Position paper from the American Association of Radon Scientists and Technologists (AARST) on the Potential use of HEPA or Other High Efficiency Filtration Methods to Remove Radon Progeny from the Air to Attempt to Mitigate the Health Risk Associated with Radon Gas.

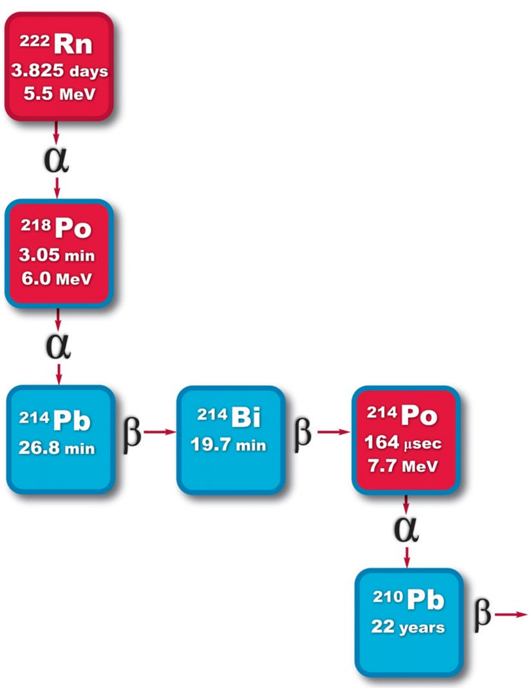
Executive Summary: *AARST does not support the use of HEPA or high efficiency air filters to reduce the health risk associated with radon exposure by filtering out radon progeny. AARST acknowledges that radon progeny filtering does not affect radon gas concentration. AARST agrees with the USEPA that that the best means available to reduce the health effects from radon exposure is to prevent the radon gas from entering the building.*

Radon

Radon is a colorless, odorless, radioactive gas that occurs naturally in all parts of the US. Radon is a "Group A" carcinogen and the leading cause of lung cancer in nonsmokers. Radon is estimated to be responsible for the death of about 20,000 people in the United States every year. The only way to determine the concentration of radon in a building is to perform a test.

The Radon Decay Series

Radon gas has a radioactive half-life of 3.82 days. Radon decays into a series of solid radionuclides that are known as "radon progeny" (also called "radon decay products" or "radon daughters"). The first four radionuclides in the series that follow the decay of radon are called the "short-lived radon progeny" because their half-lives are short compared to that of radon. These radionuclides are polonium-218 (^{218}Po), lead-214 (^{214}Pb), bismuth-214 (^{214}Bi) and polonium-214 (^{214}Po). The last three radionuclides in the series (lead-210, bismuth-210 and polonium-210) are called "long-lived radon progeny" and are unimportant in the consideration of the radiation dose to the lung from radon and radon progeny. Unlike radon, which is chemically inert, radon progeny are chemically reactive metals that can attach to walls, floors, airborne particles or combine with water vapor and other gases in the air. The portion of the radon progeny that are attached to particles in the ambient atmosphere is called the "attached fraction"; whereas "unattached fraction" refers to suspended individual atoms or ultra-fine particle clusters. Radon progeny that attach to walls or other surfaces are considered to be "plated out" and therefore removed from the air and can no longer be inhaled.



When the short-lived radon progeny are inhaled, a portion of them can attach to the lining on the bronchioles of the lung. Because of their short half-lives, the lung cannot clear itself of these materials before they undergo radioactive decay. Of particular importance are polonium-218 and polonium-214, which emit highly energetic alpha particles (a). These alpha particles can strike sensitive cells in the bronchial tissue and cause damage that could lead to lung cancer. It is these two polonium radionuclides that produce the bulk of the radiation dose to the lung and create the greatest source of risk of lung cancer from exposure to radon and radon progeny.

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HEPA Filtration

It is accepted that a High-Efficiency Particulate Air filter or HEPA filter can remove significant particulate matter from the air and reduce the radon progeny from the ambient atmosphere only in those areas being filtered. However, because the radon gas concentration is unaffected by the HEPA filter the progeny are continually replaced by subsequent radioactive decay of the radon gas. Further, filtration of the air changes the distribution of the sizes of the particles in the air to lower sizes. Radon progeny attached to particles of decreased size present in the air may become more effective in delivering dose to the lung thus the reduction in progeny filtration may not provide equal health risk reduction.

The USEPA also points out that some of the complicating factors with the use of HEPA filtration include: a potential increase in ultra-fine particles available for progeny attachment and deposition in the lung; a potentially larger percentage of progeny as an unattached fraction available to be deposited in the lung; maintaining consistent air volume setting; human interference with filtration device operation; uncertainties with filter loading and progeny reductions; and the frequency of radon progeny measurements needed to maintain the target progeny concentration. [1]

Summary

While HEPA or other high efficiency filtration can be used to remove particulates and reduce radon progeny in the air, it does not affect the radon gas concentration and therefore radon progeny will continue to be produced in the ambient air. The resulting shift in particle size distribution in the air will deliver an unknown dose from radon progeny to the lung. Further, radon gas measurements will be unaffected by filtering and the assessment of the effect of filtration involves multiple measurements of radon progeny concentrations and particle size distributions throughout the building. AARST, at this time, does not support air filtration as a means of mitigating the health effects of radon and agrees with the USEPA that the best means available to reduce the health effects from radon exposure is to prevent the radon gas from entering the building [1]. Therefore, AARST recommends radon mitigation to reduce the radon gas concentration in the building as low as practicable by preventing entry or through the applied use of USEPA recommended mitigation methods listed in the following references. [2], [3].

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References

[1] Jalbert, P., Fisher, E. USEPA correspondence to Douglas County School Board Minden, Nevada March 6, 2008
[2] Mosely, R.B., Henschel, D.B. "Application of Radon Reduction Methods" EPA/625/5-88/024 August 1988
[3] Henschel, D.B. "Radon Reduction Techniques for Existing Detached Houses" EPA/625/R-93/011 October 1993

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