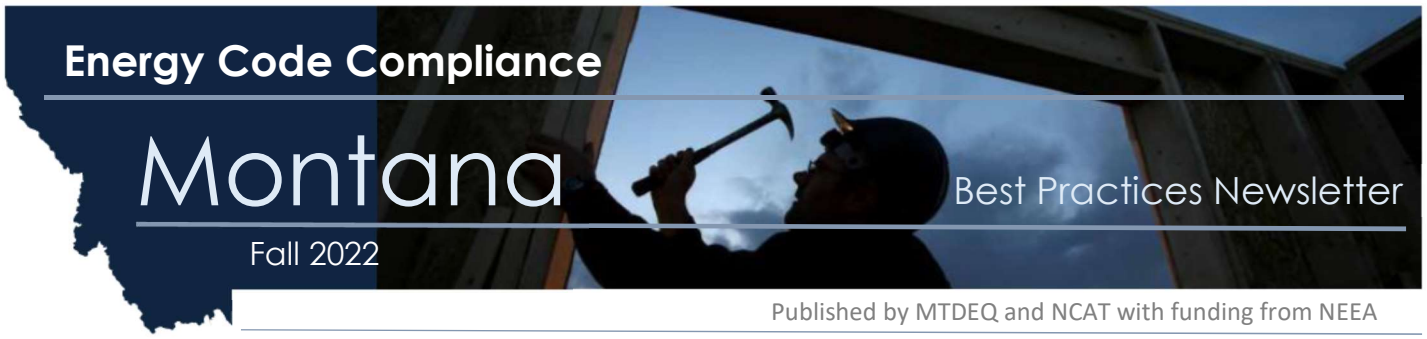

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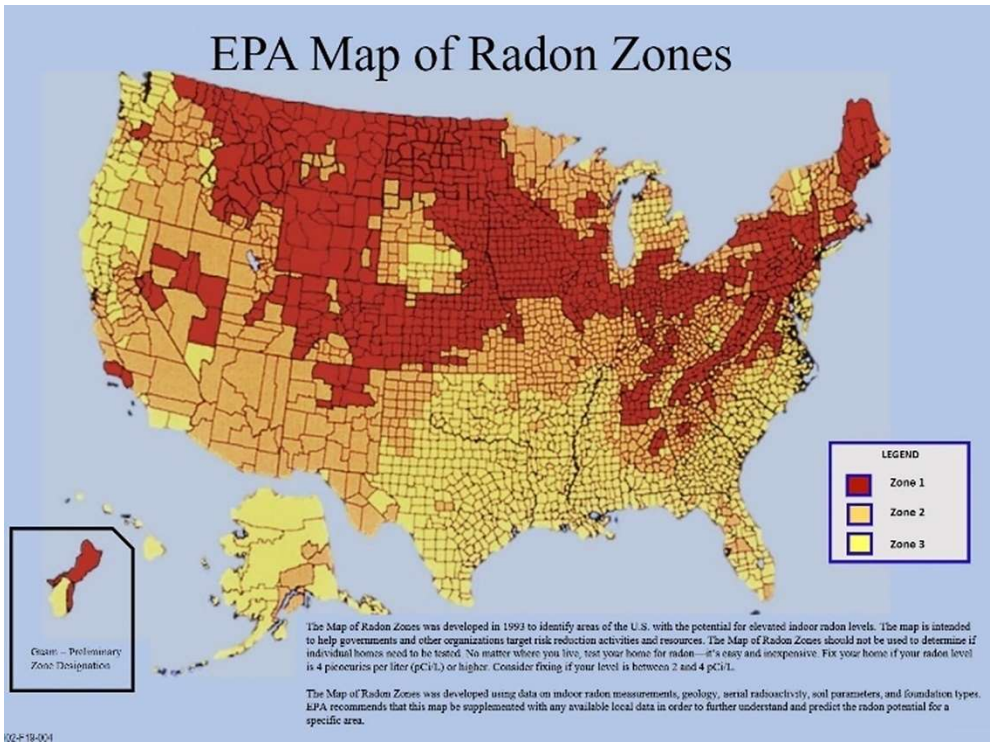
Radon Mitigation for New Homes

Radon is a radioactive gas that comes from the soil. According to the U.S. Environmental Protection Agency (EPA), exposure to radon gas is the second-leading cause of lung cancer (after smoking) in the United States. About 21,000 people die each year from radon-related lung cancer.

Radon in our homes is produced from the natural breakdown of uranium found the soil and rocks that are exposed to our indoor environment. As uranium breaks down, atomic particles form radon, a colorless, odorless gas. When radon is inhaled, the atomic particles can be deposited in our lungs, and these particles can alter cell DNA, thus increasing the risk of lung cancer. Although radon is present in all environments, it usually does not present a health risk outdoors because it is diluted in the open air. Radon can, however, build up to dangerous levels inside a house.



While our building codes do not require radon-mitigation systems in new home construction, a passive mitigation system in a new home is a small cost for insurance against the potential health consequences and future financial costs if high levels of radon are present in a new home.

