
Kakovost vode - Merjenje skupne beta aktivnosti v neslanih vodah - Metoda robustnega vira

Water quality - Measurement of gross beta activity in non-saline water - Thick source method

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Qualité de l'eau - Mesurage de l'activité bêta globale des eaux non salines - Méthode par source concentrée

[SIST ISO 9697:2010](https://standards.iteh.ai/catalog/standards/sist/4dfb35db-7f24-43b2-9aa4-d17555097d06/sist-iso-9697-2010)

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ICS:

13.060.60	Preiskava fizikalnih lastnosti vode	Examination of physical properties of water
17.240	Merjenje sevanja	Radiation measurements

SIST ISO 9697:2010**en,fr**

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9697**

Second edition
2008-11-01

Water quality — Measurement of gross beta activity in non-saline water — Thick source method

*Qualité de l'eau — Mesurage de l'activité bêta globale des eaux non
salines — Méthode par source concentrée*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 9697 was prepared by Technical Committee ISO/TC 147, *Water quality*.

This second edition cancels and replaces the first edition (ISO 9697:1992), which has been technically revised.

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Water quality — Measurement of gross beta activity in non-saline water — Thick source method

WARNING — Persons using this International Standard should be familiar with normal laboratory practice. This International Standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user to establish appropriate safety and health practices and to ensure compliance with any national regulatory conditions.

IMPORTANT — It is absolutely essential that tests conducted according to this International Standard be carried out by suitably trained staff.

1 Scope

This International Standard specifies a method for the determination of gross beta activity in non-saline waters. The method covers non-volatile radionuclides with maximum beta energies $> 0,3$ MeV. Measurement of very low energy beta emitters, such as ^3H , ^{14}C , ^{35}S and ^{241}Pu , is not included in this International Standard.

The method is applicable to the analysis of raw and potable waters.

2 Normative references

[SIST ISO 9697:2010](https://standards.iteh.ai/catalog/standards/sist/4dfb35db-7f24-43b2-9aa4-d17583097100/sist-iso-9697-2010)

The following referenced documents are indispensable for the application of this documents. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 5667-1, *Water quality — Sampling — Part 1: Guidance on the design of sampling programmes and sampling techniques*

ISO 5667-3, *Water quality — Sampling — Part 3: Guidance on the preservation and handling of water samples*

ISO 5667-14, *Water quality — Sampling — Part 14: Guidance on quality assurance of environmental water sampling and handling*

ISO 9696, *Water quality — Measurement of gross alpha activity in non-saline water — Thick source method*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

ISO 80000-10, *Quantities and units — Part 10: Atomic and nuclear physics* ¹⁾

¹⁾ To be published. (Revision of ISO 31-9:1992)

3 Symbols, definitions, and units

For the purposes of this document, the symbols, definitions, and units given in ISO 80000-10, and the following, apply.

A	beta activity, in becquerels, of the calibration source
c_A	beta activity concentration, in becquerels per litre
c_A^*	decision threshold, in becquerels per litre
$c_A^\#$	detection limit, in becquerels per litre
$c_A^<, c_A^>$	lower and upper limits of the confidence interval, in becquerels per litre
m	mass, in milligrams, of ignited residue from volume, V
m_r	mass, in milligrams, of the residue deposited on the planchet sample
r_0	background count rate, in reciprocal seconds
$r_{0\alpha}$	background count rate, in reciprocal seconds, from the alpha window
r_g	sample gross count rate, in reciprocal seconds
$r_{g\alpha}$	gross count rate, in reciprocal seconds, from the alpha calibration source
r_s	calibration count rate, in reciprocal seconds
$r_{s\alpha}$	calibration count rate, in reciprocal seconds, from the alpha calibration source
S	area, in square millimetres, of the planchet
t_0	background counting time, in seconds
t_g	sample counting time, in seconds
$u(c_A)$	standard uncertainty, in becquerels per litre, associated with the measurement result
U	expanded uncertainty, in becquerels per litre, calculated from $U = ku(c_A)$, with $k = 1, 2 \dots$
V	volume, in litres, of test sample equivalent to the mass of solid on the planchet
V_t	volume, in litres, of the water sample
ε	counting efficiency for the specified radioactive standard
χ	alpha-beta cross-talk, percentage of alpha count going into the beta window from the alpha calibration source

4 Principle

Gross beta activity determination is not an absolute determination of the radioactivity of all beta-emitting radionuclides in a sample, but a relative determination referred to a specific beta emitter that constitutes the standard calibration source. This type of determination is also known as beta index.

