BUILDING MITIGATION INTO NEW CONSTRUCTION

It is generally easier to build mitigation into new buildings. For starters, investigation, mitigation, and remediation do not disturb any building occupants because there is no building. Furthermore, even before mitigation is planned, there are two major options for reducing risk:

First, it's usually easier to remediate the source on vacant land than to work around existing buildings and subsurface infrastructure. Removal or treatment of contamination is the most permanent way to reduce the potential for vapor intrusion. Contaminated soil can be scraped. In some cases contaminated water can be removed through excavation and dewatering, as well, though there is always a chance of recontamination from outside the excavation. Alternatively, substrates for *in situ* chemical oxidation or bioremediation can be more easily injected to reach soil and groundwater contamination.

At this school site in the Bronx, New York, builders excavated and dewatered the most contaminated area and built mitigation systems into the new buildings.

Second, building footprints can be moved away from the most contaminated areas. For example, at large residential developments the actual living spaces can be placed on the cleanest portions of the properties, while parking or open space can be situated over the subsurface hotspots.

Depressurization systems can more easily be installed before the building's foundation is in place. In existing buildings perforated pipe is usually inserted vertically through the slab or floor. This requires identification of hidden utilities, drilling, and other potentially disruptive activities. In new construction horizontal perforated pipes can be laid. Normally, they are then covered with **vapor membranes**.

Rubber or plastic vapor membranes can prevent vapors from intruding, but they may be damaged during installation, perforated during building modification or maintenance, or fail due to earth movement and age. Thus most agencies consider membranes helpful, but not reliable in the long run as stand-alone mitigation. Similarly, cracks, holes, gaps (at the edges of barriers where they should attached to foundations), and other openings through which vapors might enter the building should be sealed with impermeable, but flexible material.

It is common practice to place a high permeability gravel bed beneath the slab to allow the free movement of vapor. In larger installations, such as commercial buildings, it's possible to install plastic separators resembling footstools—such as Cupolex®—before the concrete slab is poured. The free space beneath the concrete facilitates depressurization and the venting of vapors.

Where the need for active depressurization is uncertain, passive venting systems can be installed instead. If vapor intrusion is detected after construction, fans can be attached later. EPA notes, however: "Passive systems are generally less predictable and less efficient at preventing vapor intrusion than active systems and, therefore, typically warrant more intensive monitoring, all else being equal."

Heating, ventilation, and air conditioning (HVAC) systems can also be designed with the vapor intrusion potential in mind. EPA's *Technical Guide* states:

> [HVAC systems] are normally selected based only on economics, aesthetics, preference, and custom. A system design that avoids creating under-pressurization inside the structure and maintains over-pressurization inside the structure may be effective in mitigating vapor intrusion.

However, there have been situations in which HVAC systems appeared to be working, for climate-control purposes, but were not preventing vapor-intrusion. If HVAC systems are the primary form of mitigation, there need to be clear rules for running the system (maintaining ventilation) even when heating and cooling are not needed, as well as monitoring systems to ensure that the HVAC is protective against vapor intrusion.

Finally, podium construction can be used, with a low occupancy area such as a parking garage, on the bottom floor. This space should be well ventilated to prevent the accumulation of both intruding vapors and auto exhaust.

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