United States Geological Survey

Reston Stable Isotope Laboratory

Report of Stable Isotopic Composition

Reference Materials USGS25 and USGS26

(Nitrogen Isotopes in Ammonium Sulfate)

These reference materials (RMs) are intended for normalizing stable nitrogen ($\delta^{15}N$) relative isotope-ratio measurements of unknown nitrogen-bearing samples. A unit of USGS25 and USGS26 consists of approximately 0.8 g and 0.8 g, respectively. USGS25 and USGS26 NH_4SO_4 were prepared by Böhlke et al. [1]. USGS25 and USGS26 also may be available from the International Atomic Energy Agency (IAEA) [2,3] or from the U.S. National Institute of Standards and Technology (NIST) [4], respectively, as RM 8550 and RM 8551.

Recommended values: Stable nitrogen isotopic compositions are expressed herein as delta values [5] relative to atmospheric nitrogen, which is isotopically homogenous [6]. On this scale, the $\delta^{15}N_{AIR}$ value of USGS32 KNO_3 has a consensus value of +180 ‰ exactly [7,8]. The uncertainties of the $\delta^{15}N_{AIR}$ values are the one-sigma uncertainties estimated by Böhlke et al. [7].

Description	$\delta^{15}N_{AIR}$	Data Source
USGS25	–30.41 ± 0.27 ‰	[7]
USGS26	+53.75 ± 0.24 ‰	[7]

Technical coordination for this RM was provided by J.K. Böhlke and H. Qi of the RSIL.

Reston, Virginia 20192
August 17, 2026

Tyler B. Coplen, Director
Reston Stable Isotope Laboratory

Expiration of Reference Value: The reference value for the isotopic compositions of USGS25 and USGS26 are valid until December 31, 2036, provided these RMs are handled in accordance with the instructions given in this Report of Stable Isotopic Composition (see "Instructions for Use"). A reference value is nullified if the RM is damaged, contaminated, or otherwise modified.

Maintenance of RM certification: The Reston Stable Isotope Laboratory (RSIL) will monitor these RMs. The RSIL will notify the purchaser if substantive technical changes are observed that affect the stable nitrogen isotopic composition over time.

Distribution and stability: Units of USGS25 and USGS26 are supplied in glass vials that are vacuum sealed in plastic pouches. Ammonium sulfate salts should be kept in a dry environment, as they may attract water when exposed to air.

Instructions for use: These RMs can be dried in a low-temperature oven or under vacuum before being weighed for analysis. They can be used at the beginning, the middle, and the end of the analysis sequence to enable satisfactory correction of drift with time [9].

Reporting of stable-isotope-delta values: The following recommendations are provided for reporting stable nitrogen isotope-delta values:

- The $\delta^{15}N$ values of all nitrogen-bearing substances may be expressed relative to atmospheric nitrogen gas (N_2) [6] on a scale in which the $\delta^{15}N_{AIR}$ value of USGS32 KNO_3 is +180 ‰ exactly [8].
- Authors should report delta values of internationally distributed (secondary) isotopic reference materials that were assumed for normalization of data for samples of similar chemical composition, as appropriate for the measurement method. In this manner, measurement results can be adjusted in the future as analytical methods improve and consensus values of internationally distributed isotopic reference materials change.

REFERENCES

[1] Böhlke, J.K., Gwinn, C.J., Coplen, T. B., 1993, New reference materials for nitrogen-isotope-ratio measurements. Geostandards Newsletter, v. 17(1), p. 159−164. https://doi.org/10.1111/j.1751-908X.1993.tb00131.x

[2] IAEA, Reference Products for Environment and Trade, USGS25. https://analytical-reference-materials.iaea.org/usgs25/

[3] IAEA, Reference Products for Environment and Trade, USGS26. https://analytical-reference-materials.iaea.org/usgs26/

[4] National Institute of Standards and Technology (NIST), SRM. https://www.nist.gov/srm

[5] Coplen, T. B., 2011, Guidelines and recommended terms for expression of stable-isotope-ratio and gas-ratio measurement results: Rapid Communications in Mass Spectrometry, v. 25(17), p. 2538–2560. https://doi.org/10.1002/rcm.5129

[6] Mariotti, A., 1983, Atmospheric nitrogen is a reliable standard for natural ^{15}N abundance measurements: Nature, v. 303, p. 685–687. https://doi.org/10.1038/303685a0

[7] Böhlke, J.K., Coplen, T. B., 1995, Interlaboratory comparison of reference materials for nitrogen-isotope-ratio measurements, in Reference and Intercomparison Materials for Stable Isotopes of Light Elements; In Proceedings of a consultants meeting: Vienna, Dec. 1993; IAEA-TECDOC-825; p. 51–66 (1995). https://www-pub.iaea.org/MTCD/Publications/PDF/te_825_prn.pdf

[8] Brand, W. A., Coplen, T. B., Vogl, J., Rosner, M., Prohaska, T., 2014, Assessment of international reference materials for stable isotope ratio analysis 2013, Pure and Applied Chemistry, v. 86(3), p. 425-467. https://doi.org/10.1515/pac-2013-1023

[9] Hannon, J. E., and Böhlke, 2008, Determination of the $\delta(^{15}N)$ of ammonium (NH_4^{+}) in water; RSIL lab code 2898, chap. 15 of Stable isotope-ratio methods, sec. C of Révész, K., and Coplen, T.B. eds., Methods of the Reston Stable Isotope Laboratory: U.S. Geological Survey Techniques and Methods, book 10, 30 p. https://pubs.usgs.gov/publication/tm10C15