Pure & Appl. Chem., Vol. 64, No. 6, pp. 907–908, 1992.
Printed in Great Britain.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

INORGANIC CHEMISTRY DIVISION
COMMISSION ON ATOMIC WEIGHTS AND ISOTOPIC ABUNDANCES*

REPORTING OF NITROGEN-ISOTOPE ABUNDANCES

(Technical Report)

Prepared for publication by

T. B. COPLEN[1], H. R. KROUSE[2], and J. K. BÖHLKE[1]

[1]U.S. Geological Survey, Reston, Virginia 22092, USA
[2]The University of Calgary, Calgary, Alberta T2N 1N4, Canada

*Membership of the Commission during the preparation of the report (1989–1991) was as follows:

J. R. De Laeter (Australia, *Chairman*); K. G. Heumann (FRG, *Secretary*); R. C. Barber (Canada, Associate); J. W. Cesario (France, Titular); T. B. Coplen (USA, Titular); H. J. Dietze (FRG, Associate); J. W. Gramlich (USA, Associate); H. S. Hertz (USA, Associate); H. R. Krouse (Canada, Titular); A. Lamberty (Belgium, Associate); T. J. Murphy (USA, Associate); K. J. R. Rosman (Australia, Titular); M. P. Seyfried (FRG, Associate); M. Shima (Japan, Titular); K. Wade (UK, Associate); P. De Bièvre (Belgium, National Representative); N. N. Greenwood (UK, National Representative); H. S. Peiser (USA, National Representative); N. K. Rao (India, National Representative).

Reporting of nitrogen-isotope abundances (Technical Report)

Abstract — To eliminate possible confusion in the reporting of nitrogen-isotope analyses, the Commission on Atomic Weights and Isotopic Abundances recommends that the value 272 be employed for the $^{14}N/^{15}N$ value of N_2 in air for calculating atom percent ^{15}N from measured $\delta^{15}N$ values.

COMMENT

Nitrogen isotope-ratio analyses generally are expressed either in atom percent ^{15}N or in parts per thousand (‰) difference from atmospheric nitrogen gas. Thus, for a sample x

$$\delta^{15}N \text{ (in ‰)} = \left[\frac{\left(\frac{^{15}N}{^{14}N}\right)_x}{\left(\frac{^{15}N}{^{14}N}\right)_{Air\ N_2}} - 1 \right] 1000.$$

Junk and Svec (58JUN1) found $^{14}N/^{15}N = 272.0 \pm 0.3$ in atmospheric nitrogen. The IUPAC report titled "ISOTOPIC COMPOSITIONS OF THE ELEMENTS 1983" (84CAW2) rounds the Junk and Svec data and reports, as the best measurement from a single natural source, values of 99.634 ± 0.001 and 0.366 ± 0.001 atom percent for ^{14}N and for ^{15}N, corresponding to $^{14}N/^{15}N = 272.22$. The difference between the two sets of values corresponds to a $\delta^{15}N$ difference of 0.8‰, which is about 10 times the measurement precision of many stable-isotope laboratories and may be at least as many times the natural variation of atmospheric N_2 (83MAR1).

When converting from isotope ratios to delta values and vice versa, some workers have accepted the IUPAC-recommended isotopic abundances, whereas others have relied on the original isotopic values reported by Junk and Svec for atmospheric N_2. When reporting data, authors sometimes fail to state which of these two values they used. Discrepancies may be compounded if atom percent ^{15}N data derived from $\delta^{15}N$ data using one convention are converted back to $\delta^{15}N$ values using the other convention in a later publication.

The basis of the problem is the well known fact that the precision of relative isotope abundance measurements generally is much better than the accuracy of absolute abundance determinations. However, until such time as the determination of absolute abundances of nitrogen improves, there is a need for consistent reporting of data. Therefore, the Commission recommends that "The value of 272 be employed for $^{14}N/^{15}N$ of N_2 in air for the calculation of atom percent ^{15}N from measured $\delta^{15}N$ values."

The reader should note that if all nitrogen isotopic abundances were measured and reported as $\delta^{15}N$ values with respect to air, the problem would be eliminated.

REFERENCES

58JUN1 G. Junk, and H.J. Svec, Geochim. Cosmochim. Acta, **14**, 234–243 (1958). The absolute abundance of the nitrogen isotopes in the atmosphere and compressed gas from various sources.

84CAW2 Pure Appl. Chem., **56**, 675–694 (1984). Isotopic Compositions of the Elements 1983.

83MAR1 A. Mariotti, Nature, **303**, 685–687 (1983). Atmospheric nitrogen is a reliable standard for natural ^{15}N abundance measurements.