The sample, taken, handled and preserved as specified in ISO 5667-1 and ISO 5667-3, is evaporated almost to dryness, converted to the sulfate form and then ignited at 350 °C. A portion of the residue is transferred to a planchet and the beta activity measured by counting in an appropriate counting assembly calibrated against a suitable beta calibration standard, such as potassium-40 (^{40}K) or strontium-90-yttrium-90 ($^{90}\text{Sr} + ^{90}\text{Y}$).

If simultaneous gross alpha and beta measurements are required on the same water sample, the procedure specified in this International Standard is common to that of ISO 9696, and sample sources can be measured up to 10 mg/cm².

5 Reagents and equipment

5.1 Reagents

Except for the certified reference solution, all reagents shall be of recognised analytical grade and shall not contain any detectable beta activity.

NOTE A method for preparing reagent blanks to check for the absence of any endemic radioactivity or contamination is given in Clause 7.

5.1.1 Water, complying with ISO 3696:1987, grade 3.

5.1.2 Certified reference solution. A calibration laboratory establishes traceability of its own measurement standards and measuring instruments to the International System of Units (SI) by means of an unbroken chain of calibrations or comparisons linking them to relevant primary standards of the SI units of measurement. The link to SI units may be achieved by reference to national measurement standards. National measurement standards may be primary standards, which are primary realisations of the SI units or agreed representations of SI units based on fundamental physical constants, or they may be secondary standards which are standards calibrated by another national metrology institute. When using external calibration services, traceability of measurement shall be assured by the use of calibration services from laboratories that can demonstrate competence, measurement capability and traceability. The calibration certificates issued by these laboratories shall contain the measurement results, including the measurement uncertainty and/or a statement of compliance with an identified metrological specification.

The choice of beta standards will depend on the knowledge of the type of radioactive contaminant likely to be present in the waters being tested. Among standard solutions of beta-emitting radionuclides, ^{90}Sr and ^{40}K are commonly used.

NOTE The beta activity of ^{40}K in natural potassium is 27,4 Bq/g and hence in potassium chloride, it is 14,4/1 000 Bq/mg.

5.1.3 Nitric acid, $c(\text{HNO}_3) = 8 \text{ mol/l}$.

5.1.4 Sulfuric acid, $c(\text{H}_2\text{SO}_4) = 18 \text{ mol/l}$, $\rho = 1,84 \text{ g/ml}$, mass fraction $w(\text{H}_2\text{SO}_4) = 95 \%$.

5.1.5 Volatile organic solvents: methanol and acetone.

5.1.6 Calcium sulfate, CaSO_4 .

CAUTION — As calcium salts may contain trace amounts of ^{226}Ra and/or ^{210}Pb , checks for the presence of these nuclides shall be made.

5.2 Equipment

Usual laboratory equipment and, in particular, the following.

5.2.1 Beta counter, preferably of the gas-flow proportional type, incorporating a plastic scintillation detector or a silicon-charged particle detector [passivated implanted planar silicon (PIPS)].

When using a gas-flow proportional counter, it is advisable to choose the beta window to have the beta-alpha cross-talk close to zero and take into account the alpha-beta cross-talk. If equipment other than gas-flow proportional counters is used, then cross-talk may be ignored.

If a windowless gas-flow proportional counter is used, carry out regular checks for possible contamination of the counting system by counting blank samples.

NOTE The particulate nature of the source to be counted can give rise to contamination if operated in a vacuum (as in the case of a PIPS) or gas-flow systems (as used in a proportional counter).