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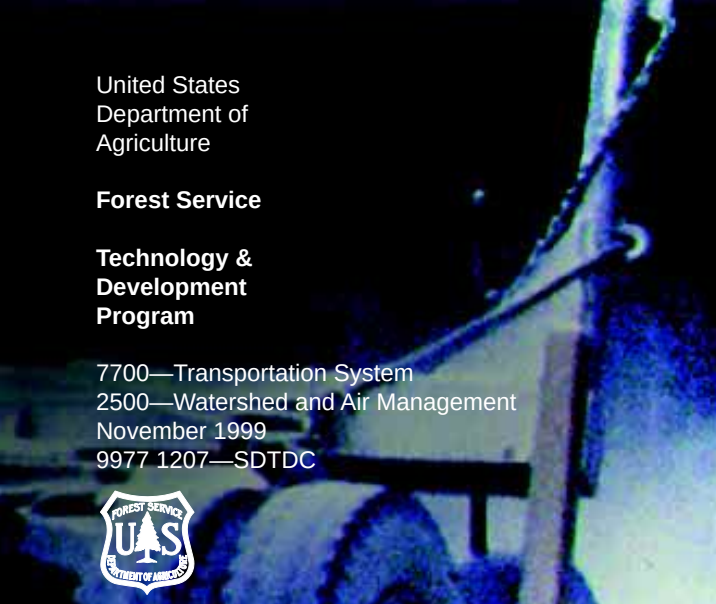
Dust Palliative Selection and Application Guide



DUST PALLIATIVE SELECTION AND APPLICATION GUIDE

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INTRODUCTION

The purpose of this publication is to help practitioners understand and correctly choose and apply the dust palliative that is appropriate for their particular site, traffic conditions, and climate. In addition, this publication describes the expected performance, limitations, and potential environmental impacts of various palliatives.

This guide examines most of the commonly available dust palliatives currently available and does not endorse any particular product. Since new products will become available and existing products will most likely change following publication of this report, it is recommended that this guide be used as a starting point for determining which palliative would be most appropriate for a given situation.

DUST ABATEMENT BASICS

Dust from unpaved roads is not only a nuisance but creates a safety hazard by reducing the driver's visibility. Dust also affects the health of road users and increases wear-and-tear on vehicles. Dust is always considered an intruder at campsites and picnic areas. In some areas there are regulations that limit the amount of particulate allowed in the atmosphere.

Fine particles, including dust, act to help hold the surface of unpaved roads together. With a loss of fine particles from the roadway, there is an increase in roadway surface raveling and maintenance costs. These fines are smaller than what the eye can see and pass through the 75 μm (No. 200) sieve.

How can dust emissions from the roadway be reduced or eliminated? Since the fines act as a binder that holds the surface of the unpaved road together, removing them is not a good option. Sealing the surface with an asphalt or concrete pavement or Bituminous Surface Treatment eliminates the dust problem; however, the low traffic on most Forest Service roads does not justify the cost of sealing the road with asphalt, concrete, or a surface treatment. Another alternative is to apply a dust suppressant product. These products are not a permanent solution and will require further applications as the effectiveness of the product decreases with time. Dust suppressants are one of many possible methods to control dust (Foley 1996; UMA 1987; Washington Dept. of Ecology 1996).

Dust suppressants work by either agglomerating the fine particles, adhering/binding the surface particles together, or increasing the density of the road surface material. They reduce the ability of the surface particles to be lifted and suspended by either vehicle tires or wind.

To properly select the appropriate palliative one must understand the primary factors that generate dust. They include the following:

- Vehicle speed
- Number of wheels per vehicle
- Number of vehicles
- Vehicle weight
- Particle size distribution (gradation) of the surface material
- Restraint of the surface fines (compaction, cohesiveness/bonding, durability)
- Surface moisture (humidity, amount of precipitation, amount of evaporation).

An excellent description of these factors that generate dust and how to analyze total long-term costs can be found in Foley et al. (1996) and UMA Engineering (1987).

Selection of the proper dust abatement program must include an understanding of not only the above factors, but the total long-term cost and environmental impacts of that program. Long-term costs include road improvement, road preparation, application of the suppressant in conjunction with the number of times the palliative needs to be applied, and expected change in maintenance practices. Environmental considerations typically

include impacts to the water quality, aquatic habitat, and plant community.

