NIVITEX FIBREGLASS & RESINS

Solutions for Dust on Dirt Roads

DS-11-LB

(Dust Suppressant 11 Lignin Base)

Tel: 087 310 2500 • info@nivitex.co.za • www.nivitex.com

Solutions for dust on mining haul roads

Dust on Mining Haul Roads

Often built in less than ideal locations, roads on mines are constructed using materials that would be considered problematic. Whether above or below ground, haul and access roads are susceptible to high dust emissions. The heavy use of roads equated with mining operations increases the problem.

Dust emissions increase the maintenance costs on vehicles due to the additional wear and tear experienced, and affect visibility, often leading to higher accident rates. Inadequate road stabilization requires additional road maintenance, with costly gravel replacement and down time exacerbating the issue for mines.

For these reasons, mining, environmental and OHS regulations require that dust emissions be controlled. Although widely used, water is an expensive and inefficient method. Water scarcity and its increasing value ue to climate change have meant that an alternative solution has to be found.

DS-11-LB Dust Suppressant will:

- Improve driver visibility and therefore safety
- Create a hard, smooth surface that is dust-free
- Reduce water usage by up to 90%
- Increase the load-bearing capacity of the materials used in road construction
- Reduce gravel loss and replacement costs
- Reduce vehicle maintenance costs
- Minimize the cost of road maintenance and equipment requirements
- Reduce water run-off and erosion
- Be a high-performance product that is extremely cost-effective

Advantages of using DS-11-LB Dust Suppressant:

- Meet an exceed health and safety standard requirements
- Improve environmental compliance
- Improve financial performance
- Reduce fuel consumption
- Reduce labour costs

DS-11-LB Dust Suppressant is non-toxic, renewable and environmentally friendly, reducing the carbon footprint of the business.

About the Product

DS-11-LB Dust Suppressant is a by-product of the pulp wood industry, making it biodegradable. Made from renewable material, it is non-toxic to humans, flora and fauna.

The product bonds the road base particles together, reducing the need for water or other aggregates to control dust emissions.

DS-11-LB Dust Suppressant does not require specialized equipment. It can be incorporated into the materials being used when the road is constructed, or applied to existing road surfaces.

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How to use DS-11-LB Dust Suppressant?

DS-11-LB Dust Suppressant performs effectively on a wide range of base materials. Although not material specific, the efficacy of DS-11-LB Dust Suppressant will be more noticeable on road constructed using appropriate materials and to recognized road construction standards.

The materials used and method of construction will affect the volume of DS-11-LB Dust Suppressant to be applied. Application rate and method should be adapted to the specific circumstances, and in some cases a soil test may be required.

Material selection guidelines for unsealed roads:

	Guideline	
Characteristic	Access	Haul
Maximised Size	37.5mm	75-100mm
Oversize index	<5%	<10%
Shrinkage product*	50 - 400	50 - 400
Grade Coefficient**	16 - 34	16 - 34
CBR***	>15	>40
Hardness****	20 - 65	20 - 65

'* Linear shrinkage x % passing on 0.425mm sieve

'** (% passing 26.5mm - % passing 2.0mm) x % passing 4.75mm/100

'*** California bearing ratio – soaked at > 95% Mod AASHTO

'**** Treton impact value

The use of no-conforming materials or non-standard construction and maintenance may lead to defects such as erosion, potholes, slipperiness and corrugation. The table on the right illustrates the predicted performance in these circumstances.

Surface Haul Roads

Where high riding quality, regular access and low maintenance are a prerequisite, the material selection guidelines in figure 1 re recommended.

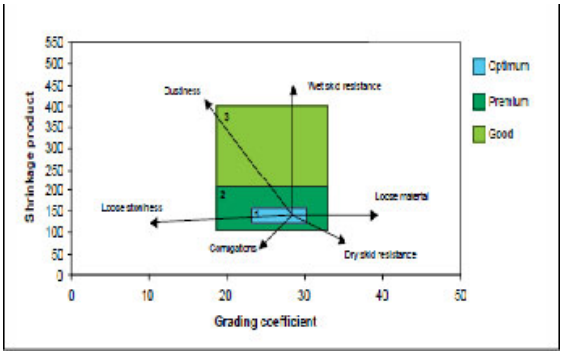
Application rate is determined by soil mechanical properties, rather than soil chemistry. DS-11-LB Dust Suppressant can be combined with the base materials during construction of a new road, or applied on the surface of existing roads.

