

# Evaluating Smoke Odor Damage

In this second installment of a three-part series of guidelines on the investigation of fire and smoke damage claims, the authors examine the sometimes perplexing subject of smoke odors.

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Consider the following scenario: *An electrical fire on the fifth floor of an office building disrupted operations for the aerospace tenant. The building's insurer negotiated an after-hours repair schedule with a preferred vendor. The work progressed smoothly and staff moved back as planned. Unfortunately all was not well: the receptionist complained of a smoke odor in the elevator lobby and the adjoining hallway. Several employees confirmed the odor and extended the area to include two lavatories.*

*The adjuster ordered the contractor to correct the problem, but three weeks' effort left the complaints unresolved. The issue grew more pressing when a staff member complained of breathing difficulty, possibly from an odor treatment applied over the weekend. The tenant mentioned relocation to another floor. Oddly, neither the contractor nor the insurance adjuster could detect the odor.*

Students of odor psychology will recognize an example of conflicting odor perceptions. The scenario may also resonate with seasoned adjusters and restorers because smoke odor claims after fire repair are not unusual. But let's assume that these odors and the stakeholders remained intractable and the case has moved to litigation. Predictable questions would be raised, such as:

“Is the odor real or imaginary?”

“If only a few people can detect it, does the odor constitute a loss?”

“How can the odor's existence be validated?”

“What would be the amount of the loss?”

“Who should pay it?”

The prospect of litigation will likely sharpen counsels' interest in *the basis of odor, human response to odors, toxicity of odors, and the relation of odor to damage*, followed by an immediate search for experts who might support their position.

The purpose of this paper is to provide information on smoke odors as they relate to property losses. In this effort the authors will combine published odor research with their direct experience in smoke odor investigations. It is hoped that the discussion will add clarity to property claims involving smoke odors.

## What is an odor?

The sensation of odor is a triggered by the impingement of airborne molecules on receptors in the nasal cavity, as processed in the mind of the receiver. The experience of odor (olfaction) is psychological, since interpretation of an odor involves memory and emotion. Response to an odor seems to occur at the moment it is detected. While abundant information is available on how humans process odors, no rationale has been able to predict an individual's sensitivity or response.

As a result, there exist no objective standards for evaluating an odor's effect.

## What is smoke odor?

Combustion usually produces smoke, an airborne mixture of solid particles, liquids, aerosols and gases, some of which solidify and deposit. Many of these combustion products emit volatile particles fine enough to trigger a human odor response. Variations in combustion temperature and fuel generate an array of substances with different scents and intensities. Even though there exists no single smoke odor, a general "burnt" component is almost always recognizable. Char and combustion particles may continue to emit odors long after they deposit.

- **Subjectivity:** Essentially, the experience of an odor is what a person makes of it. Odors are not inherently pleasing or obnoxious. No device can accurately predict what a person senses or how they will respond to an odor. Cumulative reports by test subjects may generate average response curves, but those arrays do not claim to mirror the response of a specific individual.
- **Gender:** Controlled tests seem to establish that females are generally more perceptive of odors than males. That does not mean that every woman's nose is more acute than any man's, but it may explain some differences of opinion.
- **Fatigue:** Odor receptors are numbed by continued exposure to a scent. The term of exposure before olfactory fatigue sets in has been estimated to be about one minute. This may explain why a smoke odor sometimes seems to disappear, or to arise when a person first enters a particular area.
- **Conditioning:** While human odor sensitivity appears to be inborn, the ability to identify and distinguish between scents can be learned. Perfumers and wine tasters demonstrate this acquired ability. Similarly, damage restorers can often distinguish residues of smoldering fires or of

wood or electrical fires by their characteristic odors. Individuals predisposed to finding smoke odors sometimes affix the smoke odor label to other odors that happen to be present.

