The Three E's of Managing Dust Control Performance: Exposure, Efficiency and Emissions

By Chrissy Klocker, Donaldson Industrial Air Filtration

When it comes to evaluating the performance of a dust collection system, there's a lot of industry talk about filter ***efficiency***. But how well your dust collector filter works is only part of the equation.

Two other factors in your ventilation system are important to monitor: ***exposure*** and ***emissions***. Here is why each "E" is important to address, and how they work together to drive the overall system performance.

Exposure

In and around your manufacturing process, you need to focus on nuisance dust exposure. This includes:

- The properties of the materials you produce or use in your facility, and
- The locations in your process where employees are potentially exposed to those materials.

A qualified industrial hygienist can audit your facility, look at various job functions, and take samples of the air your employees breathe. This will determine average or peak concentrations of contaminants they're exposed to while performing certain tasks.

After this review, audit your facility to identify all fugitive dust sources and assess whether you have proper ventilation hooding. Hooding can be an effective means of reducing exposure, but only when designed effectively and properly located near the source of dust generation.. You might discover new dust generation points where you need to add controls.

Once you've determined hood locations, it's important to think beyond hood *size*. If there are existing hoods, determine whether you're drawing sufficient control volume at each exhaust ventilation hood or if modifications need to be made. A dust collector can only filter the air stream that is brought to it, so if the hood captures 20 percent of the dust, the system will perform at a maximum of 20 percent—regardless of how much more you invest in the other components.

Next, examine your ducting. Do you have a logical network of ducts to convey the dust or fumes from each hood to the collector? Are the ducts sized properly to ensure recommended minimum conveying velocities are maintained? Is the air volume sufficient to keep the dust moving to the collector rather than settling in the ductwork?

Hood and duct design cannot be over-emphasized in exposure control. Dust collector performance is dependent on how well your hoods and duct system work together to capture and convey dust from exposure areas to the collector.

Efficiency

Once you've addressed exposure areas, you can move on to considering the dust collection technology you need. A good dust collector delivers consistent, predictable performance—meaning it effectively removes the contaminants that are carried to it while maintaining a consistent air volume at a predictable energy cost.

The size and style of a dust collector influences the fan and cleaning energy necessary for stable operation. Consider the air volume you need and how to get the most efficient system to deliver it. If your system struggles to maintain design flow, or cleans excessively, it may mean that new technology is warranted.

When evaluating a new or existing dust collector, you should pay attention to filter efficiency; but don't rely merely on the rating of a new filter. A filter rated MERV 14, for example, simply means that the filter captures a percentage of test dust under specific conditions—or with no dust at all. A filter rating is much like the mpg on a new car—nice to know, but rarely reflective of real conditions.