DS-11-LB Dust Suppressant is suitable for use on unpaved roads, finely divided coal and mineral ores. The product's stabilization properties improve safety standards while enhancing the appearance of the road. Use of DS-11-LB Dust Suppressant minimizes road surface deterioration while providing a cost effective solution for dust emission control.

Underground Haul Roads

Because underground roads are generally not subject to climatic factors such as rainfall, humidity and temperature fluctuations, the guidelines are less stringent. In addition, underground roads are usually level and well supported by bedrock. To avoid disturbing traffic flow, the spray-on application method is recommended.

DS-11-LB Dust Suppressant binds dust particle together to produce a firm surface that reduces dust emissions while improving traction and water runoff thus minimizing muddy conditions.



Economic Analysis

Based on road performance production models, the table below shows the savings that can be achieved with DS-11-LB Dust Suppressant. This is in addition to the savings in vehicle maintenance and operation costs, and the fewer equipment requirements.

Gravel loss	multiply current rate of gravel loss by 0.5
Water reduction	multiply current water usage by 0.2 and up to 90% can be achieved
Grading frequency	multiply current grading frequency by the following factors: 8-14 days – multiply by 7.1 15-45 days – multiply by 4.0 46-90 days – multiply by 2.0 90-120 days – allow two per annum >120 days – allow one per annum

Product Application

- Incorporated application or spray-on.
- Key issues are dosage, product concentration and speed of application.
- For existing roads, a pre-watering of 1 to 1.5 l/m2 will be required, to a depth of 150mm.
- The concentration of DS-11-LB Dust Suppressant should be calculated in relation to the absorption rate of the surface to prevent run-off and maximize penetration.
- No specialized equipment is required.
- Application should be even across th surface.
- The road surface should be shaped to allow for water run-off, with no areas of pooling.
- A smooth roller should be used to compact the surface.

Road Stabilisation

Applied as a spray-on or incorporated material, DS-11-LB Dust Suppressant is extremely effective in stabilizing and binding gravel roads.

Because haul roads are normally not decommissioned, spray-on applications are most common. The road surface should be compacted at a density of no more than 93%. The surface should be clear of loose materials and be shaped to a camber that facilitates water run-off. The surface should be watered before each application.

Multiple applications are recommended, using a 10% solution of product with water. The road may be used immediately after treatment.

For incorporated applications the products is added to the base during the water bonding process. This type of application is used to bind and stabilize a base layer with thickness of 50 to 200mm. Conventional road marking equipment is used for this application.

The road should be ripped to 150mm, with large clods no more than 50mm in diameter. When the approximate volume of water required for optimum moisture content has been calculated, add two-thirds of the product. This solution should be applied to the prepared road surface in 4 to 6 applications, mixing thoroughly between each application. To provide adequate drainage, shape the surface to the required camber. Compact the road with a roller to the required density. The remaining product (one third) should be sprayed onto the finished surface while it is still damp. The road may be used immediately after treatment.

Other Areas

Low volume traffic areas such as road verges, car parks and lay down areas will benefit from the application of DS-11-LB Dust Suppressant. A dilution of approximately 10:1 will achieve 2 litres of DS-11-LB Dust Suppressantper m2 when applied as a spray-on application.

Maintenance

Heavy rainfall or unseasonably dry weather may necessitate re-application. A planned road maintenance and DS-11-LB Dust Suppressant rejuvenation schedule is essential to optimize performance and keep the road dust free.

The frequency and volume of product to be applied will vary according to factors such as material, original application method, traffic density and speed, as well as climate.

Payload spillage, debris and dust blown onto the surface will also influence the required frequency of re-application. Ideally, rejuvenation should take place before any significant deterioration of the surface occurs. Generally, rejuvenation should use 0.08 litres of V per square metre. This can vary and should be assessed by a DS-11-LB Dust Suppressant representative.

DS-11-LB (Dust Suppressant 11 Lignin Base)

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How Does DS-11-LB Dust Suppressant Work?

