



Govt. of India
Ministry of Labour and Employment
Directorate General of Mines Safety
• **Dhanbad – 826 001**



No. DGMS (Tech.)/ (S&T)-Circular No. 2/700 Dhanbad, Dated the 14th August, 2008.

To:

The Owner, Agent & Manager of Coal Mines

Sub: Use of Chemical Additives for Dust Suppression in Coal Mines

Sir,

Dust in coal mines is the primary cause of concern due to its being not only hazardous to human health but also dangerous due to being catalyst for ignition and explosion in coal mines. Coal Workers Pneumoconiosis as well as Silicosis is the two major occupational diseases notified under the Mines Act, 1952. The exposure of workers to airborne respirable dust leads to such diseases. A number of statutory provisions against dangers from airborne respirable dust have been made in the Coal Mines Regulations, 1957. Medical examination of workers as well as study of personal exposure to dust profiles is normally carried out to a certain the conditions of health of workers exposed to airborne respirable dusty environment.

To prevent dust getting airborne and dangerous to persons working in the mines, many companies have developed chemical additives to be used as dust suppressant. Such chemical additives were tried in India also for dust suppressing in mines. However, it is reported that some toxic and hazards chemicals are being used in such dust suppressant materials.

In order to prevent use of such type of hazardous chemicals in mines, Ministry of Environment and Forest, Government of India, constituted a committee to examine environmental issues pertaining to the use of chemical

additives for suppression of dust in coal mines. The recommendations of the committee were forwarded to the Ministry of Coal, Ministry of Labour and Employment and other concerned. Thereafter, it was decided by the Ministry of Environment and Forest that the Director General of Mines Safety would be the nodal agency to issue national certification / technical certificate to the industry regarding toxic effect of chemicals. The Ministry further recommended that the manufacturers of chemicals used in suppression of dust in coal mines would apply to the Director General of Mines Safety in the prescribed format, along with a copy of test report to be obtained from the identified national laboratories on the chemical composition of additives. Manufacturers are therefore required to seek approval of the Director General of Mines Safety before their products are used in mining areas. This matter was referred to this Directorate vide letter No. Z-16011/2/2000-CPA dated 30.05.2001 enclosing therewith a copy of the committee's report. The salient points of observations and recommendations of the committee are reproduced below:

Places and operations where dust is generated in open-cast mines are mainly drilling and blasting operations, working faces, shovel loading, dragline operations, coal transportation corridor, loading and transfer points, coal handling plants, coal stockpiles, overburden dumps and coal crushing. In underground mines, the places where dust is generated are extraction faces, transfer points, belt conveyors, drilling and blasting operations.

Most difficult and important areas of dust control are the haul roads in open cast mines. The influencing factors are vehicle speed, concentration of traffic, weight and pay load of trucks, type of material transported, weather conditions and also the condition of the haul roads.

Construction, repair and maintenance of the haul roads in opencast mines are extremely important for dust control. Paving of haul roads can prevent dust generation to a great extent. Water spraying is the most common method of dust control. However, this is not so effective in case of coal dust, which is hydrophobic in nature. To reduce the requirement of water and for better dust suppression, chemical additives in water solution could be used for spraying purposes.

Some chemicals are simple wetting agents that enhance water penetration into the soil and increase water retention time, which helps in better dust control whereas some organic chemicals form a bond by cementing the loose

particles together which helps in suppressing the dust raised along the haul roads.

Some wetting agents are blend of surfactants that can enhance water's ability to 'wet' and suppress the road dust. In most of the coal producing countries such as in Europe, Australia and USA biodegradable and non-toxic substances are permitted for the purpose.

Other set of chemicals are emulsion of semi-liquid resins (60%) and wetting solutions (40%). When mixed with water and applied to dust/soil, forms a strong attachment, which is resistant to leaching or percolation. Such formulations are marketed under various trade names, such as – Penn Suppress EC, Top Shield, Envirokleen, Coherex etc.

The chemicals when sprayed lead to polymeric dust control by forming chains of polymer molecules that are cross-linked in grid-like patterns, cementing loose particles together.

Recently, some chemicals extracted from orange peels have made their place in the market. These citrus-based dust control agents are used in water solution and they reduce the surface tension and penetrate deeper into the road surface. They also have humic properties to promote retention of water in the treated material.

Chloride based dust control chemicals are not recommended due to corrosion potential. Waste oil based dust suppressants have been banned in the US and European countries. In Europe, phenol based chemicals have been banned for its harmful effects to human being.

In India, untreated water is most commonly used for suppression of dust in coal mines. Some chemicals are also being marketed, the efficacy of which has not been fully established. Since composition of these chemicals is not disclosed, their side effects, if any, on human being and on the soil as well as ground water are not evaluated before application.

Aspects other than the use of chemical additives to control fugitive dust emissions like compactness of all the roads should also be looked into by the coal mines to reduce the concentration of SPM in coal mines. Some coal mines have carried trials with water chemicals for dust suppression.

The recommendations of the Committee with regards to the specific terms of reference are as follows:

(1) Environmental issues pertaining to the use of chemical additives for dust suppression

The toxic and hazardous chemical additives can adversely affect the environmental quality and their exposure can be harmful to the human beings if inhaled. Such chemical additives can also affect the surface and ground water quality. Hence, it is essential that only environment friendly chemical additives are used. This will promote water conservation and enhance the efficiency of dust suppression, the use of chemical additives for dust suppression in coal mines may be permitted provided the chemicals are properly tested and certified.

