Tried and tested systems to control fugitive dust

Sometimes the most efficient and economical way to control dust is to mimic Mother Nature

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Today's port operators are under ever increasing pressure to comply with pollution and safety regulations when handling bulk materials such as coal, pet coke and other bulk materials. Fugitive dust escaping from material handling points can also be an expensive nuisance to neighbors or neighboring commodities that can be contaminated by these operations.

In the United States, many major ports have discovered that using technology that mimics nature's ability to clean the air can be the most cost effective means to control fugitive dust. Dust Solutions Incorporated (DSI) provides two of these nature-based technologies for dust control.

The first is called the Dry Fog™ system, which utilizes compressed air and plain tap water to create micron-sized fog droplets that attach to airborne dust particles, making the particles more cohesive so that they stick together. This increases their mass to the point where the agglomerated particles fall back into the process.

Using Dry Fog™ does not wet the material

Unlike conventional water spray or chemical spray systems, Dry Fog is not designed to wet the process material, it only wets the airborne dust. This makes it an ideal solution for dust from moisture sensitive materials such as coal, coke for fuel, copper concentrate, clinker and cement. Moisture addition to the material is typically less than 0.05 percent by weight and many times is undetectable.

Dry Fog systems do not require any chemicals to break up surface tension, as its unique nozzle design creates 1-10 micron-size droplets that are of like size to the airborne dust particle, as demonstrated in Figure 1 (slipstream effect). Making the droplet the same size as the airborne dust particles overcomes surface tension as well as the slipstream effect that larger droplets (mist) create, making them ineffective in removing particles from the air.

The flow rates of DSI nozzles are measured in gallons or liters per hour not minute, ranging from 3.5 gallons/13.25 liters per hour, up to 13 gallons/60 liters per hour. It has been estimated that a DSI nozzle can cover the surface area of half a football field with fog with only 1 gallon/3.78 liters of water. This allows DSI nozzles to create large volumes of fog in dump pockets or hoppers. The fog system is activated just prior to the discharge of material into the hopper. When the dust-laden air inside the hopper is displaced by the material being dumped, the fog essentially 'scrubs' the displaced dust-laden air. Dust reductions from hoppers have been measured to remove 96 percent or more of these particles vs. uncontrolled dumps.

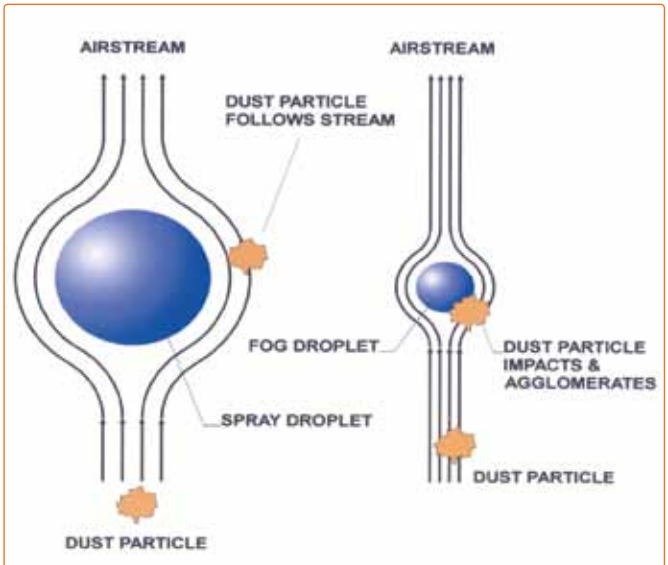

Figure 1. How droplet size effects agglomeration.

Misting systems are not fog systems

Don't be fooled by high-pressure misting systems that claim to be fogging systems. Mist droplets typically are above 20 and up to 100 microns in diameter and use very high water pressures over 1000psi to squeeze the water through an orifice around 0.006 of an inch. This combination of high pressure and small orifice makes these systems subject to a high rate of plugging.

