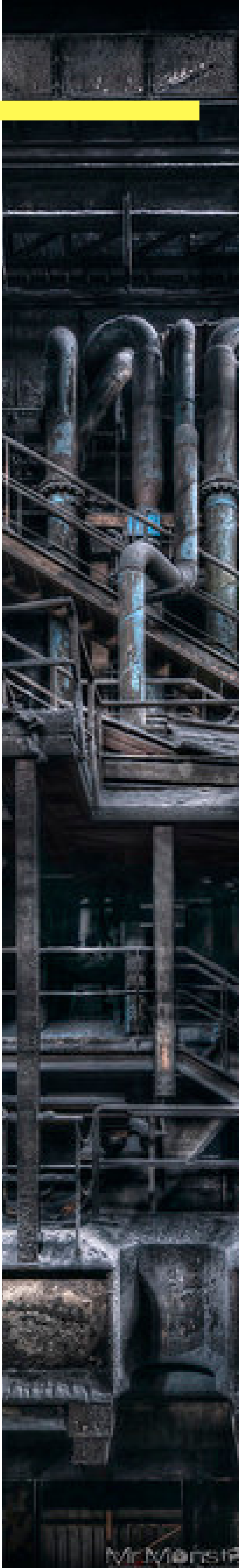
ARRELIC INSIGHT

DUST CONTROL SYSTEMS

THE FUNDEMENTALS

Dust collection systems are the most widely used engineering control technique employed by mineral processing plants to control dust and lower workers' respirable dust exposure. A wellintegrated dust collection system has multiple benefits, resulting in a dust-free environment that increases productivity and reclaims valuable product.
The most common dust control techniques at mineral processing plants utilize local exhaust ventilation systems (LEVs). These systems capture dust generated by various processes such as crushing, milling, screening, drying, bagging, and loading, and then transport this dust via ductwork to a dust collection filtering device. By capturing the dust at the source, it is prevented from becoming liberated into the processing plant and contaminating the breathing atmosphere of the workers.
LEV systems use a negative pressure exhaust ventilation technique to capture the dust before it escapes from the processing operation. Effective systems typically incorporate a capture device (enclosure, hood, chute, etc.) designed to maximize the collection potential.
As part of a dust collection system, LEVs possess a number of advantages:
1. The ability to capture and eliminate very fine particles that are difficult to control using wet suppression techniques;
2. The option of reintroducing the material captured back into the production process or discarding the material so that it is not a detriment later in the process; and
3. Consistent performance in cold weather conditions because of not being greatly impacted by low temperatures, as are wet suppression systems.
In addition, LEVs may be the only dust control option available for some operations whose product is hygroscopic or suffers serious consequences from even small percentages of moisture (e.g., clay or shale operations).
In most cases, dust is generated in obvious ways. Anytime an operation is transporting, refining, or processing a dry material, there is a great likelihood that dust will be generated. It also follows that once the dust is liberated into the plant environment, it produces a dust cloud that may threaten worker health. In addition, high dust levels can impede visibility and thus directly affect the safety of workers.
The five areas that typically produce dust that must be controlled are as follows:
1. The transfer points of conveying systems, where material falls while being transferred to another piece of equipment. Examples include the discharge of one belt conveyor to another belt conveyor, storage bin, or bucket elevator.



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2. Specific processes such as crushing, drying, screening, mixing, blending, bag unloading, and truck or railcar loading.
3. Operations involving the displacement of air such as bag filling, palletizing, or pneumatic filling of silos.
4. Outdoor areas where potential dust sources are uncontrolled, such as core and blast hole drilling.
5. Outdoor areas such as haul roads, stockpiles, and miscellaneous unpaved areas where potential dust-generating material is disturbed by various mining-related activities and high-wind events.

While areas 4 and 5 can be significant sources of dust, they are generally not included in plant or mill ventilation systems design because of the vast area encompassed and the unpredictability of conditions. Therefore, dust control by methods alternative to LEVs is required.

Dust control systems involve multiple engineering decisions, including the efficient use of available space, the length of duct runs, the ease of returning collected dust to the process, the necessary electrical requirements, and the selection of optimal filter and control equipment. Further, key decisions must be made about whether a centralized system or multiple systems are best for the circumstances. Critical engineering decisions involve defining the problem, selecting the best equipment for each job, and designing the best dust collection system for the particular needs of an operation.

BASICS OF DUST COLLECTOR SYSTEMS

Well-designed dust collection systems need to consider not only the dust as a potential contaminant, but also the attributes of the dust capturing system. In defining the nature of dust as a potential contaminant to workers, a number of issues must be examined. These include the particle size and distribution, shape, physical characteristics, and the amount of dust emitted.
Particle size describes how coarse or fine particles are, and is normally defined by their upper
th and lower size limits. Particle sizes are measured in micrometers (μm) (1/1,000 millimeter).
The respirable dust range harmful to workers' health is defined by those particles at, or below,
the 10 μm size range. To put this size in perspective, 325 mesh is approximately 44 μm and is the smallest micrometer size that one can see with the unaided human eye. In dust collector systems, the larger particle sizes are easy to collect, often aided significantly by gravity.

