Technology Watch

Using Air Filtration Devices

By David Oakes, CR, CMH

Any process or product used on a restoration project must be justified by a legitimate need. That need can be to protect the health and safety of the owner or occupants, to lower liability exposure for both the contractor and insurance company, or to reduce the total cost of the loss. With this in mind, let's explore the use of air filtration devices (AFD) on restoration projects.

Due to the nature of a fire or water damage event, elevated levels of airborne particles can be expected. These particles and bio-aerosols have the potential for causing health-related problems, as well as increasing the cost of returning the structure to pre-loss conditions.

AFDs in a Fire Loss

In fire damage, the products of incomplete combustion (PIC) make up, in large part, the airborne contaminates. Polynuclear aromatic hydrocarbons (PAH), carbon monoxide (CO), aldehydes and volatile organic compounds (VOC) comprise most of these PICs. The chemical composition and size of these PICs will depend on several factors including: the materials burned, the temperature at which the material burned and the oxygen available. Other factors affecting the chemical composition will be the fire control and extinguishing methods used.

VOCs and particles continue to be problematic until physically removed or permanently sealed in. The smaller the particle, the longer they remain suspended in the air. Most of the larger particles, those over 5 microns (µm) in size, settle out of air within the first 30 minutes.

Particles smaller than 10µm (microns) are able to penetrate the upper regions of the body's respiratory system, bypassing the body's natural defense mechanisms.[1] Particles in the 2.5 to 10µm are classified as particle matter (PM) by the EPA. Particles under 2.5 µm are considered fine particles (PM2.5, particle matter < = 2.5µm). To get an idea of the size of these particles we can reference a human hair which is between 70 µm and 100 µm in diameter (1 micron or micrometer – µm – is 1 millionth of a meter or ~1/25,000 of an inch). Cigarette smoke particles range in size from .01 to 1µm.

The restoration process, whether or not it involves reconstruction and repair, will disturb these PICs. Even the simple act of walking through a building will disturb settled particles leading to potential heath risks and additional cleaning costs.

In addition to the personal respiratory protection worn by the technicians, the use of air filtration devices (AFDs) on fire restoration projects adds a higher level of protection for the health and safety to both the building occupants and restoration workers. In addition, the use of AFDs simplifies the cleaning and restoration process and will ultimately lower total overall costs by reduced re-cleaning. Using AFDs on fire restoration projects also reduces the need for 'chemical' odor control by removing airborne odor laden contaminates, although AFDs should not be considered as the only odor control method.

AFDs in a Water Loss

It is becoming apparent that repair of a water damage intrusion poses a unique need for AFDs. Consider a Category 1 water damage — water from a clean source, that invades relatively clean surfaces and is discovered within 48 to 72 hours. Simple as this drying and restoration project may seem, there are inherent (or un-measured) risks. After extracting the water from the affected surfaces we start the drying process using airflow. As surfaces dry (both carpet & hard surfaces) particles become airborne. If the carpet is floated during the drying process, which is becoming less popular due to contamination and delamination issues, even more particles are dispersed into the air. Just consider the dry soil you see when a carpet is lifted or removed when there has been no water damage. As these particles dry, the air movement from floating the carpet makes them airborne. Consider the effects of turning on a high velocity air mover in a clean, undamaged home. This air movement will disturb the normally settled household dust, cotton lint, human skin cells and animal dander. The water damage only adds to the potential risks by adding the necessary moisture for biological activity.

---

[1] Understanding Particle Size, U.S. EPA

The risks associated with Category 2 or 3 water damage increase greatly due to potential contamination from pathogenic components likely found in these losses.

The IICRC S500 Standard for Water Damage Restoration in the Reference Guide Section states: "**Air Filtration Devices:** A portable air moving device equipped with HEPA or carbon filtration. It can be used to filter air while creating negative pressure in contaminated areas, or as an 'air scrubber,' removing airborne contaminants without changing air pressure" (*IICRC S500 Water Damage Restoration Standard and Reference Guide, 2nd Edition*, page 23).

Although there are no specific requirements for the use of AFDs during water damage restoration, their use is prudent in any situation where there are health or liability issues. Such situations may include any water damage loss in a health care facility, day care, school, office building or where the building occupants have respiratory problems, asthma or compromised immune systems (including occupants are under 2 or over 60 years of age).

AFDs and negative air machines efficiencies are measured by particle size filtration and CFM. HEPA (High Efficiency Particle Air) filters are rated to remove 99.97 percent of particles .3 µm in size or larger. At the HEPA rating, these filters will remove dust, pollens, mold spores and bacteria. They will not filter out viruses, which are much smaller than .3 µm. However, viruses are most often spread on water droplets or grouped together, increasing the HEPA filter's ability to capture them.

HEPA and CADR

Ironically, many of the HEPA rated machines & filters are not truly HEPA at their rated CFM. In many cases, using the CADR (Clean Air Delivery Rate) can give a much more realistic image of actual unit performance. CADR is an Association of Home Appliance Manufacture (AHAM)-defined rating that evaluates not only the filters efficiency rate, but also the working airflow (CFM). The filtration effectiveness is multiplied by the airflow, resulting in the actual "clean" air produced by the machine.

For example, if an air scrubber were capable of moving 1,000 CFM, the AHAM "CADR" test protocol would require testing the filtration efficiency at 1,000 CFM. If the filter were able to remove 90 percent of particulate, than the CADR would be 900 (or, 90 percent of the 1,000 CFM).

CADR becomes particularly valuable when using AFDs as air scrubbers. When calculating the number of air changes per hour needed to control dust and particulate, it is the "clean" air that matters. When using AFDs as negative air machines, however, it is true HEPA performance that remains most critical.

The cost savings alone justify the expense of using AFDs in fire and water losses when you consider the amount of labor that can be saved by reducing deposited dusts and soils. Additionally, AFDs provided a significant improvement in indoor air quality during the drying process. They can therefore reduce liability when working in higher risk environments. For these reasons, AFDs have a place on many restoration projects.

David Oakes, CR, CMH, has worked in the field of cleaning and restoration since 1973. He currently owns and operates a full service cleaning and restoration firm, which provides fire and water damage restoration.

David has worked on large and complex commercial and residential restorative drying jobs in all capacities. He also does consulting and has worked as an expert witness for both the insurance industry and property owners. David is an IICRC Certified Senior Carpet Inspector and Master Cleaning Technician and holds an Air System Cleaning Specialist certification from NADCA. He teaches the Dri-Eaz three-day water damage restoration course, advanced building drying course, photo inventory and the introduction to the S520 mold seminar.