Figure 2. Fogging 'scrubs' the dusty air as material is discharged, as with this limestone hopper.

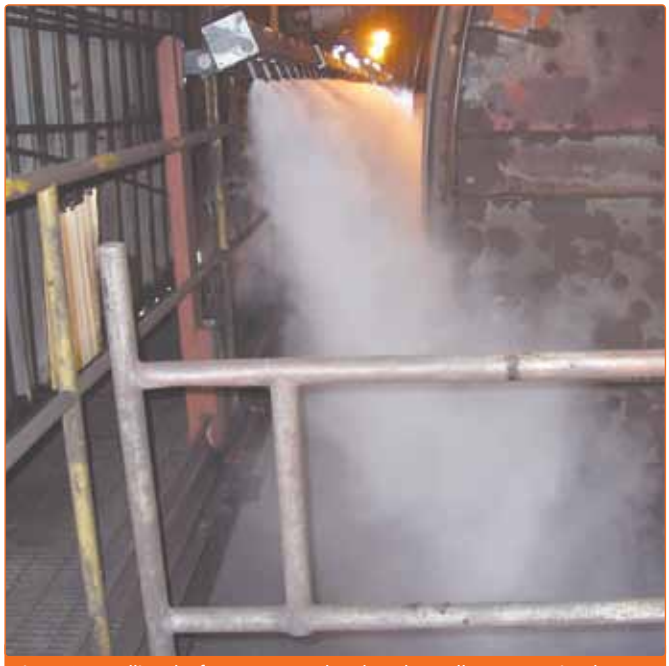

Figure 3. Installing dry fog systems, rather than dust collectors, requires less power and little maintenance.

The DSI Dry Fog system uses water pressures of 7 to 15psi, with a standing shockwave external to the nozzle orifices creating the fine atomization. This design utilizes multiple water injection ports that are much larger than high-pressure nozzles. This design along with system filtration virtually eliminates the nozzle plugging issues associated with high-pressure sprays.

Less expensive than dust collection systems

Dust collection systems are commonly used at ports. Designing collection systems for large dump hoppers means huge volumes of air must be collected, requiring large fan motors that consume large amounts of electricity. Maintaining dust collectors is a chore, and having to change or clean bags blinded from material is hazardous, requiring confined entry procedures. Dry fog systems require much less power and require little maintenance, usually amounting to water filter changes and occasional nozzle change-outs.

No explosive waste stream

Collection systems create a secondary waste stream that must re-enter the material flow or be treated as waste. When collected dust re-enters the process flow, often it creates another fugitive dust source. If the collected dust has explosive characteristics, such as coal, the dust collector can be a potential source of violent and deadly explosions.

The U.S. Chemical Safety and Hazard Investigation Board (CSB) reported on the hazards of combustible coal dust in 2006. Their investigation of dust explosions in general industry between 1980 and 2005 found that 281 combustible dust incidents killed 119 and injured 718 workers, and 'extensively damaged industrial facilities' in 44 states.

Best Demonstrated Technology for handling sub-bituminous coal

Fogging Systems were recently declared as a Best Demonstrated Technology (BDT) for coal handing equipment used on sub-bituminous and lignite coals by the U.S. Environmental

Figure 4. Fogging systems such as the Dry Fog system has been designated a Best Demonstrated Technology by the U.S. Environmental Protection Agency (EPA).

