

# Indoor Air Quality Update™

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## Scientists Debate Radon Risks

The controversies over radon risks are increasing in number and intensity. An important conference on radon and the U.S. Environmental Protection Agency's (EPA) draft revised "Citizen's Guide to

Radon" have created a great deal of debate among some of the country's most knowledgeable and powerful scientists and policy makers. In this article, we discuss both the conference and some of the comments on the draft revised guide.

ference, as well as much strong criticism of EPA's current draft revised "Citizen's Guide to Radon," raise important questions.

We previously addressed some of them (*IAQU*, September 1990) in discussing an article from *Environmental Science and Technology*. This month, we present some comments on papers from the conference as well as some of the criticisms of the draft revised citizen's guide. We hope that others who, like us, have assumed that the scientific questions and public policy issues regarding indoor radon were reasonably well resolved will begin to pay more careful attention to some of the conflicts. Ultimately, we hope that officials guiding EPA radon policy will address the conflicts more responsibly.

### Conference: "Indoor Radon and Lung Cancer: Reality or Myth?"

The U.S. Department of Energy (DOE) and Battelle Pacific Northwest Laboratories (PNL) sponsored a conference titled "Indoor Radon and Lung Cancer: Reality or Myth?" in mid-October in Richland, Washington. The purpose of the conference was to help focus the radon health risk-assessment dialogue.

The conference program announced: "This symposium will address the most important public health issue in radiation today: is indoor radon causing lung cancer?" The symposium "... will provide a forum to present and evaluate basic research data on the physical and biological mechanisms associated with, or related to, the health effects of indoor radon.... [E]mphasis will be placed on the main question: Is indoor radon causing lung cancer?"

Most people assume that the radon risk is well established; at least, that is the impression given by the public information available from EPA. Yet the divergent views on the conclusions from the con-

### Conference Results

Fred Cross of PNL was conference chairman. We asked Dr. Cross how he viewed the radon risk question after the conference. In sum, Cross said, "there is very heavy evidence on the reality rather than the myth side." In support of his observation, Cross cited two epidemiologic studies with indoor radon measurement data that show positive correlations between radon levels and lung cancer risk.

However, Dr. Susan Rose, who oversees the DOE's radon health risk studies, saw it differently. "The meeting could have been called reality or math! Everything we talked about was a mathemati-

### In This Issue

#### Feature

Scientists Debate Radon Risks . . . 1

#### News and Analysis

California Considers ASHRAE Standard 62-1989 (More or Less) . . . . . 5

EPA's Science Advisory Board Reviews Passive Smoking Reports . . . . . 7

AIA Convenes Committee on the Environment . . . . . 8

#### Research Briefs

Danish Researchers Publish Useful IAQ Guide in English . . . . . 8

#### Readers' Forum

Installing Carpet Safely . . . . . 11

#### Information Exchange

EPRI Issues Ventilation Workshop Proceedings . . . . 14

Center for Indoor Air Research Announces Grants Availability . . . . . 14

EPA Publishes School-Environment Resource Handbook . . . . 14

NIBS Publishes Lead, Radon Control Guides . . . . . 15

Canadians Revise Residential IAQ Guidelines . . . . . 15

Calendar . . . . . 16

cal construct. There is no hard evidence at average [indoor radon] levels that there is any risk at all."

Rose said animal studies were quoted, but noted that animal studies had never even shown smoking to cause lung cancer. "Therefore," she asked, "how much weight do animal studies carry in this whole issue?"

Cross told *IAQU* that he thought the conference was very successful and rewarding, and that he was pleased with the quality of the papers and discussions. Interest in the question of radon health risks runs high, according to Cross, who said the conference was well attended in spite of federal budget problems.

#### *New Jersey Study: Strong Evidence?*

One study in particular, that of Janet B. Schoenberg from the New Jersey Department of Health in Trenton, has received quite a bit of attention. Dr. Schoenberg reported finding an apparent dose-related increased risk of lung cancer in women living in homes with relatively low radon concentrations (2 to 11 picocuries per liter [pCi/l]). *Science News* reported that Naomi Harley, a highly respected radiation oncologist from New York University, viewed Schoenberg's study as one of the best supporting a low-dose radon risk. The study's strengths were in the size of the population studied and in the number of confounding variables accounted for in the study, according to Harley.

