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PROVEN SOLUTIONS GLOBAL REACH



Reducing dust emissions in underground coal mines using DUSTGRIP[®] dust suppressant products

The need for dust suppressants in the mining industry continues to increase due to health, safety, and regulatory reasons. Whether on a surface or underground mine, dust and other particulates are a constant safety concern for those working in the mining industry. These hazards can cause a wide range of issues including respiratory illnesses, exposure to noxious gases, and operational risks.

On August 1, 2016, Phase III of MSHA's respirable dust rule went into effect lowering the concentration limits for respirable coal mine dust from 2.0 milligrams of dust per cubic meter of air (mg/m³) to 1.5 mg/m³ at underground and surface coal mines. Within the dust levels recorded, quartz must be .10 mg/m³ or less of the total make up. If high quartz percentages are found a reduced total respirable coal dust standard and specific operational changes can be enforced to protect workers from the elevated levels.

CHALLENGE

A need for a dust solution developed with a coal mining operation in Southern West Virginia located in the Eagle Seam, a very brittle, but hard cutting seam, known for its dry and dusty conditions with a bottom consisting of a sandy shale to sandstone. The average coal seam height is 54" but this particular mine operates at an average height of 78" to accommodate the equipment size. Recently the operation had MSHA dust samples that were reported to be out of compliance.

While the samples recorded were .626 mg/m³, well below the MSHA standard of 1.5 mg/m³ for respirable coal mine dust, the samples' quartz percentage was nearly 21%, or .13mg/m³, 30% more than the MSHA allowed limit.

Due to the dust sample results, MSHA not only lowered the respirable coal mine dust standard for the mining company's Eagle Seam operation to .476 mg/m³, but also suspended the operation's 40' cut plan, and adjusted it to a 20' plan, until the quartz levels could be reduced.

At the time of the violation the mine conditions were sandstone top and bottom. Approximately 22-24" inches of sandstone were being mined, resulting in the higher quartz levels.

SOLUTION

With the reduced MSHA dust and quartz standards, as well as the suspended cutting plan, the customer asked Quaker Chemical Corporation ("Quaker") to help reassess their dust suppressant program and applications. Quaker suggested the implementation of a 4 step process to create a total solution for the customer's needs. The process included

1. Site audit
2. Recommendation
3. Implementation
4. Review and secondary audit

SITE AUDIT

Quaker begins every trial opportunity by sending a service representative to complete a thorough site audit and evaluation to determine the best solution for a customer



DUSTGRIP® JFP-95 – solid cartridge dust suppressant

need. This includes underground and above ground visits to assess the situation:

Determine what is causing the dust issues – whether it's where the dust originates (cutting face, drilling operation, crushing operation, etc.) or where the dust accumulates (road ways, conveyor belt lines, etc.)

Collect mine specific water and dust samples for laboratory analysis

Gather mine specifications – equipment used, water flow rates, pressures, height of coal, type of coal, mine conditions, operating schedule, manpower, etc.

Collect data and information from the customer on external factors

In this particular case, the mine was a continuous miner operation with a supersection in the Eagle Seam. The conditions were extremely dry and dusty with a mine bottom consisting of a sandy shale and sandstone. Water pressures would typically be 80 psi with a usage of 100-120 gallons per minute (GPM). The operation would average 550' of advance per day on (2) 9 hour shifts per day, 6 days per week production and maintenance on nights and Sunday. The section operated with "fishtail" ventilation, curtains, and scrubbers on each of the continuous miners.

It was determined that the dust issues were a result of conditions in the cutting cycle and needed to be treated at the working face. This was supported by dust level readings that were out of compliance on the miner operators. Additionally, samples of dust and water were taken from the operation so that a chemical analysis could be completed, and a recommendation made.

RECOMMENDATION

By assessing the situation and analyzing the data, the Quaker was able to propose a plan to reduce the mining



DUSTGRIP® JFP-95 manifold attached to a water car

operation's quartz level to be in compliance with the MSHA required limits.

It was determined that DUSTGRIP® JFP-95, a solid cartridge dust suppressant operating through a water manifold, was the best option. This product was well suited for the conditions of the mine and the management's desire to not add machinery, but rather "localize the additive". This would allow the mine to treat only the area where there was an issue, instead of the entire mine, lowering costs.

IMPLEMENTATION

As a result, the implementation phase consisting of an onsite trial and dust monitoring was initiated. Experience has taught that there is not a "one size fits all" treatment for a specific dust issue. A product must be experimented using a mine's specific conditions, machinery and practices to evaluate its overall effectiveness. In this instance, to meet the customer's needs, Quaker organized a trial with the recommended DUSTGRIP® JFP-95, dust suppressant, and also custom built a manifold to fit the customer's equipment. After letting the water circuit completely saturate with DUSTGRIP® JFP-95 dust suppressant, Quaker partnered with the mine to run a dust sampling period. Personal Dust Monitors (PDMs) were utilized to compare readings before and after the addition of DUSTGRIP® JFP-95 to the Continuous Miner operation. In this specific case, MSHA also ran samples to determine the quartz content and if the dust suppressant had any effect on the readings.

