



# DRAFT REGULATORY GUIDE

Technical Lead  
Casper Sun

## DRAFT REGULATORY GUIDE DG-8033

(Proposed Revision 2 of Regulatory Guide 8.10, September 1975)

# OPERATING PHILOSOPHY FOR MAINTAINING OCCUPATIONAL RADIATION EXPOSURES AS LOW AS IS REASONABLY ACHIEVABLE

## A. INTRODUCTION

### Purpose

This regulatory guide (RG) describes methods and procedures that the staff of the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for maintaining radiation exposures to employees and the public as low as is reasonably achievable (ALARA).

### Applicability

This RG applies to all NRC licensees (reactor and non-reactor) subject to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 20, “Standards for Protection Against Radiation” (Ref. 1).

### Applicable Rules and Regulations

- 10 CFR Part 20, Section 20.1101(b) “Radiation protection programs,” requires licensees to establish, to the extent practical, procedures and engineering controls to achieve occupational doses and doses to members of the public that are ALARA.
- 10 CFR 20.1402, “Radiological criteria for unrestricted use,” requires that the residual radioactivity be reduced to levels that are ALARA.
- 10 CFR 20.2105(a)(5), “Records of planned special exposures,” provides requirements for exposure recordkeeping to indicate how doses are maintained ALARA.

---

This regulatory guide is being issued in draft form to involve the public in the early stages of the development of a regulatory position in this area. It has not received final staff review or approval and does not represent an official NRC final staff position. Public comments are being solicited on this draft guide and its associated regulatory analysis. Comments should be accompanied by appropriate supporting data. Comments may be submitted through the Federal-rulemaking Web site, <http://www.regulations.gov>, by searching for Docket ID: NRC-2015-0286. Alternatively, comments may be submitted to the Rules, Announcements, and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. Comments must be submitted by the date indicated in the *Federal Register* notice.

Electronic copies of this draft regulatory guide, previous versions of this guide, and other recently issued guides are available through the NRC’s public Web site under the Regulatory Guides document collection of the NRC Library at <http://www.nrc.gov/reading-rm/doc-collections/reg-guides/>. The draft regulatory guide is also available through the NRC’s Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession No. ML15203B410. The regulatory analysis may be found in ADAMS under Accession No. ML15203B408.

---

## Related Guidance

- RG 1.8, “Qualification and Training of Personnel for Nuclear Power Plants,” (Ref. 2) provides qualifications for the radiation protection manager (RPM) for a nuclear power reactor facility.
- RG 1.21, “Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste,” (Ref. 3) addresses the measuring, evaluating, and reporting of effluent releases, solid radioactive waste, and public dose from nuclear power plants.
- RG 1.70, “Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition),” (Ref.4) provides information on methods for radiation protection and on estimated occupational radiation exposures to operating and construction personnel during normal operation and anticipated operational occurrences.
- RG 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition),” (Ref. 5) provides guidance regarding the information to be submitted in a combined license (COL) application for a nuclear power plant that includes radiation protection.
- RG 8.8, “Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be as Low as Is Reasonably Achievable,” (Ref. 6) provides information relevant to attaining ALARA goals and objectives during planning, design, construction, operation, and decommissioning of a nuclear power station.
- RG 8.15, “Acceptable Programs for Respiratory Protection,” (Ref. 7) specifies the conditions under which respiratory protection equipment may be used and whether the use of respirators is required based on ALARA data.
- RG 8.18, “Information Relevant to Ensuring That Occupational Radiation Exposures at Medical Institutions Will Be as Low as Is Reasonably Achievable,” (Ref.8) provides information and recommended methods relevant to attaining ALARA goals and objectives specifically for employees, visitors, and patients at medical institutions and qualifications for the radiation safety officer.
- RG 8.19, “Occupational Radiation Dose Assessment in Light-Water Reactor Power Plants— Design Stage Man-Rem Estimates,” (Ref. 9) provides information and acceptable methods for performing and determining cost-benefit assessments in Light-Water Reactor construction to ensure exposures to personnel will be ALARA.
- RG 8.31, “Information Relevant to Ensuring That Occupational Radiation Exposures at Uranium Recovery Facilities Will Be as Low as Is Reasonably Achievable,” (Ref. 10) provides guidance on design criteria and administrative practices relevant to attaining ALARA goals for uranium recovery and uranium conversion facilities.
- RG 8.37, “ALARA Levels for Effluents from Materials Facilities,” (Ref. 11) provides ALARA guidance for designing an acceptable program for gaseous and liquid effluents at materials facilities.
- The National Council on Radiation Protection and Measurements (NCRP) Report No. 107, “Implementation of the Principle of as Low as Is Reasonably Achievable (ALARA) for Medical

and Dental Personnel,” (Ref. 12) addresses the implementation of ALARA for occupational exposure of persons working in medicine and dentistry.

