

**NEI 07-08 [Revision 3]**

**Generic FSAR Template  
Guidance for Ensuring that  
Occupational Radiation  
Exposures are as Low as is  
Reasonably Achievable  
(ALARA)**

**November 2008**



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**Nuclear Energy Institute**

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## **EXECUTIVE SUMMARY**

NEI 07-08, *Generic FSAR Template Guidance For Ensuring That Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA)*, Revision 3, provides a complete generic program description for use in developing construction and operating license (COL) applications. The document reflects contemporary Nuclear Regulatory Commission (NRC) guidance, including Regulatory Guide 1.206, “Combined License Applications for Nuclear Power Plants,” and industry-NRC discussions regarding the applicable standard review plan section. A main objective of this program description is to assist in expediting NRC review and issuance of the combined license.



## **TABLE OF CONTENTS**

<b>EXECUTIVE SUMMARY.....</b>	<b>i</b>
<b>12.1 ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE ALARA.....</b>	<b>1</b>
12.1.1 OPERATIONAL POLICIES.....	1
12.1.2 REGULATORY COMPLIANCE .....	2
12.1.3 OPERATIONAL CONSIDERATIONS .....	2
12.1.4 REFERENCES .....	5





# **GENERIC FSAR TEMPLATE GUIDANCE FOR ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS IS REASONABLY ACHIEVABLE (ALARA)**

## **12.1 ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE ALARA**

### **12.1.1 OPERATIONAL POLICIES**

Company and station policies are to keep all radiation exposure of personnel within limits defined by 10 CFR 20, Standards for Protection Against Radiation (Reference 12.1-1). Administrative procedures and practices related to maintaining radiation exposure of personnel as low as is reasonable achievable (ALARA) are described in this section.

The ALARA policy is consistent with the guidelines of Regulatory Guide 8.8, *Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations Will Be As Low As is Reasonably Achievable* (Reference 12.1-7), and Regulatory Guide 8.10, *Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As is Reasonably Achievable* (Reference 12.1-9) in establishing, organizing, and operating an effective ALARA program.

To varying extents, all station personnel are responsible for ALARA. Each supervisor is responsible for enforcing the ALARA requirements as described in 10CFR 20.1101. Individual workers are responsible for complying with ALARA requirements, which are presented during initial plant training and reinforced through annual retraining in accordance with the requirements contained in 10 CFR 19.12. The extent of ALARA training provided for each person is at least commensurate with the worker's job responsibilities and plant areas frequented. The radiation protection training program is maintained and implemented by the training department.

To ensure that personnel comply with established radiological policies, procedures and practices, radiation protection management personnel are charged with the responsibility to promptly advise higher management of any radiologically unsafe practices which exceed their authority to correct. They have the authority to halt any operation which, in their judgment, is radiologically unsafe. Radiation protection technicians are responsible for notifying the operations shift supervision or radiation protection management immediately in order to stop work on any operation deemed to be radiologically unsafe.

### **12.1.2 REGULATORY COMPLIANCE**

As further discussed in FSAR Section 12.5, the station's ALARA policies and practices are consistent with the applicable regulations in 10 CFR 20 (Reference 12.1-1). Compliance with the guidance found in Regulatory Guides 1.8, 1.206, 8.2, 8.7, 8.8, 8.9, 8.10, 8.13, 8.15, 8.27, 8.28, 8.29, 8.34, 8.35, 8.36, 8.38, and the applicable portions of

NUREG-1736 (References 12.1-2 and 12.1-4 through 12.1-19) is discussed in FSAR Section 12.5, Radiation Protection. Compliance with Regulatory Guide 1.8 is further discussed in FSAR Section 13.2, Training. ALARA procedures are established, implemented, maintained and reviewed consistent with the 10 CFR 20.1101 and the quality assurance criteria described in [Reference to appropriate section in Chapter 17 or other document to be provided by COL applicant].

### **12.1.3 OPERATIONAL CONSIDERATIONS**

The ALARA program is based on mature programs in use at other operating commercial nuclear facilities. As such, it inherently incorporates lessons-learned from decades of operating experience. Industry operating experience is regularly reviewed, and applicable lessons-learned are incorporated into plans, procedures, and policies as warranted.

#### **Functional Structure**

The functional structure for the ALARA program is described in FSAR Section 12.5.

