

N323B

American National Standard for Radiation Protection Instrumentation Test and Calibration, Portable Survey Instrumentation for Near Background Operation

Accredited by the American National Standards Institute

Sponsored by the
National Committee on Radiation Instrumentation, N42



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Secretariat

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American National Standards Institute

Abstract: Minimum performance requirements for portable radiation protection instruments used for detection and measurement of ionizing radiation fields or levels of radioactive surface contamination that are near background levels are established in this standard.

Keywords: instrumentation, near background, portable survey, radiation

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Introduction

(This introduction is not part of ANSI N323B-2003, American National Standard for Radiation Protection Instrumentation Test and Calibration, Portable Survey Instrumentation for Near Background Operation.)

This standard is the responsibility of the Accredited American Standards Committee on Radiation Instrumentation, N42. Committee N42 delegated development of this standard to Subcommittee N42.RPI. Drafts were reviewed by Committee N42, Subcommittee N42.RPI, and other interested parties, and the comments received were utilized in producing the standard as finally approved. The standard was approved on N42 letter ballot of 8 November 2001.

Participants

At the time it approved this standard, the Accredited Standards Committee on Radiation Instrumentation, N42, had the following membership:

Louis Costrell, *Chair*
Michael P. Unterweger, *Vice Chair*
Sue Vogel, *Administrative Secretary*

<i>Organization Represented</i>	<i>Name of Representative</i>
American Conference of Governmental Industrial Hygienists.....	Jesse Lieberman
Bartlett Services.....	Morgan Cox
Bicron.....	Joseph G. Bellian
Chew, M.H.	Jack M. Selby
Commerce Dept., U.S., NIST	Louis Costrell
	Michael P. Unterweger (<i>Alt.</i>)
Eberline Instruments	Mitchell Truitt
Entergy-ANO	Ron Schwartz
Gamma Metrics.....	Ernesto A. Corte
Health Physics Society.....	Joseph R. Stencil
Institute of Electrical and Electronics Engineers, Inc.	Louis Costrell
	Julian Forster (<i>Alt.</i>)
	Anthony J. Spurgin (<i>Alt.</i>)
Lawrence Berkeley National Laboratory.....	Edward J. Lampo
Massachusetts Institute of Technology, Bates Linear Accelerator Center, RPO	Frank X. Masse
Nuclear Standards Unlimited.....	Al N. Tschaeche
Oak Ridge National Laboratory	Charles L. Britton
	Peter J. Chiaro, Jr. (<i>Alt.</i>)
ORTEC	Ronald M. Keyser
Overhoff Technology Corporation.....	Mario W. Overhoff
Pacific Northwest Lab	Joseph C. McDonald
St. Gobian	Richard P. Oxford
Swinth Associates	Kenneth L. Swinth
Wisconsin Public Service Group	Timothy Martinson
Members-at-Large.....	Paul L. Phelps
	Carl R. Siebentritt
	Lee J. Wagner

At the time this standard was approved, Subcommittee N42.RPI had the following membership:

Jack M. Selby, *Chair*

Joseph G. Bellian
Peter J. Chiaro, Jr.
Morgan Cox
Henry Fong
Robert Ford
Mark M. Hoover

Joseph G. Johnson
Michelle E. Johnson
R. L. Kathren
Mike Lantz
Jimmy Little
Sergio Lopez

Joseph C. McDonald
Richard P. Oxford
Carl R. Siebentritt
Al N. Tschaeché
Ed Walker
Chuan-Fu Wu

At the time this standard was completed, the ANSI N323B Working Group had the following membership:

Ed Walker, *Chair*

Eric Abelquist
James Berger
Frasier Bronson
Richard Dubiel

Philip Egidi
Donald Gregory
Mahmoud Haghighi
Ralph Jacobs

Cindt Jones
Bruce Mann
Kevin Miller
Paul Ruhter

Additional reviewers:

Peter J. Chiaro, Jr.

Morgan Cox
Mark M. Hoover

Jack M. Selby

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American National Standard for Radiation Protection Instrumentation Test and Calibration, Portable Survey Instrumentation for Near Background Operation

1. Scope

This standard establishes minimum acceptance performance requirements for portable radiation protection instruments used for detection and measurement of ionizing radiation fields or levels of radioactive surface contamination that are near background.

For purposes of this standard, portable radiation protection instruments are those battery-powered instruments that are carried to a specific facility or location for use.

Specifically, this standard is intended to apply to those instruments utilized to make in-situ measurements for confirmation of residual radioactivity levels that are below criteria established to permit the unrestricted release of a surface area or component from further regulatory controls.

This standard is intended to define performance requirements and acceptance testing that supplements those established in ANSI N42.17A-1989 [B7] and ANSI N42.17C-1989 [B8], and to define calibration requirements that supplement those established in ANSI N323A-1998 [B6].¹ This standard is applicable to the measurement of gamma, beta, and alpha radiation emissions only. This standard addresses the instrument response requirements for the same range of surface activity covered by the above ANSI standards, but extends the applicable range of dose-rate response below those standards. This is illustrated in Table 1.

Throughout this standard, three verbs have been used to indicate the degree of rigor intended for each specific test or performance criterion. The word “shall” is used to denote a requirement; the word “should” to denote a recommendation; and the word “may” to denote a permissible practice.

¹The numbers in brackets correspond to those of the bibliography in Annex B.