- NCRP Report No. 116, “Limitation of Exposure to Ionizing Radiation,” (Ref. 13) outlines the goals and philosophy of radiation protection and the basis for exposure limits.
- NCRP Report No. 120, “Dose Control at Nuclear Power Plants,” (Ref. 14) provides exposure control guidance at power plants.

### **Purpose of Regulatory Guides**

The NRC issues regulatory guides to describe to the public methods that the staff considers acceptable for use in implementing specific parts of the agency’s regulations, to explain techniques that the staff uses in evaluating specific problems or postulated accidents, and to provide guidance to applicants. Regulatory guides are not substitutes for regulations and compliance with them is not required. Methods and solutions that differ from those set forth in regulatory guides will be deemed acceptable if they provide a basis for the findings required for the issuance or continuance of a permit or license by the Commission.

### **Paperwork Reduction Act**

This regulatory guide contains and references information collections covered by 10 CFR Part 20, that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget (OMB), control number 3150-0014.

### **Public Protection Notification**

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

## **B. DISCUSSION**

### **Reason for Revision**

The NRC issued Revision 1 of this RG in September 1975. In 1991 the NRC promulgated amendments to its 10 CFR Part 20 regulations (56 FR 23360; May 21, 1991). The 1991 rulemaking included substantive amendments to the 10 CFR Part 20 regulations as well as a renumbering of those regulations. As such, this revision (Revision 2) to the guide aligns with the regulatory structure of 10 CFR Part 20 by updating the guide’s cross-references to the current 10 CFR Part 20 regulations.

In addition, this revision includes additional guidance from operating ALARA experience since 1975. It provides more details describing management responsibilities to ensure commitment to ALARA.

### **Background**

ALARA is one element of personal safety that can be integrated with the broader industrial safety program. The integration of the ALARA requirements into the safety program is intended to ensure that total safety is considered when performing activities at the licensee’s facility.

The ALARA requirement is an ongoing, cyclical process that involves the evaluation of the exposure events and identification of the potential protective options to reduce the likelihood of reoccurrence. Senior management participation is important to ensure that ALARA requirements are established, appropriate resources are committed to meeting ALARA, and that the approach to ALARA implementation is holistic. Management and radiation protection staff involvement is necessary to implement the ALARA program.

### **Harmonization with International Standards**

The NRC has a goal of harmonizing its guidance with international standards, to the extent practical. The International Atomic Energy Agency (IAEA) and the International Commission on Radiological Protection (ICRP) have established a series of safety guides and standards constituting a high level of safety for protecting people and the environment and addressing good practices in most aspects of radiation protection, including ALARA.

The NRC encourages licensees to consult these international documents and implement the best practices, where applicable. Such documents include:

- International Commission on Radiological Protection (ICRP) Publication 26, “Recommendations of the ICRP” (Ref. 15).
- ICRP Publication 37, “Cost-Benefit Analysis in the Optimization of Radiation Protection” (Ref. 16).
- ICRP Publication 55, “Optimization and Decision Making in Radiological Protection” (Ref. 17).
- ICRP Publication 60, “1990 International Commission on Radiological Protection Recommendations” (Ref. 18).
- ICRP Publication 101(b), “The Optimization of Radiological Protection – Broadening the Process” (Ref. 19).
- ICRP Publication 103, “The 2007 Recommendations of the International Commission on Radiological Protection” (Ref. 20).
- International Atomic Energy Agency (IAEA), IAEA Safety Standards for protecting people and the environment, “Fundamental Safety Principles” (Ref. 21).

It should be noted, however, that some of the recommendations issued by these international organizations do not correspond to the requirements specified in the NRC’s regulations. In such cases, the NRC’s requirements take precedence.

