Radon Presentation

F91

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Comments Please make copies for Representative Mike Davis, Representative Niilo Koponen, Senator Jack Coghill and Senator Bettye Fahrenkamp. Thank You! Paula

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Telephone number 479-ROCK (Paula)

Radon's Health Risks

The health risks from breathing radon are significantly higher for smokers, according to a recent report on radon by a National Research Council committee. But people can cut the risk of lung cancer from radon even after they have inhaled the radioactive gas by reducing further exposure, the committee concluded.

These are among the new findings of the report, "Health Risks of Radon and Other Internally Deposited Alpha-Transmitters." The report, which was released on 6 January, is based on a 3-year study funded by the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission, and is likely to be used by EPA to drive home the point with that radon is a serious problem.

Radon is a colorless, odorless gas that may be seeping into millions of American homes, EPA estimates. Radon is emitted by the radioactive decay of uranium in rock and soil and enters a building through cracks in the foundation, sump pumps, areas around drainage pipes, and other openings.

Authorities have had difficulty estimating the exact national dimensions of the indoor air pollution from radon. Radon may pose a problem in every state, EPA says based on a few surveys. In August, an EPA study of ten states showed that 21% of the 11,600 homes tested had elevated radon levels. Geology is a good indicator of high-risk areas, EPA says, but levels can vary widely from house to house.

The public health risks posed by radon have been unclear too, but the council report provides fresh findings. Experts have debated, for example, whether smoking greatly increases an individual's chances of developing lung cancer if the person is also exposed to radon. Specifically, they have questioned whether the separate risks of lung cancer from smoking and from radon exposure should be added or multiplied. The council committee found that radon exposure multiplies the lung cancer risk in smokers by at least tenfold.

Researchers also have disagreed whether the risk of lung cancer remains constant after people inhale radon, even when exposure is eliminated. Some researchers have maintained that the risk from radon, as a radioactive substance, remains the same over time, analogous to the cancer risk to atomic bomb survivors, William Ellett, staff director of the council study, explains. But the council study showed that the risk posed by radon is instead similar to the cancer risks posed by cigarette smoking. Reduced exposure to radon will reduce the chances of developing cancer, just as ceasing smoking cuts lung cancer risk. Radon exposure in homes can be reduced by increasing ventilation or sealing openings where the gas may be entering.

Uncertainties about the magnitude of the problem have led to a wide range of estimates about the number of excess lung cancer deaths. EPA has calculated that every year 5,000 to 20,000 lung cancer deaths are linked to radon, making the gas the second leading cause of lung cancer deaths. The risk estimates by the council committee fell into the middle of EPA's range, although it did not cite a specific number. Last year, 136,000 Americans died of lung cancer of which about 85% was caused by smoking, according to American Cancer Society estimates.

The committee developed its risk estimates by reviewing an extensive amount of original data from several key epidemiological studies of uranium miners from United States, Sweden, and Canada. The data were then analyzed with advanced statistical techniques developed in the past few years with the help of better, faster computers, says Jacob Fabrikant, committee chairman and professor at the University of California at Berkeley.

The council committee calculated its risk estimates using a measurement called working level months (WLM). A WLM expresses exposure based on a 170-hour work month to a specific amount of alpha particle energy per liter of air. EPA says that homeowners should reduce radon levels if they are equal to or greater than 4 picocuries per liter. A person who stays home an average of 12 hours per day exposed to 4 picocuries per liter would receive an annual exposure of about 0.5 WLM.

Only a few states, such as Pennsylvania and New Jersey, have extensive radon detection and educational programs about radon. Governments have little authority to control radon in the home, so regulatory action has been limited. EPA has been urging states to survey for radon and support educational programs. EPA itself is currently conducting another survey of another seven states this winter to detect radon on homes. ■ MARJORIE SUN

Taken from "Science" Jan 15, 1988 p. 250

From Bob Forbes

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Lung cancer risks from radon exposure

Living in a home with high concentrations of radon gas can significantly increase an individual's risk of developing lung cancer, but that risk will decrease if the radon exposure is curtailed, according to a report released last week by the National Academy of Sciences. The report, called the most comprehensive to date on the health risks of radon, also found that long-term exposure to this odorless, colorless gas hurts smokers most of all.

"There's a major difference between smokers and nonsmokers. It is truly, to me, the most compelling issue of the whole radon story, especially in males," says Jacob I. Fabrikant of the University of California at Berkeley, who chaired the committee drafting the report.

Radon is produced by the radioactive decay of radium, which is itself an indirect "daughter" of the uranium in rocks. The gas seeps into buildings through foundation cracks and other openings, and can accumulate in poorly ventilated areas. When radon decays, it creates daughters that emit alpha particles. In the lungs these particles can cause the cell damage that eventually leads to tumor growth (SN: 8/15/87, p.105).

As the focus of their three-year epidemiologic study, the academy committee combined data on radon exposure and lung cancer from four separate studies of underground miners in Ontario, Saskatchewan, Sweden and the Colorado Plateau. New statistical techniques enabled the researchers to include such variables as the cancer risk for different age groups and the time lapse after exposure ended. However, because the study was based on data from male miners, there is some uncertainty about extrapolating the risk estimates to the home environment and to women and children.

The researchers found that lung cancer risk increases with the duration of exposure, but once exposure is cut, the risk begins to drop after about 15 years. For smokers, the effect of exposure does not merely add to their already high risk of dying from lung cancer; it *multiplies* the risk, says Fabrikant.

Richard Guimond, head of the Environmental Protection Agency's radon division, says the report confirms the significance of the radon problem: "They are basically saying that radon causes serious risks at levels that we've seen in the environment, levels that we've measured in homes throughout America." The agency has estimated that up to 10 percent of U.S. homes have radon concentrations above the maximum recommended value. — *R. Monastersky*

Science News; p. 39, Jan. 16, 1988
Vol 133, No. 3

Resources
Radon
file

Radiation exposure: Safe, eye on radon

Current annual levels of exposure to radiation from all sources in the United States are, on average, not dangerously high, according to a review of available data released last wee.. by the National Council on Radiation Protection and Measurements, a nonprofit research organization in Bethesda, Md.

The report recommends, however, that a national survey of radon levels in homes be conducted. Radon gas, generated by the natural radioactive decay of radium in the soil, is estimated by the report to account for about 55 percent of the total average yearly exposure to radiation. There is growing concern that large numbers of U.S. homes have high indoor radon levels (SN: 11/22/86, p.325). Uranium miners exposed to elevated radon levels have experienced increased rates of lung cancer, notes the report. Average radon levels can vary greatly from home to home and in different regions of the country, but widespread testing has not been conducted.