Besides controlling dust, a good dust abatement program may include reduced maintenance bladings and decreased aggregate loss (UMA 1987; Addo and Sanders 1995; Lund 1973).

DUST PALLIATIVE BASICS

There are a wide variety of dust suppressants available on the market today and there will continue to be more in the future. They can be divided into seven basic categories: water, water absorbing products, petroleum based products, organic nonpetroleum based products, electrochemical products, polymer products, and clay additive products. The categories are listed in order based on an estimate of past usage/ popularity.

Typical suppressants in each category are:

- Water
- Water Absorbing Products (deliquescent/ hydroscopic)
  - calcium chloride brine and flakes
  - magnesium chloride brine
  - sodium chloride (salt)
- Organic Petroleum Products
  - asphalt emulsions
  - cutback asphalt (liquid asphalt)
  - dust oils
  - modified asphalt emulsions
- Organic Nonpetroleum Products
  - animal fats
  - lignosulfonate
  - molasses/sugar beet
  - tall oil emulsions
  - vegetable oils
- Electrochemical Products
  - enzymes
  - ionic products
  - sulfonated oils
- Synthetic Polymer Products
  - polyvinyl acetate
  - vinyl acrylic
- Clay Additives
  - bentonite
  - montmorillonite

Table 1 gives an overview of these seven categories, listing their attributes, limitations, typical application rates, and common names based on Foley et al. (1996), UMA Engineering (1987), TTAO (1986), Bolander (1997), and Scholen (1992). Table 2 lists manufacturers and some distributors of the various dust palliatives.

SUPPRESSANT SELECTION TIPS

To determine the most cost-effective dust palliative, it is recommended that the flow diagram by UMA Engineering (1987) and Washington State Department of Ecology (1996) in figure 1 be followed. Important benefiting factors (Langdon 1980) of dust palliatives that should be considered when evaluating and selecting the proper dust palliative include:

- Cohering the dust particles to themselves or to larger particles
- Resisting wear by traffic
- Remaining on the road
- Resisting aging.

Based on the above characteristics, the product selection chart shown in table 3 should aid in selecting the most suitable dust palliative (Foley et al. 1996; UMA 1987; Bolander 1997; Bolander 1999; Scholen 1992; Langdon et al. 1980; Han 1992). When using the information in table 3, first perform a soils analysis to classify the surface material. Some palliatives require a clay component (plasticity index) or specific amount of fines to properly bind and/or agglomorate. Table 1 provides additional information about dust suppressant limitations, application methods, and environmental impact, which helps further in selecting the best dust palliative. The flow diagram in figure 1 leads the practitioner to figure 2, which is a guide for determining the overall cost of the dust abatement program including the yearly and possibly the multi-year cost of a dust abatement application. Figure 3 is a guide for summarizing the expected benefits of the selected dust control plan.

If a petroleum dust palliative is being considered, further suppressant selection information can be found in Langdon (1980) and Langdon, Hicks, and Williamson (1980).

Table 1—Road dust suppressants.

