Radon: EPA's biggest air pollutant . . .

The Environmental Protection Agency (EPA) last week announced the results of a 10-state survey of indoor radon levels, the largest such survey ever conducted. It found that 21 percent of the 11,600 homes sampled last winter — or more than one home in every five — had levels of the naturally occurring radioactive gas exceeding EPA's "action level" of 4 picocuries per liter (pCi/l) of air. Last year the agency recommended that homeowners consider taking measures to reduce radon levels when homes exceed that action level. One percent of the homes in the new survey had levels exceeding 20 pCi/l, and a few had levels exceeding 150 pCi/l — a level at which the agency recommends taking immediate corrective action.

Radon is a decay product of radium, usually associated with rock-containing slate, granite, phosphate or uranium. Though it becomes harmlessly diluted when emitted into outdoor air, it can seep into homes — largely through cracks in the foundation — and collect to dangerous levels. While most attention has focused on radon, it is the gas's radioactive decay products, known as "daughters," that pose the biggest health risk (SN: 1/18/86, p.43). Able to adhere to respirable dust, they can be inhaled, lodge in the lung and there irradiate tissues.

EPA's survey was conducted using charcoal-canister devices during the winter, when homes were closed up and therefore likely not only to trap the most radon but also to yield the highest readings. EPA provided the radon-sampling devices to health or environmental agencies in states that had volunteered to participate in this first round of measurements. The states chose the homes to be sampled, distributed the devices and then returned them to EPA for analysis.

Owing to the way homes were randomly sampled in six of the states, data from them can be extrapolated as representative of each as a whole; EPA therefore concludes that its action level was exceeded in 6 percent of Alabama's homes, 17 percent of Kentucky's, 9 percent of Michigan's, 16 percent of Tennessee's, 27 percent of Wisconsin's and 26 percent of Wyoming's. Data for other states, such as Colorado — which had the largest number of homes (39 percent) exceeding the action level — are valid only for those homes actually surveyed. In those cases, too few homes were sampled before winter ended, or sampling was not random.

EPA has estimated that 5,000 to 20,000 of the 136,000 U.S. lung-cancer deaths that occur each year can be attributed to radiation from indoor radon. And the data from this new survey are consistent with those estimates, according to Sheldon Meyers, director of EPA's office of radiation programs. In fact, he told SCIENCE NEWS, the cancer risk associated with this pollutant is "much, much higher" than that associated with any other air pollutant the agency is concerned with. For comparison, he says that estimated annual cancer deaths attributable to all other toxic air pollutants combined total only about 2,000. Living in a home with just the 4 pCi/l concentration of radon carries a 1 in 100 lifetime risk of dying from lung cancer, Meyers says.

The new survey's findings "indicate that radon may be a problem in virtually every state," says A. James Barnes, EPA's deputy administrator. Toward confirming this, the agency will be surveying homes in another seven states next year. And while the agency continues to map the presence of rock formations that have been linked to radon, Meyers notes that the pollutant can prove a problem even in areas without these geologic indicators. As a result, Meyers says, the only foolproof way to rule out a radon problem in any individual home is to test the home. To help states and homeowners identify reputable radon-testing firms, EPA now compiles and distributes lists of companies it has certified as having recently conducted accurate measurements.

. . . and its leading water pollutant

The radon seeping out of rock often collects in groundwater used to supply drinking water. EPA data indicate that about 20,000 U.S. groundwater supplies — roughly 40 percent of the public drinking-water supplies — contain 200 to 600 pCi/l of radon, according to a report by the agency's C. Richard Cothern and Edward V. Ohanian. Though a far less serious risk than the radon seeping through the soil, this source of the pollutant is still estimated to contribute 30 to 600 excess lung-cancer deaths annually in the United States, they note. Paul Milvy, in EPA's Office of Drinking Water, says that makes radon his agency's leading drinking-water risk.

The health risk from radon in water is not so much from drinking it as from inhaling it during showers, bathing, cooking, washing and the flushing of toilets. As a general rule of thumb, says Sheldon Meyers, director of EPA's Office of Radiation Programs, 10,000 pCi/l of radon in water will be responsible for 1 pCi/l of radon in indoor air.

Last Sept. 30, EPA announced its intent to set limits on radon in public drinking-water supplies. Milvy says the proposed limit — expected to be announced by next Jan. 1 — will probably fall between 500 and 5,000 pCi/l. Under such a limit, Cothern and Ohanian say, radon could convey a higher allowable health risk than any other controlled drinking-water pollutant. Most toxic chemicals, for example, are controlled to limits providing just a 1-in-100,000 or 1-in-1-million risk of causing a fatal cancer. The lower limits being considered for radon offer a 1-in-10,000 lifetime risk of dying from lung cancer, according to Cothern and Ohanian, who presented their findings recently at the Health Physics Society annual meeting in Salt Lake City.

Using people to screen for home radon

Measuring radon levels in a home has traditionally required leaving a charcoal canister in the living area for 4 to 7 days, or a more sophisticated alpha (radiation)-track device in the home for up to a year. But there may be much faster and simpler ways to screen for radon — at least for levels that constitute a really serious hazard, according to scientists at Argonne (Ill.) National Laboratory. The researchers, who also presented their results at the Health Physics Society meeting, have found that measuring radon in a home's occupants can, depending on the radiation counter used, provide a gauge sensitive enough to detect home radon concentrations as low as 3 to 4 pCi/l. And they suspect that a mass screening device suitable for voluntary use — in shopping malls, for example — could be developed that would within 1 minute identify whether an individual's home had really worrisome levels of the hazardous pollutant (i.e. 20 pCi/l or more).

The researchers came up with the idea in the process of screening workers from a radium-dial plant in Pennsylvania, says Richard E. Toohey. While the monitors showed little or no radium contamination, "we did find a lot of radon daughters deposited in and on the people." To make sure this was not contamination they had carried home from work, the Argonne researchers surveyed their homes. And, notes Toohey, "our [human-contamination] data correlated well with radon levels in their homes."

The people were scanned with a sodium-iodide-crystal-based whole-body radiation counter. As the monitored individual, lying on a flat bed, was pulled under the crystal, gamma rays emitted from the body would cause the crystal to fluoresce. A photomultiplier tube converts the fluorescent light to a voltage. Since the voltage is proportional to the emitted gamma ray's energy, and because each radon daughter emits gamma rays having a characteristic energy, voltage readings permit identification of the contaminating radon daughters, Toohey explains.