Other naturally occurring radiation sources contribute 27 percent of the average yearly exposure, according to the report. These include cosmic radiation from the sun and outer space, radioactive rocks and faint traces of radioactive materials found in living creatures, including humans.

The remaining portion of the yearly radiation exposure, 18 percent of the total according to the report, comes from human-made sources. Medical uses of radiation, such as X-ray procedures and nuclear imaging, account for the bulk of these exposures. Consumer products, including cigarettes, domestic water supplies, building materials, mining and agricultural products and natural gas in heaters and cooking ranges, make up 3 percent of the total annually.

Averaged over the U.S. population, radiation levels on the job and from other environmental sources, including nuclear power plants and fallout from nuclear weapons tests, amount to less than 1 percent of the total yearly exposure.

– B. Bower

From Science News;
Nov 28, 1987
Vol 132, No.22, p. 347

Alaska State Legislature
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POSITION PAPER
HJR 38 RELATING TO RADON
JANUARY 12, 1988

Radon is a colorless, odorless gas resulting from the decay of naturally occurring radioactive elements in the earth. Rising from subsurface sources, radon enters homes where it can become a health hazard.

The U.S. Environmental Protection Agency states that nothing causes more environmental risk to the general population than radon, including toxic waste sites, gasoline combustion and industrial emissions. It is thought to be the second leading cause of lung cancer in this country, cigarette smoking being the first.

The intent of the resolution is to encourage the state and federal government to work cooperatively on Alaska's radon problem. Ten states are currently involved in a program with the EPA in conducting surveys to identify potentially high radon risk areas while 14 other states have recently requested EPA's assistance. Three other states are performing their own surveys.

The radon problem can be solved, but first we need to know where to look. The State Department of Natural Resources, Division of Geologic and Geophysical Survey, and the United States Environmental Protection Agency should participate in a study to locate the areas around the state of highest risk so that efforts to control indoor radon can be directed effectively.

A radon information program designed to meet the needs of the citizens of our state should also be developed and implemented.

Preliminary sampling in several areas of Alaska, including Fairbanks and Denali Park and Healy, have indicated levels high enough to merit concern.

The state has the responsibility to warn citizens about radon and to help people alleviate this problem, and it is essential that the legislature express its support for the necessary measures

Introduced: 1/11/88
Referred: Health, Education & Social Services

5-1448A

IN THE HOUSE BY KOPONEN AND DAVIS

HOUSE JOINT RESOLUTION NO. 38

IN THE LEGISLATURE OF THE STATE OF ALASKA

FIFTEENTH LEGISLATURE - SECOND SESSION

Relating to radon.

BE IT RESOLVED BY THE LEGISLATURE OF THE STATE OF ALASKA:

WHEREAS high concentrations of radon, a naturally occurring radioactive gas, have been found in homes around the state; and

WHEREAS radon is found in soils, rocks, and groundwater supplies, and can enter a house through various routes; and

WHEREAS a preliminary survey conducted by the Environmental Protection Agency indicated that as many as 8,000,000 or 12 percent of homes nationwide could contain dangerous levels of this cancer-causing gas, and that between 5,000 and 20,000 people each year die from lung cancer related to radon exposure; and

WHEREAS in Alaska, high concentrations of radon have been found in the areas surrounding Fairbanks, McKinley and Healy; and

WHEREAS there is no completely reliable method for predicting where high levels of indoor radon will be found because radon levels may be affected by the uranium content of nearby rock and soil, soil permeability, house construction, and other factors; and

WHEREAS the only way to determine whether a house contains a high level of radon is to test it with special equipment, because radon cannot be seen or smelled;

BE IT RESOLVED by the Alaska State Legislature that the United States and the State of Alaska should make a coordinated, joint effort to alleviate the growing indoor radon gas problem in Alaska; and be it

FURTHER RESOLVED that a radon information program designed to meet the needs of the citizens of our state should be developed and implemented.

COPIES of this resolution shall be sent to Lee M. Thomas, administrator of the Environmental Protection Agency; to the Honorable Ted Stevens and the Honorable Frank Murkowski, U.S. Senators, and the Honorable Don Young, U.S. Representative, members of the Alaska delegation in Congress; to Governor Steve Cowper; and to Dennis Kelso, Commissioner of Environmental Conservation.

An Invisible Threat

Radon, a natural, odorless gas that can seep into homes and cause cancer, has emerged as the newest national health threat. But whose problem is it? Some officials believe the states are best suited to find a solution.

By Paul Doyle

On a cold day in December of 1984, Stanley Watras went in to work at the Limerick Nuclear Generating Station in Pottstown, Pa. and set off the alarms. The first assessment was that the radioactivity was from his work at the plant, but the culprit was radon, a relatively unknown substance. And it was from his home. The exposure of Watras and his wife and two children to the radioactive gas had been equivalent to smoking 140 cigarettes per day.

Until this incident, many citizens would not have believed that an odorless, colorless natural gas that seeps out of the ground and into basements and living rooms would be a major threat to public health. But according to health officials, that is exactly what causes 5,000 to 20,000 lung cancer deaths per year.

Based on the number of potential cancer deaths per year, indoor radon is the greatest environmental problem the Environmental Protection Agency (EPA) is working on—ahead of better known and much more feared dangers such as hazardous waste, toxic chemicals and dangers from air pollution.

Radon is an invisible gas produced by the natural decay of uranium in the earth's crust. It can be found in soils and rocks containing uranium such as granite, shale and phosphate. It makes its way into homes through cracks and holes in foundations, water supplies, and spaces between the soil and the house. The gas decays into radioactive particles that attach to dust and, when inhaled, lodge in the lungs.

The EPA recommends remedial action when four picocuries per liter of radon is found in the home. A picocurie is a standard measurement of radiation. Exposure to this level of radon is equivalent to smoking eight cigarettes per day or having 200 chest X-rays per year.

Richard Guimond, division director of the Office of Radiation Protection at EPA, is certain of the high risks related to radon exposure. "Often you deal with environmental pollutants and people have a tendency to sometimes disregard a lot of the information because it is based on some mice or rat test or they are at levels that are much higher than one will ever observe in the environment," he says. "The reason the radon evidence is so strong is that in addition to animal evidence, you also have human evidence from the health problems uranium miners have contracted from their exposure to radon."

Uranium miners are not allowed to be exposed to more than 20 picocuries per liter. "It is very common to find levels in homes over 20 picocuries, some have exceeded 4,000. This is why we are taking this problem very seriously," says Guimond.

According to EPA, between 4 million and 8 million homes nationally have higher than the recommended four picocuries per liter of radon. Although areas with higher levels of uranium are more likely to have a radon problem, no state is immune. According to Guimond, "Every state has some radon in it; if I were to develop a map where radon is a problem, the map would cover the entire United States."

