METHOD OF CONTROLLING ROAD DUST IN STRIP MINES

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Appl. No.: 13/345,234

Filed: Jan. 6, 2012

Related U.S. Application Data

Provisional application No. 61/430,601, filed on Jan. 7, 2011.

Publication Classification

Int. Cl. E01H 3/02 (2006.01)

U.S. Cl. .................................................. 427/136

ABSTRACT

The present invention is directed to an improvement in dust control methods used at strip mines. The invention is based upon super absorbent polymer used in combination with water. The polymer is premixed with water and is applied to the roads by use of a conventional truck capable of dispensing water. The super absorbent polymer provides water retention and can be re-hydrated by rain, dew, or additional tanker water. The method disclosed includes the step of: adding about 15 gallons of dry super absorbent water swellable polymer to each 2000 gallons of water placed within the water tanker, stirring the polymer into the water to form a mixture, and distributing the mixture over strip mining roads.
METHOD OF CONTROLLING ROAD DUST IN STRIP MINES

CROSS-REFERENCE TO RELATED APPLICATION


FIELD OF THE INVENTION

[0002] This invention is directed to the control of road dust, and in particular, to a method of controlling dust raised by the use of roads at strip mines.

BACKGROUND OF THE INVENTION

[0003] Strip mining is an effective procedure to recover rock, stone, gravel, slag, or other valuable resources. Strip mining, also known as surface mining, typically employs the use of earth movers for removal of an overlying soil deposit to expose the useful minerals beneath. Drag mine excavators and/or bucket wheel excavators are then used to extract minerals, the amount of which is only limited by the size of the mineral bed underlying. It is not unusually for a surface mine to dig hundreds of feet into the earth or extend for miles in length.

[0004] When strip mining, the underlying minerals must be transported within the mine site for efficient processing. With the efficiency of modern digging equipment, tons upon tons of mineral can be quickly excavated. The excavated material is transported from the excavation point to a central processing location by truck. The more mature the mine the longer the distance from the excavation location to the processing location. While the trucks are capable of transporting vast quantities of material in a single load, such trucks are large, heavy and capable of creating large amounts of dust as they are driven over the roads.

[0005] Typically the trucks carry the excavated material over roads built with aggregate from the mineral being unearthed. It is not practical to pave the roads at an excavation site as the excavation equipment is moved constantly and would require additional road building nearly every day which would interrupt the flow of digging which is planned for both efficiency in removal and in a pattern that emphasizes safety of the road’s underlying bed. Further, due to the weight of the vehicles, even a properly paved road would have a limited useful life. Further, excavation may be over large areas of land causing extremely long roads; or the excavation may dig deep into the earth wherein the roads may be steep to reach the processing facility.

[0006] A problem with strip mining to which this invention addresses is that the haul roads do not retain water so when trucks are driven over the roads they create large areas of dust. Dust is known to saturate the strip mine and surrounding area with unhealthy airborne particulates. The dust can damage, if not destroy, machinery. Because the minerals are moved from the location of mining to the processing location, the trucks are driven continuously over a road that is constructed there in between. The road will be made of the material that is most available in the location and commonly referred to as crushed aggregate. The heavy construction vehicles drive over the roads wherein the weight of the heavy trucks continually crushes the material into finer and finer material that can be easily lifted by the truck tires. If the strip mine is subjected to any wind, the dust can be transported very quickly to surrounding areas where it can be offensive to the neighboring community.

[0007] It is well known that dirt and dust indigestion into an engine can result in premature wear leading to costly maintenance or repair of the engine. When a vehicle is to be used in a high dust environment, special air filters are employed that are expensive to install and need critical maintenance to assure that no damage to the filter has occurred that would allow indigestion of the dirt and dust into the engine.

