

Chapter 6

The Myth of the Quick Test

The use of short-term measures for mitigation decisions creates all kind of problems.

—Richard Sextro

The context of radon testing is explained directly by the myths of the hot house and Reading Prong. The U.S. geologic radon policy has been driven by the image of the Watras experience and by the tail of the lognormal curve, the specter of extreme hot houses exposing their residents to extraordinary risk. Abetted by the scientific consensus over risks in hot houses, EPA has crafted a policy that espouses much broader goals (the 4 pCi/l guidance and even ambient levels), but in effect focuses on finding hot houses and hot regions. Given this policy focus, the primary objective of radon testing has been to "screen" buildings to find the hot ones, to the exclusion of other objectives that should be central to a comprehensive policy for radon risk reduction.

Moreover, this emphasis upon screening for hot houses demanded a quick, inexpensive, and easy measurement approach that came to dominate U.S. radon testing. By the myth of the quick test, we refer to the inherent delusion underlying radon policy that such screening measurements, made over time intervals of only a few days, accurately reflect the risk from radon exposure in a given building. Despite serious validity questions, such tests have been widely employed for all uses. As a result, the majority of those testing have used inappropriate tests for their objectives and possibly drawn inaccurate conclusions regarding the safety of buildings, the need to remediate, and whether to proceed to purchase a house. The myth of the quick test has led policymakers, experts, and even consumer groups to create misleading programs and to provide wrong advice. We see this impact clearly when we examine error in radon testing.

Errors in Radon Testing

In our view, the challenge in radon testing has less to do with the technical problems of how to detect radon than with the central question of whether information gleaned from tests provides a valid indication of the average radon level and, particularly, the exposure of building occupants to radon. Validity requires the elimination of testing errors that might lead us to obtain false results, to make false conclusions, and to make inappropriate responses. Also requisite for validity is repeatability, since we can have no confidence in results that cannot

be replicated. Validity is threatened by six potentially interacting types of error, all found in the U.S. radon testing program.

- *Error of Policy.* Are we asking the right questions? Are we clear enough about what our goals are to select the appropriate testing methodology and technique?
- *Methodological Error.* Have we adequately sampled for radon so that our findings represent radon levels in the test setting?
- *Device Error.* Might error result from the inherent shortcomings of the radon detector that we are using, whether a charcoal canister, an alpha track detector, or an electret?
- *Measurement Error.* Is the testing device properly used and are there situational factors that might contribute to error?
- *Analysis Error.* What are the potential laboratory errors in the analysis of the radon collected in test devices?
- *Interpretation Error.* Are correct conclusions drawn from the measurement?

We will now examine how each of these errors affects radon testing policy and practice.

Errors in Policy

The primary cause of "policy error" has been a failure to clearly delineate the different goals that exist for testing and to consider whether given testing techniques achieve desired objectives. Tests valid in all other ways may fail simply because the information they provide is neither what we need to know nor, having been misled, what we think it is.

At least seven different testing goals and objectives are reflected in common practice (see table 6.1), yet these goals and the techniques most appropriate for achieving them have never been adequately differentiated in radon policy. When a careful comparison of the goals and objectives is made, some striking conclusions about radon testing and measurement can be drawn that reflect policy error. After reviewing the key questions posed by the seven different policy goals and objectives, we will examine the case of screening and the myth of the quick test more closely. Note that EPA testing protocols cited here were originally published in the 1986 *Citizens' Guide to Radon*; reference to updated protocols relies upon the revised 1992 *Citizens' Guide* (EPA 1986; 1992f). Unless noted, these two protocols were in agreement.

Table 6.1 Goals, Objectives, Location, Time, Cost, and Problems of Various Types of Measurements

Goal	Objective	Location	Time	Cost	Problems
Screening	Is the house hot? Is it above 4 pCi/l?	Lowest potential livable (lived-in) space	Short—days to a few months	Low	High false negatives and positives
Follow-up	Is remediation needed and how soon?	2(1) lived-in levels	1 yr. if greater than 4 or less than 20; short if greater than 20	Low	Inaccurate if closed house or short test
Household characterization	What is the health risk?	2 lived-in levels	1 year	Low	Long testing interval
Diagnosis	What is the best mitigation choice?	Suspected entryways	Short—grab or sniffing	High	Requires high tester skill level
Mitigation evaluation	Did mitigation work?	2 lived-in levels	Same as premitigation	Low-high	Unreliable
Realty transfer	Can safety be warranted?	Generally in lowest livable (lived-in) space	Short	Low-high	Unreliable
Institutional exposure	Are public buildings safe?	Generally in lowest occupied space	Short	Low-high	Unreliable

Source: Summarized from NYSEO, 1989; EPA, 1986; EPA, 1989a; and EPA, 1992f.

Note: Items in parentheses reflect May 1992 EPA recommendations.

Screening: Is the House Hot?

“Screening measurements” are quick initial tests for identifying houses having high concentrations of radon—the so-called hot houses. Screening seeks to measure the highest radon concentration in a building. To achieve this end, “closed-house” conditions are employed and tests were originally taken in the lowest potentially livable level of the building, later changed to the actual lowest lived-in level. Because screening measurements theoretically capture the highest radon levels found in the home, it is well recognized that they have an inherent tendency to exaggerate results. Therefore, the intended use of the screening measure is to sort buildings into those requiring further confirmatory measurements and those deemed to be safe (i.e., not a hot house). Accordingly, screening measurements are by definition quick and dirty—and relatively cheap. But, while helpful, perhaps, for a rough sorting of houses, the screening test is not helpful in determining the actual risks associated with a building or in determining whether remedial action is required. Moreover, because of sampling and other errors discussed below, short-term testing is an unreliable method for estimating lower radon levels, particularly around 4 pCi/l.

Follow-up: Is Remediation Necessary?

“Confirmatory testing” involves follow-up measurements made in upper levels or lived-in portions of the house for the purpose of estimating potential health risks and the need for remedial action. EPA recommended confirmatory testing after an initial screening test indicated a result in excess of 4 pCi/l. The urgency of the follow-up test and the resulting actions are determined by the radon level found. Screening results between 4 and 20 pCi/l (later revised to between 4 and 10 pCi/l) were to be followed by a year-long radon characterization study (now revised to a long-term test over ninety days unless results are needed quickly).¹ Should levels be confirmed, remediation is to occur within a few years. Radon screening results between 20 (now 10) and 200 pCi/l are to be followed by confirmatory tests under closed house conditions and, if confirmed, remediation is to occur within several months.² And screening values over 200 pCi/l do not require confirmation, rather remediation is recommended within a few weeks.

Household Characterization: What Is the Health Risk? Is My House Safe?

“Household characterization” seeks to estimate the long-term yearly average radon exposure in living areas in order to provide more reliable information on health risk for the occupants. House characterization should not be confused with confirmatory testing because the latter, as practiced, rarely gives a long-term average. House characterization may be made by using an alpha track de-