What's New with Radon Gas?

In the early 1990's when the Environmental Protection Agency (EPA) was designing and developing protocols for testing and mitigation, the effect of HVAC systems on interior radon levels was well known. However, the preferred testing and mitigation methods often did not involve detailed HVAC considerations. With today's renewed emphasis on indoor air quality (IAQ), current approaches to radon and IAQ should be re-evaluated.

As we all know, radon gas is a colorless, odorless gas that is a result of naturally occurring uranium breaking down in the ground. Radon levels fluctuate based on the time of day, season, weather, etc. Current EPA studies have shown that exposure to levels above 4 picocuries/liter can lead to a significantly increased risk for lung cancer. Approximately 21,000 annual lung cancer deaths are attributed to radon. That's 7 times more deaths than from drowning and more than three thousand more deaths than caused by drunk driving.

Recent evidence suggests that when evaluating interior radon levels, we must seriously consider the actual levels **when** the building is occupied. This is particularly true in schools, office buildings and commercial facilities with large air handling systems. Current methods may still be appropriate for residential settings.

Based on the type of your facility and timeframes, the EPA currently recommends testing with short-term detectors for 48 continuous hours or long-term detectors for about three months. Testing is to be done in closed building conditions to establish worst case scenarios. Results are reported as an average of all levels during the sampling period. Results from these methods may overstate actual exposures in many circumstances. Here's why….

Properly designed and maintained large HVAC systems generally put buildings under positive pressure. Building codes also call for increased number of air exchanges and fresh air intake. All of these factors greatly reduce the levels of radon in the facility when the HVAC systems are running. Hence, actual radon levels during occupied times in these types of facilities are likely significantly lower than current testing results indicate. Some recent studies have shown radon levels to be 10 times lower in occupied times then peak levels and 3-4 times lower than reported averages.

This theory assumes that HVAC systems are properly balanced and maintained. It is quite possible that a system that is not functioning properly could create negative pressure situations in some rooms (increasing radon gas entry) and thereby higher levels in select areas.

What does all this mean? First, it suggests we should take another look at our existing results and secondly evaluate our current sampling and mitigation strategies as they relate to our air handling systems. Here are some things to consider:

- In larger buildings, very few systems are evenly balanced. That is why it is imperative to simultaneously test all frequently occupied rooms that are in contact with or directly above soil. Review your results to determine if all areas were adequately sampled.

- Long term testing over the winter months is the preferred sampling strategy for this climate. Results for tests collected over other time periods are likely understated and short-term test results are statistically much less reliable.

- If HVAC systems have changed or building renovations/additions have occurred, building pressurization has changed meaning our interior radon levels have changed as well. Re-testing may be warranted.

- If HVAC systems were running during your testing period, it is possible your results are overstated for occupied times. Your results are average levels that include nights and weekends when systems were run less frequently. Hourly measurements with a continuous monitor in at least one location would help show these fluctuations.

- Residential systems are usually quite different than commercial systems and times of occupancy are different as well. Averaged results are more indicative of true exposure in these types of facilities.

- If mitigation systems are in place, limited periodic testing should be done to ensure systems are operating properly and site conditions have not changed levels of radon.

- Prior to construction, consider Radon-Resistant Construction techniques including a gas permeable layer of gravel beneath the slab, plastic sheeting placed on top of the gas permeable layer, sealing all openings in the concrete foundation and gas-tight vent piping installed during the construction process.

As with most environmental issues, a periodic review of your programs is prudent. Radon is no exception.