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**NATIONAL STANDARD OF THE  
PEOPLE'S REPUBLIC OF CHINA**

**GB/T 13163.4-2014**

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**Radiation protection instrumentation -- Radon and radon decay product  
measuring instruments -- Part 4: Equipment for the production of reference  
atmospheres containing radon isotopes and their decay products (STAR)**

辐射防护仪器 氡及氡子体测量仪 第4部分：含氡同位素及其子体参考大气的产生  
设备（氡环境试验系统）

**(English Translation)**

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## Foreword

GB/T 13163 "Radiation protection instrumentation - Radon and radon measuring instrument" is divided into four parts.

--- Part 1. General principles;

- Part 2. Particular requirements for radon measuring instruments;
- Part 3. radon measuring instruments special requirements;
- Part 4. generating device containing radon isotopes and their daughters reference atmosphere (radon test system).

This section GB/T Part of 413,163.

This section drafted in accordance with GB/T 1.1-2009 given rules.

This section uses the translation method is equivalent to using IEC 61577-4:2009 "Radiation protection instrumentation - Radon and radon measuring instruments - Part 4. Includes Isotopes of radon and its daughters reference atmosphere generating device (radon test system). " Consistency correspondence with international standards in this part of the country cited the following documents.

- GB/T 2900.61-2008 Electrotechnical terminology physical and chemical (IEC 60050-111:1996, MOD);
- GB/T 18216 (all parts) 1000V AC and 1500V DC low voltage distribution systems Electrical Safety measures Facilities for testing, measuring or monitoring equipment [IEC 61557 (all parts)];
- GB/T 27025-2008 testing and calibration laboratories General requirements (ISO/IEC 17025:2005, IDT).

For ease of use, this section of IEC 61577-4:2009 made the following editorial changes.

- "2 Normative references" to delete the text does not appear in the IEC 61557;
- Table A.1 footnote number with a, b instead of \*, \*\*;
- According to the domestic habits, atmospheric pressure units to international standards "hPa" indicates changed to "kPa" expressed.

This part of the National Nuclear Instrument Standardization Technical Committee (SAC/TC30) and focal points.

This section drafted by. China Institute of Atomic Energy.

## Introduction

Radon is a radioactive gas, respectively, by the earth's crust natural radionuclides  $^{238}\text{U}$ ,  $^{235}\text{U}$  and  $^{232}\text{Th}$  daughter of  $^{226}\text{Ra}$ ,  $^{223}\text{Ra}$  and  $^{224}\text{Ra}$  decay produced. Isotopes of radon ( $^{222}\text{Rn}$ ,  $^{219}\text{Rn}$  and  $^{220}\text{Rn}$ ) by three decay chain decay, and finally terminates in the stable lead with Isotope.

**Note:** Under normal circumstances, due to the very short half-life of  $^{219}\text{Rn}$ , compared with the two other series of radon activity, its activity and decay daughters ( $\text{RnDP1}$ ) activity can be ignored, its

health effects are not important. Therefore, in this part of  $^{219}\text{Rn}$  and its decay daughters is not considered.

Radon decay of short-lived isotopes and their respective daughters (RnDP) (for example.  $^{222}\text{Rn}$  of  $^{218}\text{Po}$ ,  $^{214}\text{Pb}$ ,  $^{214}\text{Bi}$ ,  $^{214}\text{Po}$ ,  $^{220}\text{Rn}$  of  $^{216}\text{Po}$ ,  $^{212}\text{Pb}$ ,  $^{212}\text{Bi}$ ,  $^{212}\text{Po}$ ,  $^{208}\text{Tl}$ ) is very important, as they form public and occupational radiation exposure of staff to accept the natural home to section. In some workplaces. personnel (such as underground mines, mineral water and waterworks) work by a very significant level of radon Exposure. Radon is a gas and its isotopes and their daughter are fine particles of these different amounts of airborne radionuclides are present in the form. High accuracy Measurement of natural radioactivity in the atmosphere of this level for health physics is valuable. Since these radioactive elements in the air and in phase the measuring instrument should have unique behavioral characteristics, it is necessary to test methods for measuring instruments such norms.

