the instruments adequate?
- Do operating personnel have adequate proficiency with the test equipment?

e. Wearer Qualification

Is there a system that certifies that the wearer is trained, experienced, and qualified on the equipment he uses?

5. Maintenance Program

a. Inspection, Testing and Repair

- Is there a periodic equipment testing and inspection program implemented?
- Are records kept?
- Are air and oxygen cylinders inspected monthly to ascertain charges?
- Is equipment (regulators, warning devices, etc.) tested periodically?
- Is repair accomplished by qualified, trained personnel?
- Are replacement parts certified for the equipment repaired?
- Are there provisions for verifying that new equipment is acceptable?

b. Storage

- Is equipment stored so as to prevent damage by adjacent equipment?
- Are there provisions to consider heat, cold, sunlight, moisture, etc. in the storage of equipment?

c. Inventory and Control

Is there an inventory system in effect to account for the stock level of all equipment?

d. Issuance of Respirators

Are there procedures developed and implemented for issuance and return of equipment?

e. Contamination Survey/ Decontamination

- Are there provisions for surveying equipment prior to cleaning and disinfecting?
- Are there radiological limits established for reuse of equipment?
- Are there provisions for decontamination of equipment?

f. Cleaning and Disinfection

- Are accepted cleaning procedures used?
- Is adequate care taken not to damage equipment?

g. Maintenance of Air or Oxygen Supplies

Are adequate procedures provided?

- Are fittings and components standardized to prevent inadvertent introduction of other gases?
- Are compressed gas cylinders labeled.
- Are specially designed breathing air compressors used?
- Are compressors adequately monitored for CO, oil vapors. and other contaminants?
- Is air quality routinely determined to be at least Grade D or better?

6. Quality Assurance

a. Are there Quality Assurance Procedures for qualifying results of internal dosimetry assessments?

b. Are the calibration frequencies and QA reviews appropriate for the usage factor of each dosimetry system or dose assessment technique?

3.3 Surveillance Program

3.3.1 Scope

3.3.1.1 Procedures and Basis

a. Is there a clear definition and basis of the surveillance activities?

b. Are procedures for performing routine and periodic surveys and surveillance well defined?

c. Do the procedures for performance adequately reflect instrument selection and approved usage by back shift monitors?

d. Do procedures exist for keeping the HP responsible for an RWP informed of plant conditions and changes that might impact on the RWP work scope?

e. If self-monitoring practices are used, are procedures adequate?

3.3.1.2 Responsibility

a. Are there any special surveillance or unusually complex surveillance tasks performed by an offsite team or consultant? If so, are they well described and defined?

b. Are surveillance routines reviewed with regard to both necessity and frequency consistent with good health physics practices and regulatory requirements?

c. Are routine and periodic surveillance data reviewed by the health physics staff and/or RPM for overview or possible additional actions?

3.3.1.3 Types

a. Does the surveillance program include provisions for radiation, airborne, and contamination surveys?

b. Are the various types consistent with the hazards and work condition as specified in the procedures and program basis?

c. Are all materials/tools monitored out of a work area and tagged as appropriate?

d. Is there a routine comprehensive air-sampling program implemented?

e. Are air samples (particulate and gases) representative of workers' breathing zone?

f. Are air-sampling data related to actual radiation exposure and to bioassay result?

3.3.1.4 Records

a. Are surveys and surveillance activities documented?

b. Are documented surveys clearly written and is traceability suitably indicated as to instrument, person performing measurement, locations, date, time, and other pertinent conditions?

c. Do radiation work permits correctly reflect job and work conditions (e.g., Are surveys, routine or special, adequate for the RWPs)?

d. Is there timely and adequate feedback of analytical results to user groups?

*e. Are arrangements adequate to ensure exchange of HP and operational data during emergencies?

3.3.2 Instrument Suitability and Use

a. Is there an adequate complement of instrumentation for the performance of the HP surveillance program to minimum standards required by the regulations and license specifications?

b. Are portable instruments of sufficient number, type, range, and sensitivity for the scope of routine and non-routine HP activities?

c. Are instrumentation, supplies, forms, and support equipment adequate for the program size and requirements?

d. Are calibrations up to date and supplies replenished to complement or remove out-of-date material?

e. Is various sampling equipment of sufficient number, sampling range, type (grab air, breathing zone) for the scope of routine and non-routine HP activities?

f. Have operational checks been developed and adopted for field use?

g. Is there an adequate complement of semi-fixed and fixed (dedicated) instrumentation?

h. Are thorough HP reviews of need and evaluation for best location performed before installing semi-fixed instrumentation?

i. Is semi-fixed equipment accorded the same operational check, calibrations, and maintenance as fixed (dedicated) instrumentation?

j. Are instruments dedicated to analysis properly and adequately maintained?

k. Are calibration checks and calibration procedures adequate?

l. Are calibrations traceable to a recognized standard?

m. Are inoperative instruments properly marked, stored, and repaired?

*n. Does the licensee pre-position emergency supplies and survey instrumentation at specified locations or in kits?

o. Were kits and equipment located as specified in the plan/procedures?

*p. Were inventories of major items or emergency equipment correct (e.g., survey instruments, protective gear)?

*q. Was the emergency kit equipment operable?

*r. Does equipment to be used for team re-entering the facility or portions thereof include provisions for extremity monitoring and detection and measurement of radiation fields up to 1,000 R/hr?

*s. Is there a capability to detect and measure radioiodine concentrations in air of at least 5 x 10-8 mCi/cc under field conditions in any kind of weather without the presence of noble gases and background radiation decreasing the stated minimum detectable limits?

t. Is there an adequate in-plant capability for detecting airborne iodine in the presence of noble gases?

*u. Are the numbers and locations of the area monitors adequate to assess accident conditions? (e.g., could they be affected by elevated background radiation or be inaccessible during a serious emergency)?