- **Emotion:** Direct neural connections between odor receptors and the brain's limbic system (described as the seat of emotional response) may explain the strong emotion that sometimes accompanies perception of an odor. It has also been found that an odor related to personal trauma may reawaken the earlier pain or anxiety. This may explain the strong aversion to smoke odor in some individuals who have experienced a disastrous fire.
- **Suggestion:** Odor experiences are vulnerable to suggestion. Controlled experiments have demonstrated that odor responses can be induced where in fact no odor is present. Circumstances may produce an inherent bias. For example, the authors have never encountered a case where smoke odor undetectable to an insured was found to be objectionable by an adjuster or contractor. The importance of context is demonstrated when an individual who finds smoke odor repugnant is undisturbed or even attracted to the aroma of a fire-grilled steak.
- **Toxicity:** An aversion to smoke odor may arise from the notion that the odor itself is toxic. In reality, the mechanism of odor perception is independent of other physical effects. The toxicity of smoke has been exhaustively explored and does not correlate with odor. In fact, the most hazardous component of smoke, carbon monoxide (CO), is odorless. Conversely, as obnoxious as the odor of skunk is for many people, its physical effects are benign. In a fire the smell of smoke may be critically important in alerting residents to danger, but the toxicity of smoke does not reside in its odor.

- **Environment:** Environmental factors may amplify or diminish the intensity of odors, as warm, humid conditions tend to increase odor intensity and cold, dry air to reduce it. This may reflect the effect of moisture on neural receptors as well as the tendency of heat to energize volatile residues. Smoke odors may accumulate within an enclosed space, such as an attic, and escape with changes in temperature (pressure). Elevators may act as pumps and spread odors to other floors. Such intermittent incursions of odor may be difficult to trace.
- **Allergic reactions:** Allergic reactions occur when a person's immune system reacts to normally harmless substances in the environment. Higher concentrations of an allergen usually induce more acute symptoms. Even though a particular type of smoke may have an easily identified odor, the odor itself is not an allergen. This is the same distinction noted with toxicity. While the distinction may seem academic, it has real consequences: individuals are not allergic to odors, but to substances that may accompany them. Perception of a smoke odor does not necessarily indicate the presence of an allergen.

## What is Damage?

Damage to property can be defined as an alteration in appearance, utility, life-expectancy or value. Different measurements may be applied, but the degree of damage is often a matter of judgment. For example, establishing a fair market value requires comparative sales data, but determining what properties are comparable lies within the appraiser's judgment. Depreciated value projects a property's hypothetical life expectancy had the damage not occurred; this again is a personal judgment, and may involve other factors than age. For musical instruments, artworks or structural impairments, an expert's assessment of damage may be essential. When damage is partial, the degree of loss is also a judgment call, perhaps informed by expert opinion, perhaps by the con-

viction of the owner. A property's loss from damage is ultimately an opinion expressed in monetary terms.

### Insurance damage

In property insurance policies *damage* is treated as one component of a loss. Different forms of damage characterize various perils. Mold is a potential effect of water damage. Fire can blacken, char, burn, warp, bubble, fade or consume property beyond the point of reasonable repair. Smoke odor is another effect of fire.

### Odor damage

An inappropriate odor may render a property less desirable to its owner and to others. The condition represents a loss in utility. Even if the odor is caused by circumstances not otherwise thought to be damaging, an inappropriate scent can have a detrimental effect on how the property is perceived. For example, a garment in which the owner detects an unexpected scent will probably not be worn, even if the scent is pleasant. The same loss of utility might occur to a home or office suite. Great efforts have been expended in ridding a property of the scent of a prior occupancy (such as a hair salon).

One might expect the effect of an odor to be proportional to its intensity. This is not always the case: a faint odor sometimes triggers a disproportionate response. As we have observed, smoke odor that accompanies fire damage may carry an emotional impact. There is often an apprehension that persisting smoke odor could indicate other deficiencies.

The degree to which a smoke odor might diminish the value of real property is not easily established. Disclosure rules and liability concerns usually require that potential buyers be informed of a significant damage event. A realtor may refuse to list a fire-damaged property even if it has been fully repaired. Others might propose a reduction in price. The price reduction may exceed the actual cost of repair because of the added psychological

effect (stigma) of fire damage. A perceivable smoke odor would reinforce a lower valuation.

