Radon Today

The Role of Flimflam in Public Policy

Philip H. Abelson

The Environmental Protection Agency and some members of Congress are embarked on a questionable radon program that will entail great costs and produce trivial benefits. The costs include huge financial expenditures for renovation and new construction in schools, residences, large buildings, and federal buildings, as well as fees for litigation. The program also will cause needless anxiety for millions of people.

In its warnings to the public and in its guidelines the EPA adopts what it calls a conservative approach. It gives credence to the piece of evidence or analysis that implies the greatest risk or danger. Solid evidence that the risk is minimal is disregarded. As a result of that approach to asbestos, radon, and industrial chemicals, our country is on the road to wasting a trillion dollars or more to obtain negligible health benefits.

This article will analyze the shaky scientific basis on which the EPA has set goals for radon levels. It will provide evidence that EPA estimates of the carcinogenicity of radon at low levels are unreliable, and it will describe some of the efforts of the EPA to frighten the public.

The EPA has issued many statements about the number of lung cancer deaths attributable to radon. The numbers vary but are of the order of 16,000 per year, with an upper limit of 43,200 per year. The numbers are not supported by epidemiological studies, but are based on limited data derived mainly from experiences of uranium miners. The data, many of which are based on high exposures in dusty unventilated mines, have been extrapolated to low doses in relatively dust-free living rooms.

Shortly after World War II, the Atomic Energy Commission embarked on a high-priority program to develop domestic sources of uranium. A high price was established for crude uranium-containing ores. John Morgan, a purchasing agent for the Atomic Energy Commission in the early days, observed that many truck drivers and other amateurs had used geiger counters to prospect for uranium. As a result, a substantial number of the prospectors became millionaire miners. Indeed, about 2,000 small mines were soon producing uranium. Morgan called the mines "dog holes" since in many cases the openings were scaled to a size more comfortable for dogs than for humans. The early mines were not ventilated. Howard L. Kusnetz, who as an officer of the U.S. Public Health Service from 1951 to 1971 monitored conditions in the uranium mines of the Colorado Plateau and developed improved methods of radon determination, told of primitive conditions in the small mines in which he crawled to measure radon levels. He spoke of the early difficulties of obtaining reliable results and stated that many of the reported measurements were made by miners. Their data were not reliable and tended to understate exposures.

The vast majority of the miners were smokers. In the cramped mine quarters, all those present inhaled the smoke. But during the 1950s the small unventilated mines contained more than cigarette smoke and radon. There were also nitrogen oxides and mineral dusts. The dust itself contained uranium and its decay products. Beyond the effects of radia-

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tion were the lung irritant effects of the dust itself. It is well known that asbestos workers who smoked had a greatly enhanced frequency of lung cancer. In any event, conditions in the mines were not conducive to good health. Silicosis, chronic obstructive pulmonary disease, and other noncancerous lung pathologies were noted in nonsmokers. The miners—smokers and nonsmokers—were exposed to pathology-inducing mineral irritants not present in one's home.

The EPA's statements on the carcinogenicity of radon and its decay products depend heavily on a report of a committee of the National Research Council—the so-called BEIR IV report. That report is largely based on a survey of literature relevant to uranium miners on the Colorado Plateau and includes references before 1987. It is a careful study, but it can be no more reliable than the fragmentary data available to the committee. A table in the document indicates how poorly radon exposures were monitored during the 1950s. For example, in 1955 radon was measured in only four of more than 2000 mines. In the interval from 1951 to 1958 the fraction of mines monitored seldom exceeded about 7 percent. The committee did recognize that the data and models on which they based their report were controversial. The council's report concluded: "In summary, a number of sources of uncertainty may substantially affect the committee's risk projections; the magnitude of uncertainty associated with each of these sources cannot readily be quantified. Accordingly, the committee acknowledges that the total uncertainty in its risk projection is large."

As a result of the EPA's conservative approach to estimating the risk of asbestos, radon, and industrial chemicals, our country is on the road to wasting a trillion dollars or more to obtain negligible health results.

The one conclusion of the report that is valid beyond doubt is that at high doses of radon, miners who are cigarette smokers experience an enhanced incidence of lung cancer. The data with respect to nonsmokers are less impressive. Only small numbers of cancers are involved in this cohort.

In its projections to estimate dangers associated with low exposures, the committee made the conventional assumption that risk is a linear function of dose. That is, one can extrapolate from high-dose effects to predict those at low doses. This assumption has never been proved.

