



U.S. Environmental Protection Agency

Updated assessment of risks from radon in homes

The U.S. Environmental Protection Agency has updated the estimates of lung cancer risks from indoor radon based on the National Academy of Sciences' (NAS) latest report on radon, the Biological Effects of Ionizing Radiation (BEIR) VI Report (1999). EPA worked closely with the Science Advisory Board (SAB), an independent panel of scientific experts, to determine how best to apply the risk models developed by the BEIR VI committee. The SAB's advice and recommendations were incorporated modifying and extending the methods and approaches used in BEIR VI to construct a single model yielding results midway between the results obtained using the two models preferred by the BEIR VI committee. The agency's updated calculation of a best estimate of annual lung cancer deaths in the U.S. from radon is about 21,000 (with a range of 8,000 to 45,000), which is consistent with the estimates of the BEIR VI Report. A single risk model also permitted the Agency to calculate a numerical estimate of the risk per unit exposure [lung cancer deaths per working level month(WLM)] that will be used to update estimated lung cancer risks from radon in various publications, including "A Citizen's Guide to Radon" and the "Home Buyer's and Seller's Guide to Radon".

The full text of the updated risk assessment, "EPA Assessment of Risks from Radon in Homes" (EPA 402-R-03-003) is available as a downloadable Adobe Acrobat PDF file - <http://www.epa.gov/radiation/docs/assessment/402-r-03-003.pdf>

The following is an updated chart of the lifetime risk of lung cancer death per person from radon exposure in homes (excerpted from the updated radon risk assessment).

Radon Level ^a PCi/L	Lifetime Risk of Lung Cancer Death (per person) from Radon Exposure in Homes ^b		
	Never Smokers	Current Smokers ^c	General Population
20	36 out of 1,000	260 out of 1,000	110 out of 1,000
10	18 out of 1,000	150 out of 1,000	56 out of 1,000
8	15 out of 1,000	120 out of 1,000	45 out of 1,000
4	73 out of 10,000	62 out of 1,000	23 out of 1,000
2	37 out of 10,000	32 out of 1,000	12 out of 1,000
1.25	23 out of 10,000	20 out of 1,000	73 out of 10,000
0.4	73 out of 100,000	64 out of 10,000	23 out of 10,000

a : Assumes constant lifetime exposure in homes at these levels
 b : Estimates are subject to uncertainties as discussed in Chapter VIII of the risk assessment
 c : Note: BEIR VI did not specify excess relative risks for current smokers

Fact sheet: Updated risk assessment for radon in indoor air

EPA's indoor radon program promotes voluntary public actions to reduce the risks from indoor radon. EPA and the U.S. Surgeon General recommend that people do a simple home test and if high levels of radon are confirmed, reduce those high levels with straight-forward techniques.

EPA recently completed an updated assessment of the Agency's estimates of lung cancer risks from indoor radon. This assessment reinforces EPA's recommendations on radon that homeowners should still test and fix their homes for radon.

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Found all over the U.S., radon is a naturally occurring radioactive gas without color, odor, or taste that comes from the radioactive decay of uranium in soil, rock, and groundwater. It emits ionizing radiation during its radioactive decay to several radioactive isotopes known as radon decay products.

Radon gets into the indoor air primarily from soil under homes and other buildings. Radon is a known lung carcinogen and is the largest source of radiation exposure and risk to the general public. Most inhaled radon is rapidly exhaled, but the inhaled decay products readily deposit in the lung, where they irradiate sensitive cells in the airways increasing the risk of lung cancer.

EPA updated the Agency's estimates of lung cancer risks from indoor radon based on the National Academy of Sciences' (NAS) latest report on radon, the *Biological Effects of Ionizing Radiation (BEIR) VI Report (1999)*. This report is the most comprehensive review of scientific data gathered on radon and builds on and updates the findings of the previous NAS BEIR IV Report (1988). NAS concluded that findings of BEIR VI showed that if homeowners haven't yet tested their homes for radon and fixed them if the levels are elevated, they should do so.

The *NAS BEIR VI Report* confirmed EPA's long-held position that radon is the second leading cause of lung cancer and a serious health problem. NAS estimated that radon causes about 20,000 lung cancer deaths each year. The report found that even very small exposures to radon can result in lung cancer and concluded that no evidence exists that shows a threshold of exposure below which radon levels are harmless. The report also concludes that many smokers will get lung cancer due to their radon exposure who otherwise would not have gotten lung cancer. This is because of the synergistic relationship between radon and cigarette smoking in causing lung cancer.

To update EPA's previous risk estimates, EPA worked closely with the Agency's Science Advisory Board (SAB), an independent panel of scientific experts, to determine how best to apply the various risk models developed by the BEIR VI committee. EPA incorporated the SAB's advice and recommendations for modifying and extending the methods and approaches used in BEIR VI and constructed a single model yielding results midway between the results obtained using the models preferred by the BEIR VI committee. These adjustments did not result in significant changes to the BEIR VI risk estimates.

EPA's updated calculation of a best estimate of annual lung cancer deaths from radon is about 21,000 (with an uncertainty range of 8,000 to 45,000) and is consistent with the estimates of the BEIR VI Report. [EPA's previous best estimate of annual lung cancer deaths from inhaled radon was based on the earlier BEIR IV Report and was about 14,000 (with an uncertainty range of 7,000 to 30,000)].

The SAB-endorsed modifications included applying the Agency's definition of excess risk that includes all radon-induced lung cancer deaths, rather than excluding premature deaths caused by radon in people who would otherwise have eventually died of lung cancer. EPA also used more detailed smoking prevalence data and more recent mortality data to calculate risks that were used by the BEIR VI committee. EPA also calculated numerical estimates of the risk per unit exposure [lung cancer deaths per working level month (WLM)], whereas BEIR VI estimated the fractional increase in lung cancers due to radon.

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