*v. Are there procedures for using area radiation monitor readings under accident conditions? Are they located where workers may need to be (e.g., emergency decontamination center, sampling areas, ECCS equipment areas. etc.)?

*w. Are readings from these instruments readily available to those in the emergency organization who would use the information to assess the accident?

*x. Are these methods adequate?

*3.3.6 Offsite Emergency Radiological Surveys

*a. Are the methods and equipment to be used to perform emergency offsite radiological surveys and pre-planned survey points or routes specified?

*b. Is there a means for team members to record

*- the date and time of each survey?

*- the location of each survey?

*- the name(s) of the individual(s) who performed the survey?

*- the instrument used, by type and serial number?

*- the mode in which the instrument was used, i.e., window open or window closed?

*- the duration of the meter reading?

*- air sampler flow rates?

*- background radiation levels at the time of air sample counting?

*- sample count time?

*c. Is each environmental sample collected uniquely labeled for later identification?

d. Is the means specified by which collected data to include the original data sheets, are provided to the organizational element responsible for emergency assessment functions?

*3.3.7 Onsite (Out-of-Plant) Emergency Radiological Surveys (3.3)

The same as described in "b" above.

*3.3.8 In-Plant Emergency Radiological Surveys

The same as described in "b" above.

*3.3.9 Emergency Personnel Monitoring and Decontamination

*a. Do procedures provide for monitoring all individuals leaving restricted areas or other areas known or suspected to be contaminated?

*b. Are the contamination levels that require decontamination actions specified to include or reference decontamination procedures for various levels and types of contamination including skin contamination with radioiodine?

*c. Are action levels specified that will require further assessment to include designation of the elements of the emergency organization responsible for performing the followup assessment?

*3.3.10 Radiation Protection During Emergencies

*a. Do radiation protection procedures clearly reflect their applicability during emergencies?

*b. Are the following areas included:

*- personnel dosimetry?

*- exposure records?

*- positive access controls?

*- instructions to emergency workers (licensee as well as contractor or other persons/agencies augmenting the onsite emergency organization) regarding radiological conditions?

*- dose assessment?

*- provisions for preventing re-exposure of individuals or limiting further exposure?

4.0 RADIOACTIVE-WASTE-MANAGEMENT SYSTEM

4.1 Program Responsibility

a. Is the responsibility for radioactive waste management assigned?

b. Is the responsibility assigned at a sufficiently high level?

c. Is there proper attention, review, and management oversight?

4.2 Waste Processing Systems

4.2.1 General

a. Is there verification that each system meets design objectives (e.g., FSAR, Appendix I, and Regulatory Guide 1.143)?

b. Are standby or alternate processing systems available?

c. Are the standby systems properly maintained and operable?

d. Do process systems operate within experienced/expected decontamination factors, radionuclide concentrations, and equipment specifications?

e. Are the above factors verified on a periodic basis?

f. If there have been any changes or additions to the waste system, what considerations went into the 10 CFR 50.59 safety evaluation?

g. Are 10 CFR 50.59 evaluations documented?

4.2.2 Liquid and Gaseous

a. Are checks, tests, and laboratory analysis performed on HEPA filters and charcoal adsorber systems?

b. Are checks, tests, and laboratory analysis performed on installed air-cleaning systems not specifically listed in the Technical Specifications?

c. Are plant operations/maintenance reviewed and conducted so as to minimize waste sources and effluent releases?

d. Have any additions to the waste systems (i.e., new storage capacity, portable treatment systems, etc.) been designed and evaluated with current criteria documents (Standard Review Plan Sections 11 and 15 and Regulatory Guide 1.143)?

e. Are there specific waste-handling capabilities such as processing of contaminated oil, organics, and decontamination solutions?

f. Do procedures exist for moving and discharging liquid and gaseous effluents?

g. Do the procedures address: release rates, alarm set-points, laboratory analysis results, compliance with Technical Specification (TS) limits, total activity release, total volume released, valve line-up, and appropriate review and approvals?

h. Do procedures specify types of samples to be collected, the analysis performed on each sample, and appropriate sampling and analysis schedules?

i. Are the sample collection media and the delivery systems adequate regarding constant gaseous monitors?

j. Are the sample collection points: easily accessible, properly shielded, and properly ventilated?

k. Are the samples representative?

l. Are the liquid and gaseous sample collection systems adequate for obtaining routine grab samples?

m. When the plant is operating, are remote systems used to collect containment and drywell samples?

n. Are all potential radioactive effluent release pathways monitored and/or sampled?

o. Is the liquid and gaseous radwaste equipment adequately maintained and operated?

p. Are plant operations such that liquid and gaseous releases are minimized to as to satisfy ALARA recommendations?

q. Is there adequate storage available for safely holding and monitoring liquid and gaseous materials?

4.2.3 Solid Waste Processing Disposition

a. Do processed waste packages conform to DOT regulations for shipment?

b. What steps have been taken to comply with new burial site requirements?

c. Have there been changes or additions to solid-waste-processing facilities and what safety evaluations were completed prior to these changes (i.e., 10 CFR 50.59, SRP Sections 11 and 15, Regulatory Guide 1.143)?

d. Does a volume-reduction program exist at the facility? If so, has it been effective?

e. Is there a QA program for packaging and transportation of solid waste that meets 10 CFR 71 criteria?

f. Is the radwaste equipment properly maintained and operated?

g. Is solid waste processed, packaged, and shipped in a timely manner so as to avoid the unnecessary build-up of on-site waste materials?

h. If mobile solidification units are utilized, have 10 CFR 50.59 safety evaluations been performed?

i. What on-site storage/storing exists and what provisions have been made for safety, occupation dose control, and eventual disposition?

4.3 Effluent/Process Instrumentation

a. Are the monitors of sufficient quality and do they have operating characteristics to adequately measure the type of radiation and levels involved?

b. Is there an established, routine calibration program for all instrumentation?

c. Are there written procedures for each type of calibration?

d. Are calibrations adequate for the need?

e. Is there a QA program for packaging and transporting solid waste that meets 10 CFR 71 criteria?

f. Is the radwaste equipment properly maintained and operated?

g. Is solid waste processed, packaged, and shipped in a timely manner so as to avoid the unnecessary build-up of on-site waste materials?

h. If mobile solidification units are utilized, have 10 CFR 50.59 safety evaluations been performed?

i. What on-site storage/storing exists and what provisions have been made for safety, occupation dose control, and eventual disposition

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a. Are the monitors of sufficient quality and do they have operating characteristics to adequately measure the type of radiation and levels involved?

b. Is there an established, routine calibration program for all instrumentation?

c. Are there written procedures for each type of calibration?

d. Are calibrations adequate for the need?

e. Are the installed monitors adequate to address normal and anticipated occurrences?

f. Are the monitors properly maintained?

g. Are operability checks performed routinely on all monitors? Are they adequate

h. Were setpoints on the monitors properly noted?

i. Are alarm systems and process-monitoring control points installed and operable?

*j. Are the number and locations of process monitors adequate to assess accident conditions?

*k. Are there procedures for using process radiation monitor readings under accident conditions?

*l. Are readings from these monitors readily available to those in the emergency organization who would need the information?

*m. Does the licensee have interim methods (e.g., use of portable instrumentation or calculational methods) for estimating high-level releases?

5.0 ALARA PROGRAM

5.1 Program Establishment

a. Is there a written management policy or commitment to ALARA?

b. Are there written administrative procedures to implement the ALARA policy?

c. Do facility equipment and design features incorporate ALARA concerns?

d. Are the responsibility and authority assigned to an individual in upper management?

e. Does the RPM have responsibilities to the ALARA program as described in Regulatory Guide 8.8?

5.2 Facility/Equipment Design Features

a. Is there an adequate system established to avoid unnecessary or inadvertent personnel exposures as described in Regulatory Guide 8.8?

b. Is shielding/geometry designed:

- for servicing equipment?
- to provide distance when possible?
- to reduce streaming?
- to provide easy access to equipment and rapid removal?

c. Are reach rods utilized?

d. Are remote readouts utilized?

e. Are ventilation systems adequate?

f. Are flow rates adequate?

g. Is surface contamination controlled adequately?

h. Is the [illegible] portion of [illegible] adequately controlled by the [illegible]

i. Are decontamination methods effective?

5.3 Integration With Radiation Protection Program

a. Is there adequate preparation and planning incorporated in work activities?

b. Are health physicists involved in the planning of work activities?

c. Is cleanup of leakage/spillage and material which is contaminated given thorough decon treatment to reduce further spread of contamination?

d. Are formal/informal post-operational briefings held?

e. Is the information used to increase job performance in regard to ALARA?

6.0 HEALTH PHYSICS FACILITIES AND EQUIPMENT

6.1 Facilities

6.1.1 Radiation Protection

a. Are suitable areas available at appropriate locations for:

- counting room?
- calibration?
- personnel decontaminating?
- access control?
- offices?
- equipment decontamination?
- instrument storage?
- external dosimetry?
- internal dosimetry?
- respiratory protection - fitting/testing/cleaning?
- training facilities?
- contaminated equipment storage
- laundry?

b. Do the design features acknowledge the need to practice ALARA philosophy?

c. Does the facility maintain adequate change rooms, equipped with sufficient lockers and reasonably close to decontaminating area and control points?

d. Does the licensee have an adequate personnel-decontaminating area, (e.g., sole-use area with dedicated showers, basins, and installed "frisker" equipment)?

e. Does the licensee have provisions for offsite decontamination of personnel?

f. Do adequate calibration facilities exist for the portable equipment?

g. Is the medical facility adequately equipped to handle contaminated workers?

6.1.2 Chemistry

a. Do the physical facilities for the chemistry functions meet the design criteria?

b. Are the facilities adequate for the present scope of operations?

c. Are suitable areas available at appropriate locations for:

- analysis?
- sampling storage?

d. Are sampling areas available for safe and efficient collection of:

- primary coolant?
- airborne effluent?
- containment atmosphere?
- secondary systems?

e. Can grab samples be taken of containment atmosphere?

f. Are the sampling lines adequately shielded?

g. Does the licensee have and maintain an adequate chemistry laboratory, (e.g., fume hoods, hot drains, shielding, location, etc.)?

6.2 Protective Equipment

6.2.1 Respiratory Protection Devices

a. Are the quantities and types adequate for normal operations? For anticipated abnormal operations?

*b. Have actions been planned for rapid procurement of extra supplies in the event of an emergency?

*c. Have actions been planned for expanded decontamination and repair services in the event of an emergency?

6.2.2 Anti-Contamination Clothing

a. Are the quantities and types adequate for normal operations? For anticipated abnormal operations?

b. Is special clothing, such as disposable paper and plastic suits, available?

c. Are contamination limits established for reusable clothing?

6.2.3 Temporary Shielding

a. Are various types of temporary lead shielding (e.g., bricks, blankets, lead shot, sheets) available?

b. Are the supplies readily available and are the health physicists knowledgeable of the types and method of procurement?

c. Are the contaminated supplies controlled adequately?

6.2.4 Containment Materials

a. Are adequate supplies of containment materials, (e.g., heavy-gauge plastic sheeting, plastic windows, non-skid floor coverings) maintained?

b. Have the materials been evaluated for compatibility with the plant systems (e.g., chloride content, etc.)?

c. Are there specific instructions available for the construction of containment structures?

6.2.5 Portable Ventilation Systems

a. Are portable ventilation systems available for use?

b. Are the portable systems adequately filtered?

c. Are the contaminated systems properly controlled?

