



DRAFT REGULATORY GUIDE

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DRAFT REGULATORY GUIDE DG-8036

(Proposed Revision 1 of Regulatory Guide 8.4, dated February 1973)

PERSONNEL MONITORING DEVICE—DIRECT-READING POCKET DOSIMETERS

A. INTRODUCTION

This guide provides guidance acceptable to the U.S. Nuclear Regulatory Commission (NRC) staff for use in complying with the NRC's regulations on direct-reading pocket dosimeters; it includes specific performance standards for personnel monitoring but not for area monitoring. This regulatory guide replaces the existing Regulatory Guide (RG) 8.4, "Direct-Reading and Indirect-Reading Pocket Dosimeters" (Ref. 1), issued February, 1973.

The regulatory requirements for use of personnel monitoring devices are mainly established in Title 10 of the *Code of Federal Regulations*, Part 20, "Standards for Protection against Radiation" (10 CFR Part 20) (Ref. 2), which requires licensees to determine and record occupational exposures to demonstrate compliance with dose limits for adults, for an embryo/fetus, and for minors, and to supply and direct the use of individual monitoring devices. In addition, 10 CFR Part 34, "Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations" (Ref. 3), includes a specific provision in 10 CFR 34.47, "Personnel Monitoring," that requires the use of a direct-reading pocket dosimeter or, as an alternative to an ion-chamber pocket dosimeter, an electronic personnel dosimeter for personnel monitoring. Also, NUREG-1556, "Consolidated Guidance about Materials Licenses," Volume 2, "Program-Specific Guidance about Industrial Radiography Licenses," issued August 1998 (Ref. 4), provides guidance for the use of pocket dosimeters in industrial radiographic operations.

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 (including any implementation schedule) and its associated regulatory analysis or value/impact statement. Comments should be accompanied by appropriate supporting data. Written comments may be submitted to the Rulemaking and Directives Branch, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; submitted through the NRC's interactive rulemaking Web page at <http://www.nrc.gov>; or faxed to (301) 492-3446. Copies of comments received may be examined at the NRC's Public Document Room, 11555 Rockville Pike, Rockville, MD. Comments will be most helpful if received by June 8, 2010.

Electronic copies of this draft regulatory guide are available through the NRC's interactive rulemaking Web page (see above); the NRC's public Web site under Draft Regulatory Guides in the Regulatory Guides document collection of the NRC's Electronic Reading Room at <http://www.nrc.gov/reading-rm/doc-collections/>; and the NRC's Agencywide Documents Access and Management System (ADAMS) at <http://www.nrc.gov/reading-rm/adams.html>, under Accession No. ML093410077.

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.

This regulatory guide contains information collection requirements covered by 10 CFR Part 20 and 10 CFR Part 34 that the Office of Management and Budget (OMB) approved under OMB control numbers 3150-0014, and 3150-0007, respectively. The NRC may neither conduct nor sponsor, and a person is not required to respond to, an information collection request or requirement unless the requesting document displays a currently valid OMB control number.

B. DISCUSSION

The pocket dosimeter, also known as a direct-reading dosimeter, self-reading pocket dosimeter, and pocket electroscope, provides individuals with an immediate reading of their exposure to x rays and gamma rays. Although this dosimeter was originally designed to measure x-ray and gamma-ray exposures, it can also respond to beta radiation above 1 million electron volts. Neutron-sensitive versions have also been developed. The previous version of this guide included guidance on indirect pocket dosimeters. However, this guide excludes such dosimeters because they are essentially no longer used.

Direct-reading dosimeters are still in operation because they are compact and reusable, allowing individuals to determine their exposure at any time with reasonable accuracy on a daily or a single entry dose assessment, which is an important advantage when working in high-radiation fields. However, their readings may be affected by shock; are subject to drift, especially in conditions of high humidity; and may be difficult to read under certain work conditions, such as in low light. Therefore, this type of dosimeter has been supplanted in some industries by electronic dosimeters that perform the same functions with greater reliability and accuracy as well as provide many additional important capabilities (Ref. 5).

The NRC staff provided guidance on direct-reading dosimeters in RG 8.4, endorsing the American National Standards Institute (ANSI) N13.5-1972, "Performance Specifications for Direct Reading and Indirect Reading Pocket Dosimeters for X- and Gamma Radiation," (Ref. 6). ANSI N13.5-1972 was reaffirmed in 1989, but it has not since been revised and ANSI considers the standard withdrawn. Therefore, ANSI N13.5 is not endorsed in this guide.

