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Technology: Coal Dust Solutions

New Technology and Programs Revealed to Help Relieve the Coal Dust Problem

By James A. Marcrum and Trey Cranfill of AKJ Industries, Inc.

Dust from coal mining and transportation has become an industry cocktail party topic of discussion — of course, not quite up there with the cost of gasoline, but ever more popular. The coal dust problem is discussed in numerous news reports ranging from worker health and safety to air quality in and around train tracks. Articles even go as far as listing coal dust as a contributing factor in coal mine disasters around the world.

People that live along railroad tracks and roads used to transport coal bring up the subject in town meetings and in local newspapers. Dust falling onto railroad tracks is sometimes blamed in car derailments due to ballast draining problems.

Representatives in Washington have several bills on the table aimed to solve the dust problem from mine safety to explosive concentrations of all kinds of dust.

History

Fugitive dust is caused by small particles created from material impact 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.

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

Many materials, especially coal, defy being dampened by water alone because they both have the same electrical charge and repel each other. Drenching the material can counter the repelling effect but can have a negative impact on the handling system and create costly BTU penalties in burning the treated material.

Methods of Water / Chemical Mitigation of Dust

The recent emphasis on coal dust issues and energy efficiency create a need for dust control programs. Options for dust control include wet spray and foam programs. Wet spray programs involve mixing surfactants with water. The resulting solution contacts the material being treated in a way that controls the dust and the amount of moisture added is minimized.

Foam programs involve mixing surfactants, water and air such that the resulting foam contacts the material being treated to control dust and minimize the amount of moisture addition.

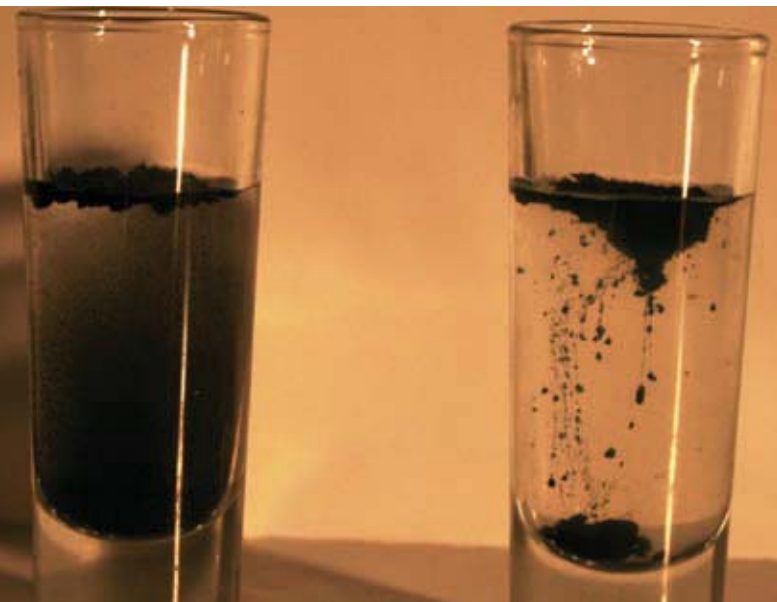


Untreated and treated coal after “mixing” in a high speed blending. No dust is generated in this test when treated with AKJ DC-2008.

In the past, the use of foam allowed plants to control dust with lower solution application rates, and therefore lowered moisture levels and costs. But these benefits no longer exist. New surfactant technology allows wet spray programs to perform at equivalent application rates with no loss in performance. Since the dilution ratios are normally much higher with the wet spray program, costs are lower than with the dated technology foam programs.

In plants that still use foam systems, 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 improvement in results.

A third hybrid, and environmentally clean, method was recently introduced by AKJ Industries, Inc.: EnviroGreen Dust Control. This hybrid is “foam without the fuss” in that the applied solution of water and chemical product sits on the surface of the coal. It stays where it is sprayed without the need for air injection. This unique, patent-pending product works by allowing a solution of product to effectively impact dust particles to provide point of application dust suppression. The dust particles are captured by the solution that is then mixed and settles on bigger pieces of the material being treated. The chemical/water solution resists being wicked into the internal surfaces of the larger particles resulting in the applied moisture lasting longer before it dries completely. This provides more effective dust control than products that do not have this feature.



Fine, powdered coal “wetted” with water alone floats on the surface and disperse to completely cloud the glass. Same type dust is “wetted” with water/DC-2008 and fine particles bind together to form larger, heavier particles that sink and never cloud the glass. blending. No dust is generated in this test when treated with AKJ DC-2008.

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AKJ's new technology also provides for downstream dust mitigation due to its hydroscopic nature where it is actually reactivated as it absorbs new moisture from the surrounding humid air for days after it is first applied.

