Radon is a radioactive naturally occurring gas. It is inert and does not have a color or odor. It is harmful to people’s health because as it decays, it gives off small radon decay products which can cause lung cancer. In the atmosphere, it can be found in trace amounts, meaning that it diffuses rapidly in the outdoor air and is so diluted that it would not affect anyone’s lungs. However, when radon is trapped indoors it can build up to levels that would be harmful to be exposed to. If, for example, radon gas seeped through cracks in a building’s foundation, it could become artificially concentrated and expose the residents to radiation emissions that are damaging to the DNA and cause them to have a higher risk for lung cancer. Lung cancer is a particularly lethal disease, as more than half of people who develop lung cancer do not survive a full year past their time of diagnosis and the five-year survival rate is 18.6%, which is much lower than many of the other leading forms of cancer.[[1]](#footnote-1) A population’s exposure to indoor radon would certainly constitute a public health issue.[[2]](#footnote-2)

Radon is classified as a known human carcinogen and is recognized by the Center for Disease Control, the American Lung Association, the American Medical Association and the American Public Health association as a significant health problem.[[3]](#footnote-3) In the United States, radon is the second leading cause of lung cancer for smokers, and the leading cause for non-smokers. When one inhales radon overtime it increases their risk for developing lung cancer. The EPA guidelines state that 148 Bq/m3 (4 pCi/L) is the action level for radon, meaning that if the radon count in one’s home is above that level, they should take corrective measures to reduce the exposure.[[4]](#footnote-4) Corrective measures include active soil depressurization, in which radon-rich air is pumped out from the soil beneath a home with a fan and suction system, sealing cracks in the floor, and less costly methods such as fans to bring air outside to reduce the RDPs in the air inside the home. [[5]](#footnote-5) However, it is important to note that without the right equipment and technical background, one would actually increase the radon level and create additional hazards, so it is best to use qualified contractors unless one is certain that they have the proper tools and training.[[6]](#footnote-6)

Although any level of radon in the air can carry a risk, studies estimate that reducing radon concentrations to below this action level could avoid about one third of the radon-induced lung cancer. A study using mortality data and vital statistics from 2014 found that 12,900-15,900 deaths each year could be attributed to indoor radon exposure. The authors concluded that the overall radon risk is elevated above the acceptable levels of risk from environment factors relative to other such natural occurring hazards. [[7]](#footnote-7)

A study from 2019 found that there was an overall increase in radon exposure in more modern residential structures across North America. Newer homes contained greater radon counts than older ones. The authors explained that this issue is in contrast to European countries, such as Nordic countries and north-western Spain, whose newer homes have less radon compared to the older ones. The homes in North America with increased radon exposure also had larger amount of square footage in direct contact with the bedrock or soil, taller ceilings, basements, and the windows on the upper floors had reduced ability to open. However, they reported that having plumbing in the basement, the thermostat setting, and the type of basement walls did not have a significant correlation with the amount of radon exposure. [[8]](#footnote-8)

In addition to causing lung cancer, radon has also been studied for its correlation with mortality from non-malignant respiratory diseases. The Cancer Prevention Stud-II uses nearly 1.2 million Americans who were recruited in 1982 for a large prospective cohort study. They linked the average radon concentrations of the test subjects ZIP code at the time of enrollment to their development of respiratory diseases. Using Cox proportional hazards regression model to estimate the hazard ratios, they found that radon was significantly associated with chronic obstructive pulmonary disease mortality. Of the 811,961 participants who remained in the study, there were 28,300 non-malignant respiratory disease deaths in 2006. There was also a statistically significant increase in COPD mortality with increasing amounts of radon concentrations.[[9]](#footnote-9) Although the authors cautioned that further research must be done to better understand this relationship and confirm their findings, I still feel that this issue is one that should be acted upon by public health officials to improve the public health.

In one particularly harrowing example, a non-smoking Illinois resident, Joe Linnertz, died from Stage 4 lung cancer six weeks after his diagnosis. His home was tested after his death to reveal radon levels more than four times the EPA’s action level. His wife, Gloria, commented, “We didn’t know this silent killer was living with us.” [[10]](#footnote-10) She is not alone in this, however, because the EPA estimates that almost 1 in 15 homes in the United States has elevated radon levels.[[11]](#footnote-11)

Radon exposure in school buildings is also a significant concern, because children will be exposed repeatedly over many years during a biologically susceptible time in their lives. The children will then have many years for the cancer to develop and produce a clinical impact. One alarming study has shown that this issue of radon in schools has not been well researched or reported. There is no federal limit for radon levels in schools, and therefore the state regulations regarding policies and funding for radon testing and mitigation can vary greatly. For example, in California, there is no state funding specifically designated to aid the schools in testing for radon. The authors proposed a few measures that can be taken to correct this issue, including training the school staff to collect radon data for initial testing and, if elevated, report it for further testing by certified professionals. [[12]](#footnote-12)

