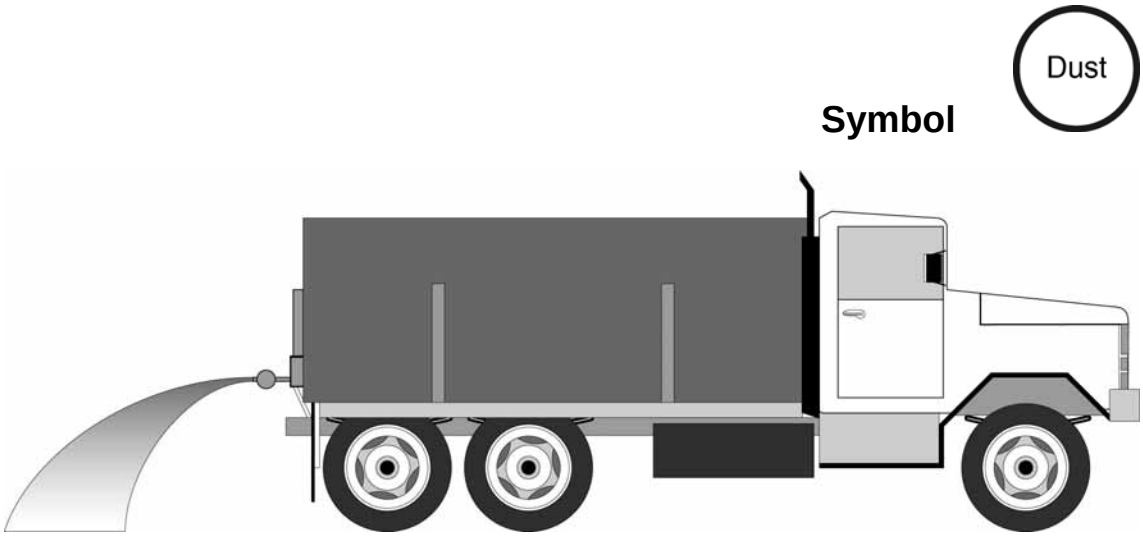
Dust Control

EROSION CONTROL TECHNIQUE

Revegetation	[1]	Temperate Climates	✓	Short-term	✓
Non Vegetation	[1]	Wet Tropics	✓	Long-term	[2]
Weed Control		Semi-Arid Zones	✓	Permanent	

[1] Treatment options can include temporary vegetation and non-vegetated treatment options.

[2] Most treatment options, excluding permanent revegetation, provide only short-term benefits.



Key Principles

1. Potential adverse impacts of dust control products/chemicals on the environment (both short- and long-term) **must** not exceed the potential benefits achieved by their use, or any locally adopted measures of unacceptable environmental risk.
2. Critical design parameters include ability to control dust generation, suitability of the product to the work place conditions and the soil type.
3. Effectiveness and durability of most treatment measures depends on soil type, weather conditions, and frequency of disturbance (e.g. traffic movement).

Design Information

Dust control involves the suppression of dust particles generally in the range 0.001 to 0.1mm (1 to 100 microns). Much of the dust generated on construction sites is likely to be greater than 10 microns. Non-visible dust particles (less than 5 microns) are potentially the most harmful to human health.

Dust generation associated with wind erosion is normally controlled using one or more of the following techniques:

(i) Maintaining moist soil conditions (water trucks and sprinkler systems)

(ii) Chemical sealants placed over the soil surface (refer to *Soil Binders* fact sheet)

(iii) Surface roughening (refer to *Surface Roughening* fact sheet)

(iv) Revegetation (short- and long-term ground cover options)

(v) Wind breaks (e.g. retention of existing vegetation, or 60:40 fabric:opening shade cloth).

Dust problems can also be reduced by the following activities:

- Limiting the area of soil disturbance at any given time.
- Promptly replacing topsoil after completion of earthworks
- Programming works to minimise the life of soil stockpiles.
- Temporarily stabilising (e.g. vegetation or mulching) long-term stockpiles.
- Gravelling unsealed access and haul roads.
- Minimising traffic movements on exposed surfaces.
- Limiting vehicular traffic to 25kph.
- Retaining existing vegetation as wind breaks.

International Erosion Control Association (IECA, 1993) reports that:

- 30% soil cover will reduce soil losses by 80%.
- Roughening the soil to produce 150mm high ridges perpendicular to the prevailing wind can reduce soil losses by 80%.
- A small decrease in velocity can have a major impact in reducing wind erosion given that the erosive power of wind is proportional to the cube of the velocity.
- For wind barriers perpendicular to the wind, the width of the [protected] zone leeward of the barriers is around 8 to 10 times the height of the barrier.

Possible treatment options for dust are summarised in Table 1. A summary of dust suppressant agents is provided in Table 2. Discussion on the use of soil binders for dust control is provided in the *Soil Binders* fact sheet.