Commenting on the New Jersey study, however, DOE's Dr. Rose said: "It wasn't statistically conclusive despite exaggerated reports of what it showed." She said the data are statistically inconclusive; the uncertainty in the few lung can-

cer cases that Schoenberg's study was actually based on was large. The chances were equally good of coming up with the opposite results in the few cases that Schoenberg had. "I think the low-level issue, the lung cancer risk at levels confounded by smoking, is no less certain after the meeting than at the start," Rose said.

According to Rose, "No one has shown that anywhere in the world, where ecological studies have been done, do high exposure areas have excess lung cancer cases. The opposite situation occurs everywhere that it has been looked for. Ecological studies are not the scientific equivalent of case control studies, but they raise serious questions which deserve to be answered."

#### *Radon, Leukemia, and Prostate Cancer*

Even more provocative than the lung cancer problem, Cross said, was the suggestion by a British scientist that indoor radon might cause leukemia and prostate cancer. Denis Lee Henshaw from Great Britain presented results of his calculations showing, at least theoretically, that radon from indoor air can produce sufficiently high doses to bone marrow to cause leukemia and prostatic cancer.

But Rose disagrees again. She says that the hypothesis flies in the face of evidence from exposures in Hiroshima and Nagasaki and known biological studies. Nonetheless, this is something worth further investigation, she added.

#### *Myth or Reality?*

We do not feel comfortable with either conclusion. Both camps have interesting points, and we have very high regards for Cross,

Rose, and Harley. However, they don't agree, and we must wait until they do.

### **Commenters Strongly Criticize EPA's New "Citizen's Guide to Radon"**

As EPA reviews the comments it has received on its draft revised "Citizen's Guide to Radon," controversy and disagreement abounds over many of the assumptions and policy decisions that underlie the guide's provisions. We reviewed several comments from various scientists and others. Among the contested issues are the following:

- Is EPA terrorizing people about radon with its public outreach? This outreach includes television ads that show skeletons and frightened children. Many responsible scientists think the outreach is excessive and have told the agency so in their comments on the draft.
- Many argue that a greater health risk comes from smoking and that no lung cancer prevention program should fail to stress the importance of stopping smoking, especially given the synergism between ETS and radon; or, in the case of children, the importance of not starting.
- Has EPA taken a wrong-headed approach in encouraging mitigation on the basis of a short-term test? Many believe that the false positives and negatives associated with short-term tests make them an unreliable basis for sound decisions. While EPA urges follow-up measurements, it suggests that they be done by contractors; presumably, these are people with a bias in favor of remediation action.

This raises a different question regarding the ability of EPA or any government agency to protect consumers against incompetent or biased advice.

- Are children's risks really as great as suggested by the draft and other EPA outreach material? This has been a focus for much of the policy that focuses attention on schools and on the presumed greater threat of radon to children. Dr. Jay H. Lubin, health statistician with the National Cancer Institute, disagrees with EPA's handling of the estimates of children's risks. Lubin cites newer data, published after the data relied upon by EPA, that questions the risk model EPA uses. In particular, the risks assumed from analysis of effects among A-bomb survivors is inappropriate because of differences in the type of radiation involved. Even if this fact is ignored, Lubin claims, "... there are no significant age-at-exposure effects among the A-bomb survivors." He goes on to assert that "the preferred model for respiratory cancer does not depend upon age at exposure."
- Is EPA acting responsibly (some would say, truthfully) in many of its public statements? For example, it states in the guide that high levels of naturally occurring radon had only recently (the agency says since 1985) been measured in homes across the country. Anthony (Tony) Nero of Lawrence Berkeley Laboratories (LBL) disputes this and says that EPA itself recognized the existence of elevated radon levels in homes across the nation by 1980.

- Because the radon policy impacts real-estate transactions and a large public investment in testing and mitigation, it should receive full public review comparable to that given EPA regulatory standards. One commenter stated that the radon industry estimates that "80% of all radon tests are real-estate driven." In spite of this, the comment says, the draft guide's attention to radon testing and home purchasing is scanty.

Some scientists have criticized EPA for developing policy with such far-reaching consequences as the radon program's without full public and scientific review. While the "Citizen's Guide to Radon" has been sent out for comment to hundreds of scientists, many of these same scientists complain that their comments on the previous guide and other aspects of the EPA radon program were not reflected in the final document. Of course, it remains to be seen whether they will feel the same way this time. However, a deeper criticism is that the radon policy is, in effect, a *de facto* standard and therefore should be subject to the same kind of public review as other standards developed by the agency.