## C. STAFF REGULATORY GUIDANCE

The sections below describe staff regulatory guidance for compliance with ALARA requirements.

### 1. *Management Commitment*

The highest levels of management in an organization should support ALARA requirements and should:

- Make available ALARA policy statements, instructions to personnel, and similar documents to personnel.
- Provide resources and funding to meet implementation of ALARA policies and procedures.
- Promote a safety-conscious work environment where employees are encouraged to raise ALARA concerns and receive timely feedback on submitted issues.
- Ensure that personnel having responsibilities and implementing requirements for the radiation protection program are properly trained in ALARA principles. Regulatory Guides 1.8 and 8.8 present the qualifications for the RPM for a nuclear power reactor facility. Applicants for any specific license other than a nuclear power reactor license should select and state the qualifications for the lead individual who will be responsible for implementing the radiation protection program for the facility (i.e., the RSO). The qualifications should be commensurate with the potential problems that the applicant expects to encounter in a facility of the type subject to the license.
- Provide the RPM or the RSO with sufficient authority to enforce safe plant operation, to audit and prevent unsafe practices, to approve radiation safety-related issues, and to communicate promptly to an appropriate level of management.
- Require an independent formal audit as established in the facility's ALARA procedures to determine how exposures might be lowered. This audit should be performed by personnel who are knowledgeable of radiation protection practices but are not directly responsible for directing the facility's radiation protection program. The audit should include reviews of operating procedures, past exposure records, facility inspections, and consultations with the radiation protection staff or outside consultants. The audit should include recommendations to pursue future dose reductions.
- Ensure that workers receive sufficient training on radiation protection. The worker should understand how radiation protection relates to his or her job and should be tested on this understanding at least annually. A worker should have frequent opportunities to discuss radiation safety with the radiation protection staff whenever the need arises. Management should be committed to a review of radiation protection at least once every 3 years. Training should be sufficient to ensure that workers can correctly answer questions on radiation protection as it relates to their jobs.
- Give the RPM or the RSO sufficient authority to enforce safe facility operation. The RPM or the RSO should have the authority to prevent unsafe practices and to halt an operation he or she deems unsafe. Radiation protection personnel should review and approve operating procedures related to radiation safety. This authority should be demonstrable by written policy statements.

- Make modifications to operating and maintenance procedures and to equipment and facilities where they will substantially reduce exposures. Management should be able to demonstrate, with documented ALARA reviews, that improvements have been sought, that modifications have been considered, and that improvements and modifications have been implemented where practical. The licensee should be prepared to describe its reasons for not implementing a modification that its management had considered.

## 2. *Radiation Protection Manager and Radiation Safety Officer*

The RPM or the RSO is responsible for the overall radiation safety at a licensed facility. As such, it is imperative that the RPM and RSO have sufficient authority and responsibility to do their jobs. The RPM or the RSO responsibilities should:

- Require involvement in the development and pre-planning of radiological work activities and the preparation of Radiation Work Permits (RWP), which can be an important job-planning tool for achieving ALARA goals.
- Assure that RWPs are used to authorize entry into radiologically controlled areas and provide information on the latest radiological conditions, such as radiation exposure rates and contamination levels, in the work area. RWPs should provide detailed work requirements, such as dosimetry and protective clothing needed, and describe work precautions and ways to effectively use ALARA engineering controls (e.g., time, distance, shielding, containments, ventilation, and source reductions). For work in high dose rate and high contamination areas, RWPs should discuss the options of performing the work remotely or using robotic devices and video monitoring. RWPs should be retained as radiation safety records.
- Provide assurance that the proper quality and quantity of radiation protection instrumentation and protection equipment and supplies are available at workplaces, and that they are in good working order and are used properly. Written procedures for the use of equipment should be made available and should be followed.
- Require an annual review of a portion of the radiation protection program so that all phases of the radiation protection program will be reviewed on a 2-3 year review cycle. The review of the ALARA program should include reviews of exposure records (including what groups of workers are receiving the highest exposures and what jobs these exposures are associated with), plant inspections, and consultations with the radiation protection staff or license consultants regarding the application and implementation of ALARA.
- Require, where practical, modifications to standard operating procedures, equipment, and facilities that will substantially reduce exposures.
- Ensure that proper focus is given to the source of licensee radiation exposures in the facility by location, operation, and job category and maintain awareness of trends in exposures. The RPM or the RSO should be able to describe which locations, operations, and jobs are associated with the highest exposures and explain why exposures are increasing or decreasing.
- Investigate unexpected exposures to determine the causes, take steps to reduce the likelihood of similar occurrences in the future, and document conclusions and corrective actions.