- DS-11-LB Dust Suppressant coats the particles of dust on the surface.
- When dry, the particles stick together because of this coating.
- DS-11-LB Dust Suppressant aids distribution during compacting, dispersing smaller particles and thereby reducing soil pore volume.
- Less water is needed to achieve optimal compaction, similar to concrete plasticizing.
- High compaction will achieve better performance.

Benefits of Using DS-11-LB Dust Suppressant

- DS-11-LB Dust Suppressant is environmentally friendly.
- Improved visibility and road safety due to suppression of dust means fewer accidents.
- Dust free, hard and smooth road surfaces.
- Provides excellent traction in both wet and dry conditions.
- Vehicle wear and road maintenance are significantly reduced.
- Significant water savings are incurred over the life of the treated roads.
- Existing equipment can be used.
- User-friendly application.
- P.I. in material is reduced.
- Improved CBR of treated wearing course.

Application Rates – Geology, Soil Types

CSIR tests have shown DS-11-LB Dust Suppressant to be compatible with all aggregates.

Use of materials with sufficient Grading Modulus (GM) will achieve better results.

Approximate Dilution Guidelines

- Clay – 10% for easy penetration
- Normal aggregate - 15%
- Soil sand – 20%
- Very porous material – use a thicker solution
- Use a thicker solution for improved penetration of very porous material.
- A more diluted solution is recommended to penetrate dense material.

Soil Compaction

A site assessment to determine requirements is recommended, as site conditions will vary. Proper compaction is vital to obtain maximum performance and life expectancy when constructing a road.

In order to work out the compaction ratio or CBR (California Bearing Ratio), the OMC (Optimum Moisture Content) for the particular soil geology must be determined. This will ensure that the best performances for the materials will be achieved.

Mix-in application of DS-11-LB Dust Suppressant is effective not only in terms of dust suppression, but also for improving the quality of the completed road. Application of DS-11-LB Dust Suppressant on top of the surface after compaction assists in the reduction of quarry material due to dust generation from traffic. Quarry material is non-renewable and is expensive to source if the road surface has deteriorated.

Road Preparation

Site conditions also affect the preparation required. Drainage of marshy areas and stabilization may be needed. Additional graded aggregate may be necessary in areas of sandy soils to build a stable base. Top soil and vegetation will need to be stripped off to create a stable platform for road construction. Again, the expense of bringing in quarry material from a borrow pit must be considered.

Because it chemically improves the CBR of materials used, DS-11-LB Dust Suppressant can achieve similar if not better results using local or on-site materials. To extend the service life of the road, maintenance is critical. Spray-on application on existing roads should only be carried out on compacted, graded and dust-free surfaces to ensure even penetration.

Dilution

The initial and any subsequent rejuvenation applications of DS-11-LB Dust Suppressant generally make use of a spray-on solution of the powder and water. The viscosity or thickness of the solution is affected by the percentage of solid matter in the solution.

The liquid DS-11-LB Dust Suppressant should be diluted to 10 – 30% solids, as penetration into the soil particles is affected by the thickness of the solution. The finer the particles, the more difficult penetration is; for coarsely graded soils a higher solids content application is recommended.

DS-11-LB Dust Suppressant is supplied as:

- A powder in bags
- A pre-mixed solution delivered by road tanker

The Specific Gravity (SG) of a solution increases as the solid content is raised. Water has an SG of 1, therefore a litre of water weighs 1 kilogram. A solution if 50 – 53% solids is the maximum effective dilution of DS-11-LB Dust Suppressant.

Pumpability and other handling issues may arise at a higher dilution. This is also the optimum in terms of transport costs, as an SG of 1.267 will weigh 1.267 kilograms.

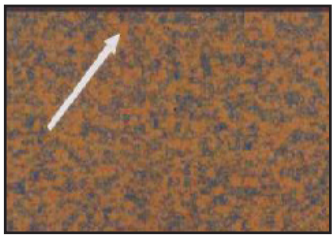
Specific Gravity affects product application. DS-11-LB Dust Suppressant liquid at 53% solids is 1.267 times as heavy as water. The recommended dosage is therefore 1 litre per square metre; the solids equivalent is 1.267 x0.53 which equates to 0.67kg per metre squared.

It is therefore logical that the application rate in lt/m2 will increase as the product is diluted with water, but still yield the necessary mass of solids.