If a fire loss is valued at the cost of repairing the damage, the amount of a smoke odor loss would be the cost of eliminating the offending odor, provided it is less than the cost of replacement. A variable element would be the opinion of the insured as to whether the odor has been truly eliminated. As suggested earlier, the opinions of outside experts are open to challenge, and confirming testimony can almost always be obtained by a claimant, given the influence of suggestion, sympathy and other inducements.

Field experience suggests that the failure to recognize potential odor sites and to properly perform basic restoration procedures are principle causes of post-repair smoke odors in buildings.

### Causes of Persisting Smoke Odors

The source of persistent smoke odor is the presence of combustion products that continue to emit volatile material. An obvious preventive would be to expose and remove all char and combustion particles before covering or enclosing them. Unfortunately, the problem is not always simple.

The solubility and pungency of fire residues vary with the temperature of combustion, the nature of the fuel and the term of exposure. Some combustion particles chemically bond to surfaces, precluding full removal. Particles from smoldering fires tend to be viscous and penetrating, so customary cleaning procedures may not be adequate. Extreme remedies such as pressure washing or grit blasting may be necessary. Removal of undamaged building elements such as air ducts or plumbing fixtures may be

required in order to expose inaccessible surfaces for treatment.

### Who is Responsible for Persisting Smoke Odors?

In the immediate aftermath of a fire, demolition and cleaning constitute the first steps towards recovery. Based on the nature of the fire and the building layout, a seasoned specifier may anticipate potential odor sites and call them out, sometimes performing an aggressive search for fire residues. Experience has demonstrated that the most aggressive treatments are relatively inexpensive if performed at the outset of repairs. To this end, quality control during the early

stages of restoration is paramount in preventing smoke odor problems later.

Field experience suggests that the failure to recognize potential odor sites and to properly perform basic restoration procedures are principle causes of post-repair smoke odors in buildings. If the specifications are adequate, responsibility may lie with personnel charged with performing and approving the work.

### Resolving Persisting Smoke Odor Claims

When a smoke odor is pungent enough to be recognized by casual observation, the remedy is to find the source and remove it. This may be problematic after repairs have been completed. Unlike the search for moisture, devices for locating hidden odors do not exist. As a result, exposing odor sites often involves a disruptive trial-and-error process. Persistent smoke odor sites usually display

accumulations of absorbed or settled combustion residues. Knowledge of building design and smoke behavior can narrow the search, as will the review of repair specifications and post-damage photographs.

Various commercial products and devices are claimed to deodorize combustion residues with masking scents, odor “neutralizers”, sealers, or chemical agents such as ozone or hydroxyl ions. These procedures may be effective in some situations. Unfortunately, their results are often temporary and they may contribute odors or other unwelcome side effects. None can effectively treat unexposed odor sites. It has been the authors’ experience that only procedures which physically remove the odor sources can reliably eliminate smoke odors.

When a reported smoke odor is too faint to be independently verified, evidence-based remedies are futile. Does the odor objectively exist? If a specific area or repeated appearance is cited, logical analysis may provide an explanation. If logic offers no answers, evaluation of the complaint might include the individual’s attitude or the exist-

tence of unstated motives. For example, imminent relocation or sale of the property has driven smoke odor complaints. Such considerations become relevant when objective evidence of odor damage is not present.

Whether search-and-removal or replacement is more feasible often hinges on larger issues of time and cost. In commercial situations, relocation to unaffected surroundings may be necessary to avoid disrupting business. Collateral issues such as seasonal pressures or revenue loss may determine the feasibility of various repair options.

### Conclusion

The experience of odor is inherently subjective. However, the subjective nature of smoke odors should not be a reason for abandoning rational analysis. Where the odor is clearly apparent, attention can be directed to finding and removing the source(s). Odors too faint for independent confirmation require a different approach. In both situations, familiarity with the mechanisms of odor perception can inform the response to smoke odor claims, and may simplify their resolution. 🌐

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