

## 12.1 ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS REASONABLY ACHIEVABLE (ALARA)

### 12.1.1 POLICY CONSIDERATIONS

#### 12.1.1.1 Management Policy

It is the policy of PP&L to maintain occupational radiation exposure As Low As Reasonably Achievable (ALARA) at the Susquehanna SES. This includes maintaining the annual dose to individuals working at the station ALARA, and keeping the annual integrated dose to station personnel ALARA. The management of this Company is firmly committed to performing all reasonable actions to ensure that radiation exposures are maintained ALARA.

Subsection 12.1.2 and Section 12.3 discuss the ALARA considerations that have been incorporated into the design of the Susquehanna SES.

Susquehanna SES will be operated and maintained in such a manner as to ensure occupational radiation exposures (ORE) are ALARA. The operational ALARA program is described in Section 12.5. Training programs will be established to assure personnel understand both why and how occupational radiation exposures will be maintained ALARA. A Station ALARA Committee has been established to ensure implementation of ALARA policy by various program reviews.

#### 12.1.1.2 Management Responsibilities

Figures 17.2-2 and 13.1-2 exhibit the management organizational structure for the Susquehanna SES.

The Vice President–Nuclear Operations has the corporate responsibility for the ALARA program. The responsibility for the coordination and administration of the ALARA program is assigned to the General Manager–Nuclear Engineering and the General Manager–Susquehanna SES and their reports. They are responsible to ensure the policies and commitments contained in the PP&L ALARA Program are being properly implemented and maintained.

During the design and construction phase, the Susquehanna SES Project Manager is responsible to ensure that the design and construction of the facility is such that occupational exposures will be ALARA. This will include ensuring that, to the extent practicable:

- a. Design concepts and station features reflect consideration of the activities of station personnel that might be anticipated and that might lead to personnel exposure to substantial sources of radiation and that station design features have been provided to reduce the anticipated exposures of station personnel to these sources of radiation.
- b. Specifications for equipment reflect the objectives of ALARA, including among others, considerations of reliability, serviceability and limitations of internal accumulations of radioactive material.

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During the operational phase, the General Manager–Nuclear Engineering is responsible to ensure that the Station design remains in compliance with all applicable radiation safety standards found in 10CFR20, 10CFR50, 10CFR50.67, 40CFR190 and applicable regulatory guidance documents.

The Manager–Nuclear Modifications is responsible for ensuring the PP&L ALARA program is incorporated into the design of plant modifications and new facilities related to the SSES.

The Manager–Nuclear Technology is responsible to ensure that a radiation protection staff with health physics and radiological expertise is adequately maintained to support Nuclear Engineering, Susquehanna SES plant staff and other functional group activities as appropriate.

During the startup and operation phase, the General Manager–Susquehanna SES is responsible for ensuring radiation exposure is controlled in a manner consistent with ALARA requirements and is specifically responsible for the onsite radiation protection program. Additionally he is responsible for:

- a. Ensuring support from all station personnel for the implementation of the Station ALARA program
- b. Providing management oversight of the accumulation of personnel exposure at SSES and reviewing and concurring with annual personnel exposure goals
- c. Ensuring resources needed to achieve ALARA goals and objectives are made available.

Additional General Manager–Susquehanna SES responsibilities are implemented through the Health Physics Supervisor.

Major ALARA responsibilities of the Health Physics Supervisor or designee, include the following:

- a. Participating in reviews of design changes for facilities and equipment that can affect potential radiation exposures;
- b. Identifying locations, operations, and conditions, that have the potential for causing significant exposures to radiation;
- c. Initiating and implementing an exposure control program which includes the establishment of manrem goals,
- d. Developing plans, procedures, and methods for keeping radiation exposures of station personnel ALARA,
- e. Reviewing, commenting on, and recommending changes in applicable procedures to maintain exposures ALARA;
- f. Developing or participating in the development of appropriate Health Physics training programs related to work in radiation areas or involving radioactive material;
- g. Supervising the radiation surveillance program to maintain data on exposures of and doses to station personnel by specific job functions and type of work;

- h. Supervising the collection, analysis, and evaluation of data and information attained from radiological surveys and monitoring activities;
- i. Supervising, training, and qualifying the radiation protection staff of the station; and
- j. Ensuring that adequate radiation protection coverage is provided for station personnel during all working hours.

Chapter 13 provides additional information concerning responsibilities and reporting relationships at the Susquehanna SES.

#### 12.1.1.3 Policy Implementation

The management ALARA policy is implemented at the Susquehanna SES by the Health Physics Staff under the direction of the General Manager-Susquehanna SES and the Health Physics Supervisor. The policy implementation is formalized by the incorporation of ALARA philosophy and considerations into permanent plant procedures dealing specifically with ALARA concerns. The operational ALARA considerations identified in Subsections 12.1.3 and 12.5.3.2 are implemented by these procedures.

Subsection 12.5.3.7 describes the training program established to give appropriate station personnel the necessary knowledge to understand why and how they should maintain their ORE ALARA.

The Station ALARA Committee has been established to review the implementation of the Company ALARA Program. Specific responsibilities of the Station ALARA Committee include:

- a. Assuring the effectiveness of the ALARA program as implemented at the Susquehanna SES.
- b. Assuring that high exposure maintenance and modification tasks receive proper management attention ensuring they are planned in accordance with sound ALARA principles.
- c. Reviewing, prioritizing and recommending potential action items for inclusion into the Nuclear Department long-term exposure reduction plan and monitoring status of action items included in the plan.
- d. Administering the Employee ALARA Concerns program.
- e. Assuring Station activities are conducted in an ALARA manner maintaining the balance between cost, schedule and personnel exposure.
- f. Reviewing exposure goals, monitoring performance against these goals and taking action as appropriate when goals are jeopardized.
- g. Monitoring individual personnel exposures to ensure they are minimized to the extent possible while maintaining overall collective exposures ALARA.

12.1.2 DESIGN CONSIDERATIONS

This subsection discusses the methods and features by which the policy considerations of Subsection 12.1.1 are applied. Provisions and designs for maintaining personnel exposures as low as reasonably achievable are presented in Subsections 12.3.1, 12.3.2 and 12.5.3.

Experiences and data from operating plants are evaluated to decide if and how equipment or facility designs could be improved to reduce overall plant personnel exposures. During plant design, operating reports and data such as that given in WASH 1311, NUREG-75/032, NUREG-109 and Compilation and Analysis of Data on occupational Radiation Exposure Experienced at Operating Nuclear Power Plants, AIF, September 1974, References 12.1-1, through 12.1-4 respectively, were reviewed to determine which operations, procedures or types of equipment were most significant in producing personnel exposures. Methods to mitigate such exposures were implemented wherever possible and practicable.

General design considerations and methods employed to keep in-plant radiation exposures ALARA have two objectives:

- a) Minimizing the necessity for the amount of personnel time spent to radiation areas; and
- b) Minimizing radiation levels in routinely occupied plant areas and in the vicinity of plant equipment expected to require personnel attention.

Both equipment and facility designs are considered in keeping exposures ALARA during plant operations including normal operation, maintenance and repairs, refueling operations and fuel storage, in-service inspection and calibrations, radioactive waste handling and disposal, and other events of moderate frequency. The actual design features used are described in Subsection 12.3.1.

12.1.2.2 Equipment General Design Considerations for ALARA

The following equipment general design considerations to minimize the necessity for and amount of personnel time spent in a radiation area include, where practicable:

- a) Reliability, durability, construction, and design features of equipment, components, and materials to reduce or eliminate the need for repair or preventive maintenance;
- b) Servicing convenience including ease of disassembly and modularization of components for replacement or removal to a lower radiation area for repair;
- c) Provisions, where practicable, to remotely or mechanically operate, repair, service, monitor, or inspect equipment; and
- d) Redundancy of equipment or components to reduce the need for immediate repair when radiation levels may be high and when no feasible method is available to reduce radiation levels.