The SG affects the penetration of the liquid into the soil. A fine compacted silt substrate, such as clay, will require more dilution with water as a thick solution will not penetrate. The opposite is true for sandy or loosely packed soil.

In winter months, further dilution may be required as viscosity increases under low temperature conditions.

Measurement of water and DS-11-LB Dust Suppressant should be interpolated for convenient measurement on site.



Depth of DS-11-LB Dust Suppressant penetration in Clay Soils

Depth of DS-11-LB Dust Suppressant penetration in Sandy Soils

Which Application Method?

- Spray-on application is suitable if limited equipment is available.
- Spray-on application is recommended if the road has to stay in operation.
- Mix-in application will achieve better results where water penetration is more difficult.
- For short duration application, the spray-on method is suitable.
- If the application is required to last over a long period, mix-in or spray-on with rejuvenation will be suitable

When applying DS-11-LB Dust Suppressant it is important to note that:

- DS-11-LB Dust Suppressant creates a mechanical bond, and therefore the size of the aggregate is more important than the road base soil type.
- Road design should comply with best practice.

Application Rates

Initial application is 0.2 – 0.8 litres of DS-11-LB Dust Suppressant per square metre of road surface area.

0.2 litres per square metre is recommended for dust suppression on parking areas, road verges and laydown areas.

0.8 litres per square metre is recommended for areas that require road stabilization, where higher traffic speed and density is common. Above ground, haul, access and service roads as well as below ground applications require the higher concentration of DS-11-LB Dust Suppressant to ensure optimum performance.

Spray-On Application:

- Sprayed onto the road surface, DS-11-LB Dust Suppressant acts as an instant dust suppressant.
- Uses less product
- Reduces water requirement
- Less costly application method
- Little or no disruption to road use
- Immediate improvement in road safety
- Rejuvenation done when required

Method

A water cart or water tanker is required for spray-on application.

- If the road is in good condition and well compacted, spray-on application is considered the most suitable application method.
- Check the water penetration of the surface and use this as a measure of the amount of liquid to apply per square metre.
- Consider the amount of water to be added relative to the OMC (Optimum Moisture Content) for compaction, including the moisture in the road.
- If penetration is good, use a solution of higher solid content for quicker application.
- If penetration is poor, use a higher dilution and repeat application more to achieve good results.
- Pre-wet the surface, or apply after light rain to improve penetration.
- Add 0.02 litres of DS-11-LB Dust Suppressant per litre of water.
- Apply water between multiple applications to further assist with penetration.
- Application while the road is in use can aid compaction, but only if there is no mud, as this will cause distortion of the shape and camber of the road.
- The shape of the road should contribute to proper drainage.
- Ensure the surface is free of loose material and that it is firm.
- Apply the product in multiple applications.
- When compaction is complete and the road shape and quality are satisfactory, apply 0.7 litres per square metre on the road surface.
- Use rejuvenation coats to suppress the dust as required. The remaining 0.3 litres of product will be diluted for rejuvenation after one week. Thereafter, a maintenance coat should be sprayed on every two weeks, using 0.03 litres of the liquid per square metre.

Equipment for Spray-On Application:

There are two methods of application suitable for spraying DS-11-LB Dust Suppressant, dependent on the required volume and frequency of application.

For small scale application, a portable tank with a pump and hand spray unit will suffice, as illustrated below.

1. Operator experience is an important factor in manual spraying to avoid wastage and reapplication. Use nozzles that produce a large number of small drops and decrease the contact angle of the spray to improve surface wetting.
2. Continuous application to large areas requires a tanker fitted with a spray bar unit. The equipment should be capable of distributing the mixture uniformly at a specific application rate.

Pressure Distributors

If a pressure distributor is used, it should be propelled by a power unit that is capable of maintaining the required speed.

The pressure distributor should have the following equipment:

- a pump capable of developing uniform pressure within the require range
- a visible pressure gauge that is accurate to 15kPa
- a rear-mounted spray bar with instant shut off.
- The bar should be adjustable in terms of height and spraying width (1 – 3m) in order to ensure that the road surface and shoulders can be sprayed.

