



RADON

What Health Care Providers Should Know

DRINKING WATER FACT SHEET #7

What is Radon and Why is There Concern about Its Presence in Drinking Water?

Radon is a naturally occurring radioactive gas formed by uranium and radium in rocks and soil. Most radon seeps into the air of buildings through sump holes, floor drains, cinderblocks, dirt floors, and cracks in foundations and concrete floors. However, radon can also enter homes via the drinking water supply. Groundwater dissolves radon from uranium-containing rock, resulting in generally higher concentrations of radon in well water compared with drinking water derived from surface waters, such as rivers and lakes (1).

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Most radon exposure results from inhalation of radon emitted from soil in contact with the home. However, radon is also released into indoor air during water use. Household water uses involving water agitation and evaporation, such as showering, washing clothes, and flushing toilets, can contribute to inhalation exposure to radon (1). Typically, household water contributes only a small increment of radon to indoor air, but very high radon concentrations in water can represent an important source of inhalation exposure (1). Radon exposure can also occur through the ingestion of contaminated drinking water.

Radon exposure cannot be detected without testing—radon gas is imperceptible by taste, color, or odor. While exposure to radon and its by-products causes no

immediate obvious symptoms of irritation or discomfort, long-term exposure can lead to serious health effects, including lung cancer (2).

What are the Health Effects of Radon in Drinking Water?

Radon is a known human carcinogen (3), and causes an estimated 19,000 deaths in the U.S. each year from lung cancer (1). The U.S. EPA attributes about 168 cancer deaths per year to radon in drinking water. There is limited evidence that ingestion of radon-contaminated drinking water may increase the risk of stomach cancer (1,4), and a small percentage of these deaths is attributed to stomach cancer (5). However, EPA estimates that most of the deaths (89%) are due to lung cancer caused by breathing radon released to indoor air from water (5). Inhalation exposure is thought to be more significant because of radon's short residence time in the stomach (3).

Radon is thought to cause lung cancer through the damage inflicted by its radioactive breakdown products on the genetic material of cells (6). In addition to lung cancer, radon exposure may contribute to increased risk of non-malignant lung disease, including emphysema, pulmonary fibrosis, and chronic interstitial pneumonia (2).

Is Radon of Greater Concern to Certain Populations?

Smokers exposed to radon are estimated to have 10 to 20 times greater risk of lung cancer than nonsmokers similarly exposed (2). It is believed that radon and cigarette smoke work synergistically, such that their combined effects far exceed their individual effects. Homeowners living in areas with high deposits of uranium, shale, granite, and phosphate may also be exposed to higher than average radon levels (2). This includes parts of the Rocky Mountains, New England, the Appalachian states, the Southwest, and the Great Plains, although radon levels may be elevated in other regions as well (1).

The evidence for increased health risks among children exposed to radon is extremely limited, although

it is plausible that children may be more highly susceptible to radon's effects (3). Children may also receive somewhat higher inhalation doses of radon than adults due to differences in lung structure and higher respiratory rates. Exposure to carcinogens such as radon early in life also allows a longer latency period for cancer to develop (2).

How is Radon Regulated in Drinking Water?

The 1996 Safe Drinking Water Act Amendments require the EPA to establish health-based regulations to address the risks of radon in public drinking water supplies (7), but the final regulation is not likely to be in effect before 2005. EPA's proposed regulation gives the states two options for reducing the public's total radon exposure. Under the first option, states would develop Multimedia Mitigation (MMM) programs to reduce indoor air exposure to radon, while requiring individual water systems to reduce radon levels in drinking water to 4,000 picoCuries per liter (pCi/L) or lower. The second option would require individual water systems to either reduce radon levels in drinking water to 300 pCi/L or develop local MMM programs and reduce levels in drinking water to 4,000 pCi/L. Water systems already at or below the 300 pCi/L standard would not be required to treat their water for radon. EPA believes that the first option is the most cost-effective way to achieve the greatest radon risk reduction.

What Can Health Professionals Do to Reduce the Public Health Threat from Radon?

Because patients exposed to radon have no visible symptoms, health care providers should emphasize prevention, especially with those patients at higher risk.

- EPA recommends that all homes be tested for radon contamination by a qualified professional. Because radon in indoor air is the larger health concern, encourage patients to test their air before testing drinking water. If radon levels in air are higher than EPA's recommended 4 pCi/L level, urge patients to take action by increasing ventilation and preventing soil gas entry into the home. State radon offices can provide information about EPA-certified radon mitigation contractors.
- Encourage patients with private wells, particularly those who live in areas with high radon levels, to have their drinking water tested for radon. EPA's Safe Drinking Water Hotline at (800) 426-4791 can direct individuals to state laboratory certification offices. Well owners

may also call the National Radon Hotline at (800) SOS-RADON for guidance (5).

- Inform patients that drinking water can be treated to remove radon. Contact NSF International at (800) 673-8010 or the Water Quality Association at (630) 505-0160 for information about radon removal methods.
- Health professionals can be vital resources in local, state, and national efforts to reduce radon contamination of drinking water sources. PSR's *Safe Drinking Water Advocacy Kit* includes advice on how to become involved.

Sources of Additional Information and Guidance

- Physicians for Social Responsibility: (202) 667-4260 or www.psr.org
- PSR/ACPM online CME course, "Drinking Water and Disease": www.acpm.org/ehealth/sdw_intro.htm
- U.S. EPA Office of Ground Water and Drinking Water: www.epa.gov/safewater/radon/qa1.html

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This document is one in a series of Drinking Water Fact Sheets developed specifically for health care providers by Physicians for Social Responsibility. These fact sheets provide practical and concise information to assist health care providers in recognition and prevention of disease caused by exposure to drinking water contaminants.



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