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Standard for indoor environmental pollution control of civil building engineering

民用建筑工程室内环境污染控制标准

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Standard for indoor environmental pollution control of civil building engineering

1 General provisions

1.0.1 This standard is formulated, in order to prevent and control indoor environmental pollution, which is caused by main materials and decoration materials, in civil construction projects; protect public health; safeguard public interests; achieve advanced technology and economical rationality.

1.0.2 This standard is applicable to the control of indoor environmental pollution, in newly constructed, expanded, reconstructed civil construction projects.

1.0.3 The indoor environmental pollutants, which are controlled by this standard, include radon, formaldehyde, ammonia, benzene, toluene, xylene. total volatile organic compounds.

1.0.4 The division of civil construction projects shall meet the following requirements:

1 The category I civil buildings shall include residences, residential functional apartments, hospital wards, elderly care housing facilities, kindergartens, school classrooms, student dormitories, etc.;

2 The category II civil buildings shall include office buildings, shops, hotels, cultural and entertainment venues, bookstores, libraries, exhibition halls, gymnasiums, public transportation waiting rooms, restaurants, etc.

1.0.5 The main building materials and decoration materials, which are selected for civil construction projects, shall comply with the relevant provisions of this standard.

1.0.6 The indoor environmental pollution control of civil buildings shall not only comply with the provisions of this standard, BUT also comply with the relevant current national standards.

2 Terms and symbols

2.1 Terms

2.1.1 Civil building engineering

The general term for newly built, expanded, reconstructed civil building structural engineering and decoration engineering.

2.1.2 Environmental test chamber

An equipment, which simulates the indoor environment, to test the release of chemical pollutants from decoration materials.

2.1.3 Radon exhalation rate from the surface

The radioactive activity of radon, which is released from soil or material surface per unit area and unit time.

2.1.4 Internal exposure index (I_{Ra})

The quotient, which is obtained -- by dividing the specific activity of the natural radionuclide radium-226 in the main building materials and decoration materials BY the specific activity limit value of 200.

2.1.5 External exposure Index (I_{γ})

The sum of the quotients, which are obtained by -- dividing the radioactive specific activities of natural radionuclides radium-226, thorium-232, potassium-40 in the main building materials and decoration materials BY the specific activity limit values of 370, 260, 4200, respectively.

2.1.6 Radon concentration

The radioactive activity of radon per unit volume of air.

2.1.7 Wood-based panels

The panels or formed products, which are produced by using wood or non-wood plant fibers as the main raw material; processing it into various material units; applying (or not applying) adhesives and other additives; gluing together. It mainly includes the products, such as plywood, fiberboard, particleboard, surface decorative panels.

2.1.8 Wood-plastic composite products

3.5 Water-based treatment agents

3.5.1 For indoor water-based flame retardants (including fire-retardant coatings), waterproofing agents, preservatives, enhancers and other water-based treatment agents, in civil construction projects, it shall measure the content of free formaldehyde; the limit shall not exceed 100 mg/kg.

3.5.2 The measurement method of free formaldehyde content in water-based treatment agent shall be carried out, according to the method specified in the current national standard "Determination of formaldehyde content of waterborne coatings -Spectrophotometric method with acetylacetone" GB/T 23993.

3.6 Others

3.6.1 For concrete admixtures, which are used in civil construction projects, the amount of ammonia released shall not be greater than 0.10%. The measurement method of ammonia release shall comply with the current national standard "Limit of ammonia emitted from the concrete admixtures" GB 18588.

3.6.2 For the amount of ammonia, which is released from flame retardants, fire retardant coatings, water-based architectural waterproof coatings, as used in civil construction projects, it shall not be greater than 0.50%. The measurement method shall conform to the current industry standard "Limit and test method of harmful substances in fire-retardant coating" JG/T 415.

3.6.3 In the concrete admixtures, which can release formaldehyde AND is used in civil construction projects, the amount of residual formaldehyde shall not be greater than 500 mg/kg. The measurement method shall comply with the current national standard "Limit of residual formaldehyde from the concrete admixtures" GB 31040.