For ease of application, GB/T 13163 series of standards are divided into the following different parts.

GB/T 13163.1. focus on specialized areas of measuring radon and radon (RnDP) The term with the unit, a brief introduction for radon RnDP test and measurement equipment and calibration of radon test system (STAR).

GB/T 13163.2. This section is dedicated to  $^{222}\text{Rn}$  and  $^{220}\text{Rn}$  meter test.

GB/T 13163.3. This section is dedicated to the  $^{222}\text{Rn}$  and  $^{220}\text{Rn}$  daughters (RnDP222 and RnDP220) meter test.

GB/T 13163.4. detailed description of the structure and application of the STAR test.

1) RnDP is the abbreviation of radon decay products, and radon daughters equally be used (see reference [1]).

Radiation protection instrumentation - Radon and radon measuring instrument Part 4. containing radon isotopes and their daughters Reference atmosphere generating device (radon test system)

## 1 Scope and objectives

GB/T 13163 contains radon and radon testing and calibration of measuring instruments general characteristics, but also provides the proof instrument qualified to perform Type test. GB/T 13163.2-2005 and GB/T 13163.3-2014 describes these types of tests. This section only relates to measure Instruments and related methods  $^{220}\text{Rn}$  and  $^{222}\text{Rn}$  and its short-lived daughter isotope amount of gas.

This section applies to test radon test system (STAR) radon and radon measuring instruments needed in reference radon gas. The following terms only it does not resolve the

establishment produces radon and its daughters reference gas environment with all issues related to the equipment, can not describe all the methods used, but Experiencing these problems can guide people to choose the best method can be employed in all relevant knowledge.

## 2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version suitable for use herein Member. For undated references, the latest edition (including any amendments) applies to this document.

GB/T 2900.81-2008 Electrotechnical terminology Nuclear Instruments Physical phenomena and basic concepts (IEC 60050-393:2003, IDT) GB/T 2900.82-2008 Electrotechnical terminology nuclear instrumentation equipment, systems, equipment and detectors (IEC 60050-394:2007, IDT) IEC 60050-111:1996 International Electrotechnical Vocabulary Chapter 111. Physics and Chemistry (Internationalelectrotechnicalvo-cabulary (IEV) -Part 111. Physicsandchemistry) ISO/IEC Guide 99:2007 International Metrology Vocabulary of Basic and General Concepts and Associated Terms (VIM)  
(Internationalvo-cabularyofmetrology-Basicandgeneralconceptsandassociatedterms (VIM)) ISO/IEC 17025 General requirements for testing and calibration laboratories  
(Generalrequirementsforthecompetenceof testingandcalibrationlaboratories) ICRP32 staff suction limit radon progeny (Limitsforinhalationofradondaughtersbyworkers) ICRP38 Radionuclide transformation. energy and emission intensity (Radionuclidetransformations, energyandinten-sityofemissions) ICRP65 at home and at work protection of <sup>222</sup>Rn (Protectionagainstradon-222athomeandatwork)

## 3 Terms, definitions and units

The following terms, definitions and units apply to this document.

The entire standard, the term radon and radon isotopes in this section represent all involved. Especially when a certain isotope, its chemical symbol in the upper left Angular acceleration mass number represents (such as <sup>220</sup>Rn, <sup>222</sup>Rn). Due to historical reasons, <sup>220</sup>Rn is also called thoron.

The term radon daughters (radondecayproduct, Acronym RnDP) refers to the total short-lived radon daughters in this section relates to the decay of. specific the daughter isotopes in the upper left corner by adding the chemical symbol of the quality of its numbers. In the lower right corner of the spiked symbol RnDP <sup>222</sup>,<sup>220</sup> refers to the corresponding figures all radon daughter isotopes (RnDP<sup>222</sup> means <sup>218</sup>Po, <sup>214</sup>Pb, <sup>214</sup>Bi, <sup>214</sup>Po, RnDP<sup>220</sup> refers <sup>216</sup>Po, <sup>212</sup>Pb, <sup>212</sup>Bi, <sup>212</sup>Po, <sup>208</sup>Tl).

All nuclear data used in this section are taken from ICRP38, the publication is mainly applied to radiation protection measuring instruments.