Guimond's conclusions are supported by a recent 10-state survey conducted by EPA. The 10 states volunteered to have a random sampling of homes tested for radon. Although the study showed that radon levels vary from state to state, high levels were found in every state. For example, Alabama had the lowest number of homes with more than four picocuries per liter of radon (6 percent) but the highest single reading was 180. Colorado (39 percent), Wisconsin (27 percent) and Wyoming (26 percent) were the states with the highest number of homes over the recommended EPA levels.

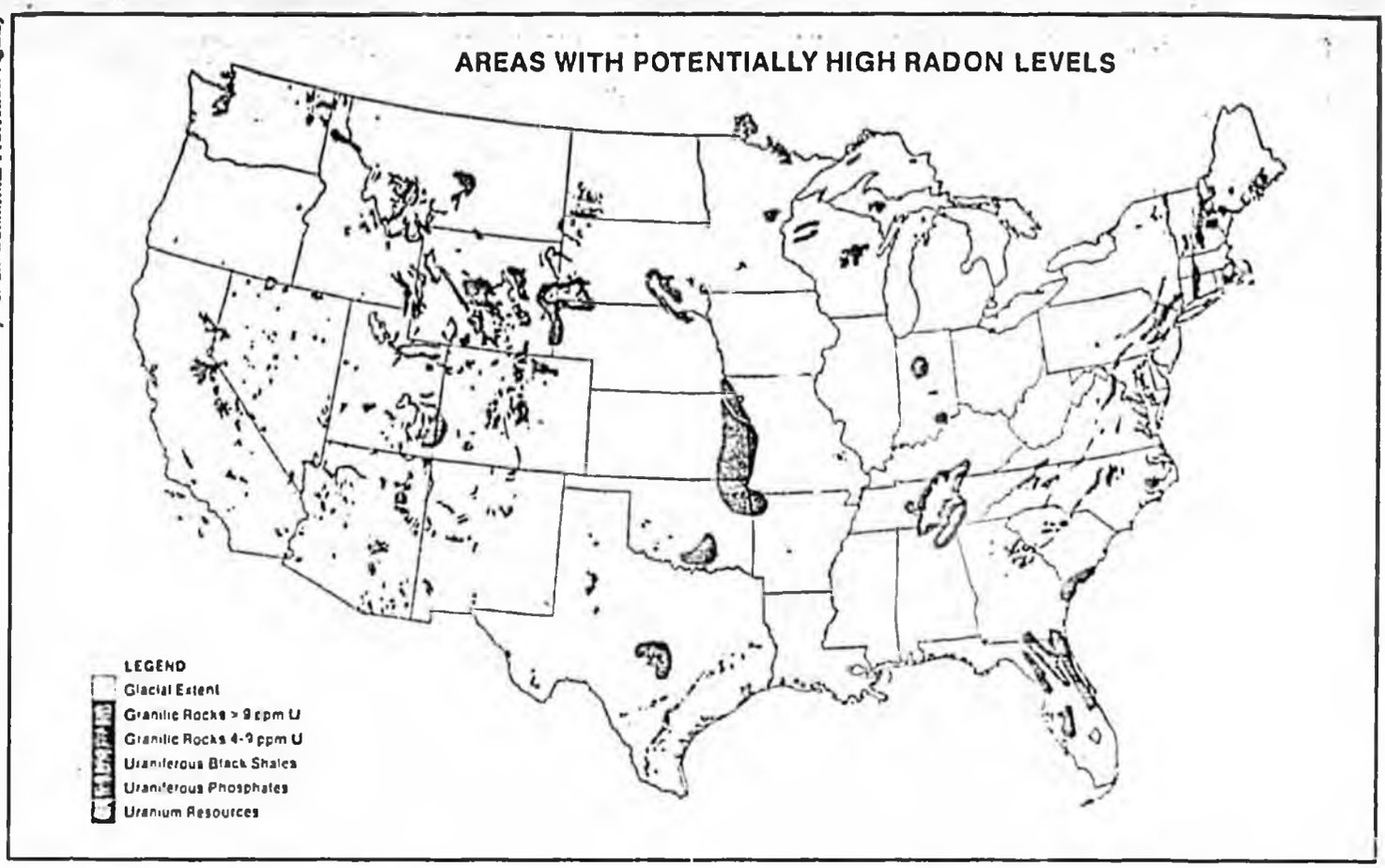
Testing for radon usually is done by placing a small canister containing charcoal in the house for approximately a week. The charcoal absorbs the radon and when analyzed, provides a reading for how much radon there is in a home.

Despite the fact that the gas is invisible, Guimond points out that "homes can be fixed." Even homes discovered to have as much as 3,000 to 4,000 picocuries per liter in parts of Pennsylvania and New Jersey have been sealed and patched so they now test under the EPA minimum standard, he says.

Once radon is found, the most common mitigation techniques include the sealing of openings and cracks to prevent any of the gas from entering the house. The average cost for such remedies is less than $400.

However, unless tested, the radon levels in a particular house cannot be easily detected. Says Pennsylvania state Senator Michael O'Pake, who represents Reading, one of the highest radon areas in the country, "Unfortunately, you can't just look at a house and tell if it has high levels of radon, you do have to measure to be sure. Of two houses sitting side by side, one house may have 1,000 percent higher

Paul Doyle is a principal research analyst in the NCSL Energy, Science and Natural Resources program.



Graphic: Environmental Protection Agency

levels of radon than the one next to it because the house may be sitting on some crack or fault."

Because of this vast difference in the millions of homes affected by radon, Guimond believes the radon crisis is a state and local problem. He thinks the federal government alone cannot effectively deal with radon. "State and local agencies are better able to understand the significance of their local situation and get information and help to the local citizens," he says.

This is a feeling echoed by Donald Deieso, assistant commissioner for New Jersey's Environmental Management and Control. "Radon is the most severe health risk we are facing and we quickly realized in New Jersey that the states are going to have the prime responsibility for its regulation; no one is going to do the job for us," he says.

In most cases, legislation requiring statewide surveys is the first step in a program. Colorado, Florida, Illinois, Indiana, Ohio and Virginia are all currently conducting these diagnostic studies, which pinpoint high radon areas in a state. Many others are expected over the next year.

A few states have gone a step further, by adopting multi-million dollar comprehensive initiatives. In 1986, the New Jersey Legislature appropriated $4.2 million for a radon project. It currently ranks with Pennsylvania and New York as the most expensive in the country. All three efforts have a wide range of radon initiatives. The New Jersey legislation, which is similar to Pennsylvania's, calls for a state radon survey and an epidemiological study to determine if radon causes cancer. New Jersey state officials will be testing the homes of 1,200 lung cancer patients for radon.

