



Designation: C1164 – 22

Standard Practice for Evaluation of Limestone or Lime Uniformity From a Single Source¹

This standard is issued under the fixed designation C1164; 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 is intended for use in instances where the purchaser desires information on the uniformity of limestone or lime produced at a single source. It is intended that this test method normally be used for the predominant material manufactured at a plant. Guidelines for sampling, testing and presentation of results (Table 1) are given.

1.2 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.3 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

- C25 Test Methods for Chemical Analysis of Limestone, Quicklime, and Hydrated Lime
- C50 Practice for Sampling, Sample Preparation, Packaging, and Marking of Lime and Limestone Products
- C51 Terminology Relating to Lime and Limestone (as Used by the Industry)
- C110 Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone
- C141 Specification for Hydrated Hydraulic Lime for Structural Purposes
- C1271 Test Method for X-ray Spectrometric Analysis of

Lime and Limestone

C1301 Test Method for Major and Trace Elements in Limestone and Lime by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP) and Atomic Absorption (AA)

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms relating to this practice refer to Terminology C51.

4. Significance and Use

4.1 This practice is designed to present in a standardized format information on the variability of limestone or lime from a single source over a period of time. It can be applied to all materials covered in Test Methods C25, C110, C1271, and C1301, and Specification C141.

5. Sampling

5.1 The sampling shall be done in accordance with Methods C50.

5.2 All sampling shall be performed by personnel qualified by specific training for this purpose.

5.3 Data points shall be an average of three or more separate determinations relative to a specified unit of time. For example: (1) n determinations for daily average, (2) daily determinations for weekly average.

5.4 The samples shall be identified by the date or dates that the represented material was obtained.

6. Procedure

6.1 The minimum amount of testing (see 5.3) and the type of test(s) to be performed should be agreed upon by the purchaser and producer.

NOTE 1—A single daily analysis does not necessarily characterize a product. A minimum of three analyses is more reasonable.

6.2 It is desirable that all tests used in a single evaluation be performed in the same laboratory, preferably by the same person, in order for the results to be comparable.

NOTE 2—In order to obtain comparable results when exchanging

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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.

TABLE 1 High Calcium Quicklime January 1989

NOTE 1—This data is presented only as a sample of the correct method for presentation. Other tests can be substituted and others omitted.

| Day | Test | | | |
|---------|------------------|-------|-------|-----------------|
| | % Acid Insoluble | % CaO | % MgO | % Available CaO |
| 1 | 0.66 | 95.85 | 2.27 | 94.90 |
| 2 | 0.84 | 95.03 | 2.87 | 94.08 |
| 3 | 1.24 | 95.85 | 1.57 | 94.90 |
| 4 | 1.22 | 96.67 | 1.49 | 95.71 |
| 5 | 1.22 | 96.26 | 1.32 | 95.31 |
| 8 | 0.68 | 95.85 | 2.06 | 94.69 |
| 9 | 0.96 | 95.54 | 2.27 | 94.89 |
| 10 | 1.26 | 96.15 | 1.74 | 95.20 |
| 11 | 1.04 | 96.04 | 2.00 | 95.11 |
| 13 | 1.26 | 96.26 | 1.51 | 95.31 |
| 15 | 1.34 | 95.23 | 2.09 | 94.28 |
| 16 | 1.28 | 95.44 | 2.34 | 94.69 |
| 19 | 0.68 | 96.15 | 1.46 | 95.20 |
| 20 | 1.42 | 95.85 | 1.27 | 94.90 |
| 22 | 1.06 | 95.85 | 1.86 | 94.90 |
| 23 | 0.58 | 96.15 | 2.09 | 95.31 |
| 24 | 0.84 | 95.03 | 2.61 | 94.08 |
| 26 | 1.28 | 95.64 | 1.39 | 94.69 |
| 27 | 1.48 | 95.54 | 1.58 | 94.39 |
| 29 | 0.98 | 94.82 | 2.71 | 93.67 |
| 30 | 1.24 | 94.41 | 3.42 | 93.67 |
| Avg | 1.07 | 95.70 | 2.00 | 94.76 |
| Range | 0.90 | 2.26 | 2.15 | 2.04 |
| Std Dev | 0.26 | 0.54 | 0.56 | 0.54 |

samples between laboratories, methods used in preparation, handling and storage of those samples must be uniform.

6.2.1 When separate evaluations of a single source are made by two or more laboratories, additional tests of a standard material or exchanged portions of the same sample may be necessary to determine differences in testing that are likely to be obtained in the different laboratories. Three or more batches may be necessary to obtain comparison between laboratories.

6.2.2 Where a within-laboratory testing standard deviation history has not been established, duplicate tests made from a single sample are required to determine the effect of testing variation on the uniformity of results made in a single laboratory.

7. Test Method

7.1 The chemical analysis of quicklime, hydrated lime, and limestone shall be determined in accordance with Test Methods **C25**, **C1271**, or **C1301**.

7.2 The physical analysis of quicklime, hydrated lime, and limestone shall be determined in accordance with Test Methods **C110**.

7.3 The analysis of hydraulic hydrated lime shall be determined in accordance with Specification **C141**.

8. Calculation

8.1 Average \bar{X} :

$$\bar{X} = \frac{(X_1 + X_2 + \dots + X_n)}{n} \quad (1)$$

where:

X_1, X_2, \dots, X_n = the individual test results in accordance with Test Methods **C25**, **C110**, **C1271**, or **C1301**, or Specification **C141**, and
 n = the number of individual samples.

8.2 Total Standard Deviation:

$$s = \sqrt{\frac{(X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + \dots + (X_n - \bar{X})^2}{(n - 1)}} \quad (2)$$

9. Report

9.1 Report the following information. Sufficient information shall be provided to identify the sample including:

- 9.1.1 Name of manufacturer and location,
- 9.1.2 Type of material or other identification,
- 9.1.3 All sampling and analytical practices used are to be noted (see **Note 3**), and
- 9.1.4 Period of time represented by the report.

9.2 The report shall not cover a period of time greater than one year.

NOTE 3—Laboratory designations are lost or are meaningless when averaging a number of determinations on individual samples. The purchaser needs to know the sampling and analytical practices used in generating a report to properly evaluate the information they receive concerning a specific product.

10. Keywords

10.1 hydrated lime; limestone; product uniformity; quicklime; sampling

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