Many epidemiological surveys and various surgeon General's reports have linked cigarette smoking with the incidence of lung cancer and other pathologies. Each year about 140,000 smokers die of lung cancer. In the days before smoking became prevalent (from 1920 to 1930) lung cancer was a rare disease. Radon levels in residences then were comparable to or greater than those now existing. In fact, the average radon levels experienced by people in the early 1900s were probably considerably higher than those of today. Radon is formed in soil and accumulates in households largely through leakage through the basement or bottom floor. Amounts of radon are greatest at the lowest floor level and much lower higher up. In today's apartment living residents receive much lower exposures than in the past. The historical data indicate that with moderate exposure to radon, nonsmokers are not subject to lung cancer. Rosalyn Yalow, a Nobel laureate, reported: "According to American Cancer Society statistics the age-adjusted lung cancer death rates in 1930 were 5 per 100,000 for males and 2.5 per 100,000 for females. At the present time, the rates are about 15-fold higher for men and 10-fold higher for women." The increased death rate is clearly linked to increased smoking.

The EPA has estimated that among a total of 140,000 lung cancer deaths, as an upper limit as many as 43,200 might be due to radon. Such a large number—whether 43,200, 20,000, or 16,000—should be glaringly evident in the population from even a casual epidemiological survey. A large number of homes have been monitored. The EPA has provided data for levels of radon in thirty-four states. Five states in the Midwest, including Iowa, have the highest radon levels. Taken together, those states were recorded as having about twice the national level. The lung cancer incidence in those five highest radon states was reported as only about 80 percent of the national average, however. Studies in other regions by Dr. Bernard Cohen and Dr. Ralph Lapp have yielded similar results. Lapp compared rates of lung cancer deaths in counties in New Jersey. Some counties over the Reading Prong have very high radon levels. Atlantic Coastal Plain counties have low radon levels. Warren County has thirteen times as much radon as the Coastal Plain counties, but rates of lung cancer deaths were the same in both regions. Moderate but higher than average levels of radon correlate with beneficial lessening

of the incidence of lung cancer. This is a finding that appears to hold elsewhere in the world.

Doctor Yalow has also commented on the epidemiological findings: "In the three states with the highest mean radon levels in home living areas (Colorado, North Dakota, Iowa: 3.9, 3.5, 3.3 pCi/liter respectively), the lung cancer death rate averages 41 per 100,000, and in the three states with the lowest radon levels (Delaware, Louisiana, California: 0.75, 0.96, 0.97 pCi/liter respectively), the rate averages 66 per 100,000."

The observation that small doses of radiation need not be harmful is counter to a widely accepted hypothesis of radiation biophysicists. But the hypothesis was created more than fifty years ago at a time of ignorance because of the absence of solid data. Actually, some experimental data indicate no effect or a beneficial effect for small radiation exposures. While it is known that ionizing radiation creates free oxygen radicals and can injure chromosomes, it is now known that repair mechanisms exist. Moreover, it has been shown that low-level radiations make the cells less susceptible to subsequent high doses of radiation. This adaptive response has been attributed to the induction of a chromosomal break-repair mechanism that can repair much of the damage when cells are exposed to high doses of radiation.

We know that when humans engage in physical exercise, their metabolism increases. This creates an enhanced level of free oxygen radicals, some of which react to destroy the integrity of DNA. But the existing repair mechanisms are effective. As a result, the exercise is overall beneficial to health.

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Evidence for absence of a carcinogenic effect of radiation and radon at moderately elevated doses was also provided by an epidemiological study financed by the U.S. National Cancer Institute and conducted in China. In some Chinese rural provinces little movement of population occurs, and there are areas where the soils contain unusually large amounts of uranium and thorium minerals. Thus, it is feasible to compare the effects of radiation on highly exposed and low-level control populations. The radiation levels differed by a factor of three. In both instances populations of 70,000 were involved. Although the numbers of lung cancer cases in both groups were small, the controls had more lung cancer than the highly exposed persons. There was about twice as much cancer of all kinds in the controls as in the highly exposed population.

"It won't bother us if we're not allowed to aim our ads at the kids. The adults are easier to fool anyway."

A crucial assumption underlying many of the regulatory standards issued by the EPA is that substances toxic at high levels are also injurious at low levels approaching zero. That is, one extrapolates from high levels to low levels by using a linear approach. The EPA uses this assumption to estimate the effect of radon as well as the effects of chemicals that are carcinogenic in animals at very high exposure levels. But the error of this approach is becoming increasingly apparent through experiments that produce data that do not fit the linear model. A striking illustration comes from human stomach cancer caused by excessive ingestion of table salt. If the EPA were consistent in its regulatory program, the known occurrence of salt-induced stomach cancer should lead to a ban on the use of table salt. A number of trace elements that are absolutely essential to life are carcinogenic at high doses. Pharmacologists have long stated that it is the dose that make the poison.