Radon enters a home through cracks and voids in the foundation and from soil gasses present in the exposed soil in crawlspaces. While building codes require vapor retarders over exposed soil in new

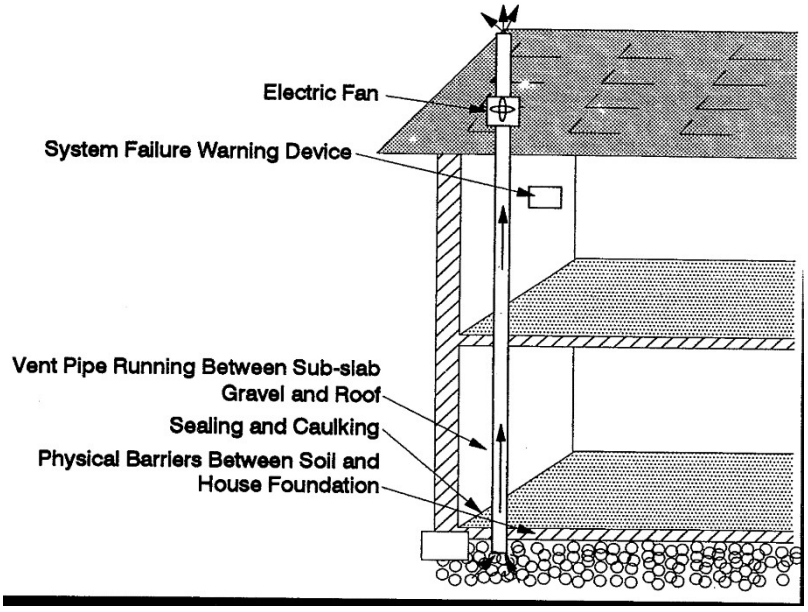
construction, the barriers are often imperfectly sealed and may allow radon to enter the home. Additionally, if pressure in the house is less than the surrounding soil, the house will act as a vacuum, drawing radon into the home.

Radon is measured in picocuries per liter (pCi/l), and EPA recommends that a radon system be installed in a home that tests above 4 pCi/l. Moreover, EPA has surveyed the U.S. and developed a map to identify areas of elevated radon levels in soil gasses. Areas included in Zone 1 in this map indicate soil gases with predictable levels of 4 pCi/l, and most counties in Montana are in the Zone 1 areas of the map. A 2006 study found that 48% of Montana houses tested above action level of 4 pCI/L. Therefore, it makes practical sense that all new homes should include a passive radon mitigation system installed during construction. A passive mitigation system can then be easily upgraded to an active system should radon levels test high after construction is completed.

EPA recommends that all homes built in Zone 1, which includes most of Montana, have radon mitigation systems installed at the time of construction. A radon mitigation system involves installation of a perforated pipe below the foundation slab, basement slab, or a crawlspace vapor retarder. This set of pipes is then vented through the roof with solid piping. This constitutes a passive mitigation system and may be enough to vent any radon present in the soil gases away from the living areas of the home. However, if a post-construction radon tests still shows radon levels of concern, a fan is installed in the solid vent pipe to create a negative pressure under the slab of vapor retarder to pull soil gases into the mitigation system and vent them to the outside.

EPA Recommended Construction Details

Radon-resistant techniques are considered best practice in residential construction. According to a recent study, incorporating radon resistance in new construction costs $300 to $500; whereas, mitigating an existing home costs $1250 to $2500. The EPA publication *Radon Mitigation Standards* includes a number of requirements for the proper construction of a radon-mitigation system. First and foremost, the mitigation system shall comply with all existing building, plumbing, and electrical codes. Additionally, the system must not create any dangerous conditions such a backdrafting of combustion appliances. Systems should also be designed to maximize radon infiltration while minimizing energy use, avoid compromising moisture and teperature controls, and minimize noise. The system must be leak-free and all piping must be selaed, as should all areas where the piping penetrates the slab or crawlspace vapor retarder. To prevent re-intrainment of radon onto the building, the point of discharge from the vent pipe must meet the following requirements: (1) be above the eave of the roof; (2) be feet or more above gound level; (3) be feet or more from any window, door opening, or other opening into conditioned spaces of the structure that is less than two feet below the exhaust point; and (4) be ten feet or more from any opening in an adjacent building.



EPA also reccomends that, if a vent fan is required, it be sealed, designed to produce enough pressure to draw soil gases from below the building, and if mounted outside, be rated for exterior use. More importantly, the fans cannot be installed below gropund or in any conditioned space, nor in basement, crawlspace, or other interior location directly beneath conditioned spaces in the structure. Acceptable locations for a vent fan are attics not suitable for habitation, garages that are not below habitable areas of the home, and the exterior of the building. All sytems should also include a system-failure warning device. The radon vent exhast should terminate at least 12 inches above the roof.

All systems should include these essential elements to ensure effective radon gas venting:

- A layer of ¾-inch crushed stone under any foundation or basement slab
- At least one horizontal section of perforated pipe that runs through the crushed stone and is connected to a vertical riser or discharge pipe
- A layer of 6-mil polyethylene above the crushed stone
- An electrical supply in the attic or at the exterior of the home where a fan can be installed if necessary

Energy Considerations

One disadvantages of an active radon-mitigation system is that the fan required in the system needs to be operated continuously. Radon fans will usually operate at 20 to 100 watts and are rated at 60 to 200 cfm, and will cost anywhere from $25.00 to $100.00 per year to operate. The crushed stone in the system will allow the use of a low-flow fan, which will help reduce energy costs of the system. All new construction should start with a passive system and a radon test when the house is completed to determine if a fan is necessary.

For more information on radon in Montana: https://deq.mt.gov/energy/Programs/radon .

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