[0008] Dust damage is not limited to internal combustion engines, the operators of the vehicles are also susceptible to inhalation of dust. It has been found that inhaling of dust can lead to asthma and in instances of coal mining, chronic problems such as black lung disease. Depending where the strip mine is located, the dust can be transported over a large distances and affect neighboring communities. Unlike the machinery located in a strip mine which includes specialty equipment for handling airborne dirt, the cars, trucks, boats, motorcycles, planes, lawn moving equipment and the like found in the neighboring communities do not include the specialty filters found at the strip mines. In many instances even the conventional air filters are neglected which can quickly lead to the early demise of the machinery. Further, while the operators of the mine equipment are cognoscente of the problems that can be caused by dust and may even wear appropriate respiratory equipment, the average consumer in a surrounding town may not understand the damage that airborne dust is having on them, or cannot afford to purchase the appropriate respiratory equipment.

[0009] The control of dust is of such a concern both in damage to health and machinery, most every mine operation includes methods that attempt to control the dust. In particular, a basic yet productive method of controlling dust is by use of a conventional water truck that is driven over the unpaved haul roads. Water from the truck is dispensed over the road, the dust kept to a minimum as long as the water does not evaporate. It is not uncommon for a mine to spray 250,000 gallons of water a day over the hauls roads to control the dust. In addition to the cost of the water, the truck(s) needed for water distribution including maintenance, as well as the cost of personnel, makes the cost of dust control a sizable expense.

[0010] Thus what is needed in the art is an improved method of controlling road dust in a strip mine operation.

SUMMARY OF THE INVENTION

[0011] The present invention is directed to an improvement in dust control methods used at strip mines, rock quarries and mining operations of all types, road building, general excavation work. For simplicity in explanation, this primary example employed throughout this specification will be the strip mine environment, however, any of the above environments will benefit from the disclosure. In particular, the invention is based upon the application of a super absorbent polymer in combination with water to the haul roads of the strip mine. The super absorbent polymer is premixed with water and is applied to the roads by use of a conventional truck capable of dispensing water. The super absorbent polymer provides water retention and can be re-hydrated by rain, dew, or additional tanker water.
The super absorbent polymer can absorb and store many times its own weight in water. Properly applied, the super absorbent polymer will reduce the amount of water lost through percolation, evaporation and runoff thereby reducing the amount of water necessary to treat a given area.

Thus, an objective of the instant invention is to disclose an additive to tank water used for control of dust in the strip mines.

Another objective of the instant invention is to reduce the amount of water employed in the control of dust and provide a material that can be rehydrated with minimum amount of water.

Yet still another objective of the instant invention is dust control on the haul roads so that the operators of the mine vehicles can readily see the other mine vehicles using the roads.

Another objective of the instant invention is to increase the efficiency of the current dust control methods to lessen lung and machinery damage that can be caused by airborne dust.

Another objective of the instant invention to provide an improved method of treating dust on roads, the method including a polymer having anti-caking characteristics that allow it to be dispersed using conventional water distribution vehicles.

It is yet another objective of the instant invention to provide a method that gives lasting and repeatable hydration for gravel roads, including home and building construction in the western United States having a fine top soil.

Another objective of the invention is to provide a method of controlling dust in underground mining operations.

Still another objective of the invention is to provide a method of controlling dust in rock excavation.

Yet still another objective of the invention is to provide a method of controlling the dust raised in unpaved race tracks used with dogs, horses, car, trucks, motorcycles to lessen the health hazard to the participants, audience as well as lessen engine wear.

Another objective of the invention is to provide a method of the controlling dust while saving water.

Still another objective of the invention is to provide a method of the controlling dust while reducing the labor expended in conventional treatment facilities.

Other objectives and advantages of this invention will become apparent from the following description taken in conjunction with any accompanying drawings wherein are set forth, by way of illustration and example, certain embodiments of this invention. Any drawings contained herein constitute a part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a pictorial view of a strip mine;
FIG. 2 is a pictorial view of a water tanker; and
FIG. 3 is a pictorial view of a water tanker.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

While a specific embodiment of the instant invention is disclosed herein, it is to be understood that the embodiment is merely exemplary of the invention, which may be embodied in various forms. Therefore, specific details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representation basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed method.

