



CERTIFICATE OF ANALYSIS

CCRL Calibration Standard Portland Cement 231

This material is a calibration standard and is not a certified reference material. This material is intended primarily for use in calibrating instrumental equipment used in the analysis of cement and similar materials. A unit of CCRL Calibration Standard – Portland Cement 231 consists of a vial containing approximately 30 g of portland cement passing a 150 μm sieve. Portland Cement 231 is an ASTM C150 cement meeting Type I-II specifications. This cement contains limestone additions.

Certificate Values: Values for twenty constituents in CCRL Calibration Standard – Portland Cement 231 are listed in Table 1. The values in Table 1 are consensus values derived from CCRL Portland Cement Proficiency Sample 231.

Expiration of Certificate and Stability: The certificate of this calibration standard is valid until 1 June 2029 provided the standard is handled and stored in accordance with the instructions given. This material is considered to be stable during the period covered by this certificate within the limitations given in “Instructions for Use”.

INSTRUCTIONS FOR USE

Cement powder is hygroscopic and will react with moisture changing the chemical composition. Each unit of the calibration standard is stored in a sealed pouch during preparation to prevent moisture uptake. The unit should be left in the sealed pouch until just before it is needed in the laboratory. After the vial is removed from the pouch, the vial should be stored in its original container, recapped tightly, and stored in a desiccator immediately after use.

Reporting: For all constituents, values are reported as mass fractions on as-received basis. The constituents are expressed as the chemical forms and in the order given in ASTM C 114-24, Table 1.

Table 1. Values for CCRL Calibration Standard 231 – Portland Cement

Constituent	Value %	Expanded ^(a) Uncertainty %
SiO ₂	20.38	0.005
Al ₂ O ₃	4.94	0.003
Fe ₂ O ₃	3.17	0.002
CaO	62.36	0.007
MgO	3.30	0.003
SO ₃	2.62	0.003
LOI	2.07	0.003
Na ₂ O	0.182	0.002
K ₂ O	0.771	0.002
SrO	0.090	0.001
TiO ₂	0.25	0.001
P ₂ O ₅	0.069	0.001
ZnO	0.019	0.001
Mn ₂ O ₃	0.030	0.001
Cl	0.017	0.001
IR	0.40	0.004
Free Calcium Oxide ^(b)	1.15	0.007
CO ₂	1.25	0.005
Limestone Content	3.4	0.008
Cr ₂ O ₃	0.009	0.001
^(a) The uncertainty listed was calculated as a 95% confidence interval from the standard error of the mean (sd / \sqrt{n}) with a coverage factor (k) of 2.0. ^(b) Value consists of free CaO and, if present, free Ca(OH) ₂ .		

Cooperating Laboratories: Analytical determinations for certificate values of this calibration standard were performed by the participating laboratories of the Cement and Concrete Reference Laboratory proficiency sample program. The number of participants involved in these determinations varied from 91 to 193 depending upon which constituent was being determined.