10 Ways to Get the Best Sustainability Benefits from a Dust Collection System

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ANSI/ASHRAE Standard 199 dust collector testing facility

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A high-efficiency industrial dust collector designed specifically for your operation is an accepted and proven engineering control that will filter hazardous dust and fumes and make your bulk processing facility safer and healthier. In fact, a properly designed dust collection system can contribute to your plant's overall sustainability. Here are 10 ways you can achieve the best environmental benefits from your system:

1. Maintain Environmental Compliance

Air quality testing can show if you are meeting OSHA exposure limits for the dusts produced at your facility. OSHA has established Personal Exposure Limits (PELs) based on an eight-hour time-weighted average (TWA) for hundreds of dusts. They are listed in OHSA's annotated PEL tables. The OSHA PEL requirements will determine the minimum level of filtration efficiency that your fume collector must achieve. For example, if the established limit for your particulate is an average of 5 mg/cu m, the dust collector manufacturer must provide a guarantee of something less than that—preferably at least half the limit.

OSHA and the EPA want to know that emissions will be at or below their required thresholds. The Minimum Efficiency Reporting Value (MERV) ratings scale provides a good indicator of a dust collector filter's initial efficiency. However, it does not measure pressure drop, emissions while pulsing, energy performance or the other parameters that better reflect dust collector efficiency.

A way to measure your dust collector's emissions effectiveness is to test it according to ANSI/ASHRAE Standard 199-2016, Method of Testing the Performance of Industrial Pulse Cleaned Dust Collectors. This standard is designed to help end-users evaluate collection equipment with much greater accuracy. The test measures four key performance parameters: emissions, pressure drop, compressed air usage and emission reading.

Before this standard was enacted, there was no appropriate test standard to measure the effectiveness of dust collectors and filters. End-users could not get the data required to compare how different collector designs and filter options affect factors like emissions and energy consumption.

See Image 1

2. Recirculate the Air Downstream for Energy Savings

If you are containing factory air indoors and the air is climate-controlled, air recirculation is an ideal way to save energy and maximize the return on investment of a dust collector. By recirculating heated or air-conditioned air back through the plant instead of venting it outdoors, the cost to replace that conditioned air is eliminated. Facilities in all regions of the U.S. report five- to six-figure annual energy savings, with the greatest savings seen in northern climates that experience longer, colder winters. In addition, you will eliminate the complex EPA paperwork and monitoring procedures involved when fumes are exhausted outdoors.

When recirculating cleaned air, you need to keep below OSHA PELs for your particular dust contaminants. Secondary HEPA-grade integrated safety monitoring filters (iSMF) provide a final cleaning of the air before it goes back into the facility. Where toxic dusts are present, a safety monitoring system is mandatory and should always use a HEPA filter as the final filter.

See Image 2

Also, dust collection systems for production areas with high ceilings can often improve the efficiency of a heating system by recirculating the air, because the system takes the hot air away from the ceiling and delivers it back to ground level.

See Image 3

3. Accurately Size the Dust Collector

Although a small car is considered more energy efficient than a big gas guzzler, the analogy does not hold true when it comes to dust collection equipment. A dust collector must be properly sized to run dependably and efficiently at the required airflow.

If a collector is undersized, a host of problems can result. The operating pressure drop may be too high, filters may be overloaded and require frequent changeouts, and larger maintenance problems may surface. If any of these occur, operating costs and energy usage can actually be higher for a smaller unit than for a large one.

4. Select a Heavy-Duty Dust Collector for Longer Life

Heavy-duty construction is likely to result in longer life. This is particularly true of a dust collector equipped with explosion protection devices, which is required for combustible dust applications. Vessel strength is an important factor in determining which type of explosion protection technology is required and how the equipment should be sized.

A heavy-duty collector, constructed of thick-gauge metal and with a high pressure rating, might enable you to use a simpler and less costly explosion protection system to comply with National Fire Protection Association (NFPA) standards. Field experience has shown that heavy-duty collectors are far more likely to survive a combustible dust explosion, whereas lighter-weight models have to be scrapped, generating waste.

5. Specify Sustainable Materials and Processes

Dust collectors that are manufactured using environmentally friendly paint finishes and construction materials contribute to sustainability. Energy-efficient components in the system also make it a greener machine. Ask your dust collection supplier to provide a sustainability report or other documented evidence of its green manufacturing initiatives. Also ask whether energy-efficient components are offered as standard or optional.

6. Use Long-Life Filters to Reduce Replacement Frequency

Extended-life cartridge filters reduce filter changeout frequency. This minimizes worker exposure to dust, saves on maintenance and disposal costs, and reduces landfill impact.

A misconception exists that the more media a filter contains, the longer it will last. Actually, the size of media area contained in a filter is not as important as the area of usable media surface. Many filters have media packed so tightly into the cartridge that most of it is not available for filtering. When the pleats of the filter media are tightly packed, the reverse pulse cleaning system of the dust collector will not eject the dust that has settled in between the pleats. Tightly packed pleats increase the resistance of the air through the filters and diminish airflow.

The key is to use a wide pleat where 100 percent of the media is usable. This design improves airflow through the filter, which reduces pressure drop and saves energy. Open-pleat filters also respond well to pulse-cleaning and use less compressed air than some other filter designs, saving more energy and lasting longer, which in turn lowers replacement and disposal costs. A wide-pleat filter allows the collected dust to release from the filter, keeping the resistance lower through the filter for a longer time.

See Image 4

7. Don’t Use a PLC to Control Pulse Cleaning

Though programmable logic controllers (PLCs) are popular in many manufacturing processes, they are not well suited to control pulse cleaning of dust collector filter cartridges. Pulse cleaning relies on very brief (about 150 milliseconds), high-energy bursts of compressed air to blow dirt off the filter surfaces. Typically, a PLC's valve opens too slowly for proper pulsing to occur. To optimize cleaning and ensure reliable and efficient dust collector operation, use a timer board designed for filter pulsing. It can be used independently or tied into your PLC.

See Image 5

8. Conduct a Filter Cost of Ownership Analysis

When choosing a cartridge dust collector filter, consider calculating total cost of ownership to help you make the most economical and sustainable choice. Similar to life-cycle costing, total cost of ownership is a step-by-step evaluation of the four main components of filter cost—energy, consumables, maintenance and disposal.

To choose the most economical and sustainable filter, it is best to do a total cost of ownership calculation that takes all these components into account. A filter with a lower initial price may end up costing thousands of dollars a year more in energy and operating expenses. See the sample worksheet in Image 6 to help you gather total cost of ownership data that you can use to compare the expense of operating a dust collector with different filters.

See Image 6

9. Use a Variable-Frequency Drive to Control Fan Speed

Incorporating a variable-frequency drive (VFD) to control fan speed on a dust collector saves energy on motors because they aren't running at full speed and use only the energy needed to operate. For example, a dust collector with a fan featuring a VFD that is governed by the under-pressure in the ducts makes the system automatic. After a worker opens an extraction point, the pressure in the system goes down. This drop in pressure triggers the VFD, which increases the fan speed to maintain both the pressure and air volume extracted. This process offers significant energy savings.

By maintaining the desired airflow through the collector, energy use is greatly decreased, with a typical return on investment in the VFD of less than one year. Also, a VFD may lower your utility rate by helping to reduce the spike in overall energy consumption.

10. Use a Premium Efficiency Fan Motor

Industrial electric motors are known to waste significant energy. According to the EPA, more than half of the electricity used in manufacturing goes to powering motor-driven systems. Premium efficiency fan motors are designed to improve energy performance and meet or exceed requirements of the Energy Independence and Security Act of 2007.

Designed for cooler operation and more efficient performance, a premium efficiency motor can pay for itself in reduced electrical power use. Many electric utilities offer rebates and incentives that can add even more savings. You can use premium motors with VFDs for optimal fan speed control and energy savings.

See Image 7

As you can see, there are many ways a properly designed dust collection system can contribute to sustainability beyond cleaning up dust and fumes. If you keep these ten steps in mind while considering a new dust collector or operating your current system, you'll achieve a more efficient operation that is good for the environment, your employees and your budget.

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