



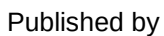
American National Standard

ANSI/HPS 43.8-2008

Classification of Industrial Ionizing Radiation Gauging Devices

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Abstract

This American National Standard applies to the radiation safety aspects of gauging devices, commonly called devices, that use sealed radioactive sources or machine-generated sources for the determination or control of thickness, density level, interface location, particle size distribution, or qualitative or quantitative chemical composition. This standard establishes a system for classification of gauging devices based on performance specifications relating to radiation safety. In addition to specific tests for use conditions and accident conditions (fire), guidelines for other safety features and considerations are presented. This standard does not apply to the measurement performance of gauging devices.

Key words: Device safety performance classification; gauging devices; devices; ionizing radiation; radiation measurements; radiation safety; standard

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Foreword (This foreword is not part of American National Standard ANSI/HPS N43.8-2008)

In 1972, the U.S. Atomic Energy Commission identified a number of areas in the regulatory process for which nuclear standards were desired. An appeal was made to the Priorities Committee of the ANSI Nuclear Technical Advisory Board for support, and Subcommittee N43-3.2 was activated under the sponsorship of the National Bureau of Standards to develop this standard for gauging devices. Work on the standard was begun in 1973, and the draft proposal was completed in 1976. The standard was ultimately published in 1979 as ANSI N538-1979. It was also identified as NBS Handbook 129.

This standard establishes a system for classification for gauging devices that use sealed radioisotopes or machine-generated sources of radiation based on performance specifications relating to radiation safety. In addition to specific tests for use conditions and accident conditions (fire), guidelines for other safety features and considerations are presented. This standard does not apply to the measurement performance of gauging devices.

ANSI N538-1979 was submitted to ISO/TC 85 and was merged with a French national standard to produce ISO 7205-1986, Radionuclide gauges – Gauges designed for permanent installation.

Reaffirmed and Renumbered as ANSI N43.8

In 1985, ANSI N538 was reviewed by ANSI Subcommittees N43.2 and N43. In 1986 it was reaffirmed without change. It was subsequently renumbered and reissued as ANSI N43.8 and reaffirmed again in 1988.

Revised Standard ANSI/HPS N43.8-2001

Review of ANSI N43.8 was undertaken again in 1994. Subcommittee N43.2 identified the need for numerous changes to make it compatible with the new 10 CFR 20 and other changes in the field. After a number of review sessions with extensive comments, a final consensus was reached in February 1999. The original document was recreated in digital form. It was revised again to convert it to the new ANSI style and was submitted to N43 and HPS for review and voting. It was finally published in 2001.

Revised Standard ANSI/HPS N43.8-2008

Formation of the five-year review subcommittee for ANSI N43.8 was initiated on February 20, 2006. Five subcommittee reviews were held during 2006. One additional review was held during 2007. The scope was broadened to include devices with any machine-generated source of radiation, not just x-ray tubes and radionuclide sources. Section 3.2 is new and a number of definitions were added. References were updated, errors were corrected, text was clarified, and SI units were made dominant throughout. The document was submitted to N43 for ballot on April 1, 2007.

Classification of Industrial Ionizing Radiation Gauging Devices

1.0 Scope

This standard applies to radiation gauging devices, commonly called devices, that use sealed radioactive sources or machine-generated sources for the determination or control of thickness, density, level, interface location, particle size distribution, or qualitative or quantitative chemical composition. The standard establishes a system for classification of the gauging devices based on performance specifications relating to radiation safety. In addition to specific tests for use conditions and accident conditions (fire), guidelines for other safety features and considerations are presented. This standard does not apply to the measurement performance of gauging devices.

2.0 Definitions

accessible surface: any surface of the device that can readily be reached by any part of the human body without the use of tools or without the removal of any part of the device.

ALARA: acronym for “as low as reasonably achievable,” which means making every reasonable effort to maintain exposures to radiation as low as practical, consistent with the purpose for which the activity is undertaken, taking into account the state of technology and economic and social considerations.

dose rates

shallow dose equivalent rate (7 mg cm^{-2}): For x-ray, gamma, and charged-particle radiation, the radiation level in $\mu\text{Sv h}^{-1}$ (mrem h^{-1}) measured with a detector having a total window and absorber density thickness no greater than 7 mg cm^{-2} of tissue equivalent material. All neutron radiation levels in $\mu\text{Sv h}^{-1}$ (mrem h^{-1}) are also included.

eye dose equivalent rate (300 mg cm^{-2}): For x-ray, gamma, and charged-particle radiation, the radiation level in $\mu\text{Sv h}^{-1}$ (mrem h^{-1}) measured with a detector having a total window and absorber density thickness no greater than 300 mg cm^{-2} and no less than 270 mg cm^{-2} of tissue equivalent material. All

neutron radiation levels in $\mu\text{Sv h}^{-1}$ (mrem h^{-1}) are also included.

deep dose equivalent rate ($1,000 \text{ mg cm}^{-2}$): For x-ray, gamma, and charged-particle radiation, the radiation level in $\mu\text{Sv h}^{-1}$ (mrem h^{-1}) measured with a detector having a total window and absorber density thickness no greater than $1,000 \text{ mg cm}^{-2}$ and no less than 900 mg cm^{-2} of tissue equivalent material. All neutron radiation levels in $\mu\text{Sv h}^{-1}$ (mrem h^{-1}) are also included.

dummy source: facsimile of a radioactive source of exactly the same material and construction as a sealed source but containing, in place of the radioactive material, a substance resembling it as closely as practicable in terms of physical and chemical properties.

gauging device (device): a mechanism containing a source of ionizing radiation that is designed and manufactured for the purpose of determining or controlling thickness, density, level, interface location, or qualitative or quantitative chemical composition of materials. It may include components such as radiation shields, useful-beam controls, and other safety features in order to meet the requirements or specifications of this standard.

interlock: an electrical and/or mechanical safety feature designed to preclude access to an area of radiation hazard either by preventing entry or by automatically removing the hazard.

isodistance contour: the imaginary surface around a device at a specified distance from the nearest accessible surfaces. For practical reasons in this standard, the literal interpretation has been simplified as defined in Section 7.3.2 and Figures 1-1 and 2-1 through 2-6.

leakage radiation: all radiation coming from within the source housing, except the useful beam.

machine-generated source: a non-radioactive component that is used as a source of ionizing radiation (including x-ray tubes, particle accelerators, neutron generators, etc.). Note: Some machine-generated sources may contain a very small amount of radioactive material.

measuring gap (air gap): the distance between the source housing and the detector housing for