

## Growing your business through indoor air quality particulate profiling

### Application Note



Jim Johnson, a major appliance specialist and instructor, conducts a particle assessment at an air filter.



Test both return and conditioned ducts for contaminants, indicating leaks or other system malfunctions.

You've probably heard mold referred to as the "new asbestos" for HVAC/R. Concern about mold and its health effects is driving consumers to have their indoor air quality (IAQ) situation assessed and, if necessary, repaired.

If you're the contractor they call, keep in mind that mold isn't the only issue to consider when assessing the IAQ of a commercial building or residence. Many different kinds of particulates in a work or living environment can cause Sick Building Syndrome and aggravate allergy and respiratory conditions.

IAQ has generated so much awareness that you may want to consider offering IAQ assessments and particulate counts to all of your customers, as an extra service—just like when the mechanic charges you for a diagnostic check. If you can present a convincing case, many facilities

managers and homeowners will agree that measuring particulate pollutants such as plant pollen, animal dander, fiberglass, combustion particles or airborne bacteria, is important.

With a particulate counter, you'll also be able to present real data in support of any repair or purchasing recommendations you make. Before and after particulate readings are an especially powerful way to win customers for life and build word of mouth about your service.

Taking the first step is logical: understanding how indoor air quality relates to HVAC systems. The second step is deciding what tools you need. Once you have the tool, start measuring and learn how to interpret the data. Soon, you'll be ready to offer a complete IAQ assessment, including particulate profiling, to your customers.

If you think "pollutants" is too strong a word to use when describing particulate measurement situations, consider this: Studies conducted by both government and independent entities have come to the conclusion that indoor air in some commercial settings can be up to five times more polluted than outdoor air.

## Step 1: How IAQ analysis and particulate profiling fits into HVAC systems

We all remember our fundamental facts related to air flow: standard air at 70 °F (at sea level) and 50 % relative humidity has a weight of .075 pounds per cubic foot. That means a typical 5-ton cooling system moves 9,000 pounds of air in one hour, or up to 216,000 pounds in a 24-hour period.

These are more than just impressive numbers for customers.

Consider something as simple as a 10 % leak rate in the return duct system (not uncommon in residential) in an attic crawl space. Now, consider the dust and other particulate levels in that crawl space. And, finally, imagine the amount of particulates being distributed throughout the ducts in your customer's home.

So, it's not just door openings, or air seeping in around windows and other small openings that affect indoor air quality. Dust and other contaminants can be constantly introduced into the living

space due to leaks and other HVAC system malfunctions. And—it's not just return ducts. Duct systems within the conditioned envelope are just as susceptible to IAQ issues.

IAQ inspections are built on exactly that kind of HVAC knowledge. Using your knowledge of how HVAC systems are designed—and how the design can be compromised on installation—as well as where those systems can break, will help you track down where air quality pollutants may be coming from. On the flip side, air quality data gives you the means to track whether the HVAC system is working the way it should.

**For example:** to determine whether the duct system is responsible for introducing contaminants, you'd conduct a particle assessment at the supply registers. It's very evident at the register whether the particulate count is higher, especially in a

smaller space like an office or bedroom. Higher counts probably mean the air handling system isn't properly balanced.

If a duct system branch is an 8-inch flex, it's supposed to be moving in the neighborhood of 160 CFM, and that translates to a fairly low level of positive pressure into the room even if the system is balanced....which means that in a typical system that employs a single central return, the requirement of the free flow of air at low resistance back to the return register from that room can be compromised, leaving an even higher level of contaminants in that space.

If you can measure those contaminants, you would be able to classify them (pollen vs. soot) track their flow through the building, and identify the source—that's a much more specific service, with farther reaching solutions, that you can now offer customers.

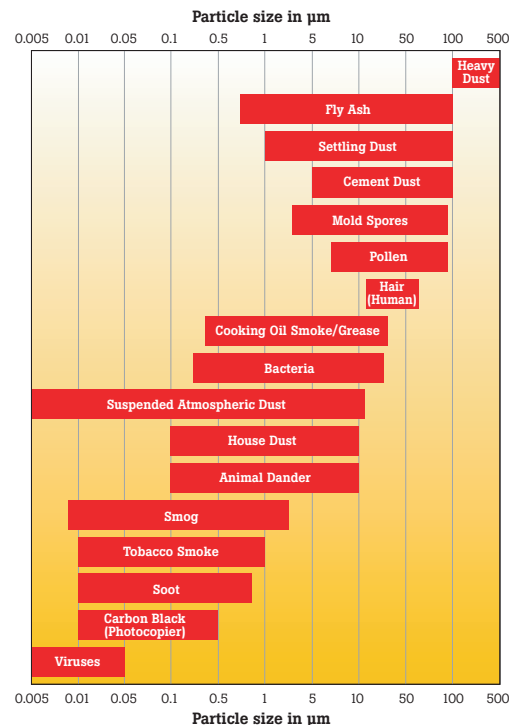
## Step 2: What tools do you need?

To conduct a complete IAQ investigation, you need to measure temperature, humidity and particulates, at a minimum. That's because temperature and humidity can take a regular particle count and magnify it times ten, by giving certain contaminants like mold a welcoming environment. That makes hand held multi-function and multi-channel particle counters, such as the Fluke 983, the most practical tool for the job.