#### Comments by Tony Nero of LBL

Tony Nero is one of the best-known scientists in the IAQ field, and his work on radon predates EPA's claimed recent discovery by almost a decade. He submitted a very lengthy and detailed set of comments that not only attacked the science and language of the documents, but also attacked the general approach taken by EPA's radon program in recent years.

#### Risk Inflation

Nero says EPA has purposely exaggerated the incidence of high radon concentrations and distorted the number in its presentation. He says only 6 or 7% of homes have radon concentrations at or above four pCi/l, while three times that number is claimed by EPA; it says the proportion is 20%.

According to Nero, using EPA's estimate of the number of false positives that would be obtained by use of a short-term test will actually result in 50 to 60% false positives; EPA states that it would only result in 8 to 13% false positives. Nero claims that many scientists believe the recommended protocol would result in 75% false positives.

#### Measurement Approach

Nero believes that long-term measurements should be obtained to reduce the false positive rate. He says the charcoal-measurement method is inherently sensitive to short-term variability. He estimates that a longer-term test, preferably a three-month test but at least a one-month test, would reduce the number of false positives by a large factor. This would be true, he says, if it were combined with some type of interpretive protocol, where "based on the local conditions, an estimate of the annual-average concentration is made from the direct monitoring result."

Unpublished research done by Professor Robert Socolow at a Princeton University test house indicates that the probability that a short-term (two-day) test will predict the annual average to within 25% of the true value ranges from a low of 15% in the summer to a high of 75% in the early spring. Measurements made in the winter would have a 50% prob-

ability, fall measurements a 35% probability, and late-spring measurements a 65% probability, according to the research. The data were attached to the comments of Dr. Ronald Colle of the National Institute of Standards and Technology.

Like many others, Nero says that testing should be done in a staged approach. It should be recommended primarily in areas identified as having higher-than-average radon potential. He is specifically critical of the failure to consider a strategy that "deliberately aims to identify homes with levels exceeding 10 or 20 pCi/l in the near term."

Targeting these homes would have a far greater cost/benefit ratio, especially if the high-risk areas are targeted first. Also, the experience gained in mitigating radon in these homes would improve the cost/benefit of mitigation efforts in areas and homes having lower concentrations.

#### Risk Communication

Nero recommends a figure or drawing of some sort that shows the proportion of people out of a population of 1,000 that would be expected to get lung cancer from radon according to reliable risk estimates. He says such a figure would show about 50 getting lung cancer from smoking, perhaps five from smoking and radon, and less than one from radon alone at the nominal level of 1.5 pCi/l, the estimated national average. For comparison, he suggests showing the number of people that would be killed from diseases other than lung cancer as a result of smoking (he gives no number), the 20 or so killed in auto accidents, and the six or so killed in accidents at home.

#### Comparing Radon Risks to Diagnostic X-Rays

Nero, like every other scientist whose comments we read, is critical of EPA's comparison of radon exposure to risks associated with medical x-rays. He believes EPA is terrorizing people with this comparison since people associate x-ray related risk with methods no longer in use; the x-ray methods of 30-40 years ago did entail risks significantly greater than those presently used.

Other commenters suggested that EPA might actually create a medical x-ray aversion reaction that would have an overall negative outcome on public health by reducing people's willingness to obtain valuable diagnostic x-rays.

#### Historical Revisionism

Nero takes EPA to task for misrepresenting the discovery of the national radon problem in 1985. He points out that David Rosenbaum, head of EPA's Office of Radiation Programs in 1980, said "Radon is by far the highest radiation danger that the American public faces. It is certainly up there with the top dangers EPA deals with. It's easily more serious than Love Canal." He questions why EPA now says: "It wasn't until 1985 that dangerous radon levels were found inside homes across the U.S." when levels in excess of 20 pCi/l had been found in Maryland, Pennsylvania, Maine, Illinois, and Montana by 1979.

#### Nero's Remedial Recommendation

Nero believes the draft guide is so flawed that it should not be issued now even with major revisions. He strongly urges EPA to develop a more rational way of communicating radon hazards and a more reasonable policy on target-

ing radon hazard homes, and to replace the two-day test with a longer test including an interpretive function based on local conditions.