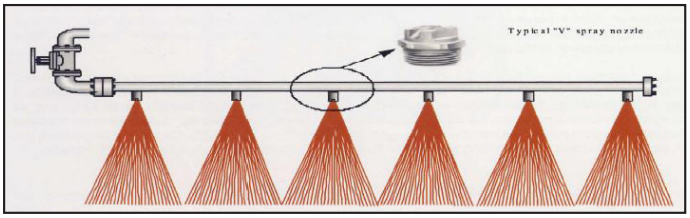
The spray bar nozzles should be:

- the same size and make to ensure uniformity
- clean and in good working condition
- set to achieve a uniform fan-shaped spray
- the nozzles should be set at an angle that ensures that adjacent fans will spray the area that
- the next nozzle would cover, should a nozzle malfunction

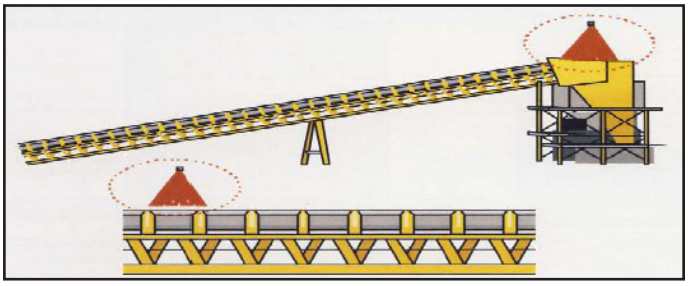
To prevent clogging of the nozzles, a strainer should be installed in the feed system.

A measuring stick calibrated for the specific tank being used, graduated in 200 litre increments, will be needed.

DS-11-LB Dust Suppressant can be used as a dust suppressor where water is normally injected, such as conveyor belts and throw-over points. It is recommended that an auxiliary pump or venture system be used to inject the concentrated DS-11-LB Dust Suppressant solution into the main water feeder system.



Spray Bar Schematic



DS-11-LB Dust Suppressant Spray Equipment for Conveyors and Throw Over Points

Guidelines for Equipment Use

Spray nozzles:

Set the nozzles to the required width, height and output rate. Test the equipment off-site if necessary.

Coverage:

Each pass should provide an even coat over the area to be treated.

Spray rate:

The spray rate should be set high enough to provide even coverage with multiple coats, but not so high as to cause the material to drain away from the treated area.

Cleaning:

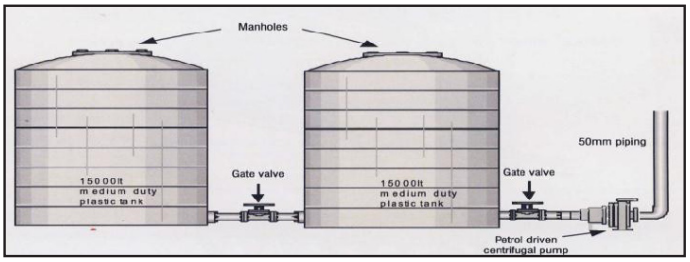
Rinse all equipment thoroughly with water. If the DS-11-LB Dust Suppressant is allowed to dry, rinse with water to remove any residue.

Traffic:

Treated areas can be opened to traffic immediately after application.

Curing:

There is no curing time required.



Typical On SIte Bulk Tank Installation

Storage & Handling

Because the viscosity of DS-11-LB Dust Suppressant is relatively high, the product needs a substantial pump for delivery into and out of bulk tanks. Petrol driven centrifugal type ums capable of high volume output are recommended.

Minimum piping diameter of 50mm is required, whether flexible or ridged. Petrol or diesel units driven by 3.5 or 5.0 HP motors are ideal for pumping viscous liquids. The equivalent electrically driven unit would be extremely bulky and expensive. Petrol driven units are also more mobile.

A pneumatically driven diaphragm, or sandpiper type unit, often used in the mining industry, will be suitable too.

Because the specific gravity of DS-11-LB Dust Suppressant is 1.267 times heavier than water, medium to heavy duty plastic bulk tanks are required for storage purposes. Conventional tanks could burst, although strapping at strategic intervals may help to strengthen the tank.

We recommend the use of two 15 000 litre units coupled with a gate valve between the piping. A single 30 000 litre tank will make access to the manhole difficult, and the height will make pumping from the bulk tanker almost impossible

Frequently Asked Questions:

Q: DS-11-LB Dust Suppressant is more expensive than water. Why should I spend more?