- Assess management of radiological work control if the planned controls (e.g., radiation work permits, ALARA plans, work order instructions, radiological hold points, and stop work criteria) are not being properly implemented.
- Routinely review ALARA plans to ensure that they are effective in maintaining plant personnel doses ALARA.

### 3. *Radiation Protection Staff Responsibility*

The below list provides examples of good ALARA practices that individual staff employees should perform:

- Be responsible for being aware of the ALARA requirements and incorporate ALARA into work habits. This includes having a familiarity with management's commitment to ALARA and knowing the basis for this standard and how it should be implemented on everyday assignments.
- Inform management, the RPM or the RSO, and other radiation protection staff of any radiation protection concerns and suggest ways to reduce doses in the facility.
- Demonstrate, where practicable, familiarity with improvements in ALARA principles and practices, why modifications have been considered, and why these modifications have been implemented.
- Obtain training for applying ALARA engineering controls on the job (i.e., time, distance shielding, containments, ventilation, decontamination, and source reduction) and employ self-checks to ensure that equipment and supplies are in good working order.
- Perform surveys of licensee operations to identify situations in which exposures can be reduced.

## D. IMPLEMENTATION

The purpose of this section is to provide information regarding the NRC's plans for using this regulatory guide and information on how the following entities ("applicants and licensees") may use this guide.

In addition, this section describes how the NRC staff complies with the Backfit Rule found in 10 CFR 50.109(a)(1), 70.76(a)(1), and 72.62(a) or any applicable finality provisions in 10 CFR Part 52, in its use of this regulatory guide.

### **Applicability**

- applicants for, and holders of: (1) licenses issued under 10 CFR Part 70 to possess or use, at any site or contiguous sites subject to licensee control, a formula quantity of strategic special nuclear material, as defined in 10 CFR 70.4; (2) operating licenses for nuclear power reactors under 10 CFR Part 50; and (3) approvals issued under subpart B, C, E, and F of Part 52 ("protected applicants and licensees").
- applicants for, and holders of, operating licenses for nuclear non-power reactors under 10 CFR Part 50.

- applicants for, and holders of, general domestic licenses for byproduct material under Part 31.
- applicants for, and holders of, specific domestic license to manufacture or transfer certain items containing byproduct material under Part 32.
- applicants for, and holders of, specific domestic licenses of broad scope for byproduct material under Part 33.
- applicants for, and holders of, licenses for industrial radiography under Part 34.
- applicants for, and holders of, licenses for medical use of byproduct material under Part 35.
- applicants for, and holders of, licenses for irradiators under Part 36.
- applicants for, and holders of, licenses for well logging under Part 39.
- applicants for, and holders of, licenses for source material under Part 40.
- applicants for, and holders of, licenses for packaging and transportation of radioactive material under Part 71.
- applicants for, and holders of, licenses for independent storage under Part 72.

### **Use by Applicants and Licensees**

Applicants and licensees may voluntarily<sup>1</sup> use the guidance in this document to demonstrate compliance with the underlying NRC regulations. Methods or solutions that differ from those described in this regulatory guide may be deemed acceptable if they provide sufficient basis and information for the NRC staff to verify that the proposed alternative demonstrates compliance with the appropriate NRC regulations. Current licensees may continue to use guidance the NRC found acceptable for complying with the identified regulations as long as their current licensing basis remains unchanged. The acceptable guidance may be the previous version of this regulatory guide.

Licensees may use the information in this regulatory guide for actions that do not require NRC review and approval. However, voluntarily using the subject matter in the guidance may change a licensee's radiation protection program such that NRC review may be required under the provisions of 10 CFR 20.1101 and should be evaluated prior to incorporating the methods into the radiation protection program. Licensees may use the information in this regulatory guide or applicable parts to resolve regulatory or inspection issues.

