Ineffective Cleaning in Generic Baghouses

ABSTRACT: Background
In a typical "generic" baghouse application, the cleaning is accomplished by back-flushing the filter with compressed air that travels through an orifice hole in a purge tube (blow pipe) and through a venturi. A typical generic cleaning system allows dust to be filtered at an air-to-cloth ratio of 5:1. That means for every 5 CFM of airflow, there is 1 square foot of media used to filter the air. This has been the industry standard for over 50 years. This standard cleaning system is not perfect and it has several inherent problems. First, due to the proximity between the orifice and throat of the venturi, not enough clean air is induced during the cleaning cycle, and a vacuum is created. Second, due to the energy contained within the compressed air and the close proximity to the orifice, as the jet expands and passes through the venturi at high velocity, it overwhelms the surrounding media with air and can create a "puffing" effect as it drives dust from one bag to another. Lastly, due to the high velocity of air after the venturi, the induced air is forced out of the bag creating another vacuum further down the bag. As a result, there is a large section of the top of the bag that is unusable for repetitive cleaning of the dust.

Results
Scientific Dust Collectors (SDC) conducted tests to observe the inherent problems and documented it in the corresponding technical paper "Advantages of Cleaning without a Venturi in Baghouse Collectors". After the completion of this technical paper, further analysis was done to find out the effects of the overwhelming amount of cleaning air and find out how much cleaning air is too much. To further understand the cleaning cycle, not only must the bag being cleaned be looked at, but also the surrounding bags must be evaluated. All filter media have permeability ratings, which is not the same number as the dust collector air-to-cloth ratio. This is the maximum amount of air (in CFM) that can permeate an area of media (typically in square feet). Taking the most common form of filter media, singed polyester, the typical permeability rating is a maximum of 40 CFM per square foot of media. This means for one typical 4 ½" diameter by 8ft long bag, taking the surface area of the bag, there is 9.46 ft^2 of available media, and therefore the maximum CFM that one filter bag can absorb would be 378CFM. Using the cross-sectional area (πr^2) of the bag and the formula Q = V A, the velocity through the bag would be 3,426 FPM. In a generic baghouse, the typical bag spacing is 1" between the diameters of the bags (or 5 ½" between the centers of the bags). To model the flow in the surrounding bags, the bag being cleaned would need to theoretically increase in size so that it's outside diameter touches the neighboring bags, this is done by adding 1" to the radius, or 2" to the diameter. Here, the new bag radius will be r = 3 ¼" (or diameter of d=6 ½"). Using the maximum velocity of 3,426 FPM and the new theoretical cross-sectional area, the maximum flow through the larger bag area is 790 CFM. Once the flow in the bag being cleaned reaches 790CFM (or a velocity of 7,153 FPM), the air expands outward and slows toward the neighboring bags. Once the air reaches the surrounding bags, it overwhelms them with air, and creates a blinding effect that hinders the overall cleaning performance and can damage the surrounding media. During the cleaning cycle of the orifice and venturi system, the cleaning flow overwhelms the surrounding media in several areas throughout the cleaning cycle as shown below in Figure 1.