Dust Suppressant Category	Attributes	Limitations	Application	Origin	Environmental Impact
Water	• agglomerates the surface particles • normally, readily available	• evaporates readily • controls dust generally for less than a day • generally the most expensive and labor intensive of the inorganic suppressants	• frequency depends on temperature and humidity; typically only effective from 1/2 to 12 hours	• any potable water source	• none
Water Absorbing: Calcium Chloride (deliquescent)	• ability to absorb water from the air is a function of temperature and relative humidity; for example, at 25°C (77°F) it starts to absorb water at 29% relative humidity, and at 38°C (100°F) it starts to absorb water at 20% relative humidity • significantly increases surface tension of water film between particles, helping to slow evaporation and further tighten compacted soil as drying progresses • treated road can be regraded and recompacted with less concern for losing moisture and density	• requires minimum humidity level to absorb moisture from the air • doesn't perform as well as MgCl in long dry spells • performs better than MgCl when high humidity is present • slightly corrosive to metal, highly to aluminum and its alloys, attracts moisture, thereby prolonging active period for corrosion • rainwater tends to leach out highly soluble chlorides • if high fines content in treated material, the surface may become slippery when wet • effectiveness when less than 20% solution has performance similar to water	• generally 1 to 2 treatments per season • initial application: flake: @ 0.5 to 1.1 kg/m^2 (1.0 to 2.0 lb/y^2), typical application 0.9 kg/m^2 (1.7 lb/y^2) @ 77% purity liquid: 35 to 38% residual @ 0.9 to 1.6 L/m^2 (0.2 to 0.35 g/y^2), typical application is 38% residual concentrate applied undiluted @ 1.6 L/m^2 (0.35 g/y^2) • follow-up: apply @ 1/2 to 1/3 initial dosage	• by-product in the form of brine from manufacture of sodium carbonate by ammonia-soda process and of bromine from natural brines • three forms: flake, or Type I, @ 77 to 80% purity pellet, or Type II, @ 94 to 97% purity clear liquid @ 35 to 38% solids	• water quality impact: generally negligible if the proper buffer zone exists between treated area and water • fresh water aquatic impact: may develop at chloride concentrations as low as 400 ppm for trout, up to 10,000 ppm for other fish species • plant impact: some species susceptible, such as pine, hemlock, poplar, ash, spruce, and maple • potential concerns with spills of liquid concentrate

Table 1—Road dust suppressants (continued).

Dust Suppressant Category	Attributes	Limitations	Application	Origin	Environmental Impact
Water Absorbing: Magnesium Chloride (deliquescent)	• starts to absorb water from the air at 32% relative humidity independent of temperature • more effective than calcium chloride solutions for increasing surface tension, resulting in a very hard road surface when dry • treated road can be regraded and recompacted with less concern for losing moisture and density	• requires minimum humidity level to absorb moisture from the air • more suitable in drier climates • in concentrated solutions, very corrosive to steel (note: some products may contain a corrosive-inhibiting additive); attracts moisture, thereby prolonging active period for corrosion • rainwater tends to leach out highly soluble chlorides • if high fines content in treated material, the surface may become slippery when wet • effectiveness when less than 20% solution has performance similar to water	• generally 1 - 2 treatments per season • initial application: 28 to 35% residual @ 1.4 to 2.3 L/m^2 (0.30 to 0.5 g/y^2), typical application is 30% residual concentrate applied undiluted @ 2.3 L/m^2 (0.50 g/y^2) • follow-up: apply @ 1/2 initial dosage	• occurs naturally as brine (evaporated)	• water quality impact: generally negligible if the proper buffer zone exists between treated area and water • fresh water aquatic impact: may develop at chloride concentrations as low as 400 ppm for trout, up to 10,000 ppm for other fish species • plant impact: some species susceptible such as pine, hemlock, poplar, ash, spruce, and maple • potential concerns with spills
Water Absorbing: Sodium Chloride (hygroscopic)	• starts to absorb water from the air at 79% relative humidity independent of temperature • increases surface tension slightly less than calcium chloride	• requires minimum humidity level to absorb moisture from the air • moderately corrosive to steel in dilute solutions • tends not to hold up well as a surface application	• generally 1 - 2 treatments per season • higher dosages than calcium treatment	• occurs naturally as rock salt and brines	• same as calcium chloride

Table 1—Road dust suppressants (continued).

Dust Suppressant Category	Attributes	Limitations	Application	Origin	Environmental Impact
Organic Petroleum Products	• binds and/or agglomerates surface particles because of asphalt adhesive properties • serves to waterproof the road	• under dry conditions some products may not maintain resilience • if too many fines in surface and high in asphaltenes, it can form a crust and fragment under traffic and in wet weather • some products are difficult to maintain	• generally 1 to 2 treatments per season • 0.5 to 4.5 L/m^2 (0.1 to 1 g/y^2) depending on road surface condition, dilution, and product • the higher viscosity emulsions are used for the more open-graded surface materials • follow-up: apply at reduced initial dosages	• cutback asphalt: SC-70 • Asphalt emulsion: SS-1, SS-1h, CSS-1, or CSS-1h mixed with 5+ parts water by volume • modified asphalt emulsions • emulsified oils • mineral oils	• wide variety of ingredients in these products • “used” products are toