



**FREQUENTLY ASKED QUESTIONS (AND ANSWERS)
ABOUT CLEANING TRANSPORT SYSTEMS:
Heating, Ventilation, Air Conditioning Decontamination**

For many years Wonder Makers has been following the research (as well as contributing some important studies) in regards to sensitized individuals. Our interest in and assistance to people who are suffering long-term effects from exposure to water-damaged buildings, mold, bacteria, and chemicals has brought us recognition from many parts of the world. In an effort to support impacted individuals, their families, and the contractors that are necessary to help them correct some problems, Wonder Makers has compiled answers to a number of frequently asked questions related to this specific subset of the restoration industry. This month we offer information about cleaning heating, ventilation, and air conditioning (HVAC) systems. Please contact us if you would like copies of earlier FAQs related to:

- Water-damaged buildings
- Source removal
- Cleaning contents
- Whole structure cleaning

Q 20: We are having remediation conducted at our home. When should the ducts be cleaned?

A 20: Although each situation should be considered individually, generally we recommend that HVAC cleaning be conducted after specific remediation activities are finished. We further recommend that cleaning of mechanical systems take place after whole house cleaning. These recommendations are based on the fact that it is easier to control the potential for cross-contamination during HVAC cleaning than it is in other aspects of restoration work.

This emphasis on minimizing cross-contamination is also why we generally recommend that ductwork be cleaned by a company that utilizes a truck-mount unit. While not an option in every case (e.g., multi-story apartment buildings), truck-mount cleaning units are preferred over portable suction devices. Generally, utilizing a truck-mount suction system creates more negative pressure and airflow in the ductwork, which moves the brushed or whipped contaminants out of the system with greater efficiency. In addition, a truck-mount suction unit attached to HVAC ductwork moves contaminants out of the house, so that if there is any failure in the filters of the suction unit the potential for cross-contamination inside is greatly reduced.

Q 21: I am hyper-sensitive. Is it possible for a duct cleaner to bring contamination into my home?

A 21: Unfortunately, even though the primary goal of the HVAC cleaning company is to reduce contamination, they can inadvertently cause some as well. The most common problem stems from bringing equipment from a previous contaminated job site to your home. This is another reason why we prefer truck-mount suction equipment over portable units for HVAC cleaning whenever possible (see question 20).

Understanding this risk, there are several things that the sensitized individual can do to minimize the possibility of a duct cleaning contractor bringing contamination into their home. Ask the HVAC company key questions like, “Do you use truck-mounted units for cleaning ductwork?” and, “Do you follow NADCA guidelines?” Then tell them, “All of your equipment needs to be cleaned before you bring it into my house, and I want to observe the cleaning being conducted.” If they ask what level of cleaning needs to occur, tell them that every piece of equipment brought into the home should be HEPA vacuumed and foam cleaned with an antimicrobial. If portable units will be used in the house, new first and second stage filters should be installed on site. This allows them to check the seal on the HEPA filter after the unit has been brought in from the truck to ensure that there are no gaps or leaks that would allow contaminated air to bypass the suction device.

Q 22: What is NADCA?

A 22: The National Air Duct Cleaners Association is a non-profit association of companies engaged in the cleaning of HVAC systems. Its mission is to promote source removal as the only acceptable method of cleaning and to establish industry standards.

Q 23: I had my ducts cleaned, but am wondering about how well the rest of the mechanical system was cleaned.

A 23: For sensitized individuals, simply cleaning ductwork is not enough. The standard cleaning process needs to be upgraded so that the mechanical components are cleaned, as well. This includes the supply fan (usually located where the return air duct connects to the furnace and air conditioning coils), coils, drip pans, and other associated components. Units that provide both air conditioning and heating generally have two sets of coils, and both need to be cleaned. While it is possible to properly clean those components while they are left in place, doing so usually requires creating a number of access panels in the housing or ductwork. Since most states require such work to be done by licensed

mechanical contractors, oftentimes it is both more efficient and more effective to remove the fans and coils from the housing and move them from the home for thorough cleaning.

Q 24: We have a mixed system. The first floor has ducts with internal insulation that looks like foam board, and there is flex duct in the attic. How should these two kinds of ductwork be cleaned?

A 24: Both internally lined ductwork and flex duct are difficult to clean properly—particularly for sensitized individuals. Indeed, there are many respected HVAC professionals who state that it is “impossible” to properly clean internally insulated ductwork and flex duct. This is especially true if they are to be held to strict clearance criteria at the end of the process rather than just a visual inspection. In such circumstances, it is often necessary for the sensitized individual to have the ductwork removed and replaced rather than cleaned.

Regardless of the type of internal insulation (fiberglass, duct board, foam board, etc.), if such ducts are cleaned rather than replaced, serious consideration should be given to encapsulating (i.e., painting) the inside of the ductwork after cleaning. Proper application of an encapsulating antimicrobial will not only seal in any remaining contamination, but will create a smooth surface on the inside of the ductwork, which minimizes the potential for dust, spores, and condensation to build up later. Only a small number of products have been approved by the U.S. EPA as antimicrobial coatings suitable for ductwork. One product we have found to work well is IAQ 8000 (or IAQ 8500). It is a water-based acrylic sealer, so it off-gasses a very low amount of volatile organic compounds (VOCs). This is critical for sensitized people as many such individuals are cross sensitive to chemicals. Regardless of the products used, sensitized individuals should not be in the building while duct cleaning is being completed, especially if chemical cleaners or sealers are to be used as part of the process.