Pennsylvania and New Jersey are also providing low interest loans to homeowners to assist in radon-reducing home improvements. Pennsylvania offers loans of up to $7,000 to the victims of radon at a graduated interest rate between 2 percent and 8 percent, depending on income.

States are also pursuing measures to encourage homeowners to test for radon. New York is selling and distributing radon detectors to its citizens. Pennsylvania provides home testing free of charge.

Deieso, however, warns of the dangers of a predominantly state-operated radon program. In New Jersey, "For the state alone to provide what was needed, we were looking at spending $200 million on testing and another $1 billion to $1.5 billion for mitigation measures," he says. "A radon program is not a one- or two-year mass study. Radon, like termites, is going to live forever more."

One of the key elements of a state effort, according to Deieso, is to encourage the private sector to become involved in the radon business. "The private sector is better suited for radon testing and remediation of individual homes than state operated programs, due to its ability to respond quickly and fill the demand in the market place."

With that encouragement the number of private firms offering radon testing in New Jersey has jumped from three in 1985 to 120 in 1987. In 1985 the state had no companies that would take care of a home exposed to radon; today there are 22. With this market-oriented approach, Deieso says that a home radon test can be done in three days and the mitigation work completed within two weeks. "And that is a better performance than any state agency, no matter how well funded."

But in order for such an approach to be effective, the state must oversee and regulate radon testing firms, he says. To maintain quality control over

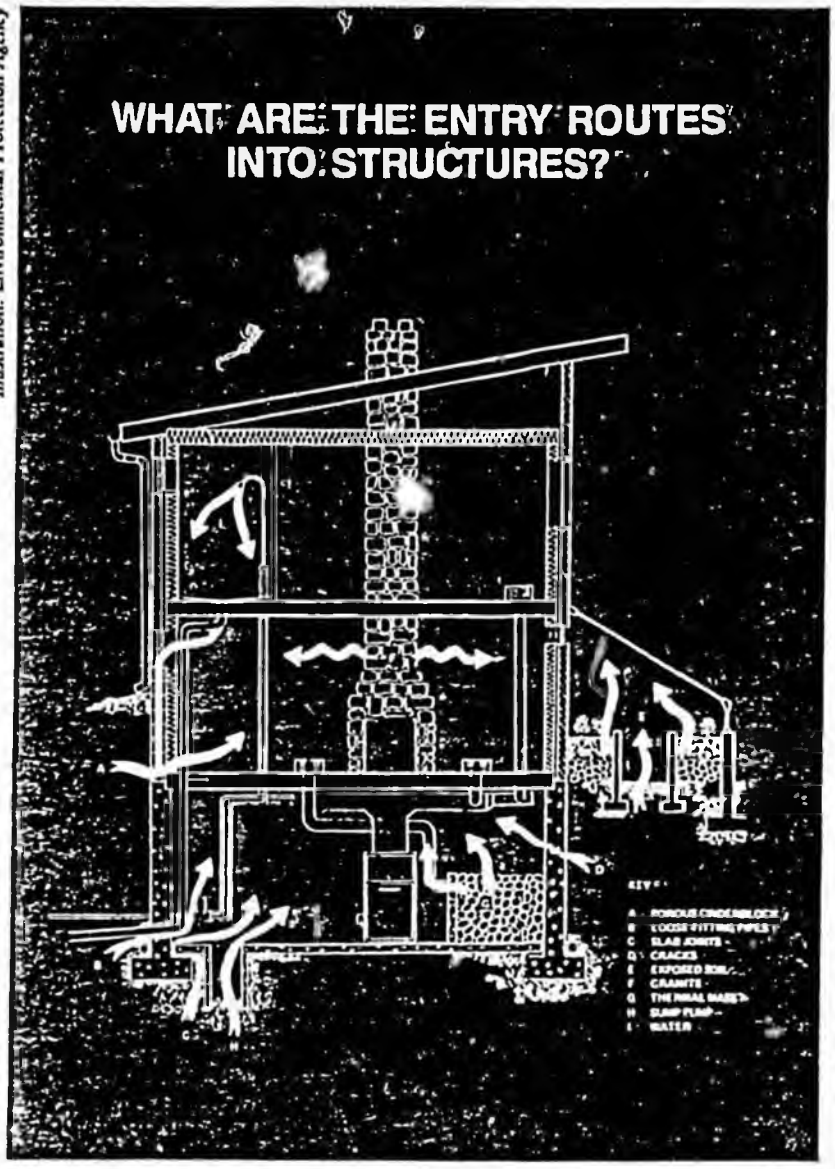


Illustration: Environmental Protection Agency

the radon testing market, New Jersey enforces strict licensing and certification standards. Since the program's inception, more than half the applicants for certification have been rejected. And to keep firms from overcharging for radon-related services, the state provides homeowners with second opinions free of charge.

States are also beefing up their efforts to inform the public of the dangers of radon. New Jersey and Pennsylvania have set up toll-free hot lines staffed by scientists to answer questions about radon. Both states have also published and distributed pamphlets and brochures to the public. New Jersey is sponsoring periodic public opinion surveys to determine the effectiveness of its program.

Despite state efforts, homeowners, for a number of reasons, don't always welcome radon information devices. In Pennsylvania, when the state went door to door offering free testing in the Reading Prong region, one of the highest radon areas in the country, only 30 percent of the homeowners agreed to test. In New Jersey, only eight people have taken advantage of the low-interest loans offered to mitigate the effects of radon.

According to Rich Guimond, part of this phenomenon boils down to perceived risks. "It's easy for someone to see a hazardous waste site down the street and be very fearful, but you don't expect a radiation problem in your 'home sweet home' and, because you can't see it, smell it or feel it, it's easy to say it's not there."

But Senator O'Pake points out that public skepticism and economic uncertainty is also a big factor in explaining people's leeriness about radon. "The public is just not sure that radon can be fixed safely and inexpensively."

Indeed, a recent survey conducted by The Eagleton Institute of Politics at Rutgers University showed that of those polled, 75 percent said that if their homes were found to have radon the real estate values would drop by more than 25 percent; and 25 percent said that even if the radon were removed from their homes the real estate values would still drop, with 50 percent saying the values would stay the same.

This attitude is reflected in parts of New Jersey where real estate transactions have dropped as much as 50 percent. "Real estate, not public health, has become the dominant feature for the radon program," Deieso says. In response, the state is implementing modifications to building codes to include radon mitigation features and incorporating a requirement for radon testing in home sale contracts.

In this age of tight budgets, states are hard pressed to find the money to explore the radon issue. Pending federal legislation is aimed at relieving this pressure. "Many states recognize that they have a radon problem but they lack the resources to investigate and develop needed new programs," says U.S. Senator George Mitchell of Maine, one of the bill's chief sponsors. The legislation directs the EPA to make available to the states $10 million for each of the next three years. In order to be eligible for the money, the states will have to provide 25 percent matching funds for the first year, 40 percent in the second and 50 percent in the third.