(2) Testing procedure of chemicals and to identify institutions for testing

At present, there is no laid out procedure for granting certification to the manufacturers for the use of dust suppression chemical additives. In order to streamline the procedure for testing and certification of such chemicals, the Committee recommends the following measures:

- (i) The Director General of Mines Safety should serve (DGMS) as the nodal agency to issue necessary certification;
- (ii) The manufacturers may be advised to apply to the DGMS in the prescribed form, along with a copy of the test report on the chemical characteristics of the additives;
- (iii) The test report should indicate the concentration of all the elements, required as per limits prescribed in the RCRA (Resource Conservation and Recovery Act) of USA or equivalent recognized standards till national standards are developed.

The manufacturers / suppliers should be responsible to provide test reports on compliance of RCRA limits. The testing should be done in any of the following institutions:

- National Chemical Laboratory, Pune
- Industrial Toxicology Research Centre, Lucknow
- Indian School of Mines, Dhanbad
- Central Institute of Mining & Fuel Research, Dhanbad

(iv) The manufacturer / supplier of the chemical additives should provide the following characteristics of their products for seeking clearance from DGMS:

- Specification details like appearance, specific gravity, solid contents etc

- (Sp. Gravity – 1.10 to 1.40)
- Solubility - (100% soluble in normal water of pH ranging from 6.5 to 8.0 at NTP)
 - Wetting - (The chemical and its admixed form on application at surface body should have a minimum of 70% water holding capacity up to 24 hours of application at N.T.P)
 - Agglomeration - (The chemical or its admixed form on application should be capable for developing agglomeration on the surface bed with minimum of 2mm layer after three consecutive applications.)
 - Methods of application including mixing ratio and frequency
 - Hazardous and toxic ingredients – (As per R.C.R.A. norms, The US environmental Protection Agency (USEPA) under the Resource Conservation & Recovery Act (RCRA), 1976) governs land disposal of solid wastes which generally required testing for 8 elements of concern (Arsenic, Barium, Cadmiums, Chromium, Lead, Mercury, Selenium, Silver etc.)
 - Precautions for use and personal safety
 - Safety measures for storage, transportation, handling of spills, container disposal, fire / explosion hazards
 - Contact Telephone nos. and address for other information etc.

According to EPA guidelines, a waste is categorized possessing toxic or hazardous characteristics, if it produces a leachate that contains any of the above elements in concentration more than 100 times the primary drinking water standards.

The RCRA limits (mg. per liter) are given below:-

Arsenic (As)	:	5
Barium (Ba)	:	100
Cadmium (Cd)	:	1
Chromium (Cr)	:	5
Lead (Pb)	:	5
Mercury (Hg)	:	0.2
Selenium, (Se)	:	1
Silver (Ag)	:	5
Ph value	:	Should be within the range of 6.5 to 8.0 pH
Flash Point	:	Should be more than 175° C
Self Life	:	Minimum 6 months.
Air Permeability	:	(For underground used only)

As per BIS Specification No. 4335/19678 under Clause 3.2.9.3 test for Air/Gas permeability for Product characteristics of Air/Gas absorption which is $1.5 \text{ m}^3/\text{min.}/\text{m}^2$.

The above mentioned information should be furnished along with the additive samples.

Chemical Additives material for dust suppression should have ionizing properly as defined in the "Principal of Operation" of DGMS Tech. Circular No. 8, 1997.

(3) Remedial measures to avoid adverse impacts on the environment

In view of the fact that opencast mining is increasing almost by six to seven percent per year, the measures for dust control deserve serious attention.

- (i) To prevent and mitigate adverse impacts on the environment, that above stated measures as recommended by the Committee require strict compliance.
- (ii) As a preventive measure, the haul roads should be paved, to the extent possible, for minimizing the generation of dust.
- (iii) The chemical additives (including chloride based chemicals, waster oil and phenol based chemicals) which are banned in other countries should not be permitted for use in India.
- (iv) The coal companies should commission systematic studies to assess the effectiveness of chemical additives in reducing the SPM levels and water consumption. Studies should also be commissioned to determine the environmental and health effects, if any, due to use of chemical additives.

In the light of the above, the Directorate General of Mines Safety is issuing no-objection certificate to the manufacturers who apply for certification of their products for use in mines. This is being adopted due to the reason that there does not exist any statutory provision regarding approval of such item in the Coal Mines Regulations, 1957. Now the opencast activities have increased manifold in the country and more and more number of large capacity loading and transport machinery are being deployed in the mine causing problems of dust hazards. Therefore, it is essential to have a statutory provision for approval of chemical additives to be used in dust suppressant materials.

In view of the above, it is decided to bring this material under the ambit of approval to be granted by the Chief Inspector of Mines before use in the mines in accordance with the provisions contained under regulation 181(3) of the Coal Mines Regulations, 1957.

A Notification No. DGMS/S&T/DSS/699 dated 14th August 2008 in this regard has been forwarded to be published in the Gazette of India and the subject matter thereof is reproduced below for information and taking necessary actions to comply with the requirement.

“In exercise of the power conferred on the Chief Inspector of Mines also designated as Director General of Mines Safety under sub-regulation (3) of Regulation 181 of the Coal Mines Regulations, 1957, I hereby declare 1st November, 2008 as the date from which all types of Chemical Dust Suppressant including the additives used therein to be used for suppressing dust in mines, shall be of such type, standard and make as approved by me by a general or special order in writing.”

You are being informed in advance to take necessary steps in this regard and requested to ensure that it is implemented and complied with.

Yours faithfully,

Sd/-

(M. M. Sharma)

Director General of Mines Safety