

INVESTIGATION 3**HOW DO YOU MEASURE RADON?****INTRODUCTION**

There are several methods available for measuring radon concentrations in indoor air (Table 1). The methods differ with respect to how they measure and as a result, what information about radon they reveal. The most popular methods for performing an initial short term test employ either an activated charcoal canister or an electret detector.

Table 1. Comparison among some commonly used methods for measuring household radon concentrations.

Method	Approximate Cost per Measurement	Typical Duration of Measurement	Ease of Use
Charcoal canister	\$10 to \$20	3-7 days	Easy, send through mail
Alpha Track	\$25 to \$100	Several months to one year	Easy, send through mail
Electret	\$100 to \$150	Comes in both short term (several days) and long term (several months to one year) varieties	Easy, placement and pickup by measurement business
Continuous Radon	Several hundred dollars	48 hours or longer	Difficult, requires special equipment and trained operator; provides hourly readings
Grab Sample	Several hundred dollars	Usually about an hour or less	Difficult, requires special equipment and trained operator

In this exercise you will examine and interpret some hypothetical radon measurement data. Then you will design a two-step measurement strategy for your own home.

OBJECTIVES

To apply units of radiation to the radon issue, to demonstrate an understanding of the major factors that influence a radon measurement, and to describe the interrelationships between natural variability, “average” concentrations, and the length of time employed for integrated measurements.

PROCEDURE

1. Examine the hypothetical data presented below for radon measurements in a New Jersey home. Enter these data into a spreadsheet and graph the data using a spreadsheet or by hand. Answer questions 3-5 in the Analysis section.
2. Map out a strategy to perform an initial test for radon in your home, describing how many and what kind of detectors you will use, where they will be placed, and for what length of time. Assuming that the initial test gives you results around 10 pCi/L, map out a strategy for the confirmatory testing. Complete questions 6 and 7 and describe your conclusions.

DATA

The results of continuous radon measurements for the last week in February and the entire month of March in the first floor living room of a home were as follows:

Radioactivity Measurement for February

Radon Concentration (pCi/L)					
Date	4 AM	8 AM	12 Noon	4 PM	8 PM
22	4	4	2	2	3
23	3	3	2	1	1
24	5	4	3	2	4
25	7	6	4	4	6
26	6	5	5	3	4
27	5	5	4	3	4
28	5	4	3	3	4



Note: One pCi/L (picocurie per liter) is about two radioactive alpha decay counts per liter of air per minute.

Radioactivity Measurement for March¹

Day	Radon (pCi/L)	Day	Radon (pCi/L)	Day	Radon (pCi/L)
1	4	11	10	21	2
2	3	12	7	22	3
3	5	13	4	23	2
4	2	14	3	24	4
5	3	15	5	25	6
6	3	16	6	26	7
7	5	17	1	27	5
8	8	18	2	28	3
9	10	19	3	29	4
10	9	20	5	30	5
				31	5

¹ All data for March are reported as average concentrations during the time period 1-3 p.m.

ANALYSIS

3. Do you notice any regular pattern to the February data? Explain the reason(s) for the observed pattern.

4. There was a severe four-day cold spell in March. When did it occur? What evidence is provided by the radon data for March that would indicate a cold spell?

5. On a Saturday in March, the homeowner (Dad) painted the kitchen and thoroughly aired out the house for about two days. On what day of the week was March 1?

6. Describe your procedures for initial and confirmatory radon measurements in your home. Justify your choices.

7. Radon measurements are often taken under "closed house" conditions. This means that windows are kept closed for at least 12 hours prior to and during the test, fans are left off, and doors are only opened for routine entries and departures. Would you employ "closed house" conditions during an initial test, a long-term confirmatory test, or both? Why?

CONCLUSIONS

8. Given the data obtained for February and March in this exercise, discuss the pros and cons of:
- a) a single grab sample for measuring radon
 - b) a 5-day screening test
 - c) a one-month long integrated test

9. How might the annual average radon concentration compare with the March data presented in this exercise? Would the annual average be higher or lower than the March average? Why?

Figure 1. There are three basic ways of measuring the radiation in this scenario. The first is to measure the number of radioactive disintegrations occurring in the radioactive isotope, using a unit such as a *curie*. The second is to measure the amount of energy absorbed by the man from the radiation source, or the man's dose, using a unit called a *rad*. Note that only some of the radioactive disintegrations actually result in any dose to the man. The third way to express the radiation in this scenario is to use a unit that reflects not only the absorbed radiation, but also the amount of biological damage done by the radiation, using a unit called a *rem*. Thus, there are several different ways of looking at, and expressing, measurement of radiation.