3.6.4 For the bonded wood structure materials, which are used indoors in civil buildings, the free formaldehyde emission shall not be greater than 0.124 mg/m^3. The measurement method shall comply with the relevant provisions in Appendix B of this standard.

3.6.5 The free formaldehyde emission of indoor curtains and soft packs of civil buildings shall not be greater than 0.124 mg/m^3. The measurement method shall comply with the relevant provisions of Appendix B of this standard.

3.6.6 The content limit of free formaldehyde, in indoor wallpaper (cloth) of civil buildings, shall comply with the relevant provisions in Table 3.6.6. The

4 Survey and designing for building engineering

4.1 General requirements

4.1.1 For newly-built or expanded civil construction projects, before design, it shall survey the radon concentration in the soil OR the radon exhalation rate from the surface in the urban area, where the construction project is located; submit the corresponding survey report. If the radon concentration in the regional soil or the radon exhalation rate from the surface has not been measured, it shall measure the radon concentration in the construction site soil or the radon inhalation rate from the soil; submit a corresponding test report.

4.1.2 The interior decoration and decoration design of civil buildings shall have pollution control measures. It shall conduct pre-assessment of decoration and decoration design pollution control; control the load ratio of decoration and decoration materials AND the release of material pollutants; adopt advanced technologies such as prefabricated decoration products; the finished products and parts for decorative purposes should be processed in the factory AND installed on site.

4.1.3 The indoor ventilation design of civil buildings shall comply with the relevant provisions of the current national standard "Unified standard for design of civil building" GB 50352. For civil building projects, which use the central air conditioning, the fresh air volume shall comply with the current national standard "Design code for heating ventilation and air conditioning of civil buildings" GB 50736.

4.1.4 In areas with hot summer and cold winter, severe cold and cold areas, the minimum ventilation frequency of category I civil buildings, which use the natural ventilation, shall not be less than 0.5 times/h. If necessary, it shall take mechanical ventilation measures.

4.2 Radon concentration measurement and resistance on construction sites

4.2.1 For the engineering geological survey data of the newly-built and expanded civil construction projects, it shall include the historical measurement data of soil radon concentration or soil radon exhalation rate from the surface AND the average data of soil radon concentration or radon exhalation rate from soil the surface, in the urban area where the project is located.

4.2.2 For civil construction projects, for which regional measurement of radon concentration in soil or radon exhalation rate from the surface has been carried out, when the average value of soil radon concentration measurement results is not more than 10000 Bq/m^3 or the average value of measurement results of the radon exhalation rate from the surface, is not more than 0.02 Bq/(m^2·s), meanwhile where there is no geological fracture structure at the site of the project, the measurement of soil radon concentration may be exempted. In other cases, it shall measure the soil radon concentration of the project site OR the radon exhalation rate from the surface.

4.2.3 When the average radon concentration of the civil construction site is not more than 20000 Bq/m^3 OR the radon exhalation rate from the surface, is not more than 0.05 Bq/(m^2·s), the engineering measures for radon prevention may be exempted.

4.2.4 When the measurement result of radon concentration in the soil of civil construction projects is greater than 20000 Bq/m^3 and less than 30000 Bq/m^3, OR the radon exhalation rate from the surface is greater than 0.05 Bq/(m^2 • s) and less than 0.10 Bq/(m^2 • s), it shall take anti-cracking measures at the ground floor of the building.

4.2.5 When the soil radon concentration of the civil construction site is not less than 30000 Bq/m^3 and less than 50000 Bq/m^3, OR the radon exhalation rate from the surface is not less than 0.10 Bq/(m^2 • s) and less than 0.30 Bq/(m^2 • s), in addition to taking anti-cracking measures for the ground floor of the building, the foundation must also be treated, according to the grade-1 waterproofing requirements in the current national standard "Technical code for waterproofing of underground works" GB 50108.

4.2.6 When the average radon concentration in the civil construction site is not less than 50000 Bq/m^3 OR the average radon exhalation rate from the surface is not less than 0.30 Bq/(m^2·s), it shall take comprehensive radon prevention measures for buildings.

