Project ID: No. 10013

Air Filtration and Airflow

Report and Conclusions

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Air Filtration Devices and Airflow

Project No. 10013

Restoration Sciences Academy
Start Date: June 14th, 2010
End Date: June 17th, 2010

RSA Restoration Sciences ACADEMY

RSA MOLD RSA WATER RSA FIRE Test Labs

Project Report

Purpose:
Determine the influence of air filtration devices (a.k.a. HEPA filters, air scrubbers) on Water Damage Restoration projects where air movers have been deployed.

Hypothesis:
Utilizing air movers in a structure will impact the indoor air quality both during and after the drying process. Turbulent air will disturb particluate and spread them throughout the structure. Particlarly when restoration procedures are invasive (e.g., floating carpet, using inter air drying, demolishing structural assemblies), both the particle volume and type will be significantly altered in the air space during the use of air movers. This presents a risk to both workers and occupants.

Using air filtration devices during the restoration process will significantly reduce the particle load during and after restoration, thereby mitigating this risk.

Testing Procedure:
Monitor particle loads at several locations throughout a space where airmovers are being used in a fashion normal or typical of a restoration project. Compare identical spaces both with and without the use of air filtration devices. Utilize the deviation between multiple examples to understand the influence of air filtration during the drying process.

Variables
The following variables may influence the outcome of the test, and are controlled:

* Particle Size:	Monitoring set to >/= .3um, per cubic foot
* Air velocity:	Monitoring points include air velocity measurement and directional indicators
* Elevation:	Fixed elevation, at three heights: - 1' above floor - 1' below ceiling - center of floor and ceiling
* Variety:	Varied locations from wall surface to center of room
* Duration:	Fixed monitoring intervals to 15 mintues between samples for all testing
* In/exfiltration:	Isolated and powered down all equipment that could pressurize the sample area
* Equipment Placement:	Held consistent for all rounds in same room
* Obstacles	All built in and temporary fixtures left in same location for rounds in same room
* Air filtration rate:	Rounds 1 & 2 = 6.8 ACH (8,800cuf, 1,000 CFM) Rounds 3, 4 & 5 = 3.6 ACH (8,424cuf, 500 CFM)

Redundancy
Completed multiple rounds of testing to validate data and rule out variables:

Round 1:	Airflow only (test 1); Airflow and air filtration (test 2)
Round 2:	Airflow and air filtration, repeated
Round 3:	Airflow only - No carpet
Round 4:	Airflow and air filtration - No carpet
Round 5:	Air filtration *then* Airflow

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Observations: Overall Particle Count Change

1. Particulate Counts Decrease with airflow

It is apparent that the net particulate count in the air is reduced as air is moved throughout the space. The particulate count decreased more rapidly in the carpeted space (*Rounds 1 and 2*, at right) than it did in a space with no carpet (see *Round 3* and *Round 4*, lower right).

This seems to support the theory that surfaces do act as a filter in the presence of moving air. When more porous materials are present, such as carpet, the rate of particulate reduction is much greater (see *Round 3*, at right).

When the air movement and air filtration are removed from the space, the particulate count is elevated more rapidly in spaces with carpet than in spaces without (see *Observations: Shutdown Particle Rise*, next page).

To fully understand this topic, additional testing is needed beyond air sampling. Surface sampling would be required to verify that particulate is indeed loading on the materials.

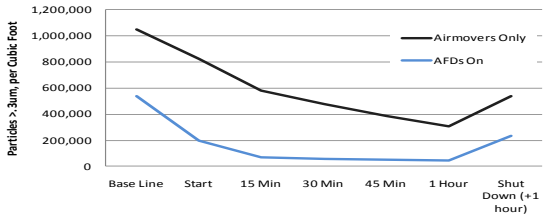
2. Air Filtration Improves Reduction

When air filtration was added, particulate reduction was significantly accelerated (see *Round 1, Round 2*, at right). As a net result of the use of air filtration, overall particulate counts were reduced by 96% (compared to 71%) in a carpeted space. When the same analysis was made in a space with no carpet, the benefit of air filtration was more significant; particuate was reduced by 86% (compared to 37% with no air filtration).

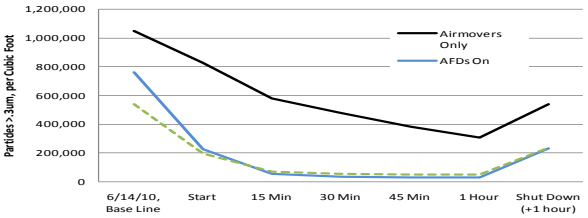
3. Air Movement also *Aerosolizes* Particulate

When particulate counts were lowered in a space by air filtration, the *addition* of air flow elevated particulate counts (see *Round 5*, at right). This indicates that airflow both *deposits* and *aerosolizes* particulate, removing particles from one location and transporting them to another. The *rate* of aerosolization and deposit each affect the net count present in the air at any given time.

