## INVESTIGATION 10

# WHAT ARE THE RISKS FROM RADON?

## INTRODUCTION

Whether or not you choose to admit it, you and your friends live with risks everyday. Statisticiant §ell us that there is a mathematical probability, or risk, associated with walking to the local 7-11 convenience store or driving your car on the freeway. Even our daily language reveals our concern with probability, though not necessarily in life or death terms. How many times have you heard someone say, "My *chances* of getting a B on the Social Studies test are not very good." or "It is *likely* that I will be invited to the party this Friday." Probability is simply a calculation or estimation of the likelihood that a particular event will occur.

In health studies, we often express health or disease as a probability. For example, what is the probability that I will develop lung cancer if I smoke cigarettes? Probability tells us how often some event may be expected to occur based on a ratio. For example, we say that the probability of a coin landing heads when it is tossed in the air is 1-in-2. Similarly, it is estimated that there is a 1-in-500 or 1/500 chance your parachute won't open if you choose to jump out of a plane at 7,000 feet. **In this activity, you will apply a probability experiment to the health risks associated with radon exposure.**

## OBJECTIVE

To apply principles of probability to the radon issue.

## MATERIALS

- Two dice

## PROCEDURE

1. Toss a pair of dice 50 times and record a check mark (✓) in the space below next to the sum of the numbers appearing after each toss. Calculate and record in the table below, the number of times each possible sum turned up during the first 50 rolls. Continue rolling the dice and perform similar calculations after 100 rolls and 150 rolls.

| Sum of Numbers on Dice | First 50 Rolls Checkmarks | First 50 Rolls Totals | Rolls 51 to 100 Checkmarks | Rolls 51 to 100 Totals | Rolls 101 to 150 Checkmarks | Rolls 101 to 150 Totals |
|---|---|---|---|---|---|---|
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |
| 12 | | | | | | |

Construct a bar graph to reflect the data.

## ANALYSIS

2. After 50, 100, and 150 tosses, which combination turned up most and least frequently?

50 Tosses _____

100 Tosses _____

150 Tosses _____

Did this finding surprise you? Explain.

_____

_____

_____

_____

3. Fill in the sample space below to help determine the mathematical probability associated with tossing two dice. Enter the sum of the two dice in each box (first die and second die).

FIRST DIE

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |

A sample space is a set of elements that correspond one-to-one with all possible outcomes of an experiment.

4. What is the probability of tossing a 6? In other words, of the 36 possible combinations, how many combinations have a sum of 6? _____

5. What is the probability of tossing a 12? _____

6. What is the probability of tossing a 4? _____

7. How closely does the mathematical probability match the actual tossing of the dice? Explain.

_____
_____
_____
_____
_____

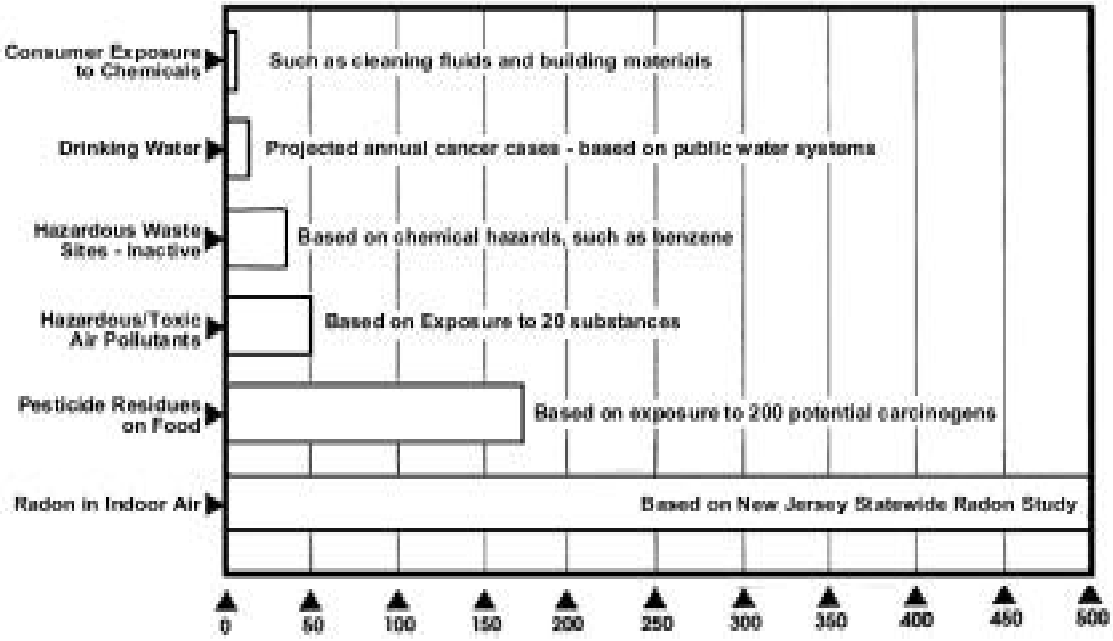
8. Based on your experiences with tossing dice, what would you predict is the likelihood or chance of a skunk getting struck by a car when it crosses a busy highway? For example: Do you think the probability 1 out of 36, 1 out of 18, or 1 out of 6? How would you go about determining this probability?

_____
_____
_____
_____
_____
_____
_____
_____

The risk or probability of suffering a health-related problem (e.g., cancer) from radon exposure is not as easily computed as flipping a coin or tossing a pair of dice. However, there are comparisons that can help us better understand the risks associated with radon.

9. Review the graph on the following page.

## Ranking of Environmental Problems on the Basis of Population Cancer Risk




**Sources: EPA-Unfinished Business: A Comparative Assessment of Environmental Problems, February, 1987, Evaluation of Carcinogenic Risk Assessments as Used by US Federal Agencies in Establishing Standards for Toxic and Hazardous Substances, July, 1985, and the NJDEPE-CDM Radon Report.**

10. Based on the graph, what would you tell a friend about the health risk from radon in indoor air compared to other environmental risks such as air pollutants or hazardous waste sites? What information about radon can you use to support youranswer?

## CONCLUSIONS

11. Why do you think it is difficult for scientists to come up with a specific risk "ratio" for the general public when discussing the radon problem?