TEACHER'S NOTES 3

HOW DO YOU MEASURE RADON?

BACKGROUND

The students are given an opportunity to design initial and confirmatory radon tests for their homes. This exercise is open-ended. It should include, at a minimum, consideration of the types of detectors available (charcoal canister, alpha track, and electret ion chamber), number of detectors used, duration of measurements, placement (including consideration of how many levels are involved and whether or not the house has a basement), and appropriate placement of test devices, considering factors like moisture and ventilation rates. Closed-house conditions are important for a short term test because the objective is to obtain a "worst case" estimate. Closed-house conditions are not necessary when measuring "average" concentrations over a longer period, such as 3 months to a year.

The basic unit that is used in the United States to measure radioactivity is the curie (named for Marie Curie, the physicist and chemist who discovered radium), which is abbreviated by the symbol Ci. Its original definition was the number of radioactive disintegrations occurring per second in one gram of radium-226. However, that is a subjective definition because it is difficult to measure exactly how many disintegrations are occurring! In 1950 the curie was redefined as 3.7×10^{10} disintegrations per second; that is a *lot* of radioactivity. For most measurement purposes, radiation scientists use smaller units of a curie, such as the microcurie (µCi, one millionth of a curie) or picocurie (pCi, one trillionth of a curie) (see Table 1). Radon is often recorded in picocuries.

There are a variety of ways of measuring radiation, depending upon the type of radiation under consideration (alpha, beta, gamma), the energy of the emitted radiation, and the purpose of the measurement (See Figure 1, page 32). For specific information about radon testing, contact your state radon program. See Resources, State Programs.

MINIMUM RECOMMENDED TIME ALLOCATION

One class period.

Table 1. Some common factors used in units of measure.

Factor	Prefix	Symbol	Explanation of Factor
10^{-1}	deci	d	one-tenth
10^{-2}	centi	c	one-hundredth
10^{-3}	milli	m	one-thousandth
10^{-6}	micro	µ	one-millionth
10^{-9}	nano	n	one-billionth
10^{-12}	pico	p	one-trillionth

STUDENT RESPONSES

Question 3: The February data presented in the exercise show a pattern of highest concentrations in the mornings and lowest concentrations in the afternoons. Such diurnal variability is common, and can be attributable to radon build-up during the night in response to closed-house conditions, and more frequent ventilation during the day (opening doors, using fans, etc.).

Question 4: The March data show increased concentrations during the period of March 8 to March 12. A cold-spell *could* cause such a pattern by increasing the flow of heated air up through the house to escape at the top. This increased heat flow would likely increase the pressure differential (vacuum) that draws radon into the house at the bottom.

Question 5: The largest sudden *decrease* in radon concentration occurred on March 17. This was probably the day that Dad painted the kitchen and aired out the house. If March 17 was a Saturday, then March 1 was a Thursday.

Question 6: Answers will vary.

Question 8: In discussing the pros and cons of the various measurements, the students should consider that the radon concentration is always changing. It is a moving target. A short-term measurement may or may not provide a snap-shot of "average" concentrations.

Question 9: The annual average concentration would probably be somewhat less than during a very cold month, mainly because of the enhanced heat flows and lessened ventilation during cold weather.

EXTENDED ACTIVITIES

If funding permits, purchase 1 to 3 charcoal canisters for students to take measurements in selected student homes or at school. Have students predict differences among results. This activity will cost about $20 to $50 (See Resources, Information Resources).

Radon Alert
Lesson Plan Evaluation Sheet
and FREE POSTER AND STORYBOOK offer

The New Jersey Department of Environmental Protection is happy to provide these lesson plans for use by teachers. In order to evaluate the use of the lesson plans, we would greatly appreciate your response to the following questions. All teachers who return these forms will receive a FREE RADON POSTER depicting information about radon in a colorful format and a STORYBOOK about a Native American child and his experience with radon in his home.

1. Which Radon Alert lesson plan(s) did you use?

_____

2. How useful did you find it/them (check one) ?

___ Not useful
___ Slightly useful
___ Moderately useful
___ Very useful
___ Extremely useful

3. Do you plan to use them again in the future? ___Yes ___ No

4. In your view, what would make the lesson plans MORE useful:

Your name:_____ Phone Number: _____

Subject area: _____Grade:_____

Mailing address:

_____

_____

To receive your FREE RADON POSTER and STORYBOOK, mail or fax this completed form to:
NJDEP Radon Program, P. O. Box 415, Trenton, NJ 08625
Fax: 609-984-5595.

(Questions? Call the Radon Program at 1-800-648-0394.)