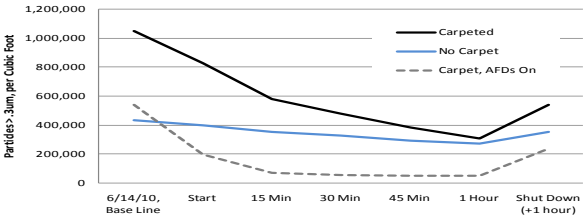
Round 1: Carpet



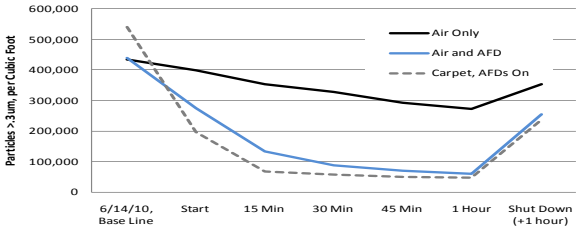
Round 2: Carpet



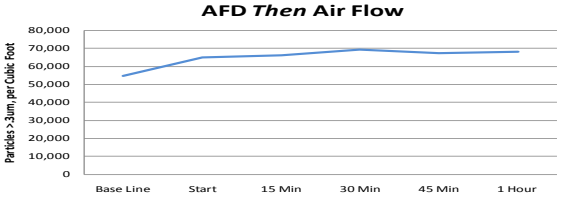
Round 3: Carpet vs. Non



Round 4: No Carpet



Round 5: AFD First



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Restoration Sciences Academy — Test Labs

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Observations: Shutdown Particle Rise

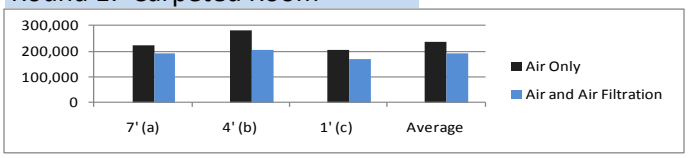
4. Air Filtration Reduces Particulate *After* Air Flow

After turning all equipment off, particulate counts were observed for one hour. At the end of that hour, particulate counts rose faster and to higher numbers *when air filtration was not employed* (see *Rounds 1-2,* at right).

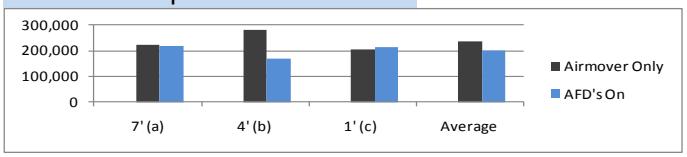
The only exception to this was in the room with no carpet. Here, the particulate rose much faster *after using air filtration devices* (see *Round 4,* at right). One significant factor in the particulate rise difference with no carpet is that the overall difference between the particle load with and without air filtration was much more dramatic (see *Round 4,* bottom of previous page) than on any other test.

This observation seems to indicate that the carpet, although it may act as a filter in the presence of air movement, releases much of the particulate once steady, consistent air movement is no longer present. Especially after several days of loading, this could present a high risk for negatively impacting indoor air

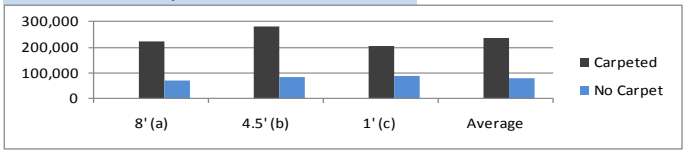
Round 1: Carpeted Room



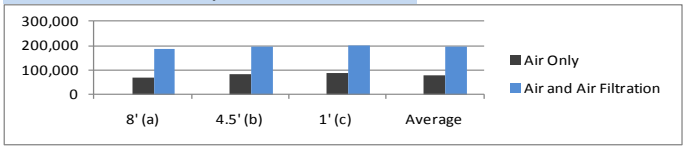
Round 2: Carpeted Room



Round 3: Carpeted vs. Non



Round 4: No Carpet



Conclusion: Air Filtration is Beneficial

This study confirms that the presence of air filtration devices during the process of drying is indeed beneficial. During a drying event, undesirable particulate loads in the environment are at a significant risk of being elevated. Particulate present in the indoor environment is likely to come from spaces that are not normal in the breathable atmosphere within the structure, as air is moved over affected structural materials, beneath flooring, in wall cavities, and across other damaged materials.

As these foreign particles are released into the air, this study indicates that those particles are (1) distributed throughout the space and (2) deposited on surfaces. Particulate loads in both the air and on surfaces, especially when considering the potential sources, create a concern for both occupant and worker health. The use of air filtration devices will eliminate the majority of this problem, as much as 85% in just one hour of operation.

Further, after drying (air movement) is complete, much of the particulate deposited onto surface are likely to be reintroduced to the air (see *Observations: Shutdown Particle Rise,* above), making them an even more significant risk to worker and occupant health.

As indoor air quality becomes a key focus in the restoration industry, use of technologies known to positively impact the health of the indoor environment both during and after restoration is a must. Air filtration devices conclusively improve indoor air quality during and after drying, and thus should be a standard practice.