ANSI developed a related standard for pocket dosimeters, ANSI N322-1997, "Inspection, Test, Construction, and Performance Requirements for Direct Reading Electrostatic/Electroscope Type Dosimeters," that was reaffirmed in 2009 (Ref. 7). ANSI N322-2009 is compatible with certain sections of ANSI N13.5-1972, but it provides more detail guidance on dosimeter performance for measuring x and gamma radiation. In addition, it provides guidance regarding testing of dosimeters to ensure that they meet certain desirable design features and considers only direct-reading dosimeters, whereas ANSI N13.5-1972 considers both direct-reading and indirect-reading dosimeters.

Although ANSI N322-2009 provides updated guidance, it has not been endorsed in this revision because several of its sections are not relevant to licensee activities in order to comply with the NRC regulations. However, the recommendations in the standard applicable to NRC licensees are included in Section C, under Regulatory Position, of this guide. This revision also references NUREG-1556,

“Consolidated Guidance about Materials Licenses,” Volume 2, “Program-Specific Guidance about Industrial Radiography Licenses,” issued in 1998, that includes guidance on direct-reading dosimeters.¹

C. REGULATORY POSITION

Pursuant to 10 CFR 20.1501 and 10 CFR 34.47, licensees must ensure that dosimeters are calibrated for the radiation measured. In addition, NUREG-1556, Volume 2, includes specific guidance for radiography licensees using direct-reading dosimeters. In general, licensees should ensure that pocket dosimeters are well maintained, clean and free of contamination, are calibrated at specified frequencies, and checked periodically for proper operation, following the manufacturer's recommended procedures. Specifically, licensees should perform the following tasks for pocket dosimeters.

1. Intervals for test and calibration

Licensees should test and calibrate pocket dosimeters before initial use and after being subject to possible damage from being dropped or from other causes. Licensees must examine pocket dosimeters at maximum test intervals of periods not to exceed 12 months for correct response.

2. Rejection

The licensee must reject the dosimeter if it fails to read within ± 20 percent of the calibrated exposure from a source traceable to the National Institute of Standards and Technology.

3. Recharge or reset

Licensees should charge dosimeters periodically, place them in an area with a low radiation background, and examine them after two to three days for excessive affect their usefulness. To ensure full-scale reading capability, pocket dosimeters must be recharged or reset at the start of each shift so that the dosimeters will be capable of reading the leakage that could full scale.

4. Environmental conditions

Licensee instructions should include how and where pocket dosimeters are to be stored when not in use. The storage place should be dry, radiation free, and cool so that the devices will not be affected by adverse environmental conditions.

5. Off-scale reading

¹ The International Organization for Standardization (ISO) developed a third standard applicable to pocket dosimeters. In 1997, ISO issued ISO 11943, “X and Gamma Radiation—Indirect- or Direct-Reading Capacitor-Type Pocket Dosimeters” (Ref. 8), which is an updated version of three older standards. However, ISO withdrew ISO 11934 on February 28, 2003, after a periodic vote by the countries that are members of the technical committee. Therefore, no relevant guidance from this standard is included in this guide.

If the individual's pocket dosimeter is found to be off-scale, and the possibility of radiation exposure cannot be ruled out as the cause, the individual's personnel dosimeter must be sent for processing within 24 hours. The Radiation Protection Manager/Radiation Safety Officer or their designee must make the determination as to whether the individual should resume work associated with the licensed material. The pocket dosimeter should also be checked for proper functioning and calibration.

6. Comparison of dose readings

Licensees should compare the total doses recorded by the pocket dosimeter for a given period with the dose recorded by the worker's primary personnel dosimetry, such as thermoluminescent dosimetry or optically stimulated luminescence dosimeters, and investigate the reasons for differences that are greater than 20 percent.

7. Training

All users must receive training in the use of personnel monitoring equipment. Training may include such elements as the proper method of charging, reading, and recording readings from the pocket dosimeter.

8. Records

Personnel should be instructed that direct reading dosimeters must be read and recorded at the beginning and end of each shift. Licensees must maintain records of all calibration and evaluation activities for each dosimeter including worker training on the use of the dosimeter.

9. Mixed Radiation Fields

Direct-reading pocket dosimeters may be used in a mixed neutron and gamma radiation field to comply with the personnel monitoring and record keeping requirements of 10 CFR Part 20 provided that all of the following conditions are met:

- a. The neutron dose equivalent rate and the gamma exposure rate at the point of personnel exposure are known from separately made determinations;
- b. The neutron-to-gamma ratio is essentially constant during the period of personnel exposure;
- c. The degree of response of the dosimeter to the neutron flux density is known.