#### **Organizational Structure**

Organizational structure is discussed in FSAR Section 13.1 and/or FSAR Section 17.5, the Quality Assurance Program Description.

#### **Radiation Protection Program**

The station has a radiation protection program and an ALARA program which contain the operational ALARA philosophy. These programs, made available to plant personnel, define management's commitment to ALARA and designate those individuals who have the responsibility and authority to implement the ALARA program. FSAR Section 12.5 provides a complete description of the radiation protection program.

#### **Training**

ALARA training is described in FSAR Sections 12.5 and 13.2.

#### **Procedures**

Procedures are developed and maintained in accordance with FSAR Sections 13.5 and 17.5. During initial preparation, radiation protection personnel review the procedures with potential radiological impact for operations, maintenance, refueling, inservice inspections, and operation of the radwaste system for compliance with ALARA guidelines outlined in the radiation protection program.

## **ALARA Program Review and Improvement**

The ALARA Committee and plant management perform periodic reviews of the radiation program content and implementation. In addition to evaluating the implementation of the radiation protection program, these reviews are used to monitor workgroup trends as a means of controlling and reducing personnel exposure. All employees are encouraged to submit suggestions on methods of reducing personnel exposure and improving the ALARA program. Operating procedures are revised, as necessary, to incorporate ALARA lessons-learned from these reviews and suggestions.

### **Plant Modifications**

Modifications to plant equipment and facilities are made where they will substantially reduce exposures at a reasonable cost. Specifications for replacement equipment reflect modifications based on experience gained from using the original equipment. Written procedures direct that all proposed plant modifications are screened for potential adverse radiological impacts. The initial screening review of these proposed modifications is typically performed by engineering personnel. Radiological protection and management personnel perform further review as warranted by level of potential radiological impact.

### **Work Practices**

Radiation protection training, the radiation protection plan, the RWP system, and procedure reviews all help to ensure that radiation exposure of personnel is maintained ALARA. The following examples illustrate the incorporation of ALARA work practices:

- Personnel required to be monitored for radiation exposure in accordance with 10 CFR 20.1502 are assigned appropriate dosimetry to establish exposure history.
- Workers are provided with direct-reading dosimeters on jobs, so that the worker can determine accumulated exposure at any time during a job.
- Dose rate meters are used as needed to identify elevated dose rates.
- Pre-job briefs are used to review radiological surveys and to plan work before personnel enter a radiation area. Written procedures provide guidelines regarding the amount of detail to be included in the pre-job briefings.
- Post-job debriefs are used to ascertain lessons learned. Incorporation of these lessons may result in lower personnel exposure on future jobs. The requirement for post-job debriefings is specified by procedures.
- For work involving high radiation areas, high collective doses, high levels of removable contamination relative to site posting criteria for contamination areas, or known or suspected airborne radioactivity areas:
  1. Work is preplanned to minimize personnel exposure as defined in ALARA program procedures
  2. Radiation protection personnel provide coverage as required by radiation protection procedures.

- On complex jobs in high radiation areas, dry-run training may be utilized. In some cases, mockups are used to familiarize workers with the operations that they are to perform. These techniques are beneficial to improving worker efficiency and minimizing the amount of time spent in the radiation field.
- On jobs where general area radiation levels are greater than 1.5 rem/hour or when individual exposure greater than 500 mrem per entry is expected, stay times are considered as further protection against unnecessary exposure.
- As practical, work area entry and exit points are established in areas with low radiation levels. This is done to minimize dose accumulated while changing protective clothing and respiratory equipment. Control points are also established to minimize the spread of removable contamination from the job site.
- As much as practicable, jobs and activities such as reading instruction manuals or maintenance procedures, adjusting tools or jigs, repairing valve internals, and prefabricating components are performed outside radiation areas.
- Individuals working in radiologically controlled areas are trained to be aware of the varying intensities of radiation fields within the general vicinity of their job locations, and are instructed to remain in the areas of lower radiation levels as much as possible, consistent with performing their assigned tasks.
- For high radiation area jobs, maps, postings, and/or detailed instructions are provided to clearly delineate the source of radiation or to alert personnel concerning the location of elevated dose rates. Provided with this information, workers will be cognizant of their immediate radiological environment, and will minimize their stay times in areas of elevated dose rates, thus maintaining exposures ALARA.
- Protective clothing and respiratory equipment prescribed by radiation protection personnel are commensurate with the radiological hazards involved. These requirements cannot be modified without the permission of radiation protection personnel. Consideration is given to the discomfort of workers to minimize the effect of protective efforts on efficiency and the time spent in a radiation area.
- Contamination containments (e.g., glove bags, plastic bottles, tents) and special ventilation systems (e.g., HEPA units) are used where practicable when personnel are working on highly contaminated equipment.
- Special tools or jigs are used on jobs when their use permits the job to be performed more efficiently or prevents errors, thus reducing the time spent in a radiation area.
- Where applicable, special tools are used to increase the distance from the source to the worker, thereby reducing the exposure received.
- Consideration is given to the use of remote monitoring of personnel with various combinations of audio, visual and dose information to reduce exposure of personnel. Direct communications (e.g., radios) may be used to further enhance radiation protection.
- Some systems and components which are subject to buildup of activated corrosion products are equipped with flush connections to reduce hot-spot buildup. Prior to performing maintenance work on these systems or components, consideration is given to flushing and/or chemically decontaminating the system or piece of equipment in order to reduce the crud levels, thereby reducing dose rates which may result in lower personnel exposure.