In accordance with an aspect of the present invention there is provided a dust control composition which is completely non-corrosive, non-flammable, non-toxic, ecologically safe, readily dilutable with water, safe to use, easy to apply to a desired surface and environmentally responsible. The composition according to an aspect of the present invention provides a dust-free, compact gravel surface which may also resist erosion. As shown in FIGS. 2 and 3, the composition is sprayed 24 onto desired surfaces and requires minimal re-application requirements under desirable weather conditions. The formula may penetrate into surfaces 26 to bind with surface materials to create a dust-free surface that can be re-hydrated as necessary. The composition suppresses dust so it is unable to be picked up and be carried away by wind. The use of the composition described herein prevents dust particles from accumulating in the surrounding environment and it is generally sprayed over the dusting material.

The super absorptive polymer of the instant invention is a fine particle powder blend that is cross linked or cross-linkable homopolymers or copolymers with water binding groups having a particle size from 1-300 microns with a preferably range of 1-50 microns. The polymer does not gel in a similar manner to super polymers thus eliminating the possibility of clogging a conventional gravity fed water tanker 20, 22 and 28. Because of the service demands on water tanker trucks 28, they are capable of carrying very large quantities of water. Typically, mines employ water tanker trucks, from 2,000 gallon capacity upwards to 50,000 gallon capacity for purposes of watering down the haul roads in order to control dust. Such water tanker trucks 20, 22 and 28 generally have spray nozzles 30 positioned on either the forward or rearward sections of the vehicles to dispense a fluid spray 24 or mist onto the ground. The water tanker truck 28 can also have hoses or water cannon 32 for washing down other mining equipment. Mixing of a conventional super absorptive polymer with water before distribution typically results in slurry capable of clogging pipes, especially if the polymer is a gel type. Even if the pipes can distribute the slurry without clogging, the distribution or spray nozzle would likely clog. Thus the present invention is directed to an effective and easy to use method for applying a super absorbent polymer for water that is specifically designed to pass through gravity fed piping and associated water pumps that are found on water tanker trucks 28.

According to an aspect of the present invention, a stable dust control composition comprises: a mixture of superabsorbent polymer and water. It has been found that this polymer can be mixed at a rate of about 15 gallons to 2000 gallons of water.

Example 1

Usually, for dust controlling solutions, the most preferred application method is spraying a mixture of the polymer and water over the road in a quantity sufficient to cover the dust. Several solution concentrations were tested and it was found that the minimum polymer concentration to achieve an excellent dust suppression level is of about 15 gallons of polymer to 2000 gallons of water. Thus, in a tanker 20 holding multiples of 2,000 gallons of water, add 15 gallons
of super absorbent polymer through the manhole for each 2,000 gallons. The polymer is stirred until wetted and the movement of the tanker 20 provides the necessary agitation to uniformly admix the polymer and water. The tanker can then be used in its ordinary and conventional manner for distribution of water over the gravel roads. The polymer maintains the water for a much longer period of time by preventing the water from leaching into the ground, as well as controlling the amount of evaporation.

[0033] The invention provides an effective and environmentally friendly dust control composition that can be applied onto a variety of gravel surfaces to control dust as well as to compact and stabilize the top or base surface. The composition is a water-dilutable formula that binds with surface materials to create a dust-free surface that resists particulate emission from traffic and does not erode after drying. The composition is designed to stabilize dust particles and create a longer-lasting dust free environment and thus reduce the number of replications. Annual maintenance or reapplications of the composition to a surface actually improves the road surface. However, the need for retreatting with a composition of the polymer may not be necessary as the polymer can be rehydrated by additional water, rain or dew. As such, use of the composition is cost-effective as it reduces the use of equipment and labor normally required to maintain a conventional dust control program through sustainability.