A particle counter senses, sizes, and counts the particles passing through it. Multi-function means the tool measures temperature and humidity along with

taking particle counts. Multi-channel refers to how many different sizes of particles the tool can measure. Knowing the breakdown of particle sizes is essential for you to diagnose what's polluting customers' air (mold particles are different sizes than dust, for example), to trace particles to their source, or to verify that a fix has really lessened the count of particles.

Handheld is also an important distinction, since some higher-end models are meant to be installed, for long term monitoring. As an HVAC technician, you'll get the most value from a handheld tool meant for onsite inspections.



### Step 3: Making the measurements

To conduct an IAQ inspection, get a map of the HVAC system, as installed, and use that to create an inspection route. Plan to take temperature, humidity, and particle samples in every zone of the building, especially in any areas where there have been complaints, as well as outside the building, as a baseline. Within each zone, take a measurement in the middle of the space as well as near the air intakes, outtakes, and any other HVAC system elements. Make particular note to measure both upstream and downstream at any HEPA filters.

Also use your own senses—look for signs of moisture leaks, smell the air for mold, and ask the people who frequent each area if they have experienced anything different, such as smells, headaches, or eye irritation.

Don't be intimidated by particulate counters—newer models designed specifically for HVAC technicians are easy to use. For example, to use the Fluke 983, power up the unit, press F1, and use the probe to start sampling. It will simultaneously record the relative humidity and temperature conditions and sample a group of particulate measurements in less than 25-seconds.

As you take your samples, use the labeling feature on your particle counter to identify samples taken from different rooms, the particle counting mode, air sampling volume and time.

Once you've collected data, transfer the information to a computer and convert it into a spreadsheet. Compare the counts in each area against the baseline and between each other. You should see patterns develop. When you detect a high-volume area, see if it's just one particle size or several, and think about what kinds of contaminants could be involved. Then, compare the particle counts to air flow balancing in the building. Always remember to take readings of the outside air in order to make meaningful comparisons with the particle levels indoors.

If you think the system itself is transporting contaminants, consider whether to propose re-balancing the existing system or adding a mechanical solution such as dehumidifiers or a better filter. Sometimes the solution can even be as simple as blocking off a room or identifying problematic behavior.

Here's one example of a particulate profile in a commercial office. The baseline six particle size scales showed:

SIZE	Particles/L	Label 1
0.3µm	814908	■
0.5µm	94271	■
1.0µm	16530	62%RH
2.0µm	7264	52°F
5.0µm	2926	1.0 CF
10.0µm	145	● Σ

COUNT SETUP CLOCK LABEL

While slightly higher than outside values, this is a fairly typical particle level. However, in one location, the particulates were:

SIZE	Particles/L	Label 1
0.3µm	2651469	■
0.5µm	291193	■
1.0µm	70852	55%RH
2.0µm	36837	54°F
5.0µm	17993	1.0 CF
10.0µm	1979	● Σ

COUNT SETUP CLOCK LABEL

You'll notice that particle sizes in almost all areas increased. Quite often, larger particles are providing nutrients to the smaller, biological particles, as well as transporting them. That's how filters that remove mostly larger particles also wind up removing many viruses and bacteria from a system.

The higher counts indicate a problem that needs to be investigated. Determine specifically where the high counts occur and then start asking questions. Is there an excessive source of moisture from an improperly draining pan under an evaporator coil? What kind of ventilation does the building have and how old is it? Has there been any new interior construction, carpeting, or painting?

By addressing all aspects of the situation, you'll treat the real problem, not just the symptom, and give your customer specific data to base buying decisions on.

## Step 4: Offering IAQ services



The easiest way to integrate indoor air quality and particulate testing into your business is to start with customers who are already sensitive to air quality.

The first time you describe IAQ to a customer, come prepared to describe how poor air quality could affect that customer's facility, either from employee health issues and product contamination to the maintenance costs and energy expenditure related to inefficient HVAC and aging filters.

Customers with HEPA filters installed will especially appreciate your knowledge of ASHRAE 52.2. That standard spells out the testing requirements that manufacturers follow, to verify filter performance before sale. As an HVAC technician with a particle counter, you can use the standard as a guideline for testing installed filters, so that customers know how efficiently their filters are removing particles and whether they're due for replacement. Particulate profiling is now recommended in the latest NADCA ACR 2005 standard for air duct cleanliness, too.

It's one thing to mention the importance of ASHRAE guidelines to a customer when selling a necessary duct renovation or other repairs, but it's another thing altogether to back that explanation up with particulate measurements and an air quality evaluation.

Next, start offering IAQ inspections and particle counts as part of your standard "seasonal start-up" maintenance check. Charge for a building or home evaluation in which a particle counter is used, similar to the way that automotive service shops charge for using a computer hookup during the diagnostic process.

Also consider offering IAQ inspections in the off season, adding a second annual visit to your accounts during months when you're not as booked.

Make sure your customers understand that IAQ analysis and particulate profiling is an above-average service that requires specialized training and tools. Just by offering the service, you take your organization to a higher level of professionalism and customer service. Your recommendations now come with supporting data, assuring the customer that you're making the right suggestions on equipment selection, installation, and repair.

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