Overview of Radon Mitigation

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Radon can enter the building by three pathways. The most significant is usually through soil gas intrusion. Another method, that can be significant, is the release from water when it is exposed to the air in the building. For water radon to be a significant radon source, there must be elevated concentrations of radon in the water along with large volumes of water exposed to the air. The least significant pathway is generally the emanation of radon from building materials.

Soil gas mitigation systems reduce the exposure to radon by either preventing the radon from entering the building or by removing it once it has entered. The most desirable method is to prevent the radon from entering the building because it provides for the lowest possible exposures.

Soil gases are pulled into buildings through holes in the soil building barrier by negative pressures created in the building. In most cases, the barrier is a concrete slab that may or may not have a membrane installed below the slab. The negative pressure is either caused by the natural stack effect of the building or by an unbalanced mechanical ventilation system. Whenever the pressure above the soil barrier is less than that below the slab, the soil gas is pulled into the building. Radon will enter the building with the soil gas.

To prevent the radon from entering the building, the pressure above the soil barrier has to be greater than the pressure under the barrier. This can be done either of two ways. One is to increase the pressure above the slab with a ventilation system or decrease the pressure below the slab with a sub-slab depressurization system.

Sub-slab depressurization systems consist of single or multiple penetrations through the slab into which pipes are inserted. In the case of multiple penetrations, the pipes are joined and routed to an area where the fan is installed. The fan must be located outside of the conditioned space and the exhaust must be above the eaves of the roof. To determine the number of penetrations, the size of the vent pipes, and required fan performance; sub-slab diagnostics are performed. These diagnostics consist of drilling multiple holes in the slab to attach a vacuum and pressure gauges. The measurement from the gauges provides the information necessary to design the system.

In a large commercial building, radon mitigation usually requires that, at a minimum, the ventilation system not add to the negative pressure created by the natural stack effect. Sometimes the ventilation system by itself can create the pressure necessary to prevent radon entry. Most of the time, however, radon mitigation requires a sub-slab depressurization system in conjunction with ventilation adjustments to maintain the pressures required to prevent radon entry.

In cases where radon entry cannot be controlled to desired levels by pressure, an increase in ventilation is necessary. This is usually done using an air to air heat exchanger. Air to air heat exchangers are sometimes referred to as heat recovery ventilators (HRV's). Using a fan; these devices bring in fresh outside air that passes through multiple small channels in a core that has separate channels for the warm air that is exhausted by a second fan. The channels for the two streams of air share at least two surfaces of each channel. These shared surfaces transfer the heat to the cold fresh air. These units typically recover sixty to eighty percent of the heat.

The above discussion illustrates the need to evaluate not only the sub-slab conditions but the operation of any existing ventilation systems when diagnosing the best solution for an elevated radon air problem.