4.2.7 When the average radon concentration in the soil of the category I civil construction project site is not less than 50000 Bq/m^3, OR the radon exhalation rate from the surface is not less than 0.30 Bq/(m^2•s), it shall measure the specific activity of the radium-226, thorium-232, potassium-40 in the soil of the project site. When the soil's internal exposure index (I_{Ra}) is greater than 1.0 OR the external exposure index (I_γ) is greater than 1.3, the soil of the project site shall not be used as engineering backfill.

4.2.8 For the method for measuring the radon concentration in the soil of the civil construction site AND the method for measuring the radon exhalation rate from the soil surface, they shall comply with the provisions in Appendix C of this

the template room, shall comply with the relevant provisions of Chapter 6 of this standard. When the test results do not meet the requirements of this standard, it shall find out the reasons AND take improvement measures.

5.2 On-site examination on building materials

5.2.1 When the inorganic non-metallic main building materials and building decoration materials, which are used in civil construction projects, enter the site, the construction organization shall check the test report of radioactive index.

5.2.2 When the area of natural granite stone or porcelain tiles, which are used in the interior decoration of civil buildings, is larger than 200 m^2, the radioactive index of different products and different batches of materials shall be checked and re-examined separately.

5.2.3 When the wood-based panels and their products, which are used in the interior decoration of civil buildings, enter the site, the construction organization shall check the test report on the release of free formaldehyde.

5.2.4 When the area of the wood-based panels, which are used in the interior decoration of civil buildings, is larger than 500 m^2, the free formaldehyde emission of different products and different batches of materials shall be checked and re-examined separately.

5.2.5 When the water-based coatings and water-based treatment agents, which are used in the interior decoration of civil buildings, enter the site, the construction organization shall check the free formaldehyde content's test report of the same batch of products. When the solvent-based coatings enter the site, the construction organization shall check the test report of VOC, benzene, toluene + xylene, ethylbenzene content of the same batch of products, among which the polyurethane type shall have a test report for free diisocyanate (TDI + HDI) content.

5.2.6 When the water-based adhesives, which are used in the interior decoration of civil buildings, enter the site, the construction organization shall check the test report for the free formaldehyde content and VOC of the same batch of products. When the solvent-based and bulk construction adhesives enter the site, the construction organization shall check the test report for the benzene, toluene + xylene, VOC content of the same batch of products, among which polyurethanes shall have a test report for free toluene diisocyanate (TDI) content.

5.2.7 The wallpaper (cloth), which is used in the interior decoration of civil

buildings, shall have the test report of free formaldehyde content of the same batch of products; meanwhile it shall meet the design requirements and the provisions of this standard.

5.2.8 When the detection items of main building materials and decoration materials are incomplete OR there is doubt about the test results, the materials shall be tested AND can be used only after passing the test.

5.2.9 For the interior decoration of civil buildings, such as kindergartens, school classrooms, student dormitories, etc., it shall spot-check and re-inspect the amount of formaldehyde released from different products and batches of wood-based panels and their products, as well as the amount of volatile organic compounds released from coatings and synthetic rubber and plastic materials; they shall comply with the provisions of this standard.

5.3 Requirements for construction

5.3.1 For civil construction projects, which adopt anti-radon design measures, the construction technology of special parts, such as deformation joints, construction joints, wall-penetrating pipes (boxes), embedded parts, reserved holes, etc. of the underground engineering, shall comply with the relevant provisions of the current national standard "Technical code for waterproofing of underground works" GB 50108.

5.3.2 When using off-site soil as backfill soil for category I civil construction projects, the backfill soil shall be tested for the specific activity of radium-226, thorium-232, potassium-40; meanwhile the internal exposure index (I_{Ra}) of the fill soil shall be greater than 1.0; the external exposure index (I_{γ}) shall not be greater than 1.3.

5.3.3 In the interior decoration of civil buildings, it is strictly prohibited to use benzene, industrial benzene, petroleum benzene, heavy benzene, mixed benzene and other benzene-containing diluents and solvents.

5.3.4 During the construction of interior decoration of civil buildings, the construction site shall reduce the operation of solvent-based coatings; reduce the wet operation, dust operation, high-noise operation and other polluting construction, on the construction site; it shall not use benzene, toluene, xylene and gasoline for oil removal and removal of old coating.

