

AKJ Industries
Dust Control & Belt Deicer Programs

Background

Fugitive dust is caused by small particles created from material impact (transferring, crushing, breaking) and wind erosion. Particles less than 200 microns become airborne from air displacement in the transfer systems or wind. Dust particles less than 10 microns are respirable and create a health hazard.

Handling of a material creates opportunities for the dust particles to become airborne and become a fugitive emission. This creates health, housekeeping and safety issues.

The percent moisture of the material and the amount of fines present, impact dust levels. Typically, at moisture levels above 8% dust will not be a problem. At moisture levels below 4%, dust will be significant.

Dust challenges vary depending upon the material being transferred. As an example, western coal is more friable than eastern coal and has less surface moisture. As such, western coal is dustier than eastern coal.

Many materials (especially coal) do not want to be wetted by water alone. This is due to the material and water having the same electrical charge, and repelling each other (much like trying to put two magnets together), and the difference in size between the dust particle and the water droplet. This can be overcome by “drenching” the material, but this can have a negative impact in the handling system (chutes plugging, belt tracking, freezing problems), and create costly BTU penalties in burning the treated material.

The recent emphasis in changing to western coals, coupled with new environmental and health regulations, has resulted in the need for dust control programs that “make water work better”, with lower water addition rates. Information on AKJ Industries dust control programs follows.

Wet Spray versus Foam

Options for dust control include wet spray and foam. Wet spray programs involve mixing a surfactant(s) with water such that the resulting solution contacts the material being treated in a manner such that the dust is controlled and the amount of moisture that is added is minimized. Foam programs involve mixing a surfactant, water and air such that the resulting foam contacts the material being treated to control dust and minimize the amount of moisture addition. Both programs work to control dust.

Dilution ratios refer to the amount of product that you add to a volume of water. As an example, a dilution ratio of 1000:1 means that you add 1 gallon of product to 999 gallons of water. Depending upon the product selected, and the material being treated, dilution ratios for wet spray programs will vary from 250:1 to 5,000:1. For foam programs, dilution ratios will vary from 50:1 to 200:1, depending upon the water hardness and quality of foam desired.

Application ratios refer to the amount of solution (or foam) that is applied to the material to control dust. Typical application rates are 0.2 to 1.0 gallons of solution per ton of material. Most plants will apply 0.4 to 0.6 gallons per ton. This equates to 0.16% to 0.25% moisture addition.

In the past the use of foam allowed plants to control dust with lower solution application rates, and therefore lower moisture levels and lower costs. This is no longer true. New surfactant technology allows wet spray programs to perform at equivalent application rates, with no loss in performance. Since the dilution ratio is much higher with the wet spray program, costs are lower than with the older technology foam programs.

In plants that currently have foam systems in use, the benefits of wet spray can be demonstrated easily by turning off the compressed air, changing the nozzles to wet spray nozzles, leaving the water flow the same, reducing the amount of chemical applied and observing system results. In some cases the nozzles may have been in the wrong locations and will need to be changed in order to realize the total improvements in results.

Residual products refer to formulations that include material that binds fines together after the initial moisture addition has dried. The most frequently

used residual material is lignin. The purpose is to reduce the number of application points required, and to provide dust control on stack out material.

Program Selection

Materials vary in their reaction to different surfactants. What works well on western coal, may not work well on eastern coal. For that reason, it is a good idea to get a sample of the material to be treated in order to conduct a sink test. Sink testing involves dropping a known volume of material onto the surface of water contained in a beaker. The time required for the material to “sink” is compared using various products, at various dilution ratios, to water alone. It is also very helpful to have a sample of competitive products for comparative purposes. Sink tests provide a quick, inexpensive and repeatable methodology to assist in selecting the best product and application recommendations.

Dust control is both an art and a science. The science part involves selecting the right product for the application, as noted above. The art part involves selecting the proper application points, and designing reliable equipment that matches the system requirements. System surveys must be conducted prior to making final recommendations.

Equipment options are numerous. It can be as simple as the use of a by-pass cartridge feeder for Coal Soap, or as complex as a load following system, treating multiple crushers with windmilling capabilities. Load following means that the system measures the flow of the material being treated and adjusts both the water and chemical to match this flow. Windmilling refers to running a crusher empty. Dust is generated when this occurs and AKJ’s systems can be designed to treat for this dust.

Equipment capital and installation costs can be covered in a number of ways. AKJ prefers way to sell the equipment to the end user complete with a maintenance agreement. Leasing, lease/purchase and chemical up-charge are additional methods that AKJ will provide where purchase is not a viable option.

Results can be evaluated as simply as using visible observations, using before and after pictures or using an instrument such as a Dustrak Monitor. The Dustrak Monitor gives an instantaneous reading of respirable dust

levels. Collecting of “before and after” data is used to calculate the effectiveness of the program.

Finally, use of a dust suppression program can only do so much. It is important that plants maintain the mechanical aspects of their equipment. Belt scrapers, side wipers and door seals are an important part of controlling coal spillage, and therefore dust.

Underground Dust Control

Underground dust control differs from dust control in handling systems (unless you are treating a crusher, stage loader or belt head) in the amount of water that is applied to the material, and how it is done. Water sprays apply water to scrub the air and treat the coal. Water addition rates are much higher (gallons per ton) than on above ground applications, so dilution ratios are also higher (500 to 5000:1 for liquid products). Sink testing is still a good means of selecting a product, but not a reliable method of determining the dilution ratio; dilution ratios can typically be higher than indicated by the sink tests.