### **Use by NRC Staff**

The NRC staff does not intend or approve any imposition or backfitting of the guidance in this regulatory guide. The NRC staff does not expect any existing licensee to use or commit to using the guidance in this regulatory guide, unless the licensee makes a change to its licensing basis. The NRC staff does not expect or plan to request licensees to voluntarily adopt this regulatory guide to resolve a generic

---

<sup>1</sup> In this section, “voluntary” and “voluntarily” means that the licensee is seeking the action of its own accord, without the force of a legally binding requirement or an NRC representation of further licensing or enforcement action.



regulatory issue. The NRC staff does not expect or plan to initiate NRC regulatory action that would require the use of this regulatory guide. Examples of such unplanned NRC regulatory actions include issuance of an order requiring the use of the regulatory guide, generic communication, or promulgation of a rule requiring the use of this regulatory guide without further backfit consideration for protected licensees.

During regulatory discussions on licensee-specific operational issues, the staff may discuss with licensees various actions consistent with staff positions in this regulatory guide, as one acceptable means of meeting the underlying NRC regulatory requirement. Such discussions would not ordinarily be considered backfitting for protected licensees even if prior versions of this regulatory guide are part of the licensing basis. However, unless this regulatory guide is part of the licensing basis, the staff may not represent to the licensee that the licensee's failure to comply with the positions in this regulatory guide constitutes a violation.

If an existing licensee voluntarily seeks a license amendment or change and (1) the NRC staff's consideration of the request involves a regulatory issue directly relevant to this revised regulatory guide and (2) the specific subject matter of this regulatory guide is an essential consideration in the staff's determination of the acceptability of the licensee's request, then the staff may request that the licensee either follow the guidance in this regulatory guide or provide an equivalent alternative process that demonstrates compliance with the underlying NRC regulatory requirements. This is not considered backfitting as defined in 10 CFR 50.109(a)(1), 70.76(a)(1), or 72.62(a), or any applicable finality provisions in 10 CFR Part 52.

If a protected licensee believes that the NRC is either using this regulatory guide or requesting or requiring the protected licensee to implement the methods or processes in this regulatory guide in a manner inconsistent with the discussion in this Implementation section, then the protected licensee may file a backfit appeal with the NRC in accordance with the NRC Management Directive 8.4, "Management of Facility-Specific Backfitting and Information Collection" (Ref. 22) and the guidance in NUREG-1409, "Backfitting Guidelines" (Ref. 23).

The backfit provisions in 10 CFR 50.109, 70.76, and 72.62 and the issue finality provision in 10 CFR Part 52 do not apply to holders of licenses under Part 31, 32, 33, 34, 35, 36, 39, 40 or 71 or holders of licenses for nonpower reactors under 10 CFR Part 50, unless those licensees also have an NRC regulatory approval under 10 CFR Part 50 (for a nuclear power reactor), 70, 72, or 52, respectively.

## GLOSSARY

- ALARA** An acronym for “as low as is reasonably achievable.” Title 10 of the *Code of Federal Regulations* (10 CFR) 20.1003, “Definitions,” states that this term refers to “making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as is practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.”
- Assessment** A planned and documented activity performed to determine whether various elements within a quality management system are effective in achieving stated quality objectives.
- Audit** A planned and documented activity performed to determine by investigation, examination, or evaluation of objective evidence the adequacy of, and conformance with, established procedures, instructions, drawings, regulations, and other applicable documents, as well as the effectiveness of implementation. An audit should not be confused with surveillance or inspection activities performed for the sole purpose of process control or product acceptance.