The EPA has no solid evidence that low levels of radon cause lung cancer, especially in nonsmokers. Epidemiological evidence (part of it gathered by the EPA) indicates the contrary. In addition, authorities in the United Kingdom and Canada do not share the EPA's view of the extent of the hazards posed by radon. In the United Kingdom radon levels in Cornwall and Devon are four times as great as the national average, but the incidence of lung cancer in those two areas is 15 percent less than the nation's average. The Canadians also have a history of radiation and health research. They have experience with high levels of radon in Manitoba and elsewhere. They have set the exposure level at which remediation is required at five times that of the EPA.

Despite such information, the EPA has chosen to rely on the questionable linear extrapolation of questionable data obtained from miners' exposures to radon to calculate effects in a quite different residential environment. In fact, the EPA seems to have become so convinced of the validity of its point of view that it has been taking strong measures to brainwash and alarm the public. It appears to have adopted the view that the end justifies the means. That is, the goal of reducing exposure to radon justifies using inaccurate data and inflicting psychological trauma.

The EPA's Public Misinformation Campaign

An elevated incidence of lung cancer in uranium miners was well known before 1980. The existence of areas with high radon levels was also known. The EPA gave no urgency to those facts until about 1985, when high radon concentrations were detected in homes on the Reading Prong in Pennsylvania. A burst of activity followed, and soon the EPA made statements to the effect that radon is the second leading cause of lung cancer.

The public did not respond in great numbers to the EPA's 1986 *Citizen's Guide to Radon* or to subsequent public urgings. The public's lack of response has led the EPA to resort to motivational efforts that depend less on truth and education and more on creating public anxiety.

In the autumn of 1988, then EPA administrator Lee Thomas appeared on national television to say that up to a third of U.S. homes had excessive radon levels. That is, the exposure levels exceeded the EPA action level of four pCi per liter. That statement conflicted with scientific studies showing that only about one-fifteenth of homes had levels exceeding four pCi per liter. From time to time the EPA issued a variety of different estimates on the fraction of homes with excessive levels. Estimates often were obtained by nonrandom state surveys that oversampled in areas with high radon levels.

The effort to motivate the public became increasingly shrill. With absolutely no proof, the agency compared the effects of radon to those of smoking. The EPA asserted that daily exposure to four pCi per liter of radon produced a lung cancer risk comparable to smoking up to half a pack of cigarettes a day. William Reilly, administrator of the EPA, revised this estimate to more than 10 cigarettes a day in an October 1989 news conference. There was no scientific basis for such a remark; no new facts had been developed to warrant a change from earlier estimates. What is inexcusable is that the statement did not differentiate between radon's effects on smokers and nonsmokers.

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A continuing series of statements by the EPA led to media coverage and in turn to congressional interest in radon. One result was legislation establishing a virtually impossible goal for the EPA of reducing residential levels of radon to the level in the outside air. The EPA has repeatedly taken the position that no level of radon is safe, and the cost of reaching the congressional goal has been estimated at about a trillion dollars. Nearly every home owner in the country would be adversely affected, most without benefit.

The key to creating action-producing anxiety is to work through mothers. When they are told that their children are at risk, they tend to respond decisively. That was observed during the asbestos scare, when large sums of money were spent to remove asbestos from schools. To create anxiety about radon, the EPA adopted a model that alleges that children are three times as susceptible to radon as are adults. Jay Lubin has written that "the proposition that children are at greater risk is currently unsupported." He based his statement on a study that was made on Chinese miners who had been first exposed to radon while under the age of thirteen. He also cited a BEIR V report on radon that stated that "the model for respiratory cancer does not depend upon age at exposure."

Despite the lack of evidence that children are particularly at risk, in 1989 the EPA participated in a campaign with the Advertising Council to exploit parents' concern for their children so as to frighten them into implementing EPA recommendations. A thirty-second television spot was created and repeatedly run. Dr. Anthony Nero, a physicist specializing in radon matters at Lawrence Berkeley Laboratory, wrote: "In the TV spot a family is seen in front of their television set. A voice says that high radon in one's home is like having hundreds of chest X rays a year. Flashes occur 7 or 8 times causing the entire skeleton of a child, safe in his mother's *(????)* lap, to appear before us. It isn't only the child's chest that is exposed to X rays. It's his entire skeleton, flashing at the rate of a thousand times an hour (a million times a year)—conveying a palpable danger of death. The frequent flashes showing us a dead child are not intended to inform, but to cause undue fear, moving people to action with the threat of death. This is terrorism."

