



Standard Practice for Statistical Analysis of Toxicity Tests Conducted Under ASTM Guidelines¹

This standard is issued under the fixed designation E 1847; 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 practice covers guidance for the statistical analysis of laboratory data on the toxicity of chemicals or mixtures of chemicals to aquatic or terrestrial plants and animals. This practice applies only to the analysis of the data, after the test has been completed. All design concerns, such as the statement of the null hypothesis and its alternative, the choice of alpha and beta risks, the identification of experimental units, possible pseudo replication, randomization techniques, and the execution of the test are beyond the scope of this practice. This practice is not a textbook, nor does it replace consultation with a statistician. It assumes that the investigator recognizes the structure of his experimental design, has identified the experimental units that were used, and understands how the test was conducted. Given this information, the proper statistical analyses can be determined for the data.

1.1.1 Recognizing that statistics is a profession in which research continues in order to improve methods for performing the analysis of scientific data, the use of statistical methods other than those described in this practice is acceptable as long as they are properly documented and scientifically defensible. Additional annexes may be developed in the future to reflect comments and needs identified by users, such as more detailed discussion of probit and logistic regression models, or statistical methods for dose response and risk assessment.

1.2 The sections of this guide appear as follows:

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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:

- E 178 Practice for Dealing with Outlying Observations²
- E 380 Practice for Use of the International System of Units (SI) (the Modernized Metric System)²
- E 456 Terminology Relating to Statistics²
- E 1241 Guide for Conducting Early Life Stage Toxicity Tests with Fishes³
- E 1325 Terminology Relating to Design of Experiments²

3. Terminology

3.1 *Definitions of Terms Specific to This Standard*—The following terms are defined according to the references noted:

3.1.1 *analysis of variance (ANOVA)*—a technique that subdivides the total variation of a set of data into meaningful component parts associated with specific sources of variation for the purpose of testing some hypothesis on the parameters of the model or estimating variance components **(1)**.⁴

3.1.2 *categorical data*—variates that take on a limited number of distinct values **(2)**.

3.1.3 *censored data*—some subjects have not experienced the event of interest at the end of the study or time of analysis. The exact survival times of these subjects are unknown **(3)**.

3.1.4 *central limit theorem*—whatever the shape of the frequency distribution of the original populations of X 's, the frequency distribution of the mean, in repeated random samples of size n tends to become normal as n increases **(2)**.

3.1.5 *central tendency measure*—a statistic that measures the central location of the sample observations **(4)**.

3.1.6 *concentration-response testing*—the quantitative relation between the amount of factor X and the magnitude of the effect it causes is determined by performing parallel sets of

¹ This practice is under the jurisdiction of ASTM Committee E47 on Biological Effects and Environmental Fate and is the direct responsibility of Subcommittee E47.02 on Sediment Assessment and Toxicology.

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² *Annual Book of ASTM Standards*, Vol 14.02.

³ *Annual Book of ASTM Standards*, Vol 11.05.

⁴ The boldface numbers given in parentheses refer to a list of references at the end of the text.