



**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 ( $\delta^{15}\text{N}$ ) 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  $\text{NH}_4\text{SO}_4$  were prepared by Böhlke et al. [1]. USGS25 and USGS26 also may be available from the International Atomic Energy Agency (IAEA) [2] or from the U.S. National Institute of Standards and Technology (NIST) [3], respectively, as RM 8550 and RM 8551.

**Recommended values:** Stable nitrogen isotopic compositions are expressed herein as delta values [4] relative to atmospheric nitrogen, which is isotopically homogenous [5]. On this scale, the  $\delta^{15}\text{N}_{\text{AIR}}$  value of USGS32  $\text{KNO}_3$  has a consensus value of +180 ‰ exactly [6,7]. The uncertainties of the  $\delta^{15}\text{N}_{\text{AIR}}$  values are the one-sigma uncertainties estimated by Böhlke et al. [6].

Description	$\delta^{15}\text{N}_{\text{AIR}}$	Data Source
USGS25	$-30.41 \pm 0.27 \text{ ‰}$	[6]
USGS26	$+53.75 \pm 0.24 \text{ ‰}$	[6]

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

Reston, Virginia 20192  
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Tyler B. Coplen, Director  
Reston Stable Isotope Laboratory

**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 [8].

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

- The  $\delta^{15}\text{N}$  values of all nitrogen-bearing substances should be expressed relative to atmospheric nitrogen gas ( $\text{N}_2$ ) [5] on a scale in which the  $\delta^{15}\text{N}_{\text{AIR}}$  value of USGS32  $\text{KNO}_3$  is +180 ‰ exactly [7].
- 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

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- [4] 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, 2538–2560. Available at <http://dx.doi.org/10.1002/rcm.5129>
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- [8] Hannon, J. E., and Böhlke, 2008, Determination of the  $\delta(^{15}\text{N})$  of ammonium ( $\text{NH}_4^+$ ) in water; RSIL lab code 2898, chap. 15 of *Stable isotope-ratio methods*, sec. C of Révész, K., and Coplen, T.B.

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