



Standard Test Method for Collection and Analysis of Hexavalent Chromium in Ambient Atmospheres¹

This standard is issued under the fixed designation D 5281; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the collection and measurement of hexavalent chromium [Cr(VI)] in the ambient atmosphere.

1.2 This test method collects and stabilizes atmospheric hexavalent chromium using an alkaline impinger buffer solution in a wet impingement sampling technique. Lead chromate [PbCrO₄], generally considered poorly soluble in water, is soluble in the impinger solution up to 940 µg/L as hexavalent chromium.

1.3 This test method measures hexavalent chromium using an ion chromatographic separation combined with a post separation reaction with a colorimetric reagent and photometric detection.

1.4 This test method is applicable in the range from 0.2 to 100 ng/m³ of hexavalent chromium in the atmosphere assuming 20 m³ of air sample. The range can be extended upwards by appropriate dilution.

1.5 The values stated in SI units are to be regarded as the standard. The inch-pound units given in parentheses are for information only.

1.6 *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 1193 Specification for Reagent Water²

D 1356 Terminology Relating to Sampling and Analysis of Atmospheres³

D 1357 Practice for Planning the Sampling of the Ambient Atmosphere³

D 2914 Test Methods for Sulfur Dioxide Content of the Atmosphere (West-Gaeke Method)³

¹ This test method is under the jurisdiction of ASTM Committee D22 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 11.01.

³ Annual Book of ASTM Standards, Vol 11.03.

D 3195 Practice for Rotameter Calibration³

D 3586 Test Method for Chromium in Workplace Atmospheres (Colorimetric Method)⁴

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms used in this test method, refer to Terminology D 1356.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *eluent*—the ionic mobile phase used to transport the sample through the ion exchange column.

3.2.2 *resolution*—the ability of a column to separate constituents under specified test conditions.

4. Summary of Test Method

4.1 Sample Collection:

4.1.1 Air is drawn at a rate of 15 L/min over a continuous 24-h period through three 500-mL glass impingers (in-line) filled with 0.02 N sodium bicarbonate [NaHCO₃] “buffer” solution. A target air volume of 20 m³ is sampled.

4.1.2 Impinger buffer solution has a pH of 8.2 and was selected to prevent hexavalent chromium from being reduced to trivalent chromium [Cr(III)] in an acidic medium during sampling (4).

4.1.3 The impinger buffer solution from each impinger is analyzed for hexavalent chromium.

4.2 Sample Analysis (1, 2, 3, 4)⁵:

4.2.1 A volume of filtered sample, typically 1 mL, is injected into the eluent flow path and separated by anion exchange using an ammonium sulfate [(NH₄)₂SO₄] based eluent.

4.2.2 After separation, the sample is reacted with an acidic solution of diphenylcarbohydrazide. Hexavalent chromium reacts selectively with this reagent to form the characteristic violet colored complex.

4.2.3 The eluent stream passes through a photometric detector for detection of the chromium diphenylcarbohydrazide complex by visible absorbance at 520 nm. Absorbance is proportional to the hexavalent chromium concentration.

⁴ Discontinued; See 1991 Annual Book of ASTM Standards, Vol 11.03.

⁵ The boldface numbers in parentheses refer to a list of references at the end of the text.