



Standard Practice for Verification and Use of Control Charts in Spectrochemical Analysis¹

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1. Scope

1.1 This practice covers procedures for determining if a spectrochemical analysis is under statistical control.

1.2 Criteria are presented for determining when corrective action is required.

1.3 Control will be effected by using verifiers to test instrument response. It is recommended, although not required, that this be accompanied by the plotting of control charts.

1.4 The preparation of control charts is described.

1.5 *Limitations*—The procedures that are described do not apply to analyses that require a calibration each time a set of analyses is run. Reference is made specifically to optical emission spectroscopy, but the practice has a more general application.

1.6 This practice does not apply to validation procedures that monitor the correctness of calibration.

2. Referenced Documents

2.1 ASTM Standards:

E 135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials²

E 158 Practice for Fundamental Calculations to Convert Intensities into Concentrations in Optical Emission Spectrochemical Analysis²

E 305 Practice for Establishing and Controlling Spectrochemical Analytical Curves²

E 456 Terminology Relating to Quality and Statistics³

E 876 Practice for Use of Statistics in the Evaluation of Spectrometric Data²

2.2 Other ASTM Documents:

MNL 7 Manual on Presentation of Data and Control Chart Analysis⁴

3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminologies E 135 and E 456 and Practice

E 876. Refer also to the glossary of terms and symbols appearing in MNL 7.⁴

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *control limits*—in control charts, the upper and lower limits of a statistic that are not expected to be exceeded, designated as UCL and LCL respectively in this practice. For the statistic that is the average of more than one reading or determination, the upper and lower limits will be equidistant from a central line (CL) representing the expected average. For the statistic of either standard deviation or range, the upper limit will be farther from the central line if the lower limit is zero.

3.2.2 *normalization*—a procedure for correcting readings to a common basis. A special case of normalization is standardization in which readings are made to conform to an existing calibration. Normalization permits gathering data in different periods of time and correcting for drift in a way that may be independent of standardization routines.

3.2.3 *variation*—difference in an observed value from a norm.

3.2.3.1 *assignable cause*—variation which can be identified and corrected. It may be the result of a condition of an instrument or a method of operation. For example, signal intensities may be affected because a spectrometer is not profiled properly.

3.2.3.2 *chance or common cause*—random variation which consistently affects a system, contributing to the imprecision in a predictable way. In the application of control charts, the assumption is made that chance causes of variation are normally distributed.

4. Significance and Use

4.1 Consistency in analysis depends on being aware of a significant change in instrumental response, such as that caused by drift or changes in analytical precision, or both, and taking corrective action. The usual corrective action for drift is standardization. Standardization, however, when there is no real need, can only broaden the spread of subsequent analyses. One purpose of this practice is to set guidelines that will avoid “overstandardization.”

4.2 To control manufacturing processes, there must be confidence that a consistent material is being produced and that the analysis of the material is reliable. For assurance that the material meets specification, a purchaser may require the

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² *Annual Book of ASTM Standards*, Vol 03.05.

³ *Annual Book of ASTM Standards*, Vol 14.02.

⁴ *ASTM Manual Series*, ASTM, 6th edition, 1990.