MEASUREMENT OF DISSOLVED RADON IN WATER OVER DIFFERENT SEASONS FROM A TYPICAL HOME IN MARYLAND

P. Kotrappa and R. Lowry

Rad Elec Inc.
5330 J Spectrum Drive
Frederick, MD 21701

ABSTRACT

Dissolved radon in water can contribute to the airborne radon in a residence. It was of interest to study whether there was any seasonal variation of dissolved radon in water samples collected from a typical single family home using the well as a main source of water supply. Samples of tap water of known volume were collected in sample bottles and each sample was placed in a radon leaktight container in which an electret ion chamber radon monitor (E-PERM^R) was present. The sample was spilled into the container, and the concentration of radon released into the container was measured using an E-PERM over a one-day period. A set of four such samples were analyzed every two weeks. Results indicated that there was no significant change over different seasons and typically varied between 700 to 900 pCi/L for this particular well.

Key words: radon, water, seasonal variation, and electret ion chamber.

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INTRODUCTION

Dissolved radon in water can contribute to the airborne radon in a home. Drinking water containing a significant quantity of dissolved radon has been reported to cause several types of cancers. Measurement of dissolved radon in water is therefore important. There are several methods of measuring radon in water. The most used method is the liquid scintillation method (Prichard and Gesell, 1977). A new method has been described recently which involves the use of electret ion chambers (Jester and Kotrappa, 1989).

It is well known that the radon concentration in homes is not only subjected to diurnal variations but also subject to seasonal variations. The purpose of this study was to determine whether there was a significant variation of the dissolved radon concentration in well water over different seasons of the year.

A typical single family home using well water for all their needs was chosen for the study. The home is located in the outskirts of Frederick, Maryland.

MATERIALS AND METHODS

A. The sample of water was collected in glass sampling bottles using the following U.S. EPA protocols:

1. Remove the faucet aerator, if present.
2. Allow the cold water to run approximately one minute or until the water temperature becomes constant.
3. Fill the sampling bottle, allowing it to overflow for a few seconds. Then carefully remove it from the flow

stream so as to maintain a meniscus (a slight protrusion of the water) above the bottle brim.

4. Immediately cap the sampling bottle firmly, being careful to avoid trapping any air bubbles. The bottle is made of glass and has a screw cap with a Teflon^{R} (Du Pont) faced compression seal at the top.

B. The procedure of using electret ion chamber methodology for making measurement of radon in the water sample is fully described elsewhere (Jester and Kotrappa, 1989). It consists of the following steps:

1. Prepare an electret ion chamber (E-PERM) (Kotrappa, et al, 1990) for making a radon measurement in air. Measure the initial electret voltage, turn it to the "on" position.

2. Lay the glass measuring jar horizontally on its side on a table. Have the sealing collar and a screwdriver ready.

3. While the jar remains in a horizontal position, gently open the cap of the sampling bottle and place the open bottle all the way to the bottom of the jar. Hang the E-PERM on the hook inside the lid and screw the cap onto the jar. (See left part of Fig. 1.)

4. Install the rubber sealing collar around the lid joint with the top of the collar flush with the measuring jar. Tighten the clamp around the collar with a screwdriver while keeping the jar still horizontal.

Bring the jar to a vertical position permitting the water in the bottle to spill into the jar. (See the right part of Fig.1.)

5. After making sure that the collar is tight, shake the jar at least 10 times to liberate the radon into the jar.
6. Leave the system in that condition for one day.
7. Remove the E-PERM and measure the electret voltage. Calculate the average radon concentration present in the jar using the standard procedure.
8. Follow the method of computing radon in water given in the paper (Jester and Kotrappa, 1989).

C. Four water samples were collected every two weeks and were analyzed for dissolved radon in water using the procedure described in A and B.

RESULTS OF MEASUREMENTS

The first set of samples were taken in October 1989 and the last set was taken in September 1990. The standard error of each data set was generally within 10% of the mean in each case. The results of the mean values for the stated month are listed in Table 1.

DISCUSSIONS AND CONCLUSIONS

No significant variation was observed during different months. The water temperature was in the range of 60° to 70° F.

REFERENCES

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CAPTIONS FOR TABLES AND FIGURES

Title of Table-1

Results of the measurement of dissolved radon in water. Against each month is an average of several results. Samples were collected from a well used by a single family home located in Frederick, Maryland.

Title of Figure-1

Radon in water measurement apparatus using E-PERM radon monitor. Position-1 corresponds to the loading of the sample. Position-2 corresponds to the actual measurement mode.

Table - 1

Month and Year		Mean Radon Concentration in Water pCi/L
October	1989	918
November	1989	836
December	1989	902
January	1990	750
February	1990	800
March	1990	750
April	1990	810
May	1990	700
June	1990	800
July	1990	770
August	1990	750
September	1990	800

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