Program Selection and Monitoring Considerations

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 test the dust-causing material using all available processes and chemicals. A new methodology of routinely accomplishing this sort of testing was developed by the Mid-Atlantic Technology, Research & Innovation Center (MATRIC) for AKJ Industries, Inc. Several approaches were investigated in the process of developing a method that would allow a quantification of the amount of dust generated from a sample of a solid mixture. Key considerations were:

1. Reproducible method
2. Capable of being performed in a laboratory
3. Does not require large amounts of sample
4. Can be used with a variety of solid materials
5. Rapid acquisition of data

The developed test protocol centers around a test apparatus that consists of placing a modified funnel with filter paper over a sample to be tested, drawing air through the funnel with a vacuum and determining the weight gain of the filter paper after a standard period of time. The sample is also vibrated during the test.

Dust control is both an art and a science. The science part involves selecting the right product for the application after conducting a screening as discussed 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 soap type surfactant products, or as complex as a load following system, treating multiple crushers with "windmilling" capabilities that run a crusher empty.

Results can be easily evaluated by user observations, before-and-after pictures or an instrument such as DustTrak Particulate Monitoring. The DustTrak Monitor gives an instantaneous reading of respirable dust levels. Collecting of before-and-after data is used to calculate the effectiveness of the program.

Procurement

Restructuring of the utility industry has caused power companies to reconsider their conventional ways of conducting business. They must now consider all options to reduce costs and redeploy capital. In response to these changes facing utilities, the NexGen Coal Services group provides a range of services

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An untreated road creates clouds of coal dust.

The 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.



Haul road is spray treated to prevent coal dust.

Underground Dust Control

Unless treating a crusher, stage loader or belt head, underground dust control differs from dust control in handling systems 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 those of above ground applications so chemical dilution ratios are normally also higher.

Treatment programs can be as simple as using a solid soap type treatment in a cartridge feeder to using a foam program with a “conditioning-following” feed system on a longwall stage loader.

AKJ’s 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. The theory behind it 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.

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 use sealant material, such as resin, latex or the new hybrid-type product mentioned above. The same technology works for sealing coal piles to control wind blown dust. Application rates are product-, material- and conditions-specific.

NCTA, coal companies and electric utilities are involved in an ambitious testing program to understand the dynamics of coal dust while being transported by rail. Results from this test work are expected by the end of 2008.

Road Dust Control

Mine haul roads generate dust that creates a safety hazard, increases vehicle and road maintenance and can cause public relation problems.

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Surfactant products work by providing reduced 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 work by binding the fines in the road surface and drawing moisture from the atmosphere to replenish the dust control. The road should be scarified prior to application. The road may be “touched up” at higher dilution ratios after being treated with concentrated calcium chloride solution.

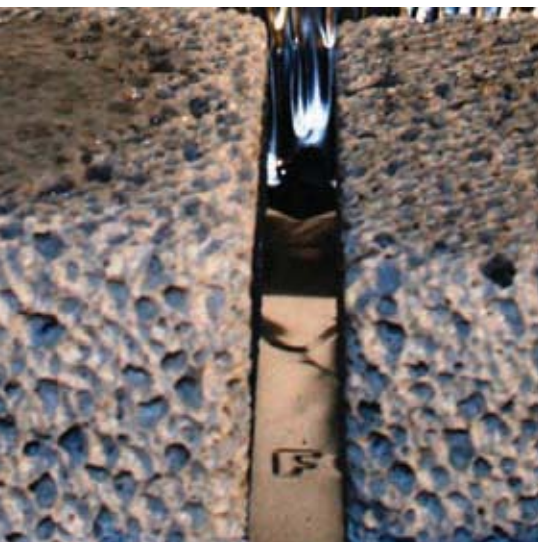
Petroleum resin-based products work by binding the fines into a hard surface resistant to rain. Typically, it is applied as noted for calcium chloride applications.



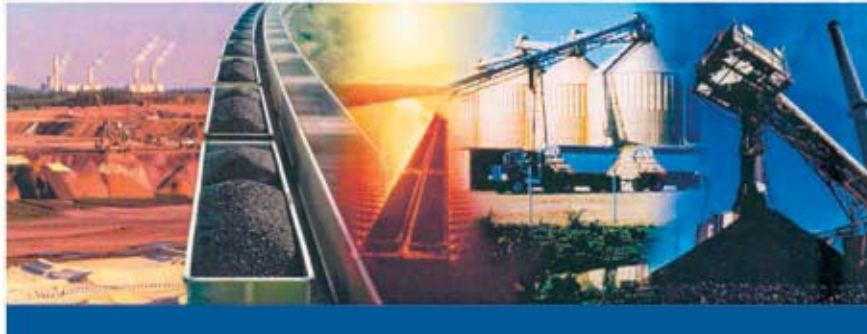
Treated road does not create coal dust.

The new hybrid products are also finding uses in treating haul road dust problems. The hybrids combine the hydroscopic properties (as found in the salt products) with the particle binding properties of the petroleum products without the corrosion of the former and the high costs of the latter.

The grill stone illustrates the “foam without the fuss.” DC-2008 stays where it’s sprayed on the surface of the stone pools, while water plus surfactant spreads out and soaks into the stone.



SAVAGE Coal and Power Generation Integrated Supply System



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