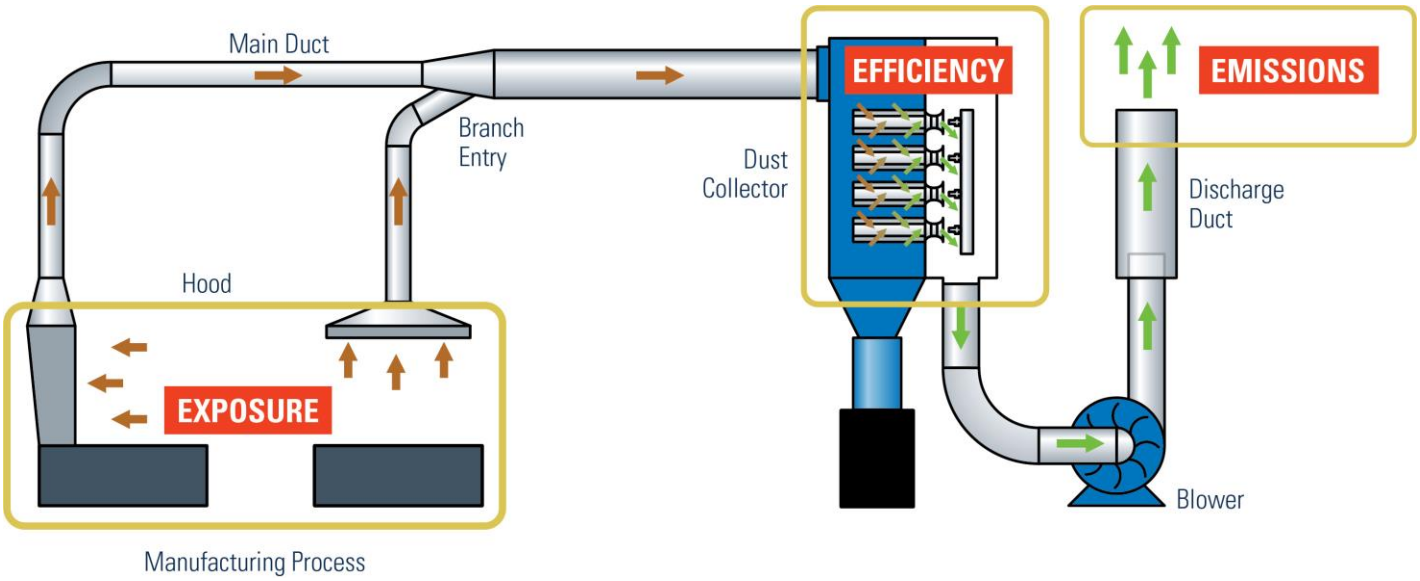
In actual operation, a filter in a regenerative dust collector is often pulse-cleaned under heavy loads. It has to handle new dust entering the collector, in addition to all the dust accumulated on the filter (dust cake) over time. When a dust collector reaches a stable operating point, the dust concentration on the media is thousands of times greater than the inlet loading. Because of this, evaluating a dust collector in terms of what it achieves at its stable set point, using exposure and emissions testing will give a better indication of the ventilation system's performance.

Emissions

What passes through the collector is considered outlet emissions. Assuming your fan is drawing filtered air from the collector to a discharge point, there are several more questions to ask: "What is the quality of the filtered air you're either emitting back into the building or exhausting outside? What besides filtered air might be present in the airstream? Are there remaining particulates, vapors, or gases? Do any of these questions pose a concern? What further actions are necessary?"

The only reliable answers come from systematic testing. A firm that monitors air quality can perform stack testing to measure the volume and concentrations of material discharged at the outlet of a collector. For some facilities, the EPA mandates continuous emissions monitoring. For others, OSHA and other standards may apply, dictating a variety of test methods and either emissions or employee exposure limits.

Once you've assessed your ventilation needs and understand your emissions limits, talk with your dust collector or filter supplier to find the right technology for your process. That partner can help you understand what the dust load demands may produce in terms of energy and cleaning consumption, and how to achieve emissions goals in both a cost- and energy-effective way. One set of equipment may deliver reasonable filter life at a lower initial cost, but have higher compressed air and cleaning costs due to aggressive filter sizing. A more conservatively sized dust collector will have a higher initial cost, but lower compressed air and energy consumption due to less frequent filter cleaning. And less frequent filter cleaning leads to lower outlet emissions.



Managing the Three E's

The intent of a dust control system is to stay within thresholds
for ***exposure*** and ***emissions;*** those are the performance indicators that really matter.
The ***efficiency*** of a dust collector and filter is the result of reaching those goals.

Because each facility is unique, managing the three "E's" may require working with multiple professionals:

- An industrial hygienist to evaluate indoor air quality and potential employee exposures, and provide recommendations for how to address them;
- An air quality monitoring firm to test outlet emissions against air quality goals; and
- A qualified industrial ventilation designer to produce a dust collection system in accordance with the Industrial Ventilation Design Manual published by the American Conference of Governmental Industrial Hygienists.

Be sure to keep these professionals engaged whenever you make changes to your facility or process. Modifying your dust collection system can throw off the delicate balance in air volume throughout the system. For example, tapping into a system with another duct may create a path of lower resistance that diverts air from the original sources. An industrial ventilation designer should advise on system modifications. Retesting for exposure and emissions will also verify that a remodeled system is performing as designed.