5.3.5 After use, the coatings, adhesives, water-based treatment agents, thinners, solvents shall be closed and stored in time; the waste shall be removed in time.

5.3.6 It is strictly forbidden to use organic solvents to clean construction

6.0.17 During the acceptance of civil construction projects, the on-site detection point of indoor environmental pollutant concentration shall be 0.8 m ~ 1.5 m above the ground of the room; it shall not be less than 0.5 m from the wall of the room. Detection points shall be evenly distributed; they shall avoid ventilation channels and vents.

6.0.18 When the concentration of formaldehyde, ammonia, benzene, toluene, xylene, TVOC in the indoor environment of civil buildings is detected, the fixed furniture, which is completed in the decoration project, shall be kept in normal use state. For the civil construction projects which adopt centralized ventilation, it shall be carried out under the condition of normal operation of the ventilation system; for civil construction projects which use natural ventilation, the detection shall be carried out 1 hour after the external doors and windows are closed.

6.0.19 When detecting the radon concentration in the indoor environment of civil buildings, for the civil building projects that use centralized ventilation, it shall be carried out under the condition that the ventilation system is in normal operation. For the civil building projects that use natural ventilation, it shall be carried out, 24 hours after the external doors and windows of the room are closed. When a category I building has no overhead floor or underground garage structure, the sampling ratio of rooms on the first and second floors should not be lower than 40% of the total number of sampling rooms.

6.0.20 When the indoor radon concentration of category I civil buildings, in high radon areas and high thoron areas, which have soil radon concentration greater than 30000 Bq/m^3, exceeds the standard, THEN, it shall carry out the investigation and assessment on the radon-220 pollution, in the rooms on the first floor of the building; meanwhile it shall take measures, according to the situation.

6.0.21 When the detection results of the indoor environmental pollutant concentrations, in all rooms of the random inspection, meet the requirements in Table 6.0.4 of this standard, the indoor environmental quality of the project shall be judged to be qualified.

6.0.22 When the detection results of the indoor environmental pollutant concentration do not meet the requirements in Table 6.0.4 of this standard, THEN, for the non-conforming items, it shall double the sampling quantity for detection, which shall include the original unqualified rooms of the same type and the original unqualified rooms. When the re-detection results meet the requirements in Table 6.0.4 of this standard, the indoor environmental quality of the project shall be judged to be qualified. If the result of the double sampling test again fails to meet the requirements of this standard, it shall find the reason and take measures to handle it, until the detection is qualified.

Appendix A

Measurement of radon exhalation rate

A.1 The radon exhalation rate on the surface of building materials which is directly measured by instrument

A.1.1 The measuring instrument, for radon exhalation rate on the surface of building materials, shall include two parts: sampling and measurement. The working principle shall be divided into passive collection type and active suction collection type. The measuring device shall meet the following requirements

1 The lower detection limit of continuous 10h measurement shall not be greater than 0.001 Bq/(m^2·s);

2 Uncertainty shall not be greater than 20% (k = 2);

3 The instrument calibration shall be qualified and within the validity period.

A.1.2 The steps for measuring the radon exhalation rate, on the surface of the passive collection measuring instrument, shall be carried out according to the following steps:

1 It shall clean the surface of the material to be tested; flatly buckle the gas collection container on the flat surface, so that the end face of the collector is sealed with the surface of the material to be tested. The ratio -- of the measured surface area (m^2) TO the net space volume of the gas collector of the measuring instrument (m^3) -- shall be about 2:1.

2 The measurement time shall be greater than 1 h; the measurement time shall be determined, according to the radon exhalation rate;

3 The measured value of the radon exhalation rate from the surface of the instrument shall be multiplied by the scale factor of the instrument, to obtain the measured value of the radon exhalation rate from the surface of the material.

4 The measurement temperature shall be within the range of 25 °C ± 5 °C; the relative humidity shall be within the range of 45% ± 15%.

A.1.3 The steps of measuring the radon exhalation rate from the surface of building materials, by the active suction collection type, shall be carried out according to the following steps:

1 Preparation of the tested block: The ratio -- of the surface area of the sample to be tested (m^2) TO the volume of the net space (m^3) in the suction

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