The following equipment general design considerations directed toward minimizing radiation levels proximate to equipment or components requiring personnel attention include, where practicable:

- a) Provision for draining, flushing, or, if necessary, remote cleaning of equipment containing radioactive material;
- b) Design of equipment, to minimize the buildup of radioactive material and to facilitate flushing of crud traps;
- c) Utilization of high quality valves, valve packings, and gaskets to minimize leakage and spillage of radioactive materials;
- d) Provisions for minimizing the spread of contamination into equipment service areas; and
- e) Provisions for isolating equipment from radioactive process fluids.

#### 12.1.2.3 Facility Layout General Design Considerations for ALARA

Facility general design considerations to minimize the amount of personnel time spent in radiation areas include where practicable:

- a) Locating equipment and instruments, which will require routine maintenance, calibration, or inspection for ease of access and a minimum of required occupancy time in radiation fields;
- b) Arranging plant areas to allow remote or mechanical operation, service, monitoring, or inspection of highly radioactive equipment; and
- c) Providing, for transportation of equipment or components requiring service to a lower radiation area.

Facility general design considerations directed toward minimizing radiation levels in plant access areas and in the vicinity of equipment requiring personnel attention include, where practicable:

- a) Separating radiation sources and occupied areas (e.g., pipes containing potentially highly radioactive fluids do not pass through normally occupied areas);
- b) Providing adequate shielding between radiation sources and access and service areas;
- c) Locating appropriate equipment, instruments, and sampling sites in the lowest practicable radiation zone;
- d) Providing means and adequate space for using movable shielding for sources within the service area when required; and
- e) Providing means (e.g., curbing, drains and flush) to control contamination and to facilitate decontamination of potentially contaminated areas.

12.1.2.4 ALARA Design Review

During the design phase, Bechtel Power Corporation, as agents for PP&L, were given the basic responsibility for the performance of the ALARA design review. PP&L provided overall coordination of and input to this review. ALARA design reviews were completed on all required systems and areas. Recommended design modifications were made. In addition to intensive system/area ALARA design reviews, field routed small piping drawings were continually reviewed, often resulting in changes in routing, valve and operator types, and connection points.

During the operational phase, ALARA considerations are included in the scoping and design phase of modifications and changes to the design of the facility. The General Manager–Nuclear Engineering has the responsibility to:

- a. Ensure that engineering personnel are adequately trained in ALARA design and engineering principles so that radiation exposure with respect to installation, operation and maintenance of plant modifications and new facilities is considered in each design.
- b. Ensure an integrated level of involvement within the modifications organizations to effectively implement the Susquehanna ALARA program.

The Manager–Nuclear Design Engineering is responsible to:

- a. Ensure ALARA/dose reduction opportunities are identified for inclusion into the design of modifications and new facilities.
- b. Ensure the Susquehanna ALARA program is incorporated into the design of plant modifications and new facilities related to the Susquehanna SES.

The Radiation Protection Manager has the responsibility to determine the requirements of the ALARA design process and ensure that ALARA design reviews are performed by qualified radiological personnel.

At the scoping phase, potential radiological impacts such as occupational and offsite exposure impacts, and radioactive waste generation are identified and considered during the design phase. Radiological personnel evaluate the proposed action and provide input into the scoping document. During the design phase, ALARA considerations consistent with the guidance contained in Regulatory Guidance 8.8 is ensured via review of the modification.

Procedures have been developed describing the training programs and requirements for personnel involved in the ALARA design process.

12.1.3 OPERATIONAL CONSIDERATIONS

To assure that the occupational radiation exposures are maintained as low as reasonably achievable (ALARA) during the operation of Susquehanna SES specific activities will be implemented.