Treatment programs can be as simple as using Coal Soap #10 in a cartridge feeder, to using a foam program with a “Conditioning-following” Feed System on a longwall stage loader.

Coal Soap #10 is a solid surfactant product designed for use on continuous miner units. The material is applied using a cartridge feeder where the product is slowly dissolved by flowing a by-pass stream of water through the cartridge feeder. The amount of the flow is controlled by a valve at the top of the feeder. A typical miner section will use a water flow of 40 gpm. At this flow rate, the continuous miner will use one to two cartridges per shift.

The “Condition-following” Feed System is unique to AKJ Industries. The theory is that the same amount of dust is not generated all the time in the longwall mining process - the harder the equipment works, the more dust is generated. The “Condition-following” Feed System takes a reading from the power center and adjusts the chemical feed rate based on the number of amps being drawn. This controlled method improves results and reduces costs.

Highwall Miner Systems

Highwall miners recover coal from strip mine highwalls. They basically operate like a continuous miner entering the coal face of the highwall, followed by a conveying system to remove the coal. The coal is stacked out, generating dust.

Water is applied to control the dust and results typically are not adequate with water alone. Additionally, due to the miners operating in remote locations, water is costly and at a premium.

AKJ Industries has developed a dust control system for highwall miners using Coal Soap #10 technology. The application equipment can be mounted on the highwall miner. Depending on the system needs, the unit can be heat traced and insulated and include a water booster pump. Use of this system will improve dust control and reduce the amount of water needed, which reduces costs.

Car Top Binders/Coal Pile Sealants

Some mines are required to treat coal for dust control in transit. A common way of doing this is to utilize sealant material, such as resin or latex. The same technology works for sealing coal piles to control wind blown dust.

Application rates are product, material and conditions specific, i.e., length of time the dust control must be provided, material being treated, etc.

Dust Control Calculations

An example of dust control calculations in these types of conditions follows;

Basis: 10,000 tons/day, application rate 0.5 gallons per ton, dilution ratio 500:1, cost per lb of product \$1.03, product density is 8.4 lbs/gallon

10,000 tons/day x 0.5 gallons/ton = 5,000 gallons of solution per day

5,000 gallons @ 500:1 dilution ratio = 10 gallons per day of product

10 gallons/day x 8.4 lbs/gal x \$1.03/lb = \$86.52/day

\$86.52/day divided by 10,000 tons per day = \$0.008652 or 0.8652 cents/ton

Road Dust Control

Mine haul roads generate dust that creates a safety hazard, increases vehicle maintenance, increases road maintenance costs and can cause public relation problems. AKJ Industries has road dust control programs that solve many of these problems.

Surfactant products, such as Coal Soap #10 on fill lines to the water trucks, work by providing reduce surface tension of the water. This effect allows the water to penetrate into the soil, reducing loss of water to evaporation and providing more effective dust control. Improved penetration reduces the frequency of applications required to maintain adequate control.

Calcium chloride based products, such as RDS-16, work by binding the fines in the road surface and drawing moisture from the atmosphere to replenish the dust control. RDS-16 is a blend of calcium chloride (binds fines/draws moisture) and surfactant (provides penetration into the road surface). Typically, it is diluted 1:1 with water and applied at a solution rate of 0.4 gallons of diluted material per square yard of road surface. The road should be scarified prior to application. The road may be “touched up” at higher dilution ratios after it has once been treated as noted above,

Petroleum resin based products, such as RDS-78, work by binding the fines into a hard surface resistant to rain. RDS-78 is a blend of petroleum resins (binds fines) and surfactant (provides penetration into the road surface). Typically, it is applied as noted for RDS-16 above (although some plants chose to dilute the material more and treat more frequently). The comments relative to “touch up” apply to RDS-78 also.

Application can be done using the mines equipment or AKJ can contract to apply the material for them. AKJ can even ship material that has been pre-diluted to the proper level for direct application.

An example to illustrate calculating the amount of product follows;

Basis: 1 mile of road, 30 feet wide, using RDS-78

1 mile x 1760 yds/mile x 30 feet/3 feet per yard = 17,600 square yards
17,600 square yards x 0.4 gallons solution per square yard = 7,040 gallons
7,040 gallons @ 1:1 Dilution Ratio = 3,520 gallons of RDS-78

Belt Deicer

Conveying systems moving coal in wintertime conditions often encounter problems with water freezing on belts which results in slippage of material. AKJ Industries has a belt deicer program that is effective in solving these problems.

Ice-Trol 941 is an extremely effective belt deicer that melts existing ice and prevents further build up. It should be applied to the belt in a light coating. The process is repeated as often as necessary to avoid slippage. Ice-Trol 941 has a freeze point of minus 50 degrees F.

The most cost-effective means of applying Ice-Trol 941 is to utilize a SCS-2000 "Smart" Conveyor Deicer System. This system is designed to automatically apply a light coating of belt deicer to the belt at a preset temperature. As the temperature drops, the frequency of application increases. Use of this system assures results, reduces manpower requirements and can reduce chemical usage by as much as 50%.