I believe that the most effective corrective measure that can be taken to reduce the amount of radon exposure and consequently reduce the risk of lung cancer in the United States would be to increase awareness for this public health issue. Before beginning this research paper, I knew almost nothing about radon exposure and certainly did not realize how prevalent it was. Anyone I discussed my paper with was also surprised as to how such a carcinogen that has been proven to be lethal over time can receive such little public notice. A cross-sectional study done on a low-income rural population found that more than a third of the residents who responded to the questionnaire underestimated the seriousness of the health effects that radon exposure can have. 39% disagreed that being around less radon could improve their children’s long-term health and 52% were unsure if radon could cause medical issues. [[13]](#footnote-13) By having a nationwide campaign to increase awareness of the issue, with TV commercials, newspaper and online advertisements, and brochures with accurate up-to-date information posted in local clinics and shopping centers people will learn to recognize the need to test their homes for radon, and be informed of the options available to do so.

This increase in radon awareness programs for the general public is certainly necessary at this time because research, policy, and public health programs have not been updated or expanded since their beginning in 1980s-1990s. Funding for the radon program in the US has gone down by 66% from 1997 to 2007. There has been no significant radon risk reduction in low-income areas and school-based radon reduction has not progressed since the early 1990s. [[14]](#footnote-14) If the public were more aware of the issue, they would certainly encourage their government officials to allocate funds for mitigating the problem. Right now, many homes with elevated radon levels are not being tested properly because the homeowners do not understand the severity of elevated radon exposure. The main advantage of a radon awareness campaign would be to prevent more cases of lung cancer from developing. If this program was also used in conjunction with anti-smoking campaigns, the results would be even greater.

The disadvantage of this awareness plan is that although testing is the first step in combatting the issue, if elevated radon levels are found, additional action must be taken to improve the situation. This can often be a costly endeavor and may not be attainable for low-income families. In addition, as mentioned above, if the construction work is not done properly it can actually make the problem worse. Residents who become aware of the issue through this campaign may try to take matters into their own hands, rather than hiring trained professionals, and this can lead to even more radon exposure. However, despite these downsides, I believe that a national radon-exposure awareness campaign would be very beneficial for public health.

1. U.S. National Institute Of Health, National Cancer Institute. SEER Cancer Statistics Review, 1975–2015. [↑](#footnote-ref-1)
2. <https://www.epa.gov/radiation/what-radon-gas-it-dangerous> [↑](#footnote-ref-2)
3. <https://www.epa.gov/sites/production/files/2015-05/documents/402-r-03-003.pdf> [↑](#footnote-ref-3)
4. <https://journals.lww.com/health-physics/Abstract/2002/07000/Residential_Radon_Exposure_and_Lung_Cancer__Risk.1.aspx> [↑](#footnote-ref-4)
5. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4852734/> [↑](#footnote-ref-5)
6. <http://www.cancer.org/cancer/cancer-causes/radiation-exposure/radon.html> [↑](#footnote-ref-6)
7. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5590909/> [↑](#footnote-ref-7)
8. <https://www.nature.com/articles/s41598-019-54891-8> [↑](#footnote-ref-8)
9. <https://www.ncbi.nlm.nih.gov/pubmed/22005921> [↑](#footnote-ref-9)
10. <https://www.nsc.org/home-safety/safety-topics/other-poisons/radon> [↑](#footnote-ref-10)
11. <https://nepis.epa.gov/Exe/ZyNET.exe/10004BNT.txt?ZyActionD=ZyDocument&Client=EPA&Index=2000%20Thru%202005&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&UseQField=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D:%5cZYFILES%5cINDEX%20DATA%5c00THRU05%5cTXT%5c00000005%5c10004BNT.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7c-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=4> [↑](#footnote-ref-11)
12. Gordon, Kelsey, et al. "Radon in schools: a brief review of state laws and regulations in the United States." *International journal of environmental research and public health* 15.10 (2018): 2149. [↑](#footnote-ref-12)
13. Hill, Wade G., Patricia Butterfield, and Laura S. Larsson. "Rural parents' perceptions of risks associated with their children's exposure to radon." *Public Health Nursing* 23.5 (2006): 392-399. [↑](#footnote-ref-13)
14. Angell, William J. "The US radon problem, policy, program and industry: achievements, challenges and strategies." *Radiation protection dosimetry* 130.1 (2008): 8-13. [↑](#footnote-ref-14)