6.2.6 Communications

a. Are temporary communications systems available?

b. Are the systems used to minimize the number of persons required in highly contaminated areas (e.g., steam generator repair work, etc.)?

7.0 MANAGEMENT OVERSIGHT

7.1 Management Adequacy

7.1.1 Planning

a. Are plans completed before being implemented?

b. Does planning consider radiation protection aspects?

c. Are objectives to be accomplished clearly stated?

d. Is forecasting used in the planning process?

e. Are the forecasts based on realistic assumptions?

f. Are the resources needed to implement plans clearly defined?

g. Are policies outlined and procedures and guidelines established as part of the planning process?

h. Are milestones and check points established?

i. Do plans include time phasing of radiation protection aspects?

j. Are plans adequately explained to and understood by the people responsible for implementing them?

k. Is worker input included in the planning process?

l. Have provisions been made for modification of plans once implementation begins?

7.1.2 Organizing

a. Is workload adequately planned?

b. Are priorities set?

c. Is the method for setting priorities adequate?

d. Is the organization production oriented, functionally oriented, or both?

e. What is the span of control at the first-line supervision level? Second, etc.?

7.1.3 Directing

Are there policy statements and/or guidance documents issued for plans and programs to the individuals having responsibility for program implementation?

7.1.4 Coordinating

a. Do various departments and managers coordinate their activities with the radiation protection organization and vice versa?

b. Does the site management coordinate with non-site personnel including contractors?

7.1.5 Controlling

a. Are standards of performance established, documented, and communicated to those responsible for meeting the standards?

b. Are individual, group, and site performance regarding implementation of the radiation protection aspects of plans and programs evaluated in comparison with standards?

c. Is substandard performance promptly corrected?

d. Is the corrective action adequate to ensure long-term resolution rather than symptomatic relief?

e. Is the controlling function performed on a routine basis?

f. Is there a formal audit program?

g. Are there self-audits and independent audits?

h. Is there adequate followup on audit findings?

i. Is there adequate control of contracted services?

j. Is there adequate direct contact and oversight of staff?

7.2 Manager Effectiveness

7.2.1 Establishing Goal

a. Are relevant program goals established?

b. Are these goals:

- stated in measurable terms?
- attainable by the individual or group to whom they pertain?
- accepted by the individuals or group responsible for attaining them?

c. Are goals short and long term in nature?

d. Are the goals consistent with other goals which are related?

7.2.2 Motivating

a. Are workers aware of what is expected of them, (e.g., standards of performance)?

b. Do workers participate in the planning and decision-making process?

c. Are workers provided with incentives or recognition for meeting program goals or meeting standards of performance?

d. Is below-standard performance corrected?

e. Do workers and managers appear well motivated?

7.2.3 Communicating

a. Are channels of communication clearly defined?

b. Are the channels respected?

c. Are methods of communication clearly defined (routine as well as non-routine) (e.g., staff meetings, open door, etc.)?

d. Is it easy or difficult to communicate?

e. Is information effectively disseminated to the HP staff?

f. Is the HP staff made aware of plant status, planned maintenance, HP problem areas, environmental reports, Bulletins, Circulars, etc.?

g. Is pertinent operational information conveyed to the HP group?

h. Is pertinent HP information conveyed to other plant groups?

i. Is there timely and appropriate HP input for planned maintenance?

j. Are arrangements adequate to ensure exchange of HP and operational data during emergencies?

7.2.4 Maintaining Cooperation

a. What is the manager's attitude regarding:

- the company?
- his position?
- his program?
- his performance?
- his workers?

b. Does the manager foster and encourage communication?

c. Does the manager attempt to broaden his staff's understanding of its mission? How?

d. Do all managers have a unity of aims in relation to the radiation protection program?

e. Does the manager promptly and adequately communicate problems and complete staff work?

7.2.5 Innovating

a. Is there an expression of a desire for constructive change?

b. Is the manager able to overcome resistance to change (his own and his staff's)?

c. Is there a suggestion program or other means to communicate innovating ideas?

7.2.6 Decision Making

a. Are decisions made in a group or individual manner?

b. Is timing adequate?

c. Are decisions clearly and promptly announced?

d. Are decisions made based on a selection of alternatives or are decisions made based on the first "alternative"?

e. Does the manager make (permit) decisions?

7.2.7 Developing Subordinates' Potential

a. Does the manager have a program for developing his people in the area?

b. Does he coach, suggest special reading, or assign special tasks related to the field?

c. Is there a personnel appraisal program?

d. Are radiation protection instructors, managers, and supervisors encouraged and/or provided with the opportunity to upgrade their skills?

e. Are individuals provided the opportunity to participate in professional meetings and "short courses"?

f. Are individuals encouraged to seek certificatic where such certification is available?

8.0 GENERAL PROCEDURES DEVELOPMENT

8.1 Format and Amendment Process

a. Is procedure format as described by ANSI N18 7?

b. Is the amendment process implemented in accordance with TS 6.8?

8.2 Job Safety Analysis

a. Is there an established priority in which jobs are to be analyzed?

b. Is the job safety analysis (JSA) method adequate?

- Is a group discussion method used? or
- Is a direct observation method used?

c Is the job broken down into elements or individual steps?

d. Are all of the contact possibilities (conditions in which personnel exposure could occur) identified?

e. Are the contact possibilities adequately reduced or eliminated by such things as engineering controls, ventilation, containment, protective clothing, etc.?