- Permanent shielding is used, where practicable, to reduce radiation exposure at the work site and in designated "waiting areas" for personnel during periods when they are not actively involved in the work.
- On some jobs, temporary shielding such as lead sheets draped or strapped over a pipe or concrete blocks stacked around a piece of equipment is used. Temporary shielding is used only if the estimated total exposure, which includes exposure received during installation and removal, is reduced. Experience with such operations is used in developing guidelines in this area.

#### 12.1.4 REFERENCES

- 12.1-1 10 CFR 20, Standards for Protection Against Radiation
- 12.1-2 USNRC, "Qualification and Training of Personnel for Nuclear Power Plants," Regulatory Guide 1.8, Revision 3, May 2000
- 12.1-3 USNRC, "Quality Assurance Program Requirements (Operation)", Regulatory Guide 1.33, Revision 2, February 1978
- 12.1-4 USNRC, "Combined License Applications for Nuclear Power Plants (LWR Edition)", Regulatory Guide 1.206, June 2007
- 12.1-5 USNRC, "Guide for Administrative Practices in Radiation Monitoring", Regulatory Guide 8.2, February 1973.
- 12.1-6 USNRC, "Instructions for Recording and Reporting Occupational Radiation Dose Data", Regulatory Guide 8.7, Revision 2, November 2005.
- 12.1-7 USNRC, "Information Relevant to Ensuring that Exposures at Nuclear Power Stations Will Be As Low As Is Reasonably Achievable", Regulatory Guide 8.8, Revision 3, June 1978.
- 12.1-8 USNRC, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program", Regulatory Guide 8.9, Revision 1, July 1993.
- 12.1-9 USNRC, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable", Regulatory Guide 8.10, Revision 1-R, September 1975.
- 12.1-10 USNRC, "Instructions Concerning Prenatal Radiation Exposure", Regulatory Guide 8.13, Revision 3, June 1999.
- 12.1-11 USNRC, "Acceptable Programs for Respiratory Protection", Regulatory Guide 8.15, Revision 1, October 1999.
- 12.1-12 USNRC, "Radiation Protection Training for Personnel at Light-Water-Cooled Nuclear Power Plants", Regulatory Guide 8.27, March 1981.
- 12.1-13 USNRC, "Audible-Alarm Dosimeters", Regulatory Guide 8.28, August 1981.
- 12.1-14 USNRC, "Instructions Concerning Risks from Occupational Radiation Exposure", Regulatory Guide 8.29, Revision 1, February 1996.
- 12.1-15 USNRC, "Monitoring Criteria and Methods to Calculate Occupational Radiation Doses", Regulatory Guide 8.34, July 1992.
- 12.1-16 USNRC, "Planned Special Exposures", Regulatory Guide 8.35, June 1992.
- 12.1-17 USNRC, "Radiation Dose to the Embryo/Fetus", Regulatory Guide 8.36, July 1992.
- 12.1-18 USNRC, "Control of Access to High and Very High Radiation Areas in Nuclear Power Plants", Regulatory Guide 8.38, Revision 1, May 2006.
- 12.1-19 USNRC, "Consolidated Guidance: 10 CFR Part 20 - Standards for Protection Against Radiation", NUREG-1736, October 2001.