



# National Institute of Standards & Technology

## Certificate of Analysis

### Standard Reference Material® 3109a

Standard Solution

Calcium

Lot Code 690808

This Standard Reference Material (SRM) is intended primarily for use in calibrating instruments used in atomic spectrometry, including atomic absorption spectrometry, inductively coupled plasma optical spectrometry, and inductively coupled plasma mass spectrometry. It can also be used in conjunction with any other analytical technique or procedure where an aqueous standard solution is required. One unit of SRM 3109a consists of 50 mL of a single element solution prepared gravimetrically to contain a known amount of calcium in an approximate nitric acid volume fraction of 9 %.

Certified Value ( $Y$ ) of Calcium: 10.01 mg/mL  $\pm$  0.03 mg/mL at 22 °C

The certified value ( $Y$ ) is based on the mass of SRM 915a Calcium Carbonate, dissolved and diluted to known volume. The value has been adjusted upward by 0.1 % relative, based on estimated transpiration losses of solvent through the container walls of 0.2 % relative per year. The density of the solution is 1.065 g/mL  $\pm$  0.002 g/mL at 22 °C.

The uncertainty in the certified value is calculated as

$$U = (2u_c + 0.001Y) \text{ mg/mL}$$

where  $u_c$  is the "combined uncertainty" calculated according to the ISO Guide [1]. The value  $u_c$  is intended to represent, at the level of one standard deviation, the combined effect of uncertainty components associated with volumetric and gravimetric factors, as well as the purity of the starting material. The additional quantity, 0.001 $Y$ , is an allowance for transpiration of solution through the container walls, which is estimated to be  $\pm$  0.1 % of the certified value during the one-year period of validity of the certification.

The combined uncertainty consists of a Type A component associated with replicate weighings of the starting material and Type B components due to uncertainties in the material purity, material handling, and dilution.

This SRM was prepared gravimetrically and analyzed using atomic absorption spectrometry by T.A. Butler of the NIST Analytical Chemistry Division.

The support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, MD 20899  
Certificate Issue Date: November 15, 1996\*  
10/11/96 (original certificate date)

\*Editorial revision

Thomas E. Gills, Chief  
Standard Reference Materials Program

## Procedures for Use

**Expiration of Certification:** This certification is valid for one year from the shipping date, provided the solution is kept tightly capped and stored under normal laboratory conditions. NIST will monitor the stability of representative solutions from the SRM lot and if any changes occur that invalidate this certification, NIST will notify purchasers.

**Preparation of Working Standard Solutions:** All solutions should be brought to  $22\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$  before use and all glass or plastic surfaces coming in contact with the SRM must have been previously cleaned. A working standard solution can be prepared from the SRM solution by serial dilution. Each dilution should be acidified with an appropriate high purity acid in high purity water. The analyst should prepare daily working solutions from 100  $\mu\text{g/mL}$  dilutions of the original SRM solution.

## REFERENCE

- [1] *Guide to the Expression of Uncertainty in Measurement*, ISBN 92-67-10188-9, 1st Ed. ISO, Geneva, Switzerland, (1993); see also Taylor, B.N. and Kuyatt, C.E., "Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results," NIST Technical Note, 1297, U.S. Government Printing Office, Washington D.C., (1994).



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ORIGINAL

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