

Wet Dust Control System Fundamentals

Wet systems are used for:

- **Dust prevention:** Humidity/moisture content in the material is increased to prevent dust from becoming airborne
- **Dust suppression/capture:** Humidity/moisture is added to the air to capture dust particles that are already airborne

These systems use spray nozzles to apply water and/or chemicals such as wetting, foaming and binding agents to dust particles. However, the system configuration varies depending on the goal – dust prevention or airborne dust suppression. Most operations require both prevention and suppression to effectively control dust. See Figures 1, 2 and 3. It is important to understand the differences between prevention and suppression systems to ensure proper spray nozzle specification and operation.

Typical Operations

Operations requiring dust prevention:

- Dumping
- Transport
- Transfer points
- Stockpiling/reclaiming

In these operations, moisture can be applied to the material when it is stationary or moving or both.

Operations requiring airborne dust suppression:

- Conveying
- Shearing
- Continuous mining
- Crushing and screening
- Dryers
- Transfer points
- Packaging/filling

Nozzles produce drops to collide with dust particles that are already airborne. The moisture weighs the particles down so they are returned to the material source or ground.

As discussed previously, both dust prevention and dust suppression may be required. The type of system will depend on the dust source and the stage in the processing operation.

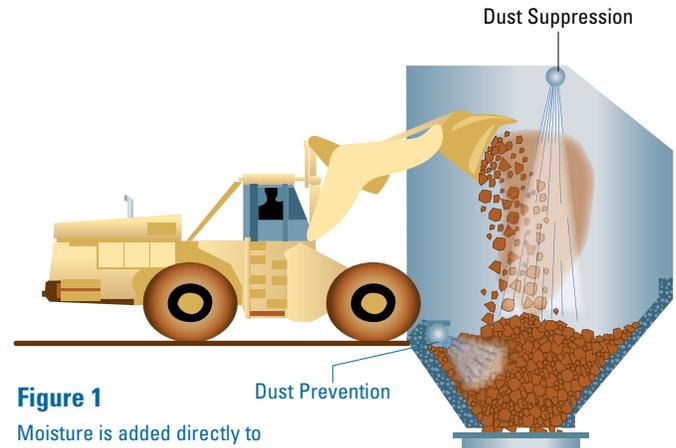


Figure 1

Moisture is added directly to the material to prevent dust from becoming airborne. Airborne dust particles are also captured by sprays during material unloading.

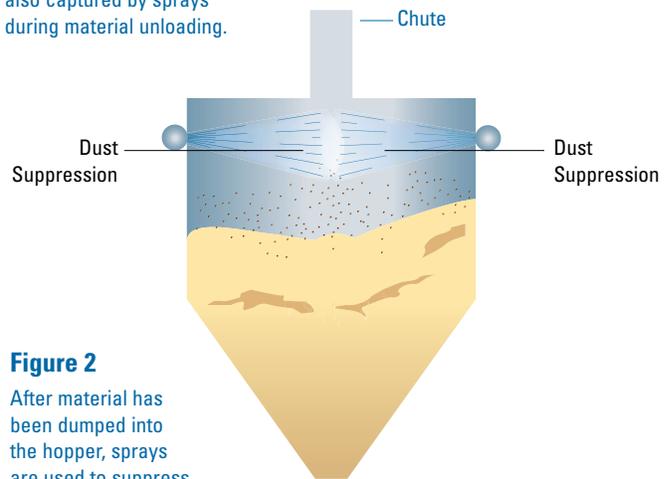


Figure 2

After material has been dumped into the hopper, sprays are used to suppress the airborne dust.

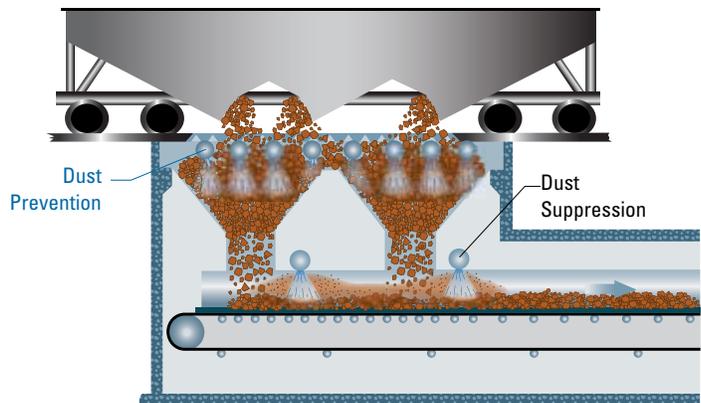


Figure 3

Moisture is added to the material to prevent dust as it is transferred from the hopper car to the hopper bin. Sprays are also used to capture airborne dust as the material moves down the conveyor line.

Start with These Key Considerations

Fundamentally, wet dust control systems are the same – all use water sprays. However, that's where the similarities end. System configuration starts by answering a few critical questions.

If you need to prevent dust:

What material are you adding moisture to?

