The Hazards of Heavier than Air Vapors

A 55-year-old Kansas homeowner just wanted to relight the pilot light of his propane water heater on August 6, 2009. Unfortunately, the propane tank was leaking heavier-than-air propane gas into the water heater's enclosure, and instead of lighting the pilot, he blew his house off its foundation and suffered burns over more than 50 percent of his body. He died of his injuries a few days later.

Heavier-than-air vapors can pose serious hazards at home or in the workplace because, unlike lighter-than-air gases (a category that includes the "lifting gases" like helium, hydrogen, ammonia, and hot air), heavier-than-air vapors don't readily dissipate into the atmosphere. If they find an area where the air is still, these vapors will simply aggregate at the bottom of an enclosure or along the floor of a room. Vapors that are flammable could form a flammable or explosive mixture, just waiting for a spark. Even if they are not flammable, the vapors can pose a hazard to personnel in an enclosed space—they could displace enough oxygen to create a toxicity or asphyxiation hazard. How can you identify and control heavier-than-air vapors in your workplace?

How Heavy is Air?

The weight of a vapor is called its "vapor density." Dry air is defined as having a vapor density of one; typically, air contains a lot of water vapor, giving it a vapor density closer to 1.2 under most real-world conditions.

Gases with a vapor density greater than one are defined as heavier than air (although, as noted above, they may not actually be heavier than air in normal atmospheric conditions). You can find a chemical's vapor density in Section 9 of its safety data sheet (SDS), which lists its chemical and physical properties. It can also be found in common chemical reference sources, such as the *Merck Manual* and the *NIOSH Pocket Guide to Chemical Hazards.*

Which Chemicals Could be Dangerous?

Gases and vapors that are heavier than air will flow downhill and gather in pits, against dikes or walls, in swales, and in other low-lying, partially enclosed areas. When they accumulate, they can create hazards. Pay attention to the vapor density of any chemicals in your facility that:

- *Are combustible, flammable, or explosive*. When these chemicals flow into low-lying areas, they can collect in sufficient concentrations to form a combustible, flammable, or explosive mixture. They can also travel along the ground to a source of ignition and "flash back" to where they originated.
- *Are toxic*. Hydrogen sulfide gas, carbon monoxide gas, and other toxic gases can accumulate in an enclosed space from the bottom upward. Air quality testing at the workers' breathing level can miss toxic levels of these gases while they are low to the ground, but if they continue to accumulate, toxic levels could develop in the breathing zone of workers.
- *Are contained in an enclosed space* where employees will be present. Any chemical can be dangerous if it displaces oxygen within a space. Workers planning to enter a space that meets the definition of a permit-required confined space must do so in accordance with ***Confined Space Entry***. However, don't overlook spaces that do not meet the definition of confined spaces but nonetheless might develop a dangerous atmosphere, such as basements and small or poorly ventilated rooms.

Remember: "No task is so important that it be done at the risk of Safety."