If the response to the neutron flux density is negligible, the gamma exposure indicated by the dosimeter may be accepted. To determine the neutron dose equivalent, multiply the indicated gamma exposure by the neutron-to-gamma ratio.

If the response to the neutron flux density is significant, the actual gamma exposure should be obtained by subtracting the neutron response from the indicated gamma exposure. To determine the neutron dose equivalent, multiply the actual gamma exposure by the neutron-to-gamma ratio.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC's plans for using this draft regulatory guide. The NRC does not intend or approve any imposition or backfit in connection with its issuance.

The NRC has issued this draft guide to encourage public participation in its development. The NRC will consider all public comments received in development of the final guidance document. In some cases, applicants or licensees may propose an alternative or use a previously established acceptable method for complying with specified portions of the NRC's regulations. Otherwise, the methods described in this guide will be used in evaluating compliance with the applicable regulations for license applications, license amendment applications, and amendment requests.

REGULATORY ANALYSIS

Statement of the Problem

The NRC first issued RG 8.4 in February 1973 to provide guidance for direct-reading and indirect-reading pocket dosimeters and to endorse ANSI N13.5-1972. ANSI considers this standard withdrawn. Current NRC regulations (10 CFR Part 20 and 10 CFR Part 34) include revised citations regarding the use of this dosimeter by licensees. Such citations have been updated in this revision to conform to the revised citations in the regulations. In addition, the NRC staff developed NUREG-1556, Volume 2, in 1998, that includes information on the description and function of the pocket dosimeters.

Objective

The objective of this regulatory action is to provide current guidance for the use of pocket dosimeters for personnel monitoring.

Alternative Approaches

The NRC staff considered the following alternative approaches:

Do not revise RG 8.4.

Revise RG 8.4.

Alternative 1: Do Not Revise Regulatory Guide 8.4

Under this alternative, the NRC would not revise the guidance, and the current guidance would be retained. This alternative is considered the baseline or "no-action" alternative and, as such, involves no value/impact considerations. However, this alternative would not address the current citations in the latest revisions of 10 CFR Part 20 and 10 CFR Part 34, the outdated ANSI N13.5-1972, and NUREG 1556, Volume 2, which was issued in 1998.

Alternative 2: Revise Regulatory Guide 8.4

Under this alternative, the NRC would revise RG 8.4, taking into consideration current regulations, guidance, and practices.

One benefit of this action is that it would reflect current NRC requirements and would enhance the personnel monitoring program. The cost to the NRC would be the one-time cost of issuing the revised regulatory guide (which is expected to be relatively small), and licensees would incur little or no cost.

Conclusion

Based on this regulatory analysis, the staff recommends revision of RG 8.4. The staff concludes that the proposed action will enhance good monitoring practices, reflect current citations to NRC regulations and other available guidance, such as NUREG-1556. Therefore, the revision of this regulatory guidance is necessary.

REFERENCES²

1. Regulatory Guide 8.4, “Direct-Reading and Indirect-Reading Pocket Dosimeters,” U.S. Nuclear Regulatory Commission, Washington, DC, February 1973.
2. 10 CFR Part 20, “Standard for Protection against Radiation,” U.S. Nuclear Regulatory Commission, Washington, DC.
3. 10 CFR Part 34, “Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations,” U.S. Nuclear Regulatory Commission, Washington, DC.
4. NUREG-1556, “Consolidated Guidance about Materials Licenses,” Volume 2, “Program-Specific Guidance about Industrial Radiography Licenses,” U.S. Nuclear Regulatory Commission, Washington, DC, August 1998.
5. P.W. Frame, “A History of Radiation Detection Instrumentation,” *Health Physics*, 88:613–637, 2005.³
6. ANSI N13.5-1972, “Performance Specifications for Direct Reading and Indirect Reading Pocket Dosimeters for X- and Gamma Radiation,” American National Standards Institute, Washington, DC, 1972.
7. ANSI N322-2009, “Inspection, Test, Construction, and Performance Requirements for Direct Reading Electrostatic/Electroscope Type Dosimeters,” American National Standards Institute, Washington, DC, 2009.
8. ISO 11934, “X and Gamma Radiation—Indirect- or Direct-Reading Capacitor-Type Pocket Dosimeters, International Organization for Standardization, Geneva, Switzerland, 1997.

2 Publicly available NRC published documents such as Regulations, Regulatory Guides, NUREGs, and Generic Letters listed herein are available electronically through the Electronic Reading room on the NRC’s public Web site at: <http://www.nrc.gov/reading-rm/doc-collections/>. Copies are also available for inspection or copying for a fee from 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.

3 Copies of the non-NRC documents included in these references may be obtained directly from the publishing organization.