Whatever the outcome of the federal legislation, the states will have the primary responsibility for warning their citizens about radon and developing programs to alleviate its potential dangers. Says Deieso, "States will soon learn that radon is not a two-year short-term environmental problem. Like the other environmental threats we face, it is here to stay."

Radiological Health Program
Dept. of Health & Social Services
Juneau, Alaska

UPDATED ALASKA RADON RESULTS

(All data through 12/10/87)

	Location	Number	Concentration of radon, picocuries per liter of air (pCi/l)			
			4 or less	5-8	9-20	20 +
1	Anchorage	69	68		1	
2	Anderson	1	1			
3	Arctic Circle H.S.	1		1		
4	Barrow	1	1			
5	Bethel	1	1			
6	Bettles	1	1			
7	Craig	1	1			
8	Deadhorse	1	1			
9	Delta Junction	3	2	1		
10	Dillingham	1	1			
11	Douglas	3	3			
12	Eagle	1	1			
13	Eagle River	14	14			
14	Fairbanks	67	43	7	7	10
15	Fort Yukon	1	1			
16	Galena	1	1			
17	Glenallen	1	1			
18	Haines	5	5			
19	Healy	3	3			
20	Homer	4	3		1	
21	Hope	1	1			
22	Juneau	26	26			
23	Kasilof	1	1			
24	Kenai	1	1			
25	Ketchikan	4	4			
26	King Salmon	1	1			
27	Klawock	1	1			
28	Kodiak	13	12	1		
29	Kotzebue	2	2			
30	Manley Hot Springs	3	2		1	
31	McGrath	1	1			
32	McKinley Park	46	32	7	6	1
33	Nenana	1	1			
34	Nome	1	1			
35	North Pole	3	3			
36	Northway	3	2		1	
37	Palmer	6	5		1	
38	Pedro Bay	1	1			
39	St. Mary's	1	1			
40	Seward	1		1		
41	Sitka	2	2			
42	Skagway	1	1			
43	Soldotna	4	4			
44	Sterling	1	1			
45	Tanacross	1	1			
46	Tok	3	2		1	
47	Unakleet	1	1			
48	Valdez	2	2			
49	Wales	1	1			
50	Wasilla	5	5			
	TOTALS	318	270	18	19	11

THE ALASKA RADON PROBLEM

by Jeffrey T. Kline and Robert B. Forbes
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Background

Radon (Rn^{222}) gas accumulation has long been known to be a serious health hazard in the uranium and phosphate mining industries, resulting in significantly elevated incidence of lung cancer in miners, but only since 1984 has it emerged as a potentially serious health problem in residences and public buildings throughout the United States.

Radon is a colorless, odorless, tasteless, and exceedingly heavy (eight times as heavy as ambient air) radioactive gas with a half-life of 3.8 days[1], which is produced by the natural decay of uranium. It occurs, at least in very small quantities, nearly everywhere at the earth's surface, and at higher concentrations where geologic conditions favor its formation, concentration, and migration in soil and water.

The recent intense interest in residential radon contamination was sparked in 1984 when a nuclear power plant worker in Pennsylvania set off radiation alarms as he entered the plant. His contamination was subsequently traced to an extremely high level of naturally occurring radon which was entering his home through the foundation, and which was emanating from the soil and backfill of the surrounding area. Further checking in the area identified several other residences which had potentially dangerous levels of radon and its radioactive daughters in the ambient air. This area, known as the Reading Prong, became the focus of research to determine the geologic conditions and construction practices which contribute to the accumulation of radon in dwellings, and to develop economically feasible counter measures.

Since that time, numerous areas have been identified throughout the United States where serious levels of radon occur in dwellings. EPA and public health officials postulate that radon exposure may be the leading source of human exposure to naturally occurring background radiation, and the leading cause of non-smoking related lung cancer which may account for from 5,000 to 20,000 cancer-related deaths per year in the United States.

More than 30 states throughout the U.S. have initiated programs to identify areas with high radon hazard potential, and to develop measures to deal with the complex health and legal aspects of the problem. Representatives from

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[1] Half life refers to the length of time in which half of a given number of atoms of a radio isotope undergoes spontaneous radioactive decay to form its daughter element.

most of these states were present at a radon geology workshop held at the U.S. Geological Survey national center in Reston, Virginia, last month.

Geologic Controls

The geology and geochemistry of radon is complex, and recognition of these factors is one of the most important keys in identifying areas which may have a high radon risk potential. One of the first considerations in radon screening surveys is the recognition of the geologic favorability or potential for radon production and release. A variety of geologic conditions may encourage the production and accumulation of radon. These conditions may act singly or in concert to favor the emanation and migration of the gas to the surface and into dwellings. Some of these factors include:

1. Bedrock type (all of the rock types below are common sources of uranium and its daughter products):

   a. black shales and slates
   b. phosphatic carbonate rocks
   c. hydrothermally mineralized metamorphic rocks
   d. feldspathic igneous rocks

2. Bedrock structure:

   Faults and shear zones which provide avenues or conduits for the migration of radium salts and radon bearing fluids.

3. Surficial geology:

   a. Highly permeable and well drained soils such as coarse alluvium, glacial outwash, dune sand, loess, and loamy saprolites allow easy migration of soil gas by diffusion along favorable pressure gradients.
   b. The presence or absence of permafrost may control radon migration

4. Groundwater geochemistry and hydrology:

   eH and pH conditions which may favor the mobilization or concentration of uranium and radium compounds.

State and National Radon Programs

At this time, more than 30 states throughout the U.S. have initiated programs to identify areas with high radon hazard potential and to deal with the complex health and legal aspects of the problem.

DOE and EPA have established offices for the coordination of state assistance programs.

Radon in Alaska

Local areas of high radon emission have been known in the state since the mid 1970s. The first radon anomalies were noted by government and industry

geologists during the course of geologic investigations, including uranium/thorium surveys and exploration programs in Interior Alaska. The most notable of these anomalies was associated with uraniferous granitic rocks in the vicinity of Mt. Prindle and Central, Alaska, located in the Yukon-Tanana Upland northeast of Fairbanks.

Experimental work on the use of radon flux variations to predict earthquakes was conducted by Robert Forbes and Daniel Hawkins several years ago, which yielded some very interesting data on relatively high bedrock and soil radon gas emanation rates at some localities in the Fairbanks District.

High radiation levels which could have resulted from radon daughter isotope decay were noted in the vicinity of Circle Hot Springs during that same time period by exploration geologists in buildings which had been closed for an extended time prior to the field season. In 1980, DGGS commented on the radon problem potential in a proposed State land disposal area in the Central area, but no follow-up seemed to be merited at the time.

