Bad Odors Are a Warning Sign of IAQ Troubles

Complaints about odors are among the most common indoor air quality (IAQ) problem, and among the most elusive to resolve. Many times, it takes careful detective work to determine the source(s) of the odors and how to best eliminate them. Odors may blend when mixed, making it difficult to identify individual smells. They also are subjective and episodic. What may be noticeable and objectionable to one person may not be for another, and odors tend to come and go, depending on their sources, building conditions and individual perceptions.

One thing is for sure: Bad odors are a warning sign of an IAQ problem, and indicate the presence of volatile organic compounds (VOCs) or other substances in the air. The concentration of these chemicals may be very low, in the parts per billion (ppb) level or even parts per trillion (ppt), which makes them very difficult to detect. Even at these very low levels, some VOCs can cause eye, nose and throat irritation; cough; headache; general flu-like symptoms; and skin irritation. Some types of mold also emit VOCs, known as microbial VOCs (or MVOCs), which are responsible for the characteristic musty, earthy odors associated with mold. Children who are sensitive to MVOCs may experience eye, nose and throat irritation. See Table 1 for the top 10 common odors, what VOCs may be associated with these odors and their sources.

Table 1. Common Odors and Related Sources

Odor	Related VOC(s)	Source(s)
Bleach, pungent, the smells associated with thunderstorms	Ozone	Room air cleaners, printers, photocopiers
Musty, rotten, foul	Sulfur compounds	Some imported drywall from China
Dead fish, putrid	Amines	Decaying materials, wet insulation, vinyl, foams
Pungent, musty, sweet, pine, citrus	Acetone, ammonia, alcohols, pinene, limonene	Cleaning products and processes
Sharp, pungent, waxy	Formaldehyde, nonanal	Furniture, paints
Putrid, sour	Butanoic acid, valeric acid	Roofing, fireproofing, woods
Sweet, play dough	Hexanols, heptanols	Flooring levelers, plastics
New carpet	4-phenylcyclohexene	Styrene Butadine Rubber (SBR) flooring
Musty, moldy	Microbial VOCs, alcohols, ketones	Active indoor mold growth
Rubber, petroleum	Naphthalene, xylenes	Adhesives, recycled rubber

Solving an odor problem requires specialized sampling and analysis techniques. AQS offers specialized VOC testing and data review for odor identification. The full odor panel features gas chromatography / mass spectrometry to discern individual VOCs in parts per billion and trillion levels. Findings are then cross-referenced with Air Quality Sciences extensive odor database of sensory perceptions and specific chemical thresholds. This level of detail gives building investigators the information they need to track the VOCs back to their sources. Product manufacturers also can have their products tested in environmental chambers, and the emissions scanned for odorants.

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A good illustration of the use of specialized testing in detecting an odor source relates to sulfur emitting from imported Chinese drywall. Although the investigations are on-going, specialized product testing yielded important clues determining that the drywall was the foul odor's source. Air Quality Sciences developed a special environmental chamber protocol for evaluating odor perceptions and chemical emissions from drywall and other porous materials such as ceiling tile. This method allows the product to produce emissions similar to the way it would emit in a home, which yields a more accurate assessment of what the product is doing in residential environments and what the chemical exposure might be for home occupants.

The results demonstrated the presence of "musty, foul or rotten" odors, as perceived by human odor panels. In addition, the products emitted certain organic and inorganic sulfur emissions, as measured by mass spectrometry. The results of these studies also showed that elevated heat and humidity exacerbate the release of sulfur compounds. In general, emission levels increased tenfold with elevated temperature from 75 degrees F to 100 degrees F. In addition, there were approximately 400 other VOCs identified as emitting from the products, all at low levels. Table 2 (at the end of the tech brief) lists sulfur compounds found to be emitting from various suspect drywall.

Very often, odor complaints do not garnish national attention, but they can be no less daunting to the building owners and facility managers. Unresolved odor problems can result in costly litigation and lower building occupancy and employee productivity.

Visit us at www.aqs.com to learn more about how odor analysis and environmental chamber testing can help you, or call us at (770) 933-0638 to order a VOC/odor analysis or to speak with Product Evaluations about testing products for VOC emissions. Also visit the AQS Aerias IAQ Resource Center (www.aerias.org) to learn more about VOCs and other indoor contaminants. For a listing of products that are certified to emit low levels of VOCs, visit the GREENGUARD Environmental Institute at www.greenguard.org.

Table 2. Sulfur Compounds Emitted from Suspect Drywall

1,2-Dithiane	Benzo[b]thiophene, 2-ethyl-7-methyl-	Ethyl n-butyl disulphide
1-Butanethiol	Benzo[b]thiophene, 2-propyl-	Ethyl n-propyl disulfide
1-Butanethiol, 3-methyl-	Benzo[b]thiophene, 7-ethyl-2-propyl-	Isopropyl isobutyl disulfide
1-Hexanethiol	Butyric acid, thio-, S-hexyl ester	Methyl ethyl disulphide
1-Pentanethiol	Cyclopentanethiol	Methyl isopropyl disulphide
1-Propene, 1-(methylthio)-, (Z)-	Dibenzothiophene	Methyl sec-butyl disulphide
2-Butanethiol	Diethyl disulfide	Propane, 1-[(1-methylethyl)thio]
2-Butanethiol, 2-methyl-	Diethyl sulfone	Sulfur dioxide
2-Hexanethiol	Disulfide, 1-methylethyl isopentyl*	Tetrahydro-1,3-oxazine-2-thione*
2-Methyl-3-(methylthio)-1-propene	Disulfide, bis(1-methylethyl)	Thiirane, methyl- (Propylene sulfide)
2-Pentanethiol	Disulfide, bis(1-methylpropyl)	Thiirane, 2,3-dimethyl-, trans-
2-Propanethiol	Disulfide, bis(2-sulfhydrylethyl)-	Thiophene, 2,4-dimethyl-
3,4-Dimethylthiophene	Disulfide, dimethyl	Thiophene, 2,3-dimethyl-
3-Methyl-3-hydroxybutane-1-thiol	Disulfide, dipropyl*	Thiophene, 2,5-dimethyl
3-Pentanethiol	Disulfide, ethyl 1-methylethyl*	Thiophene, 3,4-diethyl-
Benzenethiol	Disulfide, ethyl hexyl	Thiophene, 3-(1,1-dimethylethyl)-
Benzo[b]thiophene, 2,3-diethyl-	Disulfide, methyl propyl	Trisulfide, dipropyl
Benzo[b]thiophene, 2,7-diethyl-	Disulfide, pentyl propyl	Hydrogen sulfide
Benzo[b]thiophene, 2-ethyl-5-methyl-	Disulfide, propyl isopentyl	Carbonyl sulfide

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