Table 1 – Dust control practices [1]

Site condition	**Treatment options**							
	Permanent vegetation	Mulching	Watering	Chemical surface stabiliser [2]	Gravel road [3]	Stabilised entry/exit pad	Haul truck covers	Minimise site disturbance
Areas not subject to traffic	✓	✓	✓	✓	✓			✓
Areas subject to traffic			✓	✓	✓	✓		✓
Material stockpiles			✓	✓				✓
Demolition areas			✓			✓	✓	
Clearing & excavation			✓	✓				✓
Unpaved roads			✓	✓	✓	✓	✓	
Earth transport					✓	✓		

[1] Sourced from: California Stormwater BMP Handbook – Construction (2003).

[2] Oil or oil-treated subgrade should not be used for dust control as this may migrate into downstream water bodies. It is also noted that surface stabilising chemicals (soil binder) may make the soil water repellent, possibly resulting in long-term revegetation problems.

[3] On long-term access and haul roads, the sealing of road with an application of 10mm single-coat bitumen seal can be more effective than the application of dust suppressants.

The following materials must not be used for dust suppression purposes:

- oil;
- landfill gas condensate;
- any contaminated leachate or stormwater when the use of such material is likely to cause unlawful environmental harm.

Table 2 – Summary of dust suppressant attributes [1]

Suppressant type	Typical attributes
Soil binders	• Refer to *Soil Binders* fact sheet
Chlorides: Calcium chloride ($CaCl_2$) Magnesium chloride ($MgCl_2$)	• Chloride compounds attract moisture from the air (hygroscopic) and attach themselves to soil particles if they are applied to wet soils • Less effective in dry climates • Ease of application, with 0 to 4 hours curing time • Can be applied when temperatures drop below freezing • Most suited to temperate and semi-humid conditions • Lose effectiveness in continual dry periods • Less effective than polymers during periods of heavy rainfall • Susceptible to leaching • Suitable for use on moderate surface fines (10–20%) • Not suitable on materials with a low-fines content • High fines content surfaces may become slippery in wet weather • Corrosive impacts associated with calcium chloride
Organic, non-bituminous: Calcium ligno-sulfonate Sodium ligno-sulfonate Ammonium ligno-sulfonate	• Ligno-sulfonate (lignin) is a by-product of the pulp-and-paper industry • React with negatively charged clay particles to agglomerate the soil • Perform well under arid conditions and in dry climates • Failures occur following rains • Susceptible to leaching by heavy rains • Suitable on high fines content (10–30%) in a dense graded material with nil loose gravel • Less effective on igneous, medium to low fines content materials and crushed gravels • High fines content surfaces may become slippery in wet weather • It is best to grade haul road to remove surface material, potholes, and corrugations before application of agent • Curing takes 4 to 8 hours
Petroleum-based products: Bitumen emulsion (slow-breaking non-ionic)	• Generally effective regardless of climate • Will pothole in wet weather and high traffic conditions • Suitable on materials with a low-fines content (<10%) • Non suitable where runoff could contaminate receiving waters
Electrochemical stabilisers: Sulfonated petroleum Enzymes	• Work over a wide range of climates • Suitable for clay materials but depends on clay mineralogy • Iron rich soils generally respond well • Least susceptible to leaching • Ineffective if surface is low in fines and contains loose gravel

[1] After UMA Engineering Ltd 1987, *Guidelines for Cost Effective use and Application of Dust Palliatives.* UMA Engineering Ltd, Ontario, Canada.

Water trucks and sprinkler systems

Water trucks have traditionally been used to control dust within construction sites, particularly on haul roads and for highway construction. The maintenance of moist soil conditions through watering remains a viable dust control measure.

The addition of wetting agents and polymer binders (refer to *Soil Binders* fact sheet) to the water can decrease both the water requirements and the required application frequency. Wetting agents can improve the depth and uniformity of the soil wetting process. Polymer binders improve the binding of individual soil particles, thus reducing dust generation even after drying of the soil surface. Dust suppressing agents can be applied by both water trucks and sprinkler systems.

Dust-suppressing fog and mist generators

High volume mist generating machines can be used to suppress airborne dust resulting from blasting operations. Large cannon-like systems can throw a mist some 250m to blanket the treatment area. On small sites, hydraulic atomising misting nozzles can be attached to sprinkler-like distribution system.

An ionic wetting agent can be added to the water to improve the performance of misting dust suppression systems.

Foaming agents

Foaming agent additives can be added to directional dust-suppressing sprinkler systems to apply a foam to the surface of conveyor belt materials to reduce dust resulting from crusher and material handling plants.

Vegetable oil based soil binders

Biodegradable vegetable oil based soil binders can be applied as a water-based emulsion to provide up to 3 months service life in heavy vehicular traffic areas.

Polymer based soil binders (refer to *Soil Binders* fact sheet)

Polymeric emulsion soil binders include: acrylic copolymers and polymers; liquid polymers of methacrylates and acrylates; copolymers of sodium acrylates and acrylamides; poly-acrylamide and copolymer of acrylamide; and hydro-colloid polymers.

In general terms, polymers can provide around 9 to 18 months service life if the treated area remain free of disturbance and traffic movement. On haul roads and permanent unsealed roads, polymer soil binders can be incorporated into road maintenance (grading and rolling) to improve surface stability and compaction.

Photo 1 – Dust generation on a construction site

Photo 2 – Dust control using a water truck