Until recently, very few radon measurements had been taken on air within dwellings in the state of Alaska. In 1985, spurred by growing public awareness of the potential hazards of radon in private residences, the Arctic Environmental Information and Data Center (in cooperation with Battelle Northwest Laboratories) conducted a small radon screening study in which nine homes and one office were tested. Elevated radon levels were found in 40% of the structures tested. One of the structures had between five and ten times normal background. The study represented a 'first cut' survey and was designed to simply determine whether or not significant radon concentrations were present at all, and whether or not additional studies were warranted (CONRIM Newsletter, Summer Edition, 1986).

Another small radon survey in the Chena Hot Springs area was initiated by Milton Wiltse of the Alaska Division of Geological and Geophysical Surveys at the request of the Division of Land and Water Management. Nine dwellings were monitored during the spring and summer months of 1986 and from February 12 to May 22, 1987. While the spring and summer radon levels were well below the 4 pCi/l EPA guidelines, winter levels exceeded the guideline in four of the nine buildings in crawl space areas and two of the nine in living space areas (M.W. Wiltse, written communication, July 1987).

In early January 1986, routine water sampling of the Haines public water supply by EPA revealed elevated radon levels. Subsequent resampling of the water by Robert Forbes confirmed that the alpha emitter in the water was dissolved radon. While the levels were not high enough to cause an imminent health danger, they are suggestive that more closely spaced sampling intervals may be warranted for the area than the routine two-year interval of EPA, as radon concentrations are known to vary widely with time. The story was reported January 16, 1986, in the Juneau Empire, and on APRN news broadcasts.

More recently, a screening survey performed by Lee Leonard of DOTPF research indicated that in a sampling of selected public buildings throughout the state, four had three-month average air radon concentration levels which slightly exceeded the 4 pCi/l EPA guideline. These buildings were located in Anchorage, Homer, Seward, and Tok. Radon surveys of public facilities to date is far from complete.

Within the last few weeks, results obtained by Shelby Leonard, Dan Hawkins, and Richard Seifert of the University of Alaska, Fairbanks, from track etch detectors selectively placed in a limited number of homes around Fairbanks showed alarmingly high ambient radon levels, with the highest being 380 pCi/l as an average value for a three month exposure period. The location of this and other monitored dwellings with significantly elevated radon levels suggests that there may be a potential correlation between upland or hillside home sites, and higher radon levels (Lee Leonard, oral communication, July 8. 1987).

A follow-up study of the Ester Dome area carried out in the past two weeks, July 6 through 17, 1987, using activated charcoal detectors, revealed additional high radon values in homes on Ester Dome, with the highest being 989 pCi/l (nearly 15 times the exposure level allowed in underground uranium mines in the U.S. and Canada). We are currently running real-time air monitoring studies at this location with a scintillation counter and lucas cell apparatus, to verify the charcoal detector values. A series of real-time measurements taken at one of the high level homes showed significantly elevated levels (in the range of 195 to 271 pCi/l). These concentrations were less than those determined from 48 hour charcoal accumulators made in previous weeks; however, the weather conditions and the duration of the real-time sampling series could easily account for major fluctuations in the apparent radon values. Such fluctuations are well documented in other studies conducted throughout the U.S.

It is the actual long-term dose rate which must be considered in health risk estimates. In order to assess the annual dose rate, it is necessary to conduct a series of integrated measurements over intervals of three months, four times a year. This kind of long-range integrated counting program should be considered in homes where short duration measurements have produced high radon values.

Another statewide screening survey is currently being conducted by Sid Heidersdorf, radiologist with the Department of Health and Social Services. To date, he has accumulated data points from nearly 200 localities, including some values which exceed 4 pCi/l.

The geologic controls which govern radon emissions from soil and rock are not fully understood, nor is the scope of the problem in the Fairbanks District or Alaska. It is clear that interior Alaska has many, if not most, of the geologic and other environmental characteristics of radon problem areas elsewhere in the U.S. In addition, other factors unique to the arctic and sub-arctic environment such as permafrost and extreme temperature inversions with very long periods of calm, stable air, may tend to obscure some of the geologic correlations used in other parts of the country, and require more extensive research into mechanisms of radon emanation and migration under arctic conditions common to Alaska. No data pertaining to the behavior of radon in permafrost terranes conditions were available at the recently attended Radon Workshop in Reston.

Strategies for Alaska

Radon is an environmental hazard which can be effectively dealt with once its presence is recognized. It can be most easily mitigated during new house

construction when relatively inexpensive engineering and design modifications can essentially render a house 'radon proof.' Existing homes can generally be retrofitted with modified heating and ventilation systems and foundation sealants which usually reduce radon concentrations to acceptable levels.

These techniques have been successfully employed in areas of the eastern seaboard of the U.S. as well as Scandinavia.

The primary problem at present in Alaska and many other states is to determine the magnitude of the problem by performing careful and systematic orientation and screening surveys and correlating their results to geologic parameters. The goal of the latter is to develop a set of geologic criteria incorporating aspects of local surficial and bedrock geology by which predictions of radon potential can be made. By developing geologic models for prediction, workers in other states have been able to identify areas where the need for high density household monitoring is greatest, thereby making the most efficient use of limited funding.

The next step is to educate the public about radon, its long-term health risk, and options for mitigation.

Finally, and perhaps most difficult, is to get a handle on the etiology of long-term low-level radon exposure. It is known from studies of uranium miners that a very significantly increased risk of lung cancer exists after 5,500 hours of exposure to air containing an average radon content of 200 pCi/l. Swedish researchers conclude that a significant health risk is faced after long-term exposure to 100 pCi/l.

Unfortunately, long-range health data at low levels of exposure (the range of 4-50 pCi/l) to radon don't exist. This is primarily because low levels have not been widely monitored prior to the last few years. Most death rate figures quoted by EPA for low-level exposure (i.e. the commonly quoted 5,000-20,000 per year) are based on the extrapolation of data from high-level studies and what is currently known about household radon levels across the country. It is imperative that a better data base be generated on all fronts in order to properly address this problem.

Currently, Alaska is one of the few states for which EPA has little or no information pertaining to radon potential or actual data from radon surveys of homes or public buildings. Limited amounts of such data have been or are currently being gathered on a small scale in local orientation surveys in selected areas of the state. As yet, we do not have a handle on the statewide potential for radon hazards. Based upon presentations and discussions at the workshop, of geologic conditions which favor radon emanation in other regions of the country, and comparing those conditions to what we know about Alaskan geology, it is clear that it would be prudent to develop a multidisciplinary screening program to determine radon hazard potential in regions of this state.

Preliminary Recommendations

1. Initiate a cooperative statewide residential radon reconnaissance program as soon as possible in an attempt to locate potential radon hot spots (other than Fairbanks).

