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U.S. GEOLOGICAL SURVEY

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NATIONAL WATER QUALITY LABORATORY TECHNICAL MEMORANDUM 1993.09

August 24, 1993

To: Assistant Chief Hydrologist, PC&TS
Regional Hydrologists
Chief, Office of Water Quality
Assistant Chief, Office of Water Quality
Deputy ACH for PC&TS for NAWQA
Area Hydrologists
District Chiefs
Regional Water-Quality Specialists
Assistant Regional Hydrologists for NAWQA
District Water-Quality Specialists
Chiefs, NAWQA Study-Units
Chief, Ocala Project Office
Chief, Yucca Mtn. QE Group
Chief, Branch of Quality Assurance
Employees, National Water Quality Laboratory

From: Chief, National Water Quality Laboratory
Branch of Analytical Services

Subject: Radon.- Discontinuance of duplicate samples for radon-in-water. Change in window setting for analysis.

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Revision: No

SCOPE

DISCONTINUANCE OF DUPLICATE SAMPLES FOR RADON-IN-WATER

The Radiological Advisory Committee (RAC) sponsored by the National Water Quality Laboratory (NWQL) has approved discontinuing analyzing radon samples in duplicate at the NWQL. From 1988 to the present, the NWQL has analyzed all radon-in-water samples in duplicate. The average value from the duplicate analyses is entered into the database, and the individual values from the duplicate analyses are sent to the collector. This approach enabled the collector to check the

precision of the sampling technique because the syringe method of collection was unfamiliar to many district personnel.

Because of a short half-life (3.82 days), radon samples should be counted as soon as possible after collection. For this reason, radon samples are sent by overnight mail and it is the intent of the NWQL to count these samples within 24 hours of receipt. However, if the present practice of duplicate samples is continued, it is probable that some samples may not be counted for up to 72 hours after being received by the NWQL, when the expected increase in samples due to the NAWQA Program and the issuance of a maximum contaminant level by the U.S. Environmental Protection Agency (USEPA) are received. This delay in counting would be a problem because the samples would have gone through a full half-life from the collection to the time of counting. It would not be cost-effective to purchase additional instrumentation (the NWQL now has four liquid scintillators) just to continue this practice of duplicate analyses. Other labs analyzing samples for radon-in-water do not routinely run samples in duplicate and other sections of the NWQL do not follow this practice.

Reporting single analysis results will affect the associated error. This is caused by the way the errors were averaged:

Example:

Result #1	500 pCi/l +/- 30
Result #2	495 pCi/l +/- 30

If these results were averaged, the answer would be 498 pCi/l +/- 21

Average answer = $\text{Result \#1} + \text{Result \#2} / 2$

BUT

Average error = $(\text{square root of the sum of each error squared}) / 2$.

It should also be remembered that, for radon by this method, a single analysis reflects the uncertainty caused by the laboratory analysis. Duplicate analyses that are averaged reflect uncertainties caused by sampling as well as by laboratory analysis.

CHANGE IN WINDOW SETTING FOR ANALYSIS

This change in window setting has been approved by the Radiological Advisory Committee of the NWQL. Since 1988, the NWQL has been using a wide window (channels 60-1000) for the analysis of radon by liquid scintillation. The NWQL began using this window for purposes of continuity and comparison because many of the other labs analyzing Survey samples at that time were using this window setting.

In order to meet the USEPA's proposed analytical specifications, the NWQL as well as the other labs, must use a narrow window (channels 700-850). The results, using this window, will appear to be biased low, but in actuality, these results will be more accurate because only the region containing radon and its progeny will be counted. Results using the wide window were actually high since counts other than those caused by radon were used in the calculations.

Because this bias will vary from sample to sample depending on the constituents of each sample, there is no conversion factor that can be used to compare the results in the two windows. However, the raw data for the wide window will be kept on file at the NWQL. Therefore, if a district is doing a time study of radon at a particular site and needs the wide window results for comparison, these results can be calculated and reported on an individual and unofficial basis.

These changes will become effective October 1, 1993. Contact Ann Mullin or Jeanne Hatcher, (303) 467-8237 (JHATCHER), at the NWQL if you have requests or questions.

/signed/

Peter F. Rogerson

cc: Radiological Advisory Committee

Supersedes: None

Key Words: Radon, half-life, scintillation

Distribution: See above plus QWTALK.