THE AARST POSITION ON INDOOR RADON

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ABSTRACT

As a well established non-profit, professional and trade association, the American Association of Radon Scientists and Technologists (AARST) is often sought out for knowledgeable information on radon issues. An AARST position statement on radon has been approved to assist members in responding to inquiries. This statement concludes that : 1) Radon is the largest contributor to radiation dose, 2) Radon is know to cause lung cancer in humans, 3) The U.S. should continue with a radon action level of 4 pCi/L, 4) radon testing is encouraged for all homes in the U.S., 5) Cigarette smokers have a 15 to 20 times greater risk from radon exposures than never smokers, 6) The duration of radon exposure should be considered before taking action, 7) Radon in water may contribute to radon in air, and 8) AARST recommends priorities for state and federal radon programs.

INTRODUCTION

In the years since the American Association of Radon Scientists and Technologists was founded in February 1986, AARST has become a significant stakeholder in radon testing and mitigation services in the United States. The membership of AARST includes recognized experts in all aspects of radon sciences including, measurement and mitigation technology, instruments, laboratories, radon chambers, training, testing and mitigation protocols, health effects, and public awareness. As the organization has grown in stature, federal and state agencies and the news media have come to rely on AARST as a credible, knowledgeable, and authoritative source of information on radon issues. To assist AARST members in responding to media or public inquiries, the Board of Directors has approved an official position statement on radon. This is AARST's first formal position statement. As with an position statement, it will be reviewed at least annually to assure that it is up-to-date. Comments for improving this statement are welcome at any time.

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Radon is a naturally occurring radioactive gas which comes from radium found in the ground everywhere. This gas collects in buildings and forms radon decay products which mostly attach to dust particles in the air. Inhalation of these radon decay products results in deposition of radiation energy (alpha particles) in surface tissues of the lung. This is the largest source of radiation dose to an average person and radon is a known cause of lung cancer in humans. In keeping with normal radiation safety practices for minimizing all sources of radiation dose, AARST recommends testing of all homes and other buildings and taking action to reduce radon levels below 4 pCi/L.

1. Radon is the Largest Contributor to Radiation Dose

The average person in the U.S. gets more radiation dose from exposure to indoor radon (radon decay products) than from any other source of natural or man-made radiation according to the National Council on Radiation Protection and Measurements (NCRP 1987). At the average indoor radon concentration in the U.S. of about 1.3 pCi/L, the dose from radon decay products is about 100 to 200 mrem/year*. In comparison, radiation from

the ground contributes about 28 mrem/yr and radiation from outer space contributes about 27 mrem/yr. Radioactive materials in our bodies give another 40 mrem/yr. The use of radiation in x-rays and cancer therapy, consumer products, and nuclear power adds another 65 mrem/yr to our average dose. The U.S. Nuclear Regulatory Commission limits public exposures to man-made radionuclides to 100 mrem/yr. People in homes with radon at the EPA action level of 4 pCi/L could be receiving 300 to 600 mrem/yr. State and Federal programs for radiation protection should be putting more emphasis on the largest source of radiation exposures, namely radon. The radiation dose from naturally occurring radon decay products should not be addressed differently than man-made sources of radiation exposure.

2. Radon is Known to Cause Lung Cancer in Humans

Radon is classified as a Class A known human carcinogen according to the World Health Organization's International Agency for Research on Cancer (IARC 1988). This classification is based on the strong evidence of lung cancers in underground miners. Data from 11 studies of radon-exposed underground miners show that about 40% of the 2,700 lung cancer deaths which occurred among 65,000 miners are due to radon according to the National Cancer Institute (NCI 1995). Among never-smokers, 70% of the lung cancer deaths are believed to be due to radon and 39% of the lung cancer deaths in smokers. While there are many differences in radon exposure conditions between mines and homes, it is notable that persons living in homes with radon above the EPA action level of 4 pCi/L could accumulate radon exposures similar to underground miners. Miner studies show a consistent linear no-threshold relationship between lung cancer and radon exposure down to radon levels commonly found in homes. Epidemiology studies on residential radon exposures are consistent with expectations based on the linear model. Therefore, the National Cancer Institute indicates that 10% of all lung cancer deaths in the U.S. could be due to indoor radon exposures, 11% of lung cancer deaths in smokers and 30% of lung cancer deaths in never-smokers. When differences between mine and home exposures are taken into account, we find that exposures above 4 pCi/L represent substantially greater risks than allowed for any other source of radiation exposure.

3. The U.S. Should Continue with a Radon Action Level of 4 pCi/L

For more than 25 years the U.S. Environmental Protection Agency has recommended radon mitigation for homes with radon concentrations above 4 pCi/L. AARST views this action level as cautious on the side of safety, although 4 pCi/L should not be considered as a division between safe and unsafe levels of radon . We believe that all exposures to radon and radon decay products carry some risk of lung cancer according to the linear no-threshold model which best describes the relationship of alpha particle dose to lung cancer. In 1988 Congress passed a law to establish a national goal of bringing indoor radon levels down to those of outdoors (0.4 pCi/L). While this goal is commendable by normal radiation safety practices for keeping radiation exposures as low as is reasonable achievable, it is not technically feasible. In keeping with this practice, EPA began recommending in 1992 that homeowners consider radon mitigation at levels of 2 pCi/L. Other proposals for action levels include the National Council on Radiation Protection and Measurements recommendation for action at 8 pCi/L. The International Commission on Radiation Protection has recommended action between about 5 and 15 pCi/L. Studies of underground miners show increased risk of lung cancer at levels equivalent to living in a home at 4 pCi/L for 30 to 60 years or at 8 pCi/L for 15 to 30 years. These studies also show that small exposures over a longer period of time may have a greater risk than larger exposures in a shorter time. Therefore, a recommendation for action at 4 pCi/L seems reasonable in keeping with the concern of specialists in radiation safety for minimizing radiation exposures from all sources and the economic and technical feasibility for reducing radon to levels below 4 pCi/L.

4. Radon Testing is Encouraged for All Homes in the U.S.

While only about 8% of the homes in the U.S. have radon levels in living areas above the EPA action level of 4 pCi/L, these homes cannot be found without checking all homes. AARST recommends testing of homes, schools, public, and commercial buildings in high radon areas as the first priority. However, since high radon levels have been reported in all areas of the U.S. by radon testing companies, the second priority is to encourage testing of all homes. This could be done over time as part of routine inspections for real estate transactions. Radon testing should

be done by licensed or certified testers. Radon information and test results should be mandated for disclosure at the time of real estate transactions. Radon testing of 90 days or longer under normal living conditions will provide the best indication of average radon levels as a basis for action.

5. Cigarette Smokers have a 15 to 20 Times Greater Risk from Radon Exposures Than Never Smokers

At 4 pCi/L smokers have an individual risk of about 30 per 1000 exposed, while never smokers have a risk of about 2 per 1000 exposed. Since smokers have a much greater risk from radon, they can also gain more by reducing their radon exposures. However, since most lung cancers are due to smoking, smokers can best reduce their lung cancer risk by stopping smoking. Because of the predominant influence of cigarette smoking and environmental tobacco smoke on lung cancer, we may never be able to identify individuals with lung cancer due to radon alone.

6. The Duration of Radon Exposure Should be Considered before Taking Action

The risk of lung cancer from radon is related to both the radon level and the length of time one is exposed. Consequently, if the exposure time is short, even large radon concentrations may not contribute to significant risk. Therefore, radon testing should be done in that part of a building where people spend the most time. Also, since lung cancer due to radon exposures may require several decades to occur, older people should not have as much concern for reducing radon levels as younger people. A family with young children living in a home for many years may gain a greater benefit by reducing their radon exposures.

7. Radon in Water May Contribute to Radon in the Air

The greatest concern for radon in water is not from ingestion but from the release of radon into the air, during normal household water uses, that adds to the radon levels in indoor air . Thus, an action level for radon in water should be related to expected airborne levels. Homeowners with high indoor radon levels and on private wells may want to test for radon in water to determine whether the radon is from the ground or from the water before taking action.

8. Priorities for State and Federal Radon Programs

Programs to reduce radon lung cancer risks should emphasize: 1) targeting all buildings in the highest radon areas first, 2) incorporating radon resistant features in building codes and promoting radon-resistant new construction, 3) supporting radon testing and mitigation in connection with real estate transactions, 4) assisting the real estate industry in developing testing and mitigation programs, 5) supporting public information programs to encourage radon testing, 6) developing a coordinated radon research plan. There is much we still do not know about radon health risks. Residential case control studies should be supported for improving our understanding of radon risks in homes. Also, long term radon control may best be achieved through development of good building practices and adoption of radon resistant features in building codes.

* A mrem is a unit of effective dose. In international units, 1 mrem is 0.01 millisievert (mSv).

REFERENCES

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