

RADON-BLOCKING HOUSE

By DAWN STOVER

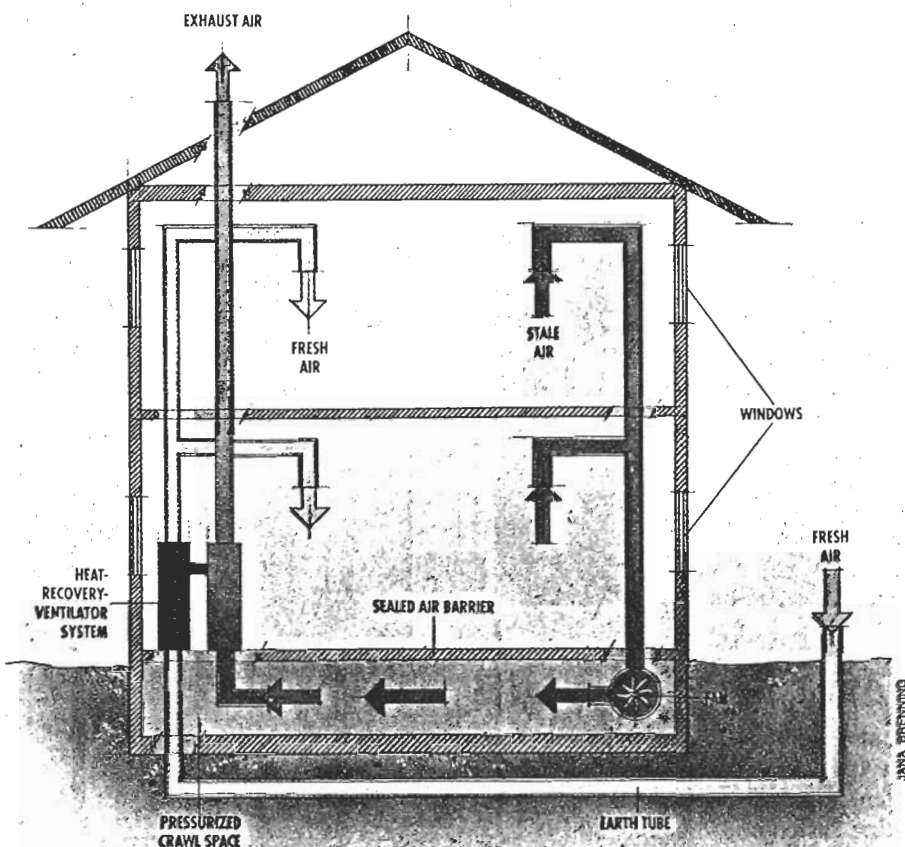
Mike Nuess lives in Spokane, which has the highest concentrations of radon found in Washington state: Some of the homes in Spokane that were tested in a recent survey had levels 50 times greater than the U.S. EPA's recommended limit. "A lot of people say you can't have an energy-efficient house and also get rid of radon problems," says Nuess, who works for the Washington State Energy Office's Extension Service. But he didn't listen to them when he built his own house. "I saw an opportunity to kill two birds with one stone," he explains.

Nuess and the four others in his core design group were so successful at creating a house that accomplishes both goals that they won the Energy Efficient Building Association's 1991 Design Competition Award as well as the EPA's 1991 Innovative Radon Mitigation Design Competition.

Radon is a radioactive gas that can cause lung cancer. It is formed by the decay of naturally occurring radium in the soil and can be pulled into a house through openings in the basement or foundation. Without a proper ventilation system, a house that is made airtight for energy efficiency and comfort can sometimes trap radon gas. However, tightness is the key to controlling radon, says Nuess.

The walls of his two-story house are a foot thick with a thermal-resistance factor of R-45, and the windows have triple glazing. Here's how Nuess keeps radon out of this tight envelope: The house is divided into two cells. The first cell contains all the living space, and the second one is a crawl space under the first cell. A barrier of plywood prevents any air exchange between the two cells. Special care was taken to seal the joints in the plywood barrier, as well as around nail holes and openings made for plumbing and wiring.

In the kitchen, Nuess takes a tissue and holds it up to the ceiling, where it's sucked onto a vent. A fan is obviously pulling air out of the kitchen, but it isn't audible. Located in one corner of the crawl space, the fan draws stale air out of the living space—depressurizing the house and pressurizing the crawl space to keep radon out. The exhaust air passes through the crawl space, warming the floor above, and then exits from the opposite corner.



In this award-winning design, a fan pressurizes the crawl space, blocking radon entry. Heat is recovered from the exhaust air. The hut in the yard covers a tube that draws fresh air into the house.

The air then passes through a heat-recovery ventilator, or HRV, before it is exhausted through a roof stack. Heat that is recovered by the HRV, which uses a small heat pump, is routed to the water heater if it is not required for space heating. If both needs are met, the compressor shuts off, and a fan simply blows the warm air up through the stack.

Because the pressure inside the house is lower than that outdoors, fresh air is drawn into the house through a 60-foot-long polyvinyl-chloride tube whose intake is sheltered by a hut located in the backyard (photo). Underground, the tube splits into two four-inch-diameter earth tubes that run parallel four feet below the surface. Cold winter air that passes through these tubes is warmed by the earth (to 45°F or more) before it enters the house. The fresh air, along with air recirculating through the living space, is warmed by the HRV.

The main purpose of the HRV is ventilation, rather than heating. But because the

house is so tight, the HRV provides about 45 percent of the required space heating. The rest comes from electric baseboards. Nuess' utility bills show that heating the house costs about one-third as much as the average cost of heating a house in the Pacific Northwest.

The radon-mitigation and energy-conservation package added about \$8,000 to the cost of the house, Nuess estimates. The payback period is 10 to 20 years, depending on whether energy credits are available.

One problem with the system is that it requires a homeowner to check pressure gauges, adjust fan speeds, and do other periodic fine-tuning. For example, the homeowner could switch the fan to a slower speed when the soil is wet, and less air is needed to pressurize the crawl space. "Not too many people are going to become house mechanics," admits Nuess, "so they'll need someone who knows how to fix it for them."