



Standard Guide for Determination of Various Elements by Direct Current Plasma Atomic Emission Spectrometry¹

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1. Scope

1.1 This guide covers procedures for using a Direct Current Plasma atomic emission spectrometer (DCP-AES) to determine the concentration of elements in solution. Recommendations are provided for preparing and calibrating the instrument, assessing instrument performance, diagnosing and correcting for interferences, measuring test solutions, and calculating results. A method to correct for instrument drift is included.

1.2 This guide does not specify all the operating conditions for a DCP-AES because of the differences between models of these instruments. Analysts should follow instructions provided by the manufacturer of the particular instrument.

1.3 This guide does not attempt to specify in detail all of the hardware components and computer software of the instrument. It is assumed that the instrument, whether commercially available, modified, or custom built, will be capable of performing the analyses for which it is intended, and that the analyst has verified this before performing the analysis.

1.4 *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.* Specific precautionary statements are given in Section 7.

2. Referenced Documents

2.1 ASTM Standards:²

E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

E50 Practices for Apparatus, Reagents, and Safety Considerations for Chemical Analysis of Metals, Ores, and Related Materials

¹ This guide is under the jurisdiction of ASTM Committee E01 on Analytical Chemistry for Metals, Ores, and Related Materials and is the direct responsibility of Subcommittee E01.20 on Fundamental Practices.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

E882 Guide for Accountability and Quality Control in the Chemical Analysis Laboratory

E1601 Practice for Conducting an Interlaboratory Study to Evaluate the Performance of an Analytical Method

3. Terminology

3.1 *Definitions:* For definitions of terms used in this guide, refer to Terminology **E135**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *background equivalent concentration (BEC), n —in DCP-AES, the analyte concentration whose signal is equivalent to the signal generated by the plasma and matrix at the analyte line when the actual analyte concentration is zero.*

3.2.2 *detection limit (DL), n —in addition to the DL defined in Terminology **E135**, the following detection limits are described and used in this guide:*

3.2.2.1 *instrumental detection limit (IDL), n —in DCP-AES, the analyte concentration corresponding to three times the standard deviation of the background noise beneath the analyte line on a set of nine consecutive 10-s measurements of the background intensity of the blank.*

3.2.2.2 *method detection limit (MDL), n —in DCP-AES, the detection limit measured on the matrix blank.*

3.2.3 *equivalent analyte concentration, n —the apparent concentration of an interfering element on an analyte.*

3.2.4 *linear dynamic range, n —the concentration range from the limit of quantification to the highest concentration that remains within $\pm 10\%$ of linearity based on lower concentrations.*

3.2.5 *limit of quantification (LOQ), n —the lowest concentration at which the instrument can measure reliably with a defined error and confidence level.*

3.2.6 *sensitivity, n —the slope of the analytical curve, which is the ratio of the change in emission intensity to the change in concentration.*

4. Summary of Guide

4.1 Direct Current Plasma atomic emission spectrometers, either simultaneous or sequential, measure the concentration of