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360° VI RESOURCE

MITIGATING VAPOR INTRUSION:

Is Radon Mitigation Technology Good Enough?

While at first glance it may appear that radon and vapor intrusion (VI) mitigation systems are similar, there are substantial differences with regards to both the design and construction of these systems. As the science of VI continues to evolve, so does the engineering of VI mitigation systems. Through our own recent experience and from lessons learned at notable Colorado VI sites, **Vaprōtect** engineers, scientists and construction managers have developed new design procedures, construction practices, and performance testing for these systems. There are two fundamental lessons we learned:

1. The typical radon system design and construction are not sufficient to achieve the high performance required of VI systems

2. A high level of documentation is needed to establish evidence of building conditions, as-built system configuration, and continuous long-term adherence to performance criteria

The reason for the differences between the types of mitigation systems is the need to attain the extremely low post-mitigation indoor air VOC concentrations required for vapor intrusion mitigations systems. Several states have adopted indoor air VOC concentration guidelines in the low parts per billion and USEPA has proposed concentrations as low as a few parts per trillion. Attainment of these extremely low post- mitigation concentrations is simply not feasible with traditional radon mitigation technology.

The most common mitigation technique for existing buildings is sub-slab depressurization, where a slight vacuum is pulled on the space under the building's slab (basement floor or slab on grade). Soil vapor approaching the building from beneath the slab is captured through a suction point and exhausted to the outdoors through the use of a fan. Through our practical experience in designing and installing VI systems, we have found many radon systems in operation and have learned what to expect from the design and performance of the average or "typical" radon system. The attached table summarizes the major differences between typical radon and VI systems.

Radon mitigation systems are typically installed with little, if any, evaluation of slab and structure conditions and limited performance verification following installation. These systems are typically installed by providing a suction point in the floor slab without any sub-slab communication testing, connecting the suction point to an extraction fan, and routing the discharge outdoors. Performance verification, if evaluated at all, consists of passive air sampling to verify that radon levels are less than 4 picocuries per liter of air.

The design protocol for vapor intrusion mitigation systems developed by **Vaprōtect** begins with a thorough evaluation of slab- and structure-specific conditions in order to adequately determine the:

- Location and number of sub-slab suction points
- Optimum fan size (based on sub-slab flow and pressure characteristics)
- Need for sealing of floor and wall cracks and penetrations
- Potential for backdrafting of fuel fired appliances
- Uniformity and magnitude of the subslab pressure gradient induced by the vapor intrusion mitigation system.

Following construction of the mitigation system, commissioning procedures are performed to verify proper system installation and operation. These commissioning procedures include a review and evaluation of numerous items including:

- Sub-slab soil characteristics
- Component installation inspections
- Fan performance
- Adequate sealing of floor and walls
- Sub-slab pressure gradient testing

Complete and detailed documentation throughout the entire process is essential. The attached table identifies several types of unique records that should be kept for each building. The **Vaprōtect** documentation protocol specifies data to be collected and procedures to validate a data package that becomes the permanent record.

VI mitigation systems and radon mitigations systems that appear to be similar at first glance are, in fact, substantially different in the way the systems are designed, installed, commissioned, and documented.

For these reasons, **Vaprōtect** recommends retaining an engineering and construction company with the experience and established protocols to ensure effective vapor intrusion mitigation programs.

***Vaprōtect**, a service of O'Brien & Gere, provides vapor intrusion (VI) evaluation and mitigation resources to address the migration of soil vapors into buildings. **Vaprōtect** develops regulatory strategies, conducts screening assessments, air sampling, pathway modeling and risk evaluations, supports community relations programs and installs our patent-pending VI mitigation systems. With over 40 years of experience in industrial waste remediation, nearly 1,000 VI mitigation system installations, and experience with the largest VI projects in the country, **Vaprōtect** is the industry leader in providing comprehensive, 360° VI resources.*

For more information about O'Brien & Gere and our **Vaprōtect** service, please contact Mark Distler at (315) 437-6100 (x2536) or visit **www.obg.com**

	"TYPICAL" RADON SYSTEM	VAPOR INTRUSION SYSTEM
Design Approach	Developed from guidance documents	Developed from diagnostic testing
Performance Criteria	None	Minimum differential pressure under entire slab
System Components	One suction point per 1,500 sf	As many suction points required for the specfic structure
	One fan	As many fans required to achieve performance criteria
	One fan type	Various fan types required to achieve performance criteria
Area of Depressurization	Unknown; no testing performed	Under entire slab; verified through testing
Treatment of Slab	Typically none	Sealing of cracks, sumps, drains
Treament of Walls	Typically none	Sealing of cracks, utility penetrations, hollow blocks, layed up stone
Treatment of Inaccessible Crawlspaces	None	Ventilated (with and without supplemental heating)
Treatment of Dirt Floors	Often none	New slab or membrane installation
Treatment of Backdraft	None	Testing for backdraft before and after installation
Commissioning	None	Inspection of installation to meet protocol requirements
		Verification of performance criteria
		Testing of sealed envelope
Documentation	None	Structure survey (>100 data points)
		Design and As-Built drawings of structure and system
		Photographs of before and after conditions
		Identification of hazardous materials (asbestos, mold)
		Commissioning data
		Performance testing results
		Quality control validation of all documents
Operation & Maintenance	Repairs as necessary	Routine inspections
		Repairs as necessary
		Verification of performance criteria