Additional details concerning the relationship of the EPA and the Advertising Council appear in a briefing document entitled "Radon Media Campaign." The document was apparently constructed from Xeroxed copies of slides used to brief the EPA some time in the autumn of 1990. One section of the briefing asked, "Why an Advertising Campaign?" The answers were: radon has become "old news"; the public is apathetic about radon—although most people have heard of it, fewer than 5 percent of homes nationwide have been tested; and sustained media coverage is needed to motivate public action. Another section, headed "Advertising Research Findings," noted that radon is not perceived as a serious risk, that only educated self-starters are taking action, and that smoking comparisons are not effective. It went on to suggest that an easy first step is needed and pointed out that the major problem is denial: more information results in more denial. A following section, titled "Keys to Overcoming Denial," called for relating radon risks to others in the household, personalizing radon with relevant, tangible comparisons, eliminating unnecessary information, and using strong and unsettling messages. Those last two recommendations bear emphasis. In other words they say, "Do not inform them; scare them."

For more than five years, the EPA has attempted to scare people into testing for radon. The efforts have been fostered by a tremendous amount of media coverage, but only about 5 percent of the public has responded.

In August 1990 the EPA circulated a draft of a proposed revised *Citizen's Guide to Radon.* The subtitle to the draft was *Don't Let A Dangerous Intruder Invade Your Home.* The document employed the "scare them" strategy; it was designed to raise anxiety rather than to present facts. Many reviewers of the draft denounced the strategy as inappropriate. In the November 9, 1990, publication of *Inside EPA* one reviewer reportedly castigated the agency's use of emotional motivational language to spur public action on radon as "little more than a euphemism for misrepresentation and obfuscation." Another reviewer described the draft guide as "a clever example of deceptive advertising and a distortion of scientific fact." Other reviewers compared the guide to "an advertisement for radon contractors," criticized "improperly presented scientific information, omission, and just plain fictitious statements," and suggested that the guide should "emphasize much more that people should stop smoking." A frequently recurring criticism related to the lack of credibility the EPA would have for publishing such an alarmist guide. One reviewer wrote: "[T]he long-term negative effects of the alarmist approach as presented by this guide are not evaluated. One should not underrate the need to retain credibility." As a result of largely scathing comment about the draft of the 1990 *Citizen's Guide,* the document was not issued. A revision is in progress, however.

The repeated concern about the guide's destruction of the credibility of the federal government was also present in other correspondence. Scare tactics that employ demonstrably inaccurate data are bad public policy. In the case of radon such tactics have proved ineffective. For more than five years, the EPA has attempted to scare people into testing for radon. The efforts have been fostered by a tremendous amount of media coverage, but only about 5 percent of the public has responded. Even with the ghastly thirty-second TV spot showing children's skeletons, the response was not great. Is the public becoming jaded after a long series of scary media coverage of environmental matters?

The answer may lie in another direction—does the individual believe that a risk is being imposed by others? A substantial fraction of the population smokes, although the public has been repeatedly

informed of the great hazard of lung cancer. When told of miniscule hazards from chemicals emitted by industry, however, smokers react strongly, for the risk is imposed by others. In contrast, radon is produced by Mother Nature, so it cannot be very bad.

Many scientists and physicians have suggested that if the EPA were really determined to diminish lung cancer deaths due to radon, it would engage in a campaign to reduce smoking. Reducing the number of smokers by a few percent would more effectively improve health than would a frontal attack on radon that would cost hundreds of billions of dollars.

One strategy designed to diminish exposures to radon that has been partially implemented has to do with real estate sales. Increasingly, owners find that to sell their homes they must test for radon and remediate if necessary. Were the EPA to lower the radon exposure levels that would require remedial action to meet congressional goals of a level equivalent to that of the outside air, the costs of remediation would become enormous. In that event, the EPA would surely come under angry scrutiny. The best policy would be for the EPA to abandon attempts to frighten all the citizens and instead concentrate on identifying those areas of the country and the circumstances in which high levels of radon prevail.

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Levels of radon are variable around the country, and in areas where the uranium content is high, the radon hazard is correspondingly elevated. In limited areas the levels of radon in homes are at least 100 times higher than the national average. Scientists have repeatedly urged the EPA to focus its efforts on attaining remediation in those areas. Legislation now pending in Congress mandates such efforts.

One of the weaknesses of the EPA is that it seems unable to learn. Its basic policies were set nearly twenty years ago. Whenever a risk is identified, the EPA takes what it calls a conservative approach. This entails developing worst-case scenarios and giving credence to sloppy data if they indicate a greater risk. Experiments that later show that no risk exists are disregarded. Very rarely indeed has the EPA loosened regulations on the basis of new, valid scientific data. With respect to radon, new data could be obtained. An epidemiological survey could establish the extent to which, if any, nonsmokers are affected by ambient levels of radon. Some millions of dollars devoted to such a study would be a better investment than spending billions of dollars on remediations that might merely be a waste of money. Since the EPA has not shown the alacrity to foster such a study, another agency such as the National Institutes of Health or the Department of Energy should be assigned the task.