Australian Standard®

Waters

Part 5: Determination of gross alpha and gross beta activities

This Australian Standard was prepared by Committee CH/22, Methods for Examination of Waters. It was approved on behalf of the Council of Standards Australia on 16 June 1989 and published on 19 January 1990.

The following interests are represented on Committee CH/22:

Australian Construction Services

Australian Government Analytical Laboratories

Australian Mining Industry Council

Confederation of Australian Industry

Department of Conservation, Forests and Lands

Department of Health, N.S.W.

Department of Local Government, Qld

Department of Water Resources, N.S.W.

Engineering and Water Supply Department, S.A.

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National Association of Testing Authorities, Australia

National Health and Medical Research Council

Rural Water Commission, Vic.

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PREFACE

This Standard was prepared by the Standards Australia Committee on Methods for Examination of Waters, under the direction of the Chemical Standards Board, to supersede AS 2531—1982, *Waters—Determination of gross alpha and gross beta activities*. This edition includes mainly editorial changes and the allocation of a new number to move it into the AS 3550 series of Standards.

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FOREWORD

The radioactivity in waters may be due to many different radionuclides, either naturally occurring or man-made. Gross measurements of activities provide a means of screening samples to determine whether or not tests for individual radionuclides are necessary.

STANDARDS AUSTRALIA

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Waters

Part 5: Determination of gross alpha and gross beta activities

1 SCOPE. This Standard sets out an empirical screening method for measuring gross alpha and gross beta radiation in waters. The method is applicable to such natural waters as fresh and brackish, and also to some wastewaters. The method is not recommended for highly saline waters such as sea waters.

2 REFERENCED DOCUMENT. The following document is referred to in this Standard:

AS
2031 Selection of containers and preservation of water samples for chemical and microbiological analysis
2031.1 Part 1: Chemical

3 PRINCIPLE. A sample of water is evaporated and the residue is transferred to a planchet for counting gross alpha and gross beta activities. For water containing non-filtrable matter, the sample is filtered and the non-filtrable residue is dried, ignited and counted.

NOTES:

1. The contribution of alpha emitters could be affected by the loss of radon and other volatile alpha emitters such as polonium-210.
2. The measurement efficiency for beta emitters varies considerably, and depends on the energy of the beta particle and the type of counter.
3. The small contribution from gamma activity is allowed for by calibrating the counter against a source such as potassium-40.

4 REAGENTS AND MATERIALS.

4.1 General requirements. Unless otherwise specified, use analytical grade reagents and distilled water or water of equivalent purity.

4.2 Reagents.

4.2.1 *Ethanol* (950 mL/L).

4.2.2 *Binder solution.* Dissolve 50 mg of polymethylmethacrylate (acrylic sheet) in 100 mL of acetone.

4.2.3 *Acetone-ether* (1:1 *V/V* solution).

WARNING: BOTH ACETONE AND ETHER ARE EXTREMELY VOLATILE, FLAMMABLE SOLVENTS. APPROPRIATE SAFETY PRECAUTIONS SHOULD BE TAKEN WHEN USING THESE SOLVENTS.

4.2.4 *Nitric acid* (ρ_{20} 1.42 g/mL).

4.3 Standard certified radioactive source materials for calibration of counting instruments.

4.3.1 *Uranium oxide.* U_3O_8 (large particle size powder) is suitable for calibration of internal proportional counters. For use as a beta standard source it should be covered with thick (approximately 30 mg/cm^2) aluminium foil and, for use as an alpha source, it should be left uncovered.

4.3.2 *Caesium-137*—is suitable for internal proportional counters and end-window beta counters.

4.3.3 *Potassium-40 or strontium-90.* Potassium salts (because of the potassium-40 content) and strontium-90/yttrium-90 are suitable for end-window beta counters.

5 APPARATUS.

5.1 Counting planchets. Counting planchets should be of corrosion-resistant metal, about 50 mm in diameter, 6 mm to 10 mm in height, and thick enough to be serviceable for use once only.

NOTE: Stainless steel or aluminium planchets are satisfactory.

5.2 Filters. Membrane filters* of pore size 0.45 ± 0.05 μm shall be used.

5.3 Counter. A variety of counting instruments may be used to measure alpha and beta radiation. Instruments vary in counting efficiency, cost and background count rate, and in the care required in preparing the sample. The final choice of counting instrument should be made after all factors have been considered.

NOTES:

1. An internal proportional counter can be used to measure both alpha and beta radiation as can Geiger-Mueller tubes having a Mylar window less than 250 μg/cm^2 in area. The former has a higher counting efficiency.
2. A discussion on preferred counting instruments and calibration standards and problems encountered with radiation losses by self-absorption is presented in '*Standard Methods for the Examination of Water and Wastewater*, APHA.AWWA.WPFC, 16th Edition, 1985, Part 703, *Gross Alpha and Gross Beta Radioactivity.*

5.4 Drying oven. A drying oven capable of operating between 103°C and 105°C.

6 SAMPLING AND SAMPLES. Glass or polyethylene bottles, cleaned in accordance with AS 2031.1, shall be used for the collection of samples. A large enough sample shall be taken to ensure that the disintegration rate will be statistically significant and not primarily the result of counting error (see Clause 9). Changes in the distribution of activity between water, solid particles and container surface, and the physical decay of short-lived radionuclides shall be considered if there is to be any delay in processing the samples after collection. Preservatives such as acids should not be used if filtrable and non-filtrable solids are to be examined. Where there is little or no non-filtrable matter, the sample shall be acidified in accordance with AS 2031.1.

* Millipore type RA filters have been found to be suitable.