### 12.1.3.1 Procedure Development

Station procedures will be prepared, reviewed, and approved in accordance with Section 13.5.

#### 12.1.3.1.1 ALARA Procedures

To assure adequate emphasis on the necessity to minimize personnel exposures, ALARA procedures will be prepared. These procedures implement considerations of such topics as ALARA review of applicable Radiation Work Permits (RWP), worker feedback, special task training and evaluation of proposed changes in applicable facilities or equipment.

#### 12.1.3.1.2 Station Procedures

Administrative requirements will be implemented to assure that applicable procedures developed by other plant disciplines have adequately incorporated the principle of minimizing personnel exposure. Station administrative documents will describe the criteria for selection of those procedures and revisions that will be reviewed by Health Physics. Recommendations made by Health Physics will normally be resolved with the appropriate plant discipline prior to submission for final review and approval.

#### 12.1.3.2 Station Organization

As described in Subsection 12.5.1, the Station organization provides the Health Physics Supervisor direct access to the Vice President-Nuclear Operations to assure uniform support of Health Physics and ALARA requirements. This organization will allow the Vice President-Nuclear Operations direct involvement in the review and approval of specific ALARA goals and objectives as well as review of data and dissemination of information related to the ALARA program.

The organization also provides a Health Physics Specialist-ALARA who is normally free from routine Health Physics activities to implement the Station ALARA program. This individual is primarily responsible for coordination of Station ALARA activities and will routinely interface with first line supervision in radiation work planning and post job review.

#### 12.1.3.3 Operating Experience

The Radiation Work Permit process described in Subsection 12.5.3.2 will provide a mechanism for collection and evaluation of data relating to personnel exposure. Information collated by systems and/or components and job function will assist in evaluating design or procedure changes intended to minimize future radiation exposures.

#### 12.1.3.4 Exposure Reduction

Specific exposure reduction techniques that will be employed at Susquehanna SES are described in Subsection 12.5.3.2. Procedures will assure that applicable station activities are completed with adequate preparation and planning; work is performed with appropriate Health

Physics recommendations and support; and results of post job data evaluation are applied to implement improvements.

In addition, the Health Physics staff, will at all times be vigilant for ways to reduce exposures by soliciting employee suggestions, evaluating origins of plant exposures, investigating unusual exposures, and assuring that adequate supplies and instrumentation are available.

PP&L management will perform periodic reviews of station programs to assure workers are receiving adequate instruction in ALARA and Health Physics requirements. Implementation of the Health Physics program, selected procedures, and past exposure records will also be reviewed. Management will perform formal reviews of the Susquehanna SES Health Physics program at least once every three years and results will be forwarded to the Vice President-Nuclear Operations and appropriate members of corporate management. The results of management reviews may also include recommendations on mechanisms which may reduce personnel exposure. The Vice President-Nuclear Operations will respond to noted recommendations or deficiencies and corrective action or improvements will be verified during subsequent reviews.

#### 12.1.4 REFERENCES

- 12.1-1 T. D. Murphy, WASH-1311, UC-78, "A Compilation of Occupational Radiation Exposure from Light Water Cooled Nuclear Power Plants 1969-1973," USNRC Radiological Assessment Branch, May 1974.
- 12.1-2 T. D. Murphy, et. al., NUREG-75/032, "Occupational Radiation Exposure at Light Water Cooled Power Reactors 1969-1974," USNRC Radiological Assessment Branch, June 1975.
- 12.1-3 T. D. Murphy, et. al., NUREG-0109, "Occupational Radiation Exposure at Light Water Cooled Power Reactors 1969-1975," USNRC Radiological Assessment Branch, August 1976.
- 12.1-4 C. A. Pelletier, et. al., National Environmental Studies Project, "Compilation and Analysis of Data on Occupational Radiation Exposure Experienced at Operating Nuclear Power Plants," Atomic Industrial Forum, September 1974.