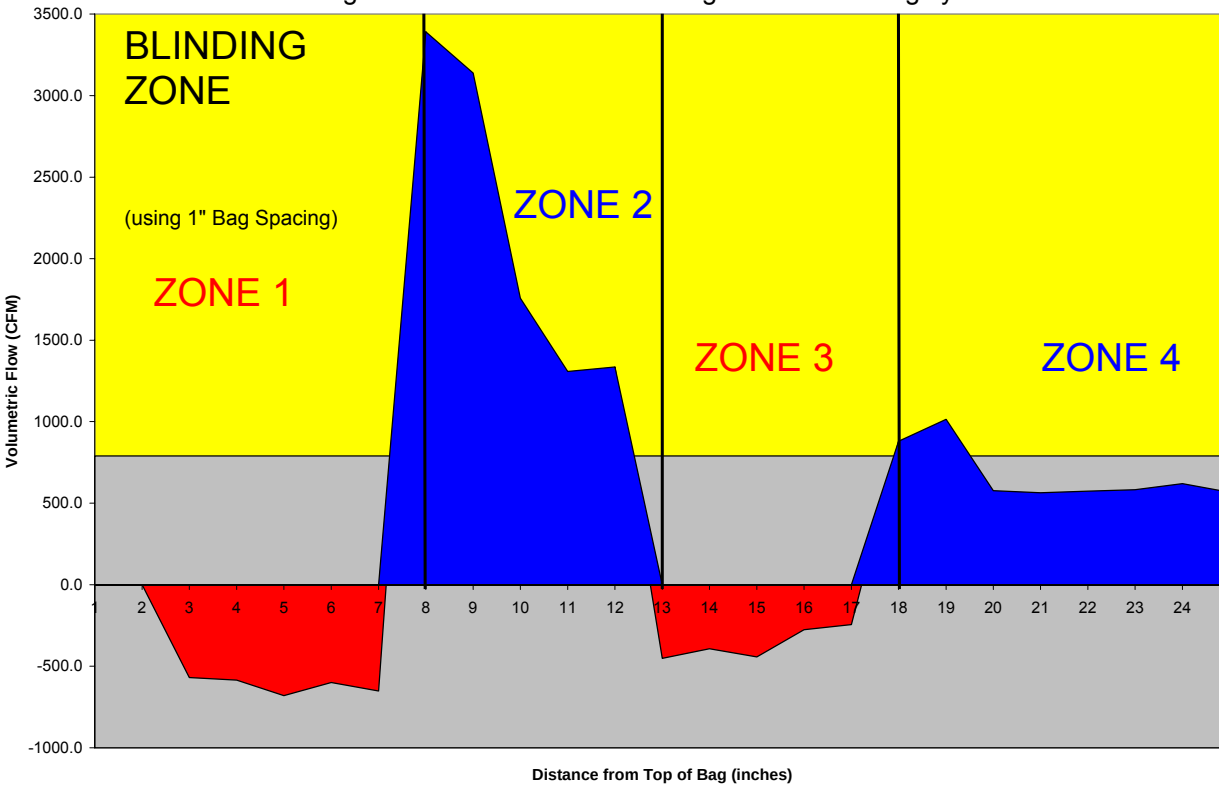

Figure 1. Blinding Zone with Generic Baghouse 1" bag spacing.

Please go to www.scientificdustcollectors.com for the full 8 page technical paper on this topic.

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Benefits

Scientific Dust Collectors' patented converging/diverging nozzle cleaning system allows for dust to be filtered at a nominal air-to-cloth ratio of 10:1. Along with our patented nozzle, we utilize a wider 3" spacing between bag diameters (7 ½" between centers of the bags) as our standard compared to the generic baghouse that only uses 1" bag spacing. Revisiting the same calculations as before, increasing size of the bag so that the new bag radius would be **r = 5 ¼"** (diameter d=10 ½") and a maximum velocity of 3,426 FPM, the maximum allowable flow is 2060 CFM. With the 3" spacing between the bags, our cleaning does not overwhelm the bags, rather it is just the right amount of cleaning as shown in Figure 2. However, with the wide 3" bag spacing, the negative effect of the generic baghouse cleaning is lessened, but not eliminated.

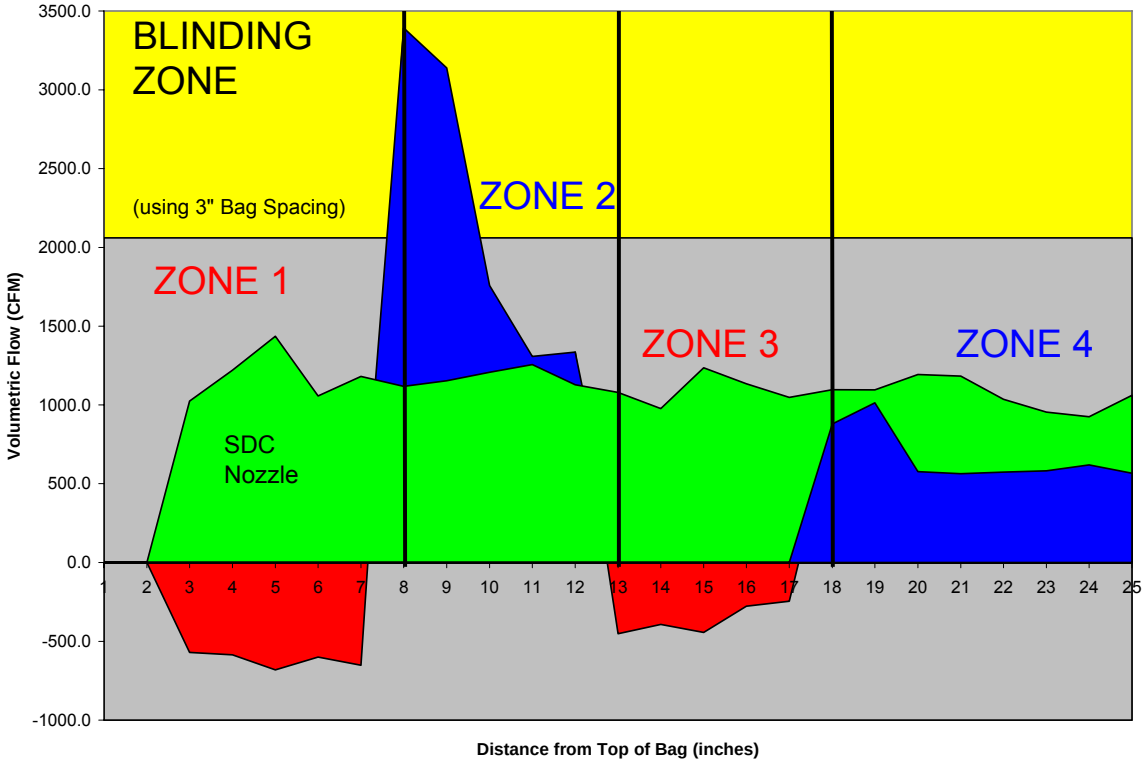

Figure 2. Blinding Zone comparison between SDC Nozzle Cleaning and Generic Baghouse.

This wider spacing promotes dust release while also protecting the surrounding media from blinding. As a result of efficient dust collector design and patented nozzle cleaning technology, Scientific Dust Collectors is able to operate at higher air-to-cloth ratios, provide better and more complete cleaning of the filter, and longer filter life.

As a recommendation, when quoting baghouse, either buying or selling, remember to ask for wide bag spacing. It is the correct thing to do.