



Standard Test Method for Gaseous Tritium Content of the Atmosphere¹

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^{ε1} NOTE—Editorial corrections were made to Sections 1 and 9 and Section 16 was added in August 1995.

1. Scope

1.1 This test method covers the measurement of total tritium activity in the atmosphere in concentrations greater than 74 mBq/m³ (2 pCi/m³). This test method covers sample collection, preparation, and radiometric assay of the sample.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

D 1071 Test Methods for Volumetric Measurement of Gaseous Fuel Samples²

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres³

D 1357 Practice for Planning the Sampling of the Ambient Atmosphere³

D 2476 Test Method for Tritium in Water⁴

D 3195 Practice for Rotameter Calibration³

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, see Terminology D 1356.

4. Summary of Test Method

4.1 Air is pumped at a sampling rate of 100 to 500 mL/min through a tube furnace packed with palladium catalyst at a temperature of 500°C or a copper oxide catalyst at a temperature of 600° to 650°C for approximately 1 week. Gaseous tritium present in the airstream is oxidized to form tritiated

water vapor which is then adsorbed on silica gel with the ambient water vapor. The water is distilled from the silica gel and the tritium activity is measured by liquid scintillation counting. The volume of air sampled and the total volume of water vapor collected during the sampling period is determined and the tritium activity of the atmosphere is calculated.

4.2 Both the palladium and copper oxide catalysts have been found satisfactory for sampling where monitoring tritium in the form of water, hydrogen gas, and heavy hydrocarbon compounds; however, the copper oxide catalyst has low efficiency for oxidizing tritium in forms such as methane.

5. Significance and Use

5.1 This test method is useful for sampling the atmosphere for tritium activity, in the form of tritiated hydrogen gas (HT or T₂), water, methane, and other gaseous hydrocarbons, and gases that can be oxidized to form water.

5.2 Tritiated particulate matter will not be collected and analyzed.

6. Interference

6.1 Volatile radioactive particulates and radioiodine can interfere and when they are expected they can be prefiltered by a charcoal cartridge or zeolite. Radioiodine and radioactive particulate matter can be filtered from the air prior to passing through the tube furnace.

7. Apparatus

7.1 *Liquid Scintillation Counter*. (See Test Method D 2476.)

7.2 *Tube Furnace* (100 mm heating length; range 750°C).

7.3 *Low-Volume Leakless Continuous Vacuum Pump*, capacity of 750 mL/min, with flow controller such as a limiting orifice.

7.4 Tubes, glass or metal, 30 to 50 mm in diameter and 250 to 350 mm long.

7.5 *Temperature-Resisting Tubing*, to hold catalyst inside tube furnace.

7.6 *Distillation Flask*, 1-L, with standard-taper connectors.

7.7 *Condenser*, with connectors to distillation flask, all “standard-taper” joints.

7.8 *Condensate Receiving Vessel*, with standard-taper joint.

7.9 *Rubber Stoppers*.

¹ This test method is under the jurisdiction of ASTM Committee D-22 on Sampling and Analysis of Atmospheres, and is the direct responsibility of Subcommittee D22.03 on Ambient Atmospheres and Source Emissions.

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² *Annual Book of ASTM Standards*, Vol 05.05.

³ *Annual Book of ASTM Standards*, Vol 11.03.

⁴ *Annual Book of ASTM Standards*, Vol 11.02.