A. Water is a scarce and valuable commodity. To achieve similar results in terms of dust emission control, water would have to be applied +/- 6 times a day. DS-11-LB Dust Suppressant however, only needs to be applied twice a month. When you factor in the daily hire of a water cart or tanker and the labour required, the savings start adding up.

Q. How often do you need to apply DS-11-LB Dust Suppressant?

A. The condition of the road dictates how often DS-11-LB Dust Suppressant needs to be applied. After the initial application rejuvenation should be done every month, or when the road gets dirty. This will vary depending on several factors such as climate, location and traffic volume.

Mix-In Application

Mixed into the road surface materials, DS-11-LB Dust Suppressant provides longer lasting protection.

- More DS-11-LB Dust Suppressant is required for this method to be effective.
- Rejuvenation with the spray-on method will be required.
- A water cart or tanker, grader and compactor will be needed.
- Mix-in application is recommended for roads that are in poor condition.

Method

- The surface should be watered to assist with the preparation.
- Rip the surface open to 100 – 150mm with a grader.
- Large clods should be broken up to ensure that the Grading Modulus (GM) is sufficient.
- Calculate the amount of water required to bring the road material to its OMC for compacting.
- Add 80 – 90% of the DS-11-LB Dust Suppressant to the water.
- For stabilization, add 1 litre of the diluted mixture per square metre into the road surface.
- It is important to consider the amount of moisture in the road, and that DS-11-LB Dust Suppressant reduces the OMC by 3 – 5%. It is important that the surface not become muddy.
- Use a grader to mix, using windrows and a water tanker.
- Using the grader, shape the road, taking into consideration drainage and levels required.
- Roll the surface with a smooth steel roller, or a pneumatic tyre roller. Vibrating rollers are not recommended as they may cause the adhesion to weaken.
- Multiple passes of the roller may be required to compact the surface to >93% Mod. AASHTO.
- Compacting should be one at the ideal OMC – hot weather will mean that more water may be needed if there are any delays.
- Once compacted, the road can be reopened for traffic.
- Use the remaining 10 – 20% of DS-11-LB Dust Suppressant to spray the surface.
- Depending on road material, conditions and traffic volume, a maintenance spray every two weeks or so may be needed.
- The liquid drainage recommendation is 2 litres per m^2. For example, if the road measures 8 000m x 3m = 48 000 litres of DS-11-LB Dust Suppressant solution will be required.