8.3 Procedural Requirements Established

a. Do the procedures for each task meet selection and training criteria and the applicable operating criteria? Are the procedures responsive to supervisory problems?

b. Do engineers and designers recognize their limitations in writing procedures for operating personnel, and of the need for selection and training criteria for operators, and of supervisory problems?

c. Are there sufficient check points in written procedures to ensure that steps are being done correctly?

d. Are procedures revised, as necessary, to agree with changes in plant or equipment?

e. Does the writing style of the procedures give consideration to variations in reading skills and intelligence of intended users? Are procedures sufficiently scoped and detailed to adequately cover all steps of a task?

f. Do procedures give users clear instructions for all anticipated emergency conditions? Are instructions easy to follow in the stress of an emergency?

g. Are dynamic and static warnings used when appropriate? Are they located at point of operation as well as in procedures? Is their meaning unambiguous?

h. Are procedures written in such a way as to ensure that the step is in an order-of-logic sequence?

i. Are lockouts and procedures used where hazardous situations are encountered or created?

j. Do the procedures adequately convey their intended message? If procedures call for coordination between users and other individuals, are these interfaces clear?

k. Is the process of accomplishing the JSA program adequately defined and staffed? Is work level employee participation requested in preparing JSAs?

8.4 Worker Participation

Is consideration of employee-developed suggestions and inputs adequate?

8.5 Feedback System

Is information on deficient procedures fed back to the procedure writers and responsible management?

8.6 Verify by Field Test

Are procedures validated with applicable criteria and tested for correctness under "dry run" operating conditions?

ATTACHMENT: FUNCTIONS OF MANAGEMENT AND THE MANAGER

Management is the process of getting things done through the efforts of others. Managers are people who make the management process work. Management (the collective group of managers) has five functions it must perform and each manager, has seven functions. The following discussion of these functions is provided to assist in the application of the management oversight tree and questions to the sub-elements of the health physics appraisal.

FUNCTIONS OF MANAGEMENT

Planning

Planning is the development of a method or scheme of action to carry out a purpose. It provides an orderly transition from one situation to another. It recognizes where the organization is, specifies where it should go, how and when it should arrive, and the price to be paid.

An integral part of planning is forecasting - taking a reasoned look into the future to consider the possibilities based on a projection of current activities and trends. It is partly accomplished by experience and is not exact.

All levels of utility management should consider and clearly include radiation protection aspects in their planning activities.

In preparing a plan, for an outage as an example, an analysis of the existing and expected radiological conditions should be made for the entire course of the outage plant implementation. Will background radiation levels rise, will they peak and then fall off, what areas of the plant will be affected and when?

Once the radiological aspects of a particular plan have been scoped (analyzed) the resources can be defined. The management team should outline policies and procedures to ensure that events occur in accordance with the plan. Short- and intermediate-range goals or check points should be established. With regard to the radiation protection input to the plan, dose limits, man-rems, or waste-creation goals allocated to each task and the total plan should be established.

The total radiation protection program aspects of plans must be given considera-tion and the goals should be explained to the workers.

Finally as actual work proceeds, plans should be modified to account for unforeseen circumstances or a broadening of scope.

Long-range programs should include appropriate sequencing and milestone events that can be related to the radiation protection program. The integration of radiation protection procedures, tasks, and considerations must be an integral part of the planning process. Regardless of the complexity of planning documents, all plans must be [illegible]

considerations are important in plans for reorganization, procedure development, training, budgets, work scheduling, maintenance, procurement, and much else.

Often management breakdowns are rooted in an ineffective planning process. Consequently, in looking at any radiation protection program, review the management team's planning process as it relates to the area of concern.

Organizing

Organization relates to the establishment of an intentional structure of roles by which people can know what their tasks and objectives are, how these fit with those of others, and how much discretion they and others have in making decisions to accomplish desired results.

Utilities have traditionally been end-result oriented. Since it is difficult to structure an organization that totally reflects the end-result approach, structures that mix both functional and product results have emerged. Such an example is the organizational structure in which radiation protection or other "functional" areas are included within the operations area. Such structures usually exhibit instances of dual command with resulting elements of confusion and lack of responsibilities.

An offshoot effect of organizational aspects involves misconceptions of the line and staff authority relationships. This misunderstanding can lead to friction and inefficiency. Confusion with regard to functional authority relationships can be troublesome. Functional authority exists when one department is given authority over other departments not reporting to it. This is the case in which operations has authority over radiation protection or vice versa.

In organizing personnel resources, the management team should carefully consider span of control. Managers should be able to reduce their overload of less important daily duties giving themselves time for thought and personal contacts within their organizations. Spans of control guidelines are not rigid rules designed to be applied to all situations, but rather to be used as a diagnostic tool when organizational weaknesses exist. The question to be answered is "How many persons should a manager or supervisor have reporting to him?"

Narrow spans of control produce long lines of communication, [illegible] tive and morale, cost more, delay decisions, decrease opportu[illegible] improvement, and cause overmanagement. Too wide a span can [illegible] manager so that he is unable to arrive at and communicate [illegible] too little time to select, appraise, and train his [illegible] little time to plan and check to see that plans do succeed, [illegible] result.

Generally, no manager should supervise [illegible] whose work interlocks. If, however, the [illegible] interrelated and managerial coordination [illegible] is well supported by his staff or where [illegible] cation between the manager and his sub[illegible] of control may be appropriate.

At higher levels, a span of control of from 3-8 subordinates and a span up to 20 people at lower levels are within range.

Directing

Directing is the function of propelling the organization toward accomplishment of plans and their objectives. The management team must clearly direct, through policy statements and procedural outlines, that its plans be implemented. If management develops plans but fails to provide clear direction regarding implementation, managers find it difficult to make it a priority and devote resources to effective implementation.

Without clear direction, plans can never get to first base.

Coordinating

Coordinating involves the process of ensuring that needed resources — time, material, and people, are available at the right time and in the proper sequence. It melds things together and makes things go. Little more need be said other than that the management team must coordinate itself and its plans.

Controlling

Controlling is making sure plans succeed. It is the measuring and correcting of activities. Effective controlling implies more than measuring and places emphasis on effective correction. Correction may require revised planning, additional organizing, better coordination or direction. As such, the controlling function closes the loop of the management process.

