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Standard Practice for Basic Statistics in Committee D19 on Water[1]

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1. Scope

1.1 This practice establishes a uniform standard for calculating, expressing, and symbolizing some basic statistical parameters.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1129 Terminology Relating to Water

E456 Terminology Relating to Quality and Statistics

3. Terminology

3.1 *Definitions:*

3.1.1 *population*—the set of data that consists of all possible observations or values of a certain phenomenon.

3.1.2 *sample*—a set of data from the population.

3.1.3 *statistic*—an estimated quantity for a parameter calculated from a sample.

3.1.4 *parameter*—a measurable quantity characteristic of a population.

3.1.5 *observation*—a fact duly noted and recorded.

3.1.6 *sample or population size*—(*N* may be finite or infinite, but *N* and *n* are finite for all calculations).

3.1.7 For definitions of related statistical terms, see Terminology E456.

3.1.8 For definitions of other terms used in this practice, refer to Terminology D1129.

3.2 *Symbols for Sample and Population:*

	Sample	Population
Observation	x_i	X_i
Sample or Population Size	n	N
Mean	$\bar{x}$	μ
Variance	s^2	σ^2
Standard Deviation	s	σ
Standard Deviation of Mean	$s_{\bar{x}}$	σ_μ
Relative Standard Deviation (%)	RSD	RSD_p

4. Summary of Practice

4.1 Prior to performing many statistical procedures certain variables need to be calculated. The technique for calculating these variables and presenting these results is developed in this practice.

5. Significance and Use

5.1 This practice assures the user that all calculations are performed in the same manner and that all results are presented consistently.

6. Calculation of Statistical Parameters

6.1 *Mean:*

$$\bar{x} = \sum_{i=1}^{n} x_i/n$$

$$\mu = \sum_{i=1}^{N} X_i/N$$

6.2 *Variance:*

$$s^2 = \sum_{i=1}^{n} (x_i - \bar{x})^2/n - 1$$

$$\sigma^2 = \sum_{i=1}^{N} (X_i - \mu)^2/N$$

6.3 *Standard Deviation:*

$$s = \sqrt{s^2}$$

$$\sigma = \sqrt{\sigma^2}$$

6.4 *Standard Deviation of the Mean*—(also known as standard error of the mean):

$$s_{\bar{x}} = \sqrt{s^2/n}$$

$$\sigma_\mu = \sqrt{\sigma^2/N}$$

[1] This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.02 on Quality Systems, Specification, and Statistics.

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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.

6.5 *Relative Standard Deviation* (%)—(also known as coefficient of variation) expressed as a percentage:[3]

$$\mathrm{RSD} = (100)\, s/\bar{x} \qquad (1)$$

$$\mathrm{RSD}_p = (100)\, \sigma/\mu$$

[3] *Manual on Presentation of Data and Control Chart Analysis*, 6th Edition, *ASTM MNL 7*, ASTM, 1990, p. 19.

7. Keywords

7.1 notation; terminology; statistics