American National Standard

for Radioactive Materials –

Leakage Tests on Packages for Shipment

ANSI American National Standards Institute
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Revision of
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for Radioactive Materials –

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Secretariat

Institute for Nuclear Materials Management

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Foreword (This foreword is not part of American National Standard N14.5-1997.)

The accredited Standards Committee on Packaging and Transportation of Radioactive and Non-Nuclear Hazardous Materials, N14, under whose jurisdiction this standard was developed, has the following scope:

> Standards for the packaging and transportation of fissile and radioactive materials, non-nuclear hazardous materials including waste and mixed materials, but not including movement or handling during processing and manufacturing operations.

This revision supersedes *American National Standard for Leakage Tests on Packages for Shipment of Radioactive Materials*, ANSI N14.5-1987. The revised standard provides acceptable methods for demonstrating that Type B packages designed for transport of normal form radioactive material comply with the regulatory containment requirements specified in Title 10 of the Code of Federal Regulations, Part 71 (effective April 1, 1996). The *International Standard for Safe Transport of Radioactive Materials - Leakage Testing on Packages*, ISO 12807-1996, was considered during the revision of this standard.

To assist a user in meeting regulatory requirements, the standard describes methods for converting regulatory requirements to allowable leakage rates. Use of these rates will facilitate demonstrating that a Type B package complies with the regulatory requirements during the package design, fabrication, maintenance, periodic, and preshipment phases. The standard also provides guidance to account for the physical form of the escaping medium, its physical properties, and conditions under which the medium escapes. The medium may contain radioactive material in gaseous, liquid, or solid forms. Many leakage test procedures are available, but the appropriate procedure will depend on its sensitivity and its applicability to the specific package. The package designer or shipper must assess the concentration of radioactive materials that might escape from the package under shipping conditions so that a leakage test procedure with adequate sensitivity can be selected.

An important aspect of this standard is the use of the term *leaktight*. In this standard, leaktight is defined as that degree of package containment that in a practical sense precludes any radiologically significant release of radioactive materials.

Finally, this standard was completely reviewed and restructured during the 1997 revision. Guidance has been added (e.g., standard leak) and removed (e.g., single trip container systems) based on state-of-the-art knowledge and general applicability. The regulatory authority may accept or reject all parts of this standard and may require other leakage test provisions not addressed in this standard.

This standard contains three informative annexes, which are not considered part of this standard.

Suggestions for improvement of this standard will be welcome. They should be sent to the Institute of Nuclear Materials Management, 60 Revere Drive, Suite 500, Northbrook, IL 60062.

This standard was prepared and approved for submittal to ANSI by the Accredited Standards Committee on Packaging and Transportation of Radioactive Materials, N14. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the N14 Committee had the following members:

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Members of the subcommittee N14.5 on Leakage Tests on Packages for Shipment of Radioactive Materials who revised this standard are as follows:

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American National Standard
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Leakage Tests on Packages for Shipment

1 Scope and field of application

This standard specifies methods for demonstrating that Type B packages designed for transport of normal form radioactive material comply with the containment requirements of Title 10 of the Code of Federal Regulations Part 71 (10 CFR Part 71).

This standard describes:

1. Package release limits
2. Methods for relating package release limits to allowable and reference leakage rates
3. Minimum requirements for leakage rate test procedures.

This standard provides requirements for the following leakage rate tests:

1. Design
2. Fabrication
3. Maintenance
4. Periodic
5. Preshipment.

This standard also contains non-mandatory appendices on leakage rate test methods, determination of reference leakage rate, and determination of activity in the medium.

2 Definitions, symbols, and units

2.1 Definitions

Terms defined in the applicable documents in clause 3 have the same meaning in this standard. Additional terms have been defined particularly for the purpose of this standard and may not conform to those in other publications.

A_2: A quantity (activity) of radioactive material specified in 10 CFR Part 71 and used to calculate the allowable release rate.

Allowable leakage rate: The maximum permissible volume of fluid leaking from the containment system per unit of time (see *leakage rate*) for either normal conditions of transport, L_N, or hypothetical accident conditions, L_A.

Allowable release rate: The maximum permissible quantity of radioactive material escaping from the containment system per unit of time (see *release rate*) for either normal conditions of transport, R_N, or hypothetical accident conditions, R_A.

Calibrated leak: (see *Standard leak*)

Containment system: The assembly of components of a packaging intended to retain the radioactive material during transport.

Hypothetical accident conditions: The hypothetical accident test conditions for Type B packages specified in 10 CFR Part 71.

Leak: Any opening through a containment system boundary that permits the passage of fluid.

Leakage rate: The volume of fluid passing through a containment system boundary per unit of time.

Leaktight: A degree of package containment that in a practical sense precludes any significant release of radioactive materials. This degree of containment is achieved by demonstration of a leakage rate less than or equal to 1×10^{-7} ref•cm^3/s, of air at an upstream pressure of 1 atmosphere (atm) absolute (abs) and a downstream pressure of 0.01 atm abs or less.

NOTE - 1×10^{-7} ref•cm^3/s is equal to 4.09×10^{-12} gram-moles/s of dry air or helium and is equivalent to a helium leakage rate, under the same conditions, of approximately 2×10^{-7} cm^3/s.

Medium: Any fluid that could transport radioactive material through a leak.

Normal conditions of transport: The normal transport test conditions for Type B packages specified in 10 CFR Part 71.