Materials will respond to moisture differently. It is important to understand exactly how much moisture to add. Too little moisture means you'll still have a dust problem. Too much moisture and the integrity of the material may be compromised and quality issues will result. For example, when applying moisture to ore, adding one gallon per ton provides adequate wetting and does not cause process and production problems. Too much moisture also means sludge and mud and frustrating, costly and potentially dangerous maintenance problems.

The material will also determine whether chemicals should be added to the water to improve suppression and/or lower overall application costs. Coal, for example, repels water and usually requires the use of chemical additives to increase absorption.

Also, consider the processing stage. Most dust particles created during breakage are not released into the air. The dust stays attached to the surface of the broken material. Adequate wetting is critical to ensure dust stays attached. Keep in mind that partially processed minerals and coal may be more sensitive to moisture than unprocessed material.

Is the material moving or stationary?

Drop size and spray angle can affect surface coverage when spraying stationary material.

Drop size and drop velocity affect coverage when spraying moving material. These factors must be considered when selecting and positioning spray nozzles.

If you need to capture airborne dust:

What is the particle size of the dust?

Dust capture is most effective when dust particles collide with water drops of an equivalent size. (See page 8 for drop size information.) Drops that are too large won't collide with the smaller dust particles and drops that are too small evaporate too quickly and release the captured dust particles. See Figure 4. Understanding the particle size of the dust is critical in effective system design.

You can use these general guidelines regarding dust particle size. However, further research may be necessary depending on the material and stage of the material in processing.

Particle diameter in microns:

- Ground limestone: 10 to 1000 μm
- Fly ash: 10 to 200 μm
- Coal dust: 1 to 100 μm
- Cement dust: 3 to 100 μm
- Carbon black: 0.01 to 0.3 μm
- Pulverized coal: 3 to 500 μm

Where is the dust?

Capturing airborne dust with water sprays is most effective in areas with little air turbulence. Depending on the environment, enclosures may be required.

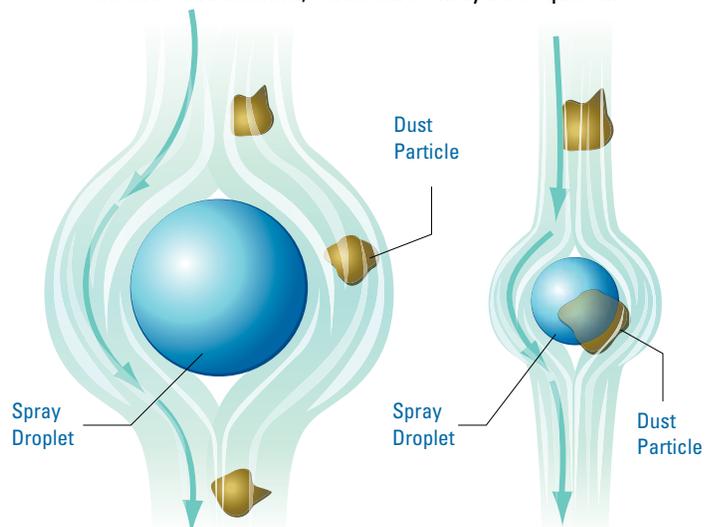


Figure 4

If the drop diameter is larger than the dust particle diameter, the dust particle will follow the air stream around the drop. (Shown left.) If the diameters of the drop and the dust particle are comparable, the dust particle will follow the air stream and collide with the drop. (Shown right.)

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General Wet Dust Control Considerations

Will the dust be returned to the product stream?

If so, the degree of wetting is especially important to avoid quality problems.

Is rollback dust a problem?

Rollback dust usually comes from under the dumping mechanism on front-end loaders, crushers, grinders, cutting heads and entrances to scrubbers. Rollback dust can be a significant problem and may require a separate system for suppression.

What is the quality of the water?

Poor quality water can be very problematic in many dust control applications. Strainers may be required – even when using a clean water supply because contaminants can be introduced to the water from eroding pipes. Poor water quality will also require more frequent nozzle maintenance, increase the nozzle wear rate and shorten service life.

Where will the system be installed?

If freezing temperatures are possible, heaters and floor drains should be considered. Spray equipment may need to be winterized.

If wind is a factor, nozzles that produce larger drops are better able to resist drift and should be used.

How important is water conservation?

Water conservation is no longer optional in most areas. It is important to specify nozzles that minimize overspray and water waste.

Controls should be used to ensure the system is active only when needed. Many options are available, ranging from simple solenoid valves for on/off control to sophisticated spray controllers that monitor a wide range of operating conditions and make automatic adjustments.

Is compressed air available?

Air atomizing nozzles mix fluid and compressed air to produce very small drops. Small drops evaporate quickly and are desirable for use in operations where wetting is needed but excess moisture cannot be tolerated. Small drops are also required when capture of small airborne dust particles is required.

What is the spray solution?

- Plain water systems are typically the least expensive and easiest to design and implement
- Adding surfactants to water will lower the surface tension and allows better interaction between water and certain types of dust that resist water absorption
- Foam systems use less water but usually require compressed air
- Binders agglomerate particles together after the moisture evaporates. However, binders can cause clogging and build-up on nozzles, conveyors and other equipment. Water-soluble binders can cause environmental problems should run-off occur