The controlling process consists of establishing standards against which performance can be measured, measuring performance, and correcting deviations from the standards or plans. Planning is the basis for controlling, and action by people with authority is its essence.

FUNCTIONS OF A MANAGER

A manager has seven general functions to his subordinates:

1. establishing goals
2. motivating
3. communicating
4. innovating
5. maintaining cooperation
6. developing subordinates
7. assessing performance

[illegible] their functions performed by example and direction in such a [illegible] confidence and respect of his subordinates. This [illegible] ability, vision, knowledge, courage, judgment, [illegible] flexibility, etc. Frequently, managers may become too involved [illegible] technical aspects of their areas, leaving management to chance.

Establishing Goals

A goal is an end to be achieved or a purpose to be fulfilled. Establishing goals sets specific targets to direct the overall actions of people and contributes directly and vitally to their performance. This contribution will be good, bad, or indifferent in direct proportion to how well the manager applies himself to this vital and continuing task.

The Need for Establishing Goals

A radiation protection staff exists to perform one major task - to limit/prevent exposures. The staff is composed of individuals, including the manager, who accomplish this task. If supervisors and technicians are to make their best contribution, goals must be set and the staff must know and understand the goals. If they do not, or if this knowledge is clouded and confused, they will be working for the sake of working and not for the sake of accomplishing anything. Therefore, establishing goals for a radiation protection staff must receive continuing attention.

The Nature of Goals

Here are some characteristics that goals should have:

1. They must be attainable.

2. They must be stated in measurable terms (how much, how many, etc).

3. They should contribute to the goals of the company.

4. They should be stated in a way that the individual's contribution can be directly related to them.

5. They are short range and long range.

6. Short-range goals should contribute progress toward accomplishment of the ultimate (long-range) goal of the organization.

7. The goals must be accepted by those responsible for their accomplishment; in this case, by every member of the station.

Acceptance of Goals

There is overwhelming evidence that acceptance of a goal by the individuals who must reach them is a vital prerequisite to their successful accomplishment. Time permitting, the managers should do all they can to ensure acceptance of radiation protection goals by the station staff. Americans believe in the dignity of the individual and feel a need to know why they should do what they do and why their organization does what it does. The radiation protection and operating staffs are no exception. The degree to which they know these things will affect their contributions as members of the station staff in meeting radiation protection goals. Understanding the purpose of the radiation protection staff is a prerequisite to acceptance of the radiation protection staff goals! When a worker understands, he will more likely become committed to the goals.

Motivating

Motivation is an artery which runs through all of a manager's tasks. The most successful manager is the one who gets his staff to work with him. To the successful manager, people are not just "resources." They are vital, creative beings with hopes, aspirations, and needs. The success of a manager is measured in large part by the extent to which he can tap the potential in each of his workers.

Motivation is the process of developing (within an indivual or group) the willing desire to accomplish results, and may be classified as primary and secondary. Primary motivation has its wellspring within the individual; secondary motivation comes from without - from the manager.

Elements of Motivation

Among many other factors, motivation includes:

1. Appreciating and integrating staff and personal needs.

2. Providing the opportunity for workers to participate in establishing goals and standards of performance. Such participation fosters acceptance of goals and stimulates workers through identification of their personal interests with the aims of the staff and company.

3. The manager setting a personal example of optimum performance

4. The manager's decisive and fair public recognition and rewarding of good performance and correction of substandard performance.

Group Motivation

Educational opportunities, promotions, and incentives help people to be productive and encourage self-motivation, but alone, they are not enough. They will not provide all the motivation which people need to be effective. The manager must provide the rest by constructive attitude and behavior. Results are obtained from people in six ways: satisfaction, reward, persuasion, authority, fear, and force.

Individual Motivation

Every individual reacts differently to various things. People are like the fractions, 1/8, 2/8, 5/8 - basically the same, but all different upstairs.

When dealing with subordinates, the manager should recognize that their emotions are facts! Needs which effect them must be considered in his relations with them. The fulfillment of their needs, not his, is what motivates them. Money, for example, is only one motivating factor.

Another principle to be considered is that needs and wants are arranged in a hierarchy of importance. As soon as needs on a lower level are fulfilled, those on a higher level emerge and demand satisfaction. This hierarchy is arranged in a pyramid of five levels, from basic physiological drives at the bottom to the desire for self-realization at the top.

A brief word of explanation of each of the five levels of needs is as follows

1. Physiological needs - oxygen, food, water, shelter, rest, etc These needs dominate so long as they are not filled. Once satisfied, however, they cease to be important motivating forces.

2. Safety needs - protection from physical and economic dangers, i.e., attack, war, fire, accidents, criminal assault, old-age risks, etc. Among the healthy adults of our society, these needs afford a minimal satisfaction Consequently, their motivating force is a diminished one

3 Social needs - love, affection, togetherness, belonging, etc Unlike physiological and safety needs, social needs are not readily satisfied in our society They have consequently become a dominant motivating force

4. Esteem needs - personal worth, dignity, achievement, recognition, status, prestige, reputation, etc. These needs are obviously important determinants of behavior They can give satisfaction.

5 Self-realization needs. This is the ultimate in the hierarcy of needs It entails the fulfillment of one's highest potential It requires making maximum use of all one has, becoming everything that one is capable of becoming As more people have their lower needs more and more satisfied, a greater number will work toward fulfilling their self-realization needs

The Manager's Responsibility

The manager must be able to translate each person's needs into a tangible effort and create a unity of purpose Awareness of the way needs influence people will help in all areas In general, appraisal and recognition of performance are essential It is a manager's responsibility to make such appraisals and give the appropriate recognition.