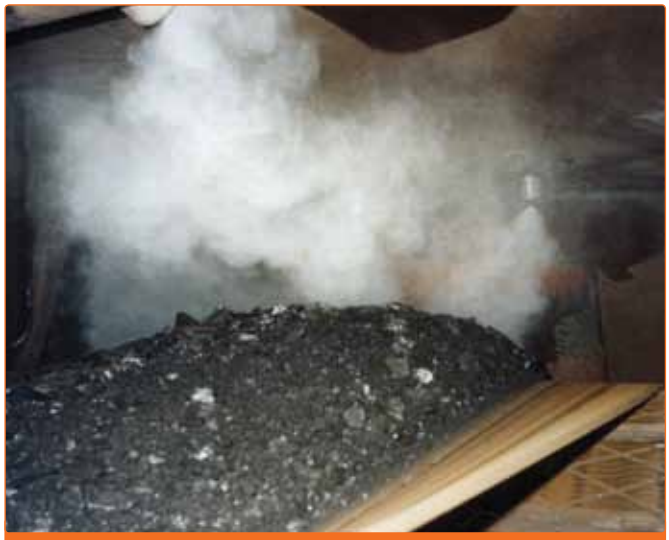

Figure 5. Using fogging systems on infrastructure such as coal conveyors also reduces the fugitive dust's explosive potential.

Figure 6. DustTamer can also be used as a stand-alone wind fence system, as shown here, to reduce air movement across a material stockpile.

Protection Agency (EPA). BDT, as defined by the EPA, is the most effective commercially available means of treating specific wastes, in this case fugitive dust emissions. Public testimony given to the EPA on fogging systems has confirmed that Dry Fog can be the most cost effective dust control system available.

The BDT designation was due in part to the supportive testimony of representatives from Powder River Basin, Wyoming coalmines, PRB coal-fired plants, mining associations, the Air Utility Group, and various state air regulators. Representatives from PRB coalmines and power plants testified that fogging systems have dramatically reduced capital and operating cost, while simultaneously increasing the efficiency of dust control. One PRB coalmine presented a detailed cost analysis of competing dust control technologies. The study concluded that, over a 30-year life cycle, the total ownership cost of dust scrubbers was 50 percent more expensive, and replacement baghouses were 400 percent more expensive than using atomizing fog for dust control.

DustTamer™ wind screen systems

The second technology by DSI is a porous fabric wind screen material called DustTamer™, which can be used in several ways to slow the movement of air. As an example, DSI uses DustTamer to reduce the ambient airflow across dump hoppers, and to contain the dust-fog mixture inside the hopper by surrounding the hopper on three or four sides with the screen.

Wind screen systems work better than a solid structure in these applications, because of the fabric's specially designed porosity. Approximately 30 percent of the ambient air will bleed though the fabric, helping to equalize the pressure differential from one side of the fabric to the other.

Solid structures generally have openings for equipment access, dumping or stacking activities. These open areas can be great sources of dust creation by allowing air to move from a high to low pressure area, increasing velocities and the amount of airborne particulate.

DustTamer can also be used as a stand-alone wind fence system to reduce air movement across a material stockpile, or to reduce air movement along an open conveyor or transfer point. The fabric is knitted from an industrial-grade woven polyester, resistant to UV rays, in-climate weather and temperature extremes. Its unique ability to be stretched and tensioned to over 500lbs of pull prevents 'flagging' of the material, and consequential damage due to abrasion.

The standard fabric width is 90cm (35.5 inches) wide and is available in a forest green color. The fabric is generally installed horizontally, spanning support columns as wide as 20 feet apart.

ABOUT THE AUTHOR

David Gilroy has over 20 years of experience utilizing Dry Fog and DustTamer wind screen systems. As Sales Manager, he coordinates domestic and international sales activity, conducts site surveys, designs systems, supervises installation and provides system start-ups and training. DSI President Glen Warrington first presented much of the information in this article in 1979, in a white paper entitled *Using Agglomerative Dust Suppression for Dust Control*.

ABOUT THE COMPANY

Dust Solutions Incorporated (DSI) manufactures Dry Fog and DustTamer systems for marine terminals; and power plants including coal, pet coke, and biomass, mines, mineral processing facilities, pulp and paper, wood products, hazardous waste, and bulk handling industries. They offer their products and services worldwide. DSI maintains two offices in the United States: Beaufort, South Carolina (HQ) and Vancouver, Washington, U.S.A. (Sales & Service).

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