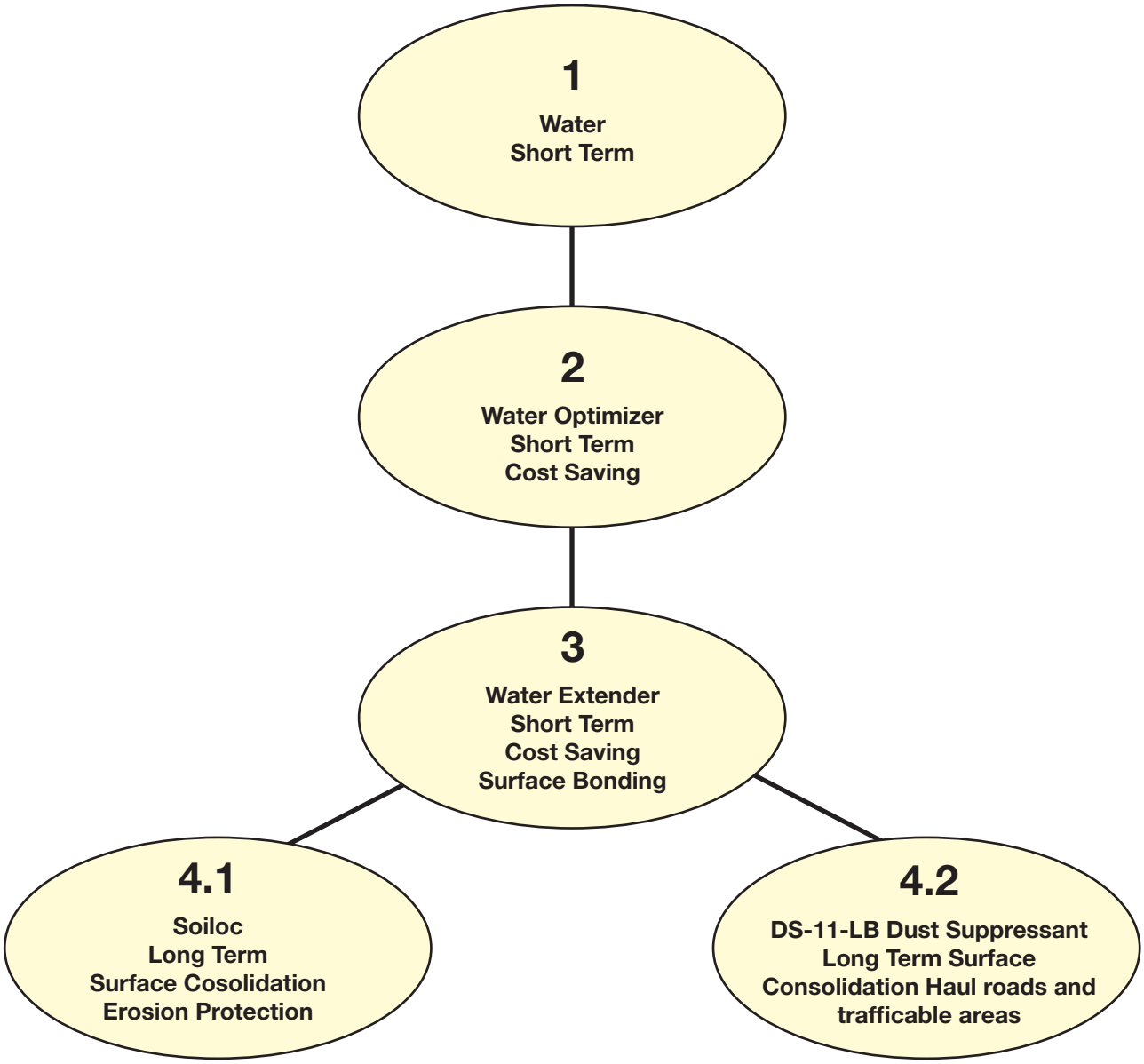
Maintenance Programme

The following is the suggested ongoing programme for maintenance:

- One week after initial application, apply water at a rate that will allow road base infiltration.
- In the second week, a single application of a 5% dilution of the initial application is recommended.
- In week 3, apply water only.
- In the fourth week, apply a 5% dilution as for week 2.

DS-11-LB (Dust Suppressant 11 Lignin Base)

A step-by-step look at dust control and water management



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Dust Suppressants

Water as a Dust Suppressant

This is the most commonly used method for dust control

There are drawbacks to this method:

- Worldwide, water is becoming a scarce resource.
- Obtaining water on site is costly; often not taken into consideration are pump costs, electricity and vehicle wear and tear. These costs are often omitted in dust control cost calculations.
- Hyper saline water is corrosive and damaging to the environment.

Water Optimizers

Water optimizers or extenders are a first step towards effective dust control.

These additives extend the effectiveness of water by improving the absorption of water into the soil. Wetting agents reduce surface tensions and thereby evaporation.

Polymers

Polymer based dust suppression is widely recognized as the most effective form of dust control.

- A large molecule composed of repeating structural units, polymers encompass natural and synthetic materials, both of which can be used in road stabilization.
- Polymers are suitable for stabilization of haul roads and other trafficable surfaces.
- Polymers reduce water application while providing more stable road surfaces with a sustainable long-term management programme

What is DS-11-LB Dust Suppressant?

A natural polymer, DS-11-LB Dust Suppressant uses a binding agent called Lignosulphonate.

- Lignin is the constituent in wood that binds cellulose fibres together. It is extracted from wood pulp as a by-product of paper manufacture.
- DS-11-LB Dust Suppressant bonds road base particles together in a mechanical, rather than a chemical, bond.
- Lignosulphonate products have been in use for over 5 decades in the construction, agriculture, food and mining sectors.
- Lignosulphonate is internationally rated, non-toxic and non-irritant.
- DS-11-LB Dust Suppressant is non-corrosive.
- DS-11-LB Dust Suppressant is an environmentally sustainable product, produced from a renewable resource.