Communicating

Communicating is anything that results in an exchange of information or understanding. It creates mutual understanding and is one of the most difficult and important areas of a manager's responsibilities The effective manager will recognize and accept the fact that adequate communication is necessary

Elements of Communication

Communication is more than "saying what you mean " It includes

1 anticipating the reactions of the recipients,

2 using language that is understood

3 stimulating recipients to want to receive and understand the information transmitted,

4 encouraging interaction and personal contact,

5. being an attentive listener and evidencing a willingness to act on what is said,

6. realizing the impacts of attitude and behavior on effectively conveying intent and motivation.

Without effective communication every element of the staff is affected; there can be no cooperative action.

Methods of Communication

Communication may be either verbal or nonverbal, written or oral. The need for written communication is obvious, but exclusive reliance upon it can retard performance. Oral messages are frequently more effective because they are timely and assist mutual understanding.

Nonverbal communication is more difficult to understand or to discuss since it involves "implications" transmitted through attitude and behavior, i.e., a frown, a smile, tone of voice, etc. Nonverbal communication supports and affects the verbal message.

Channels of Communication

An adequate communication system consists of three channels - down, up, and across. The down channel is obvious. The up channel is the channel through which reports are made and through which the workers make ideas, wants, and needs known to management. The across channel enables workers and managers to coordinate their performance with others. The across channel enables the manager to coordinate his staff's activities with other managers. If the across channel is used well, it will reduce parochialism, foster teamwork, and ensure unified effort.

In every organization, there always exists an informal channel of communication called the grapevine. The grapevine transmits speculative and hearsay information, without relation to a specific line or channel. The wise manager, instead of trying to ignore or eliminate it, feeds it with accurate and complete information, thereby putting it to work for him. If left alone and permitted to breed on false rumors and half-truths, the grapevine can become a demoralizing and disruptive influence.

The Manager's Responsibility for Adequate Communication

It is the manager's responsibility to keep his people and his supervisors informed. It is not enough to make reports and expect that they will be read and understood exactly as visualized in the orginator's mind. To be effective, the manager must realize that reports alone will not satisfy everyone's need for information, just as reports from workers do not totally satisfy the manager's need for information about work in progress. Written means of communication must be supplemented with direct contact via telephone calls, meetings, briefings, and conferences. In this way, managers can inform as well as be informed.

The type, frequency, and nature of communications that are necessary to adequately keep everyone informed should be defined. A lack of guidance regarding

what is to be communicated and how and when it should be communicated must not be used as an alibi or excuse for failing to keep people informed. Quite often, fear of being criticized, a failure to meet goals, or simple laziness are the underlying reasons for a failure to communicate.

Innovating

Innovating is doing things differently for the purpose of improvement. All variations of the word have a connotation of the new and different; all involve elements of change.

Importance of Improvement

It is unlikely that a manager will ever have enough time to do all he would like to do and knows is necessary. Therefore, he must constantly evaluate what he and his staff members do and how to get the job done making better use of time, still getting the same, or hopefully better, results. In managing, he should seek and find new and more economical ways of accomplishing all that he has to do. Innovation boils down to one thing, creativity. If something is not working, or making one work too hard, a new and better way of doing it should be developed.

Maintaining Cooperation

A manager should strive to create an atmosphere in which workers believe that their individual contributions or efforts are important and worthwhile. It should be an environment in which each worker believes that he is a member of an aggressive and progressive organization and that his manager is receptive to new ideas and to creative thinking. In brief, the manager's personal philosophy of his role, his staff, and his company is a hidden force which will permeate the staff and mold its character.

Elements of Maintaining Cooperation

This function is intimately associated with motivating, communicating, and developing a subordinate's potential. It creates and continually strengthens unity of purpose by keeping the needs of the entire staff and the needs of the individual in balance. It includes:

1. fostering unity of aims and freedom of communication,

2. broadening the worker's understanding of the staff and the company,

3. integrating the needs of the staff and the company with the interests and capabilities of the staff and the dignity of the individual.

Cooperation With Control

In establishing and maintaining a cooperative staff, the manager should establish realistic, attainable performance standards. In many cases, some of these standards are set by regulation or technical specification. A manager should, however, develop additional standards to apply to his staff. These standards should not be set arbitrarily, but, whenever appropriate, with the

workers actively participating. If the workers participate in establishing standards of performance, the standards being set will frequently be higher than those the manager might develop on his own. Standards should be revised when appropriate, with the workers participating in the revision. Such revisions, however, should not penalize good performance but should provide for improved methods and procedures.

Developing a Subordinate's Potential

Developing a subordinate's potential is providing him with the opportunity to improve his capabilities and realize this goal. The whole subject is closely interwoven with all the other functions of the manager. It is closely affiliated with motivating, communicating, and maintaining cooperation and will thrive in an environment where those functions are performed properly.

Developing a subordinate's potential is basically a training process. Ensuring that a worker is properly trained from the very beginning is critical to his further development. In helping develop a worker's potential, ask the following questions to determine what is important.

1. What does the job require that a particular worker doesn't know or is not able to do?

2 How can he be helped to learn quickly and easily?

3. How can one determine if he has learned what has been taught?

Although these questions relate to teaching a specific skill such as surveying, they are also useful in analyzing all workers and formulating a general plan for the development of the entire staff.

Techniques for Developing a Subordinate's Potential

Coaching - a cooperative attack with the worker on specific problem areas When coaching, workers are provided with suggestions of alternative ways to accomplish the same end.

Special Assignments - a worker who prepares a presentation or a particular subject will broaden his knowledge of the subject.

Developmental Reading - The manager may suggest appropriate study or reading material, for the worker to review. It may be helpful to have a library of pertinent books.

Academic Instruction - formal training. This type of instruction, coupled with experience, produces the most rapid development for some individuals.

Workers will develop more rapidly and learn more effectively under a manager who practices leadership principles rather than under one who is a driver. Recognize and be familiar with the characteristics of a so-called driver. The following comparison of the driver and the leader is provided for that purpose.

