Dry Fog Dust Suppression VS Conventional Methods

Why MARC Technologies DSI Dry Fog Dust Suppression outperforms misting, dust collection and chemical methods for controlling particulate dust

PRINCIPLES OF OPERATION

Air pollution control became a national issue both in the United States and Canada in the mid to late 1960’s, and soon after in Australia. To comply with the new air quality standards, the crushed stone industry began their search for a technology that was cost permissive and met prescribed environmental and occupational exposure regulations without sacrificing plant performance. One technology came to the forefront:

It was discovered that fugitive dust abatement can be accomplished by utilizing extremely fine atomised water droplets or simulating fog that naturally occurs in nature in industrial applications (“Dry Fog”). The use of “dry fog” enabled the mining and bulk handling industries to achieve remarkable results in extreme environments, meet stringent air pollution codes in the world, while remaining cost effective.

CHALLENGES WITH CONVENTIONAL TECHNOLOGY

Fabric filter systems usually provide very high collection efficiencies, and are not generally limited by high temperatures, however a minimum temperature limitation caused by dew point considerations can cause blinding of bags, and therefore, high maintenance costs. Baghouses, if properly designed, provide high collection efficiencies, though the upfront cost can be prohibitive. The finer the particulate captured, the higher the energy requirement, and the lower the efficiency.

Wet scrubbers utilise water “sprays” to collect and remove particulate matter, but can face issues with the secondary water pollution problem, created when particulate is trapped in a liquid film and washed away. They can also have a limited capability for controlling fine particulates, because most depend on some form of inertial collection as their primary method of capture. Because collection efficiency decreases rapidly as particle size is decreased, it becomes necessary to greatly increase the energy input to improve the collection of smaller particulate.

Traditional water spray dust suppression systems are the least expensive, but present problems which make them impractical for most crushing and screening plants. Water is used to dampen the surface area of the product to prevent dust from becoming airborne. Chemical wetting agents may be added to increase the surface covering capability, and large amounts of water need to be added to the product to achieve full coverage. Even though the initial setup can be low, drawbacks of these systems can include the following:

• the application of a wetting agent may be precluded by product specifications for some critical materials
• the system is ineffective when dust is created by a product consisting primarily of fine particles
• when secondary plant production requires fine screens wetting will cause blinding
• when water quality is not suitable for mixture with a wetting agent
• Issues when the product is extremely hygroscopic.

Goals for an effective system for the control of fugitive dust:

1. Be efficient enough to meet air pollution codes
2. Be designed for practicality
3. Have a low initial capital cost
4. Carry the lowest operating cost
Research undertaken at a University in Sweden proved it was possible to actually filter fugitive dust out of the air using the extremely fine atomisation of water, without wetting agents and without wetting the dust source.2

If the water droplet diameter is much larger than the dust particle, the dust simply follows the air stream around the droplet, and little or no contact occurs. If, on the other hand, the water droplet is similar in size to the dust particle, contact and agglomeration occurs, and the probability of impactation increases as the size of the water spray droplet decreases. This explains why water “sprays” are not very effective on respirable dust. Typical droplet sizes are 200 to 600 microns, where respirable dust can be less than 5 microns.2

Another significant phenomenon can occur when DSI Sonic nozzles are used in dust suppression. The effect can be compared to an electrostatic precipitator in which dust particles are charged and then collected on plates of opposite charge. It was found dust particles created in a crushing plant generally carry a certain negative potential, and the water droplet produced by ultrasonic atomisation carries a slightly positive charge. This resulted in the probability of a collision between a water and a dust particle being greatly increased from the spacial probability, implying the need for fewer water droplets to ensure a desired efficiency.3

Q. Does dust fogging use less water than other systems?
A. YES. The DSI Nozzle can cover half the size of a football field in fog with a single gallon of atomised water.

Q. Is the system easy to install?
A. YES. The system is modular, expandable and can be retrofitted into a facilities existing infrastructure.

Q. Are other companies using the DSI Dry Fogging solution?
A. YES. These fogging systems have been successfully installed and are operational in some of the largest mines in Australia.

Q. Can dry fogging work in cold weather conditions?
A. YES. A critical freezing mass for water droplets is above a 20 micron diameter droplet. Because Dry Fogging produces droplets in the 1-10 micron range, the droplets will not freeze. The only problem is during the transportation of the water and air to the nozzle, which is overcome by a specialised insulation and heat tracing systems, in conjunction with a post purge system that removes all of the water from the water lines and headers upon shutdown.

This unique patented nozzle is a stainless steel air driven device for atomising liquids by introducing them into a field of high frequency sound waves. The air is accelerated beyond the speed of sound through a convergent/divergent orifice, and ultrasonic technology creates a shock wave at a high frequency. These shock waves are then passed into a resonator cavity where they are reflected back to amplify subsequent waves. The result is an intense field of sonic energy focused between the nozzle body and the resonator cavity. This results in the liquid being vigorously shattered into very fine 1-10µm droplets. Because they don’t use hydraulic pressure, the nozzles operate at a very low liquid pressure. The nozzles are self-cleaning, and particles larger than the liquid that could cause internal blockages are filtered out easily.

For more information on how this technology can be used to combat your dust problems, please call MARC Technologies on (08) 9232 0430.


## COMPARISON

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<th>COMPARISON</th>
<th>DSI DRY FOG</th>
<th>DUST COLLECTOR</th>
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<tbody>
<tr>
<td>Dust Suppression Efficiency</td>
<td>99% (Droplet sizes ranging from 1-10µm clearing all PM2.5 and PM10 dust particles)</td>
<td>90-99% (depends on the design and type of collector)</td>
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<tr>
<td>Cost</td>
<td>Medium (requires air compressor)</td>
<td>High</td>
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<td>Installation Cost</td>
<td>Low</td>
<td>High</td>
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<td>Maintenance Cost</td>
<td>Very Low ($7 a month water filter)</td>
<td>High (Changing of filters and repairs on the motors)</td>
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<td>Experience in Market</td>
<td>30+ years in dust suppression for industrial clients, over 450 different clients throughout Asia, Africa, Europe, North America, South America, India, &amp; Australia.</td>
<td>Depends on the company installing it</td>
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