2. Seek and hopefully acquire emergency state and federal funding to meet DGGS obligations to the radon problem until requested funds can be obtained through formal budget channels.

3. Organize and host a conference involving participating state and federal agencies, to establish an ad hoc task force which would design and implement an accelerated statewide radon investigation program.

4. Continue constrained radon investigations on re-directed funds until supplementary financing is obtained.

5. Work with State Radiologist, EPA, and DEC to establish household radon alert network in Alaska.

6. Design short- and mid-range radon investigation program to determine inter-relationship between local and regional geologic factors and radon anomalies.

7. Initiate screening survey of radon in drinking water in cooperation with EPA, State Radiologist, and DEC.

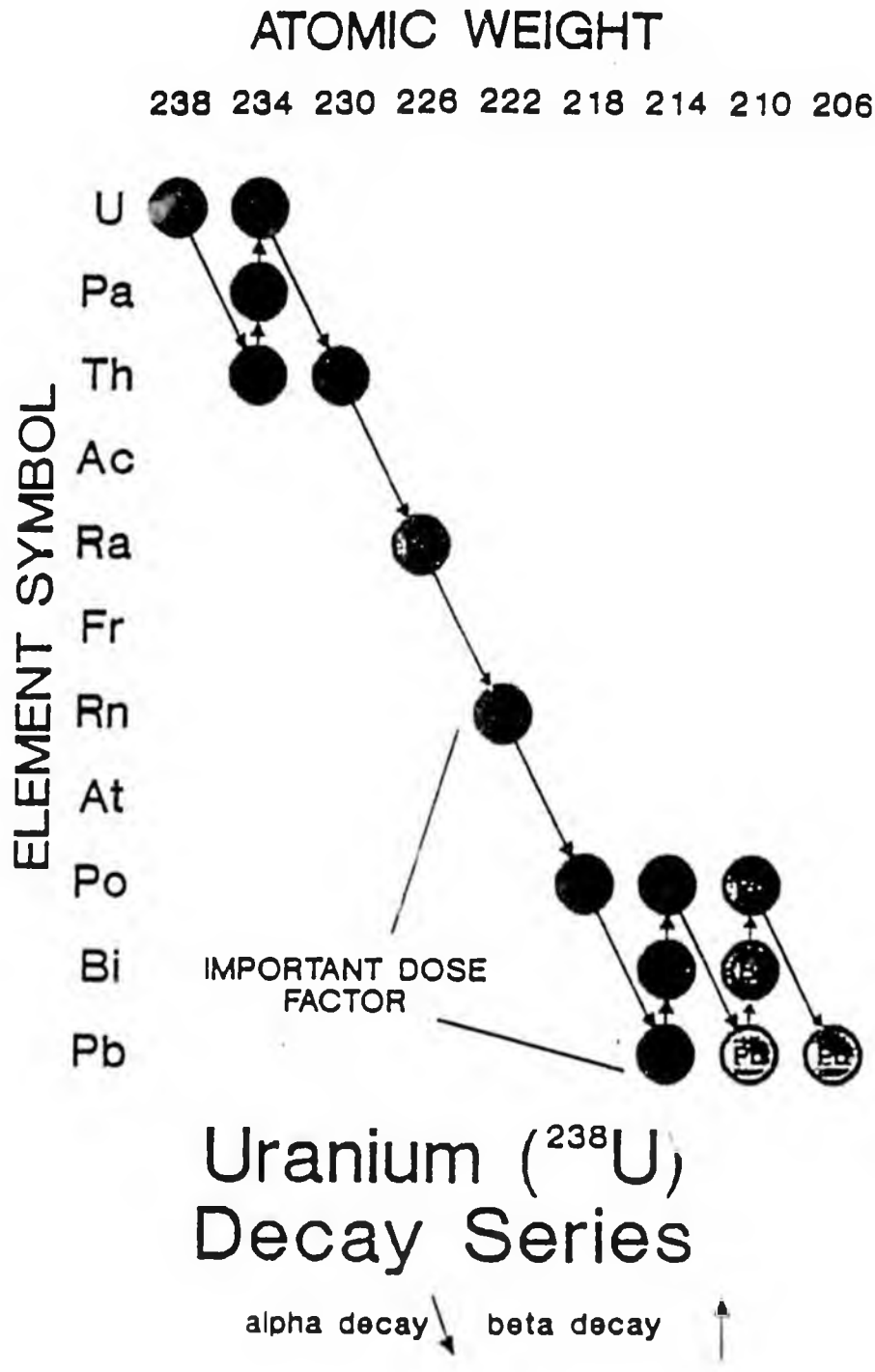
CHARCOAL DETECTOR RADON ANALYSES
FROM RESIDENCES IN THE FAIRBANKS AREA

Code #	Name	pCi/l	Comments
194602		0.3	
194604		10.7	Follow up
194605		5.7	
194606		0.7	
194608		1.0	
194609		1.7	
194610		27.4	Follow up
194611		47.1	Soil tube
194612		3.0	
194614		0.2	
194615		4.6	Follow up
194616		0.0	
194617		112.0	Remedial action
194618		13.0	Follow up
194619		0.6	
194620		1.9	
194621		66.2	Remedial action, follow up
194622		3.9	
194623		8.9	Follow up
194624		989.0	Definite remedial action
194625		0.5	
194626		3.8	
194628		2.8	
194629		1.7	
194630		0.2	
194631		13.2	Follow up
194633		3.1	
194634		6.4	Follow up
194635		4.8	
194637		17.1	Follow up
194638		4.9	Follow up
194639		15.2	Follow up
194640		0.3	
194642			

RADON CONCENTRATIONS
Determined by Jeff Kline

Reference #	Date	Name	Pylon Scintillation Count in pCi/l	Area
1	//21/87		271.0	Ester Dome
2	//22/87		8.79	Chena Ridge
3	//22/87		113.7	
4	//23/87		4.13	Goldstream above Okta
5	//23/87		16.4	Hillside above Fox tailings
6	//24/87	Gilmore Creek Tracking Station	4.1	Utilidors under main control room
7	//25/87	Soil gas, Fox tailings	185.7	Near pipeline crossing on Goldstream Road
8	//26/87	Soil gas, Chena Terrace	75.9	Pit near DGGS warehouse
9	//26/87	DGGS warehouse	8.4	Bundtzen/Kline bin
10	8/11/87	(residence)	14.73[A]	Ester Dome
	//25/87	Soil gas on Jones Road (organic silt)	5.2	Thawed organic silt near corner of Jones Road and Weldheim Drive
	//25/87	Soil gas, Jones Road school bus turnaround	27.3	Pit run alluvial gravel

[A] Gene Wescott had a three-month track etch dosimeter reading of 380 pCi/l for three months late last winter.