Dust and the Environment

- Calcium Lignosulphonate is the active ingredient in DS-11-LB Dust Suppressant.
- Lignosulphonates are widely accepted as the most environmentally acceptable dust palliatives, even when compared to synthetic polymers and chlorides.
- DS-11-LB Dust Suppressantis certified free of Dioxin, as it is produced from a process that is free of dietylene glycol which produces dioxin during acid catalyzed dehydration. This is not true of all Lignosulphonates.
- DS-11-LB Dust Suppressant meets the United States EPA levels for elemental contamination in relation to EP toxicity, applicable to, inter alia, chloride, sulphur, sodium, potassium, iton, magnesium, mercury, lead and arsenic.
- Use of DS-11-LB Dust Suppressant significantly reduces the use of water in dust emission control.
- DS-11-LB Dust Suppressant is less soluble than magnesium chloride, making it more resistant to wash-off from rain. The produce is therefore less likely to leach into water tables and surrounding eco systems.
- DS-11-LB Dust Suppressant has an extremely low toxicity to mammals.
- In contrast with synthetic polymers and chloride based products, DS-11-LB Dust Suppressant is digested and decomposed by normal soil bacterial processes.

Competitor Products

Magnesium Chloride	
Product Description: Concentrated brine that pulls water out of the air. This product sinks into the road and creates a tight, hard, compact surface that resists abrasion. Dust control is by keeping the road surface damp.	
Pros	**Cons**
Aids in road surface compaction.	Corrodes metal
Readily available	Rain causes sloppy conditions
Road can be re graded	Minimum curing time 24 hours
Rainfall does not totally deteriorate the product	Requires relative humidity greater than 32% at 250
Limited hazard to workers	No cementing action
Increases road stability	High concentration toxic to plants and water catchments
	Leachable under high rainfall conditions

Petroleum Based Emulsions	
Product Description: Petroleum based emulsions (resins combined with wetting solutions). Dust control is by cohering to and coating dust particles to form a cohesive membrane that adheres to other particles.	
Pros	**Cons**
Long-tern effectiveness	Requires special dedicated equipment
Not water soluble when dry and therefor does not leach	Potholes may develop due to rigidity and variable soil base conditions
Provides soil stability	Long term application makes grading difficult
Suitable for a wide range of soils	Environmentally less acceptable
No relative humidity requirement	
Does not attract animals	
Limited hazard to workers	
Strong bonding action	

Lignosulphonates	
Product Description: A co-product from the pulping process. Dust control is by gluing and bonding soil particles together	
Pros	**Cons**
Long-tern effectiveness is good as the product remains slightly plastic and can be graded and reformed	Discoloration due to red brown color. This applies to vehicles and run off
Less water soluble and therefor does not leach to the same extent as MgCl2	Leaching under high rain fall conditions
No relative humidity problems	May increase biochemical oxygen demand (BOD) in water
Suitable for a wide range of soils	Wearing surface needs 4-8% fines
Minimal hazard to workers	Residual acidity in non neutralised product may cause corrosion
Can be mixed with calcium salts (hydroxide or carbonate). Lime extends effectiveness and provides tighter road surface with less gravel loss	May be brittle when dry and slippery when wet
Limited hazard to workers	
Strong bonding action	
Can be used with hyper saline water	

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Product Comparison

Parameters / Product	High PI materials (PI>10)	Medium PI materials (PI bete. 3 -10)	Sandy Pi Materials (PI < 3)	All Weather Access	Steep gradients	Heavy Vehicles (mine/quarry)	High traffic volumes (> 250 vpd)	Short term applications (detours)	Long term applications (maintenance programs)	Spray on applications	Mix in applications	Grader maintenance
Wetting agents		●			●			●		●		●
Hydroscopic Salts		●				●	●	●	●	●	●	●
Natural Polymers	●	●	●			●	●	●	●	●	●	●
Synthetic Polymers	●	●	●	●	●	●			●		●	
Modified Waxes		●						●		●		●
Petroleum Resins	●	●		●	●	●		●	●	●	●	
Bitumen	Dependant on characteristics of individual products											

*Other products can be applied as long term applications, but will require periodic rejuvenation

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