#### Comments by Federal Cancer Researcher Jay Lubin

Jay Lubin, health statistician at the National Cancer Institute, commented that "... the documents do not adequately describe the consensus of scientific evidence regarding radon and risk of lung cancer and the public health impact...." He described the overall tone of the "Citizen's Guide" as "unfortunate." Many of his comments echoed those of Nero regarding the unnecessary "scare tactics" used by EPA in the draft guide.

Lubin wrote: "The 'intruder' analogy seems geared only toward generating a visceral reaction, rather than a reasoned approach to a situation which, for the vast majority of homeowners, represents a *minimal problem*; except in rare instances the health risks are neither acute nor immediately life threatening.... [T]he extent of the problem that faces the general population due to domestic exposure is still very unclear."

He goes on to say that "... [t]here is a problem associated with domestic exposure to radon and radon progeny that must be addressed; however the ... revised Citizen's Guide suggests a degree of urgency that is unsupported by current understanding, at least in the vast majority of homes."

Lubin also raises questions about EPA's use of the data from its own surveys to estimate risks in the technical support document accompanying the guide. He says that basement radon values may differ by factors of two to four from first-floor levels. He also reports that

NCI studies showed a very large difference between the number of homes exceeding four pCi/l based on year-long alpha-track measurements (4%) versus the number based on short-term measurements (18%).

#### *Nazaroff and Teichman Policy Analysis*

Many of Lubin's and others' comments strongly support the position presented by Nazaroff and Teichman in their analysis of federal radon policy published in *Environmental Science and Technology* earlier this year. (See the September 1990 *IAQU*.) Their analysis included emphasis on the cost effectiveness of measurement and mitigation activities.

They argued that measuring and mitigating homes at risks as low as four pCi/l resulted in very high cost per unit of risk reduction. Instead, they advocated a staged approach in which the highest radon level homes would be targeted first. Then, with the knowledge and experience gained from measurement and mitigation of those homes, lesser radon levels could be addressed more economically and effectively.

#### **Comment**

While neither the conference nor the draft revised guide are leading to a resolution of the issue, radon continues to receive the lion's share of the funding for IAQ research and policy. According to *IAQU* Washington sources, EPA's radon "policy" budget is ten times the indoor air policy budget. The combined DOE/EPA radon research budgets are approximately three times the combined DOE/EPA IAQ budgets.

We are perplexed by this ratio. While we think it is time that in-

door air research received reasonable funding levels — tens or scores of millions of dollars — it is clear that the money that has been spent so far on radon research is not reducing disagreement in the scientific community.

In spite of the budget-balancing problems, it is quite clear that the health risks from exposure to indoor air contaminants are far greater than those from outdoor air pollutants or many of the other risks on which EPA bases its research and regulatory actions. Apparently, the radon question requires considerably more research to resolve the uncertainties. The same is no less true for the plethora of other indoor air contaminants and the multitude of sources from which they originate. When will federal budget priorities begin to reflect the health risks of exposure to indoor air pollutants now widely acknowledged both within and outside EPA?

#### **For More Information**

Comments on the revised "Citizen's Guide" were due October 22. We believe (or hope) that serious consideration of the comments will result in a significant revision of the guide.

The person responsible for revisions to the guide is Dennis Wagner. If you would like to comment, you can obtain a copy by calling (202) 475-9605 or by writing to the Radon Division, EPA, 401 M Street S.W., Washington, DC 20460, attention Mike Walker or Dennis Wagner. ♦

#### **News and Analysis**

### **California Considers ASHRAE Standard 62-1989**

On October 19, the California Energy Commission (CEC) published proposed changes in its energy conservation standards. Separate standards are being considered for low-rise residential buildings and for non-residential buildings, high-rise residential buildings, and hotels/motels. The proposals for non-residential buildings include the incorporation of many features of ASHRAE Standard 62-1989 as well as some significant departures. If adopted by the commission, the changes would govern construction throughout California.

These proposed regulations represent the first extensive review of the adopted ASHRAE standard since its formal adoption late last year. They reflect input from not only energy commission staff but also from the Air Resources Board (ARB) and the Department of Health Services (DHS). Each of these state agencies has several full-time staff working on indoor air quality issues. Some of the California changes are likely to be seriously considered by the ASHRAE committee that will develop the next version of the standard.

#### **Noteworthy Changes from Standard 62-1989**

Some of the most noteworthy features of the proposed standards are described below.

##### *Outside Air Ventilation Rates*

Where natural ventilation is not provided, the minimum outdoor air ventilation rate shall be no less than the larger of 0.15 cubic feet per minute per square foot (cfm/sf)