The Driver	The Leader
Depends on authority	Depends on good will
Inspires fear	Inspires enthusiasm
Says "I"	Says "we"
Fixes the blame for a breakdown	Fixes the breakdown
Knows how it's done	Shows how it's done
Makes work drudgery	Makes work a contest and satisfying

Decision Making

Decision making is selecting a course of action from among alternative courses to achieve a prescribed goal. Decisions may be made by an individual or by a group of individuals. One widely accepted method of decision making is for a group of individuals to be involved. The group studies the impacts of the alternatives and makes recommendations, in order of desirability, to the manager. The manager, however, makes the final decision. Having consulted with the group and kept it informed, the manager will have created an atmosphere in which an unpopular decision is more acceptable to everyone.

Timing is an important element of decision making. Occasionally, a manager may have to make an early decision without complete information. Too many decisions are made without complete information, but all desirable information will rarely be available in time. If a manager waits too long, events may overtake him generating a greater and more complex problem. His most difficult decision may be to decide when to decide. The urgent will always take priority over the important. Frequently, the manager must decide what is urgent, what is important, and what is routine.

Once a decision is made, the manager must be sure it is stated in terms that will be understood. Here, lessons in communicating come into play. Good communication should speak the language of the listeners, write the language of the readers, and avoid the haze of ambiguity.

Indecision is infectious and epidemic. Workers properly expect managers to make positive decisions; they do not expect them to let nature take its course.

One reason for indecision and a lack of desire to make decisions is fear of conflict. If a problem involves conflict, the tendency is to put off the decision. To avoid being indecisive, a manager should develop as much comfort with conflict as he can endure.

APPENDIX B

HEALTH PHYSICS
APPRAISAL REPORTS

Name of Plant	Report Number(s)	Transmittal Letter
Arkansas	50-313/80-20, 50-368/80-20	February 23, 1981
Beaver Valley	50-334/81-05	December 23, 1981
Big Rock Point	50-155/80-04	June 13, 1980
Browns Ferry	50-259/80-36, 50-260/80-30, 50-296/80-30	February 25, 2982
Brunswick	50-325/80-45, 50-324/80-43	April 27, 1981
Calvert Cliffs	50-317/80-09, 50-318/80-07	December 11, 1980
Cook	50-315/80-23, 50-316/80-19	May 26, 1981
Cooper	50-298/80-07	September 8, 1980
Crystal River	50-302/80-25	September 8, 1980
Davis-Besse	50-346/81-11	September 2, 1981
Dresden	50-237/80-13, 50-249/80-17	September 12, 1980
Duane Arnold	50-331/80-21	February 2, 1981
Farley	50-348/80-41, 50-364/80-52	March 13, 1981
FitzPatrick	50-333/80-20	January 20, 1982
Fort Calhoun	50-285/80-16	December 27, 1980
Fort St. Vrain	50-267/80-13	October 8, 1980
Ginna	50-244/80-16	June 15, 1981
Haddam Neck	50-213/80-12	December 29, 1980
Hatch	50-321/80-27, 50-366/80-27	September 12, 1980
Indian Point 2	50-247/80-02	August 7, 1980
Indian Point 3	50-286/80-03	In preparation
Kewaunee	50-305/80-26	January 13, 1981
LaCrosse	50-409/80-10	March 3, 1981
Maine Yankee	50-309/81-01	October 7, 1981
Millstone	50-245/80-12, 50-336/80-11	March 19, 1981
Monticello	50-263/80-11	August 7, 1980
North Anna	50-338/80-21, 50-339/80-22	September 15, 1980
Nine Mile Point	50-220/80-11	March 2, 1981
Oconee	50-269/80-31, 50-270/80-27, 50-287/80-24	January 20, 1981
Oyster Creek	50-219/80-17	In preparation
Palisades	50-255/80-14	November 28, 1980
Peach Bottom	50-277/80-18, 50-278/80-10	April 2, 1981
Pilgrim	50-293/80-05	July 22, 1980
Point Beach	50-266/80-16, 50-301/80-16	November 14, 1980
Prairie Island	50-282/80-08, 50-306/80-09	August 12, 1980
Quad Cities	50-254/80-20, 50-265/80-22	October 21, 1980
Rancho Seco	50-312/80-32	January 16, 1981
Robinson	50-261/81-07	June 26, 1981
St. Lucie	50-335/80-06	June 24, 2980
Salem	50-272/80-03	June 12, 1980
San Onofre	50-206/80-17	August 15, 1980
Surry	50-280/80-29, 50-281/80-33	December 18, 1980
Three Mile Island	50-289/80-22	November 26, 2980
Trojan	50-344/80-16	October 31, 1980
Turkey Point	50-250/80-17, 50-251/80-15	August 28, 1980
Vermont Yankee	50-271/80-14	In preparation
Yankee Rowe	50-29/81-01	December 24, 1981
Zion	50-295/80-05, 50-304/80-04	June 27, 1980

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16 ABSTRACT (200 words or less)

The accident at Three Mile Island in March 1979 and subsequent investigations identified, among other items, serious concerns involving several aspects of the radiation protection program. Significantly, some concerns involved areas not addressed by regulations or facility technical specifications. This in turn led to initiation of a major effort to evaluate the adequacy and effectiveness of radiation protection programs at all currently operating nuclear power facilities during calendar year 1980 by the Office of Inspection and Enforcement (IE), Nuclear Regulatory Commission. This inspection effort was termed an appraisal since it was structured to facilitate an integrated look at the total radiation protection program, delve into matters for which explicit regulatory requirements did not exist, and emphasized evaluation of capability and performance rather than compliance with regulations. This report discusses the results of the 48 appraisals and the anticipated regulatory actions that may be taken to further address the concerns.

17 KEY WORDS AND DOCUMENT ANALYSIS

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