Q 25: Exactly how should the duct cleaning process work? I don't want anything sprayed in the ducts because I am chemically sensitive.

A 25: Disinfecting after cleaning and/or the use of chemicals does not necessarily have to be part of the HVAC cleaning process. Have the contractor clean the ducts, and if you are concerned about chemical exposure, tell them not to spray anything as part of the process. Whether chemicals are used or not, the contractor will create negative pressure inside the HVAC system and then use rotary whips and brushes to physically clean the inside of the ductwork. As noted previously in question 20, you want to make sure it is a truck-mounted unit that provides the suction for the cleaning process, if at all possible. In that case, the contractor will connect a 12-16” flex duct to the return air vent and then turn on

the unit on the truck, which creates massive suction through the system and sucks air out of the structure. Other important steps to watch for include the contractor's preparatory work, which should include sealing every supply and return vent. During the cleaning process they should open each diffuser, one at a time, and from there insert rotating brushes and whips into the duct. With the pressure pulling debris toward the suction hose attached near the furnace, the workers push the brushes/whips through each vent until they reach the HVAC system.

Q 26: How do I know whether the ducts and mechanical system (fans and coils) were effectively cleaned and decontaminated?

A 26: For sensitized individuals, strict clearance criteria should be utilized following the cleaning. In project plans that we develop for individuals suffering from chronic inflammatory response syndrome (CIRS), the cleaning of HVAC ductwork and mechanical components will be subject to a two-part post-cleaning evaluation process. A detailed visual inspection of the entire HVAC system will be conducted, including every supply air and return air diffuser. Any residual visible colonies that can be wiped off (not deep material staining) or lingering musty/mildew odor indicates that the entire HVAC system requires additional cleaning.

One spore trap air sample will be collected at the supply air diffuser closest to the mechanical components of the HVAC system, with a second spore trap air sample collected at the supply air diffuser farthest from the coils and fan. A third spore trap air sample will be collected from a representative return air diffuser. All samples will be collected following the cassette manufacturer's instructions, while the HVAC system is in operation. For supply air ducts this involves securing a spore trap cassette to the face of the diffuser so that the inlet to the cassette is facing the airstream and the air coming from the ductwork has an unobstructed path to the cassette opening. The HVAC system is then turned on for 10 minutes. If possible, that section of the HVAC ductwork should be tapped lightly while the sample is being collected. No sampling pump or vacuum device is required for supply air samples. Although different spore trap cassettes have different parameters, HVAC systems supplying air at 300 feet per minute (fpm) generally equate to a flow rate of 15 liters per minute (Lpm), with supply air at the diffuser of 400 fpm equivalent to a sample flow rate of 20 Lpm.

Sampling at a return air grille should be conducted using a standard process with a high-volume vacuum pump and plastic tubing or a battery-operated pump. The sampling pump should be calibrated at the beginning and end of each project using an approved method. The pump should be calibrated to a flow rate of between 14.5 and 15.0 Lpm, depending on the specific manufacturer's sampling instructions. Sample run time should be closely

monitored so that air is pulled through the cassette for 10 minutes, or the maximum run time allowed by the manufacturer for the specific flow rate. Generally, samples will have a total of 145 to 150 liters of air drawn through the cassette orifice.

Spore trap samples will be collected using commercially available cassettes specifically designed for the collection of fungal organisms (such as Air-O-Cell cassettes manufactured by Zefon International, Allergenco D cassettes manufactured by Environmental Monitoring Systems, Versa Trap cassettes manufactured by SKC, or others).

Sample analysis will be conducted in accordance with the American Society for Testing and Materials Standard Test Method D 7391-09 (Categorization and Quantification of Airborne Fungal Structures in an Inertial Impaction Sample by Optical Microscopy) with the following additional requirements. For sample preparation, the collection slide will be removed from the cassette and mounted under a cover slip, media side up, with appropriate mounting media. For analysis, a minimum of 27.6% of the sample trace area will be examined by direct microscopic examination at a magnification of 1000x using an appropriate oil immersion lens. Each category of particulate (fungal material, pollen, fibers, and opaques) will be quantified and reported as counts per cubic meter of air (c/m^3). Fungal types will be identified to genus level whenever possible or group level. Following the initial analysis at 1000x magnification, the entire trace area will then be scanned at a magnification of 600x, noting any bioaerosols that were not quantified, as well as any clumps, groups, and/or chains of spores that would significantly increase the count total for a particular category.

Post-Remediation Evaluation Criteria for Mold Contamination

Following analysis of spore trap samples the analytical results will be interpreted using the following five criteria. Both samples collected from the supply ductwork/diffusers must meet each of the criteria for the HVAC system to be deemed acceptable, using the return air sample as a comparison.

1. Total fungal material concentration from the HVAC system is less than 2,000 c/m^3 .
2. The total fungal material concentration from the HVAC system is below the comparison sample from return air diffuser, or is below 800 c/m^3 .
3. The level of each fungal type and hyphae recovered from the HVAC system is less than 100 c/m^3 above the comparison sample levels.
4. *Aspergillus/Penicillium* levels from the HVAC system are equal to or below 200 c/m^3 .
5. No *Stachybotrys*, *Chaetomium*, *Memnoniella*, *Trichoderma*, or *Fusarium* spores are observed during analysis (quantitative analysis or secondary scan).