ATOMIC WEIGHT
238 234 230 226 222 218 214 210 206
ELEMENT SYMBOL
U
Pa
Th
Ac
Ra
Fr
Rn
At
Po
Bi
Pb
IMPORTANT DOSE FACTOR
Uranium (^{238}U) Decay Series
alpha decay
beta decay

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MEMORANDUM

TO: ALL LEGISLATORS

FROM: REPRESENTATIVE NIILO KOPONEN

DATE: JANUARY 14, 1988

RE: RADON

Evidence continues to mount that radon is a serious health hazard. Weekly, national press features at least one report concerning radon and lung cancer. The following report states that 'spending 12 hours a day in a house with excess radon boosts a person's cancer risk by about 50%.'

HJR 38 which I have introduced in the House asks the federal and state government to make a coordinated, joint effort to investigate and alleviate the radon gas problem in Alaska.

Today at 12:30 Bob Forbes, the State Geologist and head of the Division of Geological and Geophysical Survey will be showing a slide show on Radon. The presentation will take in the Butrovich Room.

monitoring human
vever, remain skep-
New York-based
Vatch reports that
released 64 dissi-
psychiatric units
-up from 19 in
that 95 remain in
We'll be watching
ther the average
be able to use the
says the group's
Catherine Fitzpatrick.

up nonconformists for extended terms in squalid psychiatric asylums. Are such practices now to cease? That's the question being asked after the Kremlin announcement last week of a new code of legal rights for mental patients.

Advocates of human rights have protested for decades their being railroaded into Soviet asylums, where they have been forced to take powerful drugs and live for years in antiquated conditions. At an early-19th-century structure still in use near Moscow, more than a dozen people have been crammed into wards built for fewer than half that number; patients must use 70-year-old plumbing.

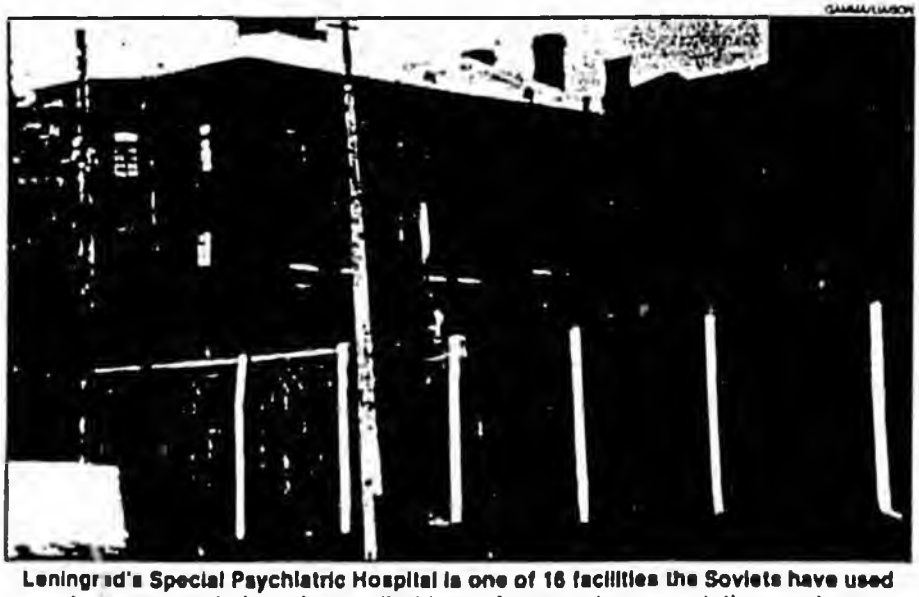
After years of criticism from international psychiatric groups, Mikhail Gorbachev's administration recently signaled change of some sort when the Soviet press began to complain about abuses. One article described the commitment of a 20-year-old Leningrad factory employe who had been branded a schizophrenic after criticizing her boss and her working conditions. Under the new policies, patients and their relatives are entitled to contest commitments in court. The Russian Republic, largest of the 15 Soviet republics, went so far as to make it a crime to force a healthy person into an asylum.

In Moscow's dissident circles, pessimism persists. "We have always had legal protection on paper, but it hasn't done any good," complains a painter who has served long stretches in asylums. "The official attitude still boils down to this: If you're different or disagree with things here, there must be something wrong with you."

HUMAN RIGHTS (CONT'D)

Gorby's curtain

As new psychiatric reforms showcase Mikhail Gorbachev's image-polishing skills, the Kremlin leader is simultaneously pursuing an emigration policy that shows his teeth of steel. After a brief period of presummit leniency, the Soviets last week began enforcing harsh 1987 laws that require a would-be émigré to be invited by a sibling, spouse, parent or child abroad. That disqualifies 90 percent of the 400,000 Jews who want out, according to the Union of Councils for Soviet Jews. Emigration peaked in 1979 at 51,000, then dropped to fewer than 1,000 yearly when détente dissolved over Afghanistan. In 1987, 200 were let go weekly, but last week the number was down again—to 79.



Leningrad's Special Psychiatric Hospital is one of 16 facilities the Soviets have used to house—and often abuse—dissidents. A new code may curb the practice

HEALTH

Lung cancer's gassy ally

Radon gas seeps into 4 to 8 million homes across the U.S., rising through the foundations from underlying soil and rock and mixing with inside air. The radioactive gas is odorless, colorless—and a cause of lung cancer. But how big a cause? Last week, a National Academy of Sciences report made possible the most authoritative answer yet.

The study's chief, Dr. Jacob Fabrikant of the University of California at Berkeley, calculated how exposure to levels of radon considered worrisome by the Environmental Protection Agency affects the odds of contracting lung cancer. His basic finding: Spending 12 hours a day in a house with excess radon boosts a person's cancer risk by about 50 percent.

Of 1,000 male nonsmokers exposed to excess radon, 16 will die of lung cancer, he estimates. That's 5 more than in a nonexposed group. Among 1,000 female nonsmokers, radon exposure ups lung-cancer deaths from 6 to 9. The statistics are much grimmer for smokers: Some 172 out of 1,000 male smokers exposed to excess radon will die of lung cancer—49 more than among nonexposed male smokers. For women smokers, radon pushes the toll from 60 to about 85.

Why radon and smoking are more lethal to men than to women is unknown. Why is radon more lethal to smokers? That, too, is not known. Some experts think smoke-damaged lungs trap the radioactive radon particles.

Homes with serious radon problems can be fixed by sealing cracks to prevent seepage and by improving ventilation. The EPA's Office of Public Affairs offers information booklets and a list of radon-detection companies. Now awaiting action in the House is a bill passed unanimously by the Senate last year that would provide $33 million to the states for radon education and pilot programs.