Table 1—Extension of requirements of ANSI N42.17A-1989 and ANSI N323A-1998 to ANSI N323B-2003 (this standard)

Standard	Dose rate	Surface activity
ANSI N42.17A-1989 [B7] ANSI N42.17C-1989 [B8]	1 $\mu\text{Gy/hr}$ – 10 Gy/hr (0.1 mrad/hr – 1000 rad/hr) 1 $\mu\text{Sv/hr}$ – 10 Sv/hr (0.1 mrem/hr – 1000 mrem/hr)	0.02 Bq/cm ² – 167 Bq/cm ² (120 dpm/100 cm ² – 10 ⁶ dpm/100 cm ²)
ANSI N323A-1998 [B6]	1 $\mu\text{Gy/hr}$ – 10 Gy/hr (1 mrad/hr – 1000 rad/hr) 1 $\mu\text{Sv/hr}$ – 10 Sv/hr (1 mrem/hr – 1000 rem/hr)	0.02 Bq/cm ² – 200 Bq/cm ² (120 dpm/100 cm ² – 1.2 $\times$ 10 ⁶ dpm/100 cm ²)
ANSI N323B-2003 (this standard)	0.1 $\mu\text{Gy/hr}$ – 100 $\mu\text{Gy/hr}$ (10 $\mu\text{rad/hr}$ – 10 mrad/hr) 0.1 $\mu\text{Sv/hr}$ – 100 $\mu\text{Sv/hr}$ (10 $\mu\text{rem/hr}$ – 10 mrem/hr)	0.02 Bq/cm ² – 167 Bq/cm ² (120 dpm/100 cm ² – 1.2 $\times$ 10 ⁶ dpm/100 cm ²)

2. Definitions

2.1 absorbed dose: The mean energy deposited per unit mass of the specified absorbing medium.

2.2 acceptable source: The source of radiation listed in the appropriate reference source table in this standard.

2.3 acceptance testing: Evaluation or measurement of performance characteristics to verify that certain stated specifications and contractual requirements are met.

2.4 accredited testing and/or calibration laboratory: A testing and/or calibration laboratory that has been accredited by an authoritative body with respect to its qualifications to perform verification and/or calibration tests on the types of instruments covered by this standard.

2.5 accuracy: The degree of agreement between the observed value and the conventionally true value of the quantity being measured.

2.6 adjust: To alter the response by means of a variable built-in control such as a potentiometer or software.

2.7 angular dependence: Response of the detector as a function of the angle of incidence of the radiation being detected and a reference orientation.

2.8 calibrate: (A) To adjust or determine the response or reading of an instrument relative to a series of conventionally true values for radiation sources; (B) to determine the activity of a radiation source relative to a standard or conventionally true value.

2.9 check source: A radioactive source, not necessarily calibrated, that is used to confirm the continuing satisfactory operation of an instrument. *See: source response check.*

2.10 coefficient of variation: The standard deviation expressed as a percentage of the mean [i.e., (standard deviation / $\bar{x}$) $\cdot$ (100)].

2.11 contamination monitor: An assembly, including one or several radiation detectors and associated assemblies, designed to measure activity (alpha, beta, photon, or alpha-beta) per unit surface area or activity of a localized source associated with the contamination of the examined object.

2.12 conventionally true value (CTV) of a quantity: The commonly accepted best estimate of the value of a quantity. This and the associated uncertainty will preferably be determined by a national or transfer standard, by a reference instrument that has been calibrated against a national or transfer standard, or by measurement quality assurance (MQA) with the National Institute of Standards and Technology (NIST), formerly the U. S. Bureau of Standards and Technology, or a qualified secondary laboratory.

2.13 correction factor: The factor by which the reading of an instrument is multiplied to obtain the conventionally true value of the quantity.

2.14 counting efficiency: The ratio, expressed as a percentage, of the instrument net reading to the surface emission rate of a source under given geometrical conditions.

2.15 decade: A range of values for which the upper value is a factor of ten larger than the lower value.

2.16 decision threshold: A measurement value which allows a decision to be made for each measurement with a given probability of error as to whether the measurement includes a contribution from a radiation source above that contained in background.

NOTE—See Type 1 error, ISO 11929-1:2000 [B17].

2.17 detection axis: A specified imaginary line through the effective center of the detector to which the radiation field direction can be referenced.

2.18 detection limit: The extreme of detection or quantification for the radiation of interest. It is the minimum statistically quantifiable instrument response or reading. The upper measurement level is the maximum level at which the instrument meets the required accuracy.

NOTE—See Type 1 error, ISO 11929-1:2000 [B17].

2.19 detector: A device or component designed to produce a quantifiable response to ionizing radiation, normally measured electronically.

2.20 dose: A generic term including absorbed dose and/or dose equivalent. *See also:* **absorbed dose; dose equivalent.**

2.21 dose equivalent (H): The product of D and Q at the point of interest in tissue, where D is the absorbed dose and Q is the quality factor.

2.22 drift: A change in reading, usually gradual, without concomitant change in the influence quantity.

2.23 effective center: The point within a detector where the response, for a given set of irradiation conditions, is the same as that produced if the entire detector were located at that point.

2.24 effective energy: The energy used to characterize a heterogeneous radiation field that behaves under specified conditions as if it were a mono-energetic radiation field of the same energy.

2.25 energy dependence: The variation in instrument response as a function of radiation energy for a constant radiation type and absorbed dose-rate reference to tissue or air.

2.26 extracameral: Pertaining to that portion of the instrument exclusive of the detector.