



IN REPLY REFER TO:

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

Box 25046 M.S. 407

Denver Federal Center

Denver, Colorado 80225

NATIONAL WATER QUALITY LABORATORY TECHNICAL MEMORANDUM 1999.01

October 8, 1998

Subject: Change in reporting unit for relative abundances of helium isotopes

Effective Date

of Change: November 1, 1998

Authors: L. Niel Plummer, Eastern region Branch of Regional Research (703) 648-5841,
(nplummer)
Ann H. Mullin, Analytical Contracting Unit, NWQL, (303) 467-8235 (ahmullin)

Revision: None

Background

The National Water Quality Laboratory (NWQL), under a contract with Lamont Doherty Earth Observatory of Columbia University, has been reporting low-level tritium (^3H) total dissolved helium (He) (61038), total dissolved neon (Ne) (61046), and the helium-3/helium-4 isotope ratio ($^3\text{He}/^4\text{He}$) of dissolved helium (61040) for purposes of ground-water dating based on the tritium/helium-3 ($^3\text{H}/^3\text{He}$) method.

Scope

Effective November 1, 1998, the reporting unit for the relative isotopic abundances of helium-3 and helium-4 will be changed from the currently reported isotope ratio $^3\text{He}/^4\text{He}$ to the value of delta helium-3, $\delta^3\text{He}$. The two terms are related by

$$\delta^3\text{He} \left[\frac{(^3\text{He}/^4\text{He})_{\text{sample}}}{(^3\text{He}/^4\text{He})_{\text{air}}} - 1 \right] 100$$

The term $\delta^3\text{He}$ expresses the percent deviation of the $^3\text{He}/^4\text{He}$ isotope ratio of the sample from that of air. Since the mass spectrometric measurement is made in terms of $\delta^3\text{He}$ rather than the $^3\text{He}/^4\text{He}$ isotope ratio of the sample, the derived value of the $^3\text{He}/^4\text{He}$ isotope ratio of the sample depends on assignment of a value for the $^3\text{He}/^4\text{He}$ isotope ratio of air. The currently accepted value for the $^3\text{He}/^4\text{He}$ isotope ratio of air is 1.384×10^{-6} (Clark and others, 1976). By reporting $\delta^3\text{He}$, our helium

data will be unaffected by possible future improvements in the accuracy and precision of the helium isotope ratio of air.

Lab codes 2124 ($^3\text{He}/^4\text{He}$) and 2145 (the associated error) will be deleted from Schedule 1033 and replaced by lab codes 2290 (delta helium-3) (parameter code 61036) and 2291 (the associated error expressed in same unit as delta helium-3) (parameter code 61037).

For samples reported previous to effective date of the memo, the delta helium-3 value is listed in reports sent to the appropriate program chiefs.

Reference

Clark, W.B., Jenkins, W.J., and Top, Z., 1976, Determination of tritium by mass spectrometric measurement of ^3He : International Journal of Applied Radiation and Isotopes, v. 27, p. 515-522.

Effect on Data Base: None.

/signed/
Robert S. Williams, Jr., Chief
National Water Quality Laboratory
Branch of Analytical Services

Supersedes: NWQL Tech memo 97.04, Tritium/helium dating of ground-water samples available through contract with Lamont-Doherty Earth Observatory of Columbia University, Palisades, New York.

Keywords: Tritium/helium-3, Delta helium-3

Distribution: E and <http://www.nwql.cr.usgs.gov/USGS>