## REFERENCES<sup>2</sup>

1. *U.S. Code of Federal Regulations (CFR)*, “Standards for Protection against Radiation,” Part 20, Chapter 1, Title 10, “Energy.” U.S. Nuclear Regulatory Commission (NRC), Washington, DC.
2. NRC, Regulatory Guide (RG) 1.8, “Qualification and Training of Personnel for Nuclear Power Plants,” Washington, DC.
3. NRC, RG 1.21, “Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste,” Washington, DC.
4. NRC, RG 1.70, “Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition),” Washington, DC.
5. NRC, RG 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition),” Washington, DC.
6. NRC, RG 8.8, “Information Relevant to Ensuring That Occupational Radiation Exposures at Nuclear Power Stations Will Be as Low as Is Reasonably Achievable,” Washington, DC.
7. NRC, RG 8.15, “Acceptable Programs for Respiratory Protection,” Washington, DC.
8. NRC, RG 8.18, “Information Relevant to Ensuring That Occupational Radiation Exposures at Medical Institutions Will Be as Low as Is Reasonably Achievable,” Washington, DC.
9. NRC, RG 8.19, “Occupational Radiation Dose Assessment in Light-Water Reactor Power Plants Design Stage Man-Rem Estimates,” Washington, DC.
10. NRC, RG 8.31, “Information Relevant to Ensuring That Occupational Radiation Exposures at Uranium Recovery Facilities Will Be as Low as Is Reasonably Achievable,” Washington, DC.
11. NRC, RG 8.37, “ALARA Levels for Effluents from Materials Facilities,” Washington, DC.
12. National Council on Radiation Protection and Measurements (NCRP) Report 107, “Implementation of the Principle of As Low As Is Reasonably Achievable (ALARA) for Medical and Dental Personnel,” NCRP, Bethesda, MD.<sup>3</sup>
13. NCRP Report 116, “Limitation of Exposure to Ionizing Radiation,” NCRP, Bethesda, MD.

---

2 Publicly available NRC-published documents are available online through the NRC Library on the NRC’s public Web site at <http://www.nrc.gov/reading-rm/doc-collections/>. The documents can also be viewed online or printed for a fee in the NRC’s Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD; the mailing address is USNRC PDR, Washington, DC 20555; telephone 301-415-4737 or (800) 397-4209; fax (301) 415-3548; and e-mail [pdr.resource@nrc.gov](mailto:pdr.resource@nrc.gov).

3 Copies of the National Council on Radiation Protection and Measurements (NCRP) documents may be obtained through the organization’s Web site: <http://www.ncrponline.org/Publications/Publications.html>] or by writing to NCRP at 7910 Woodmont Avenue, Suite 400, Bethesda, MD 20814-3095, telephone 301-657-2652, fax: 301-907-8768.

14. NCRP Report 120, "Dose Control at Nuclear Power Plants," NCRP, Bethesda, MD.
15. International Commission on Radiological Protection (ICRP) Publication 26, "Recommendations of the ICRP." Annals ICRP 1(3): 1976. Pergamon Press, Elmsford, NY<sup>4</sup>.
16. ICRP Publication 37, "Cost-Benefit Analysis in the Optimization of Radiation Protection." Annals ICRP 10 (2-3): 1983. Pergamon Press, Elmsford, NY.
17. ICRP Publication 55, "Optimization and Decision Making in Radiological Protection." Annals ICRP 20(1): 1990. Pergamon Press, Elmsford, NY.
18. ICRP Publication 60, "1990 International Commission on Radiological Protection Recommendations." Annals ICRP 21(1-3): 1990. Pergamon Press, Elmsford, NY.
19. ICRP Publication 101(b), "The Optimization of Radiological Protection – Broadening the Process." Annals ICRP 36(3):2006. Pergamon Press, Elmsford, NY.
20. ICRP Publication 103, "The 2007 Recommendations of the International Commission on Radiological Protection." Annals ICRP 37(2-4): 2007. Pergamon Press, Elmsford, NY.
21. International Atomic Energy Agency (IAEA), "Fundamental Safety Principles." IAEA Safety Standards Series No. SF-1, Vienna: 2006.<sup>5</sup>
22. Management Directive 8.4, "Management of Facility-Specific Backfitting and Information Collection," Washington, DC.
23. NRC NUREG-1409, "Backfitting Guidelines," Washington, DC.

---

4 Copies of the International Commission on Radiological Protection (ICRP) documents may be obtained through the organization's Web site: <http://www.icrp.org/>; 280 Slater Street, Ottawa, Ontario K1P 5S9, CANADA; Tel: +1(613) 947-9750 Fax: +1-613-944-1920.

5 Copies of International Atomic Energy Agency (IAEA) documents may be obtained through their Web site at: <http://www.iaea.org> or by writing the International Atomic Energy Agency P.O. Box 100 Wagramer Strasse 5, A-1400 Vienna, Austria. Telephone (+431) 2600-0, Fax (+431) 2600-7, or E-Mail at [Official.Mail@IAEA.org](mailto:Official.Mail@IAEA.org).