REVIEW AND SECONDARY AUDIT

After a solution is implemented a review and secondary audit is conducted by Quaker. The purpose of this step is to evaluate the effectiveness of the product, if it meets the customer's expectations, and if it is satisfactory to comply with federal regulations. This step can be supplemented with sampling and evaluations from federal bodies to determine if the mine is in compliance or if further action must be taken. These further actions could be adjustments to the dust suppressant concentration, or the recommendation of a trial with an alternative product. For this case study, DUSTGRIP® JFP-95, worked extremely

well and brought the mine back into compliance with the MSHA dust exposure standards.

RESULTS

When MSHA originally sampled at the mine in Southern West Virginia, the numbers below were recorded:

MSHA sample taken on miner operator before additive – Respirable dust sample- 0.626 mg/m³

Quartz sample – 20.8% or .13 mg/m³

Though the respirable dust was well below federal regulation, the high quartz content put the mine out of compliance and resulted in MSHA removing the mine's 40' cut plan and replacing with a 20' cut plan.

After adding the DUSTGRIP® JFP-95 dust suppressant to the water being supplied to the operations, the new dust samples were recorded as:

MSHA sample taken on miner operator after additive – Respirable dust sample- 0.278 mg/m³

Quartz sample – 7.4% or .021 mg/m³

By adding DUSTGRIP® JFP-95 to the water system the mine was able to realize a 56% reduction in respirable dust and an 84% in quartz content. After collecting these readings, MSHA reinstated the mine's cut plan back from 20' to 40'.

THE PRODUCT

DUSTGRIP® JFP-95 dust suppressant is a type of surfactant technology that comes in a solid, cylindrical form and is applied by adding to a water manifold built into the customer's main water line. The transportability of the manifold means that a customer can localize the dosing of the dust suppressant to only those areas where readings are out of compliance. The manifold can even be mounted on mobile equipment and connected to a flexible water supply line to treat cutting machines, roof bolting, or haul roads. Due to the small packaging of DUSTGRIP®



Left: Water sprays not functioning due to prolonged "scale" build-up; Right: Properly functioning sprays

DUST SUPPRESSION

JFP-95, the product can be easily stored next to the dosing system or carried to the area by a worker. The concentration can also simply be modified by increasing the amount of water flowing over the dust suppressant cylinder. This is done via a control valve that is part of the branched delivery line. If more dust control is needed, the valve is opened slightly to allow more water to flow over the cylinder increasing the concentration. Slightly closing the valve decreases the amount of water flowing over the cylinder, resulting in a decreased concentration.

The surfactants in DUSTGRIP® JFP-95 reduce the inherent surface tension of water from around 72 dynes/cm at 25°C (77°F) to 26.9 dyne/cm at 25°C (77°F), well under the level needed to attain maximum wetting of the dust (45 dyne/cm). When the surfactants dissolve, they lower the water's surface tension, enhancing the wettability of the water and its ability to form small droplets when sprayed under pressure through fine mist producing nozzles. These droplets collide with dust particles and are absorbed by them. As a result the dust particles bind together, which increases their overall mass and causes them to fall due to gravity.

DUSTGRIP® JFP-95 dust suppressant is designed to work in water at 35°F (1.67°C) to 85°F (29.4°C) effectively at flow rates up to 600 GPM. DUSTGRIP® JFP-95 has been proven to be a non-irritant through "in vitro" testing - where the product is tested on both ocular and dermal human cells. Additionally, DUSTGRIP® JFP-95 has reduced environmental impact, is biodegradable, non-toxic, and non-hazardous. It is also proven to reduce the build-up of calcium carbonate in water lines and sprays to make them operate more effectively without clogging.

Quaker Chemical maintains a full line of dust control products to suit the many applications found at mining operations, as well as a network of technical experts to implement those solutions. We support customers at the local level, on-site, one-on-one, our team of technical sales, laboratory development and manufacturing Associates bring unique value to the mining industry.

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DON'T GET LEFT IN THE DUST.

DUSTGRIP® KEEPS YOU WORKING HARD BY KEEPING DUST IN ITS PLACE.

When you work in harsh conditions, the last thing you need is dust getting in your way. Quaker's dust suppressant product line, DUSTGRIP®, helps support a safer work environment, improve worker health, and optimize operational efficiency by significantly reducing airborne dust. And with over 30 years of industry experience, you won't find a better partner, especially when new regulations come down the line. So team up with Quaker, and when work conditions get rough, we'll make sure the dust settles.

Trust a partner who knows the mining industry from the inside.

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