[0035] Although it is appreciated that the ratio may favor lower or higher amounts of the polymer as determined by the application, the actual determining factors may vary greatly including the relative humidity that might be present in the area. For instance, as applied to a road surface 26, there may be applications where minimal road use is intended and high levels of morning dew lessen or eliminate the need for additional applications of the polymer. Alternatively there may be instances where higher levels of polymer may be applied to gravel piles, sand piles, slag piles and the like piles that may be used for road repairs to keep windblown dust to a minimum.

[0036] The composition can be used on a wide variety of surfaces for the purposes of dust control and surface stabilization. Typical application rates are about 1.5 L of diluted product per square meter. The composition can be applied on gravel construction roads, gravel industrial roads, gravel pits, service roads, seismic roads, rural roads, access roads, driveways, gravel parking lots, storage lots, semi-permanent flooring, mine sites, drill sites and virtually any other desired surface. As used on gravel roads, application of the dust control composition of the present invention provides rapid control of dust clouds. It provides excellent wetting and binding characteristics. As a preventative dust maintenance measure, it is cost effective both in the short and with long term usage. The composition penetrates and extends bonding into a surface, such as gravel, by providing cohesion, preventing sediment wash-out and increasing the load-bearing capacity of unpaved road surfaces. Furthermore, the composition as applied to a gravel bed for example, provides a reduction of aggregate loss, enhances conservation of native gravel, provides safety to motorists and delivers effective dust control.

[0037] In this manner, the composition is used to compact road surfaces and make them generally more durable and safe through improved visibility from dust clouds. The composition is environmentally friendly. It is biodegradable and causes neither toxic leaching nor adversely affects vegetation, aquatic life or other living organisms. It does not deposit toxic residues in soils which is highly advantageous compared to waste petroleum oil based compositions or latex products commonly used in dust control.

[0038] FIG. 1 is an illustration of a strip mining operation 10 having a series of roads 12 leading from active material treating areas. The roads typically lead to a processing location 16 wherein material handling trucks 18 raise dust while water tankers 20 and 22 are actively treading the road dust with the instant composition.

[0039] It is to be understood that while a certain form of the invention is illustrated, it is not to be limited to the specific form or arrangement herein described and shown. It will be apparent to those skilled in the art that various changes may be made without departing from the scope of the invention and the invention is not to be considered limited to what is shown and described in the specification and any drawings/figures included herein.

[0040] One skilled in the art will readily appreciate that the present invention is well adapted to carry out the objectives and obtain the ends and advantages mentioned, as well as those inherent therein. The embodiments, methods, procedures and techniques described herein are presently representative of the preferred embodiments, are intended to be exemplary and are not intended as limitations on the scope. Changes therein and other uses will occur to those skilled in the art which are encompassed within the spirit of the invention and are defined by the scope of the appended claims. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are obvious to those skilled in the art are intended to be within the scope of the following claims.

What is claimed is:

1. The product comprising any feature described, either individually or in combination with any feature, in any configuration.

2. A process comprising any product described in any order, using any modality either individually or in any combination, with any modality or any feature described.

3. A method of controlling dust on strip mining roads using a water tanker having a gravity feed distribution header comprising the steps of: adding about 15 gallons of dry super absorbent water swellable polymer to each 2000 gallons of water placed within the water tanker; stirring said polymer into said water to form a mixture; distributing said mixture over strip mining roads.

4. The method according to claim 3 wherein said water swellable polymer is sized to pass through the gravity feed distribution header without clogging.

5. The method according to claim 3 wherein said water swellable polymer is less than 20 microns.

6. The method according to claim 3 wherein said water swellable polymer is an acrylate.

7. The method according to claim 3 which provides a polymer film over the dust producing strip mining roads.

8. The method according to claim 7 wherein the polymer film forms a homogeneous and resistant layer over the surface of the mining roads.

9. The method according to claim 3 wherein said mixture is from 0.1 to 1.0% of polymer to water.