The shape of particles affects how they are collected and how they are released from the collection media. Particle shape is a common terminology used in aerosol technology, while the term aerodynamic diameter is frequently used to describe particle diameters. The aerodynamic 3 diameter of a particle is the diameter of a spherical particle that has a density of 1,000 kg/m (the standard density of a water droplet) and the same settling velocity as the particle [Hinds 1999].

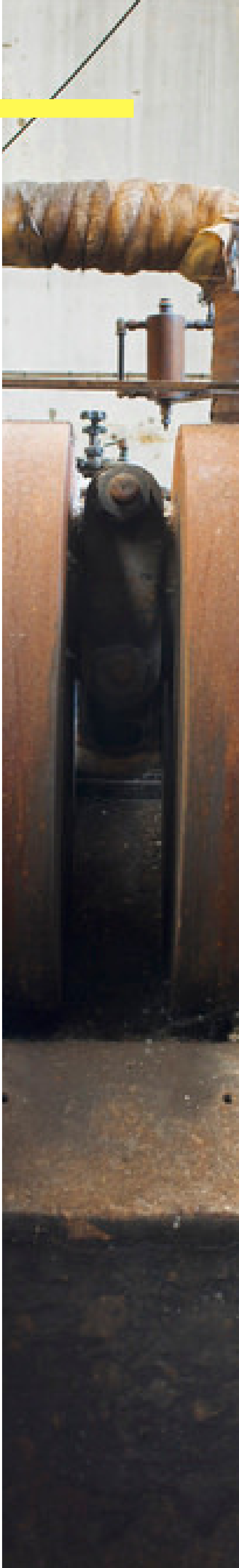
Aerodynamic diameter is used in many designs of filtration systems and air cleaners. Additional properties of the material that are key design considerations for dust collection systems are moisture and temperature. Moisture and temperature play a significant part in equipment selection for dust collector systems.

AIRFLOW AND DUST CONTROL

To control how air flows in a ventilation system, one must manage air velocities, air quantities, and temperature, as well as apply basic principles of static pressure (SP) and velocity pressure(VP).

Air velocity is measured in feet per minute and impacts the size of particle that can be carried by the airstream. Air quantity is measured in cubic feet of air per minute (cfm), which is the amount of air used in ventilating the process. Air temperature is measured in degrees Fahrenheit or degrees Celsius. It is used to determine the type of gaskets and filter media needed. Many applications where dust is being collected are thermal in nature, with examples including furnaces, kilns, and dryers.

Pressure (or head) in ventilation design is generally measured in inches of H_2O, also referred to as inches water gauge (wg). In a ventilation system, this pressure is known as the static pressure and is generally created by a fan. Static pressure is the difference between the pressure in the ductwork and the atmospheric pressure. Negative static pressure would want to collapse the walls of the duct, while positive static pressure would want to expand the walls of the duct.



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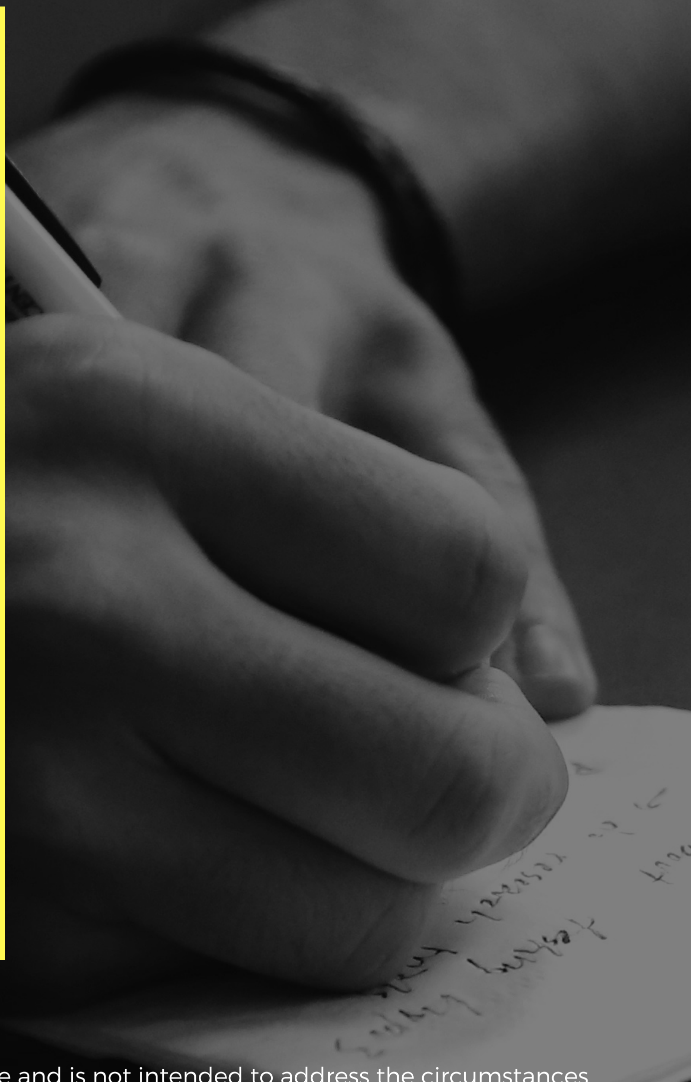

GOT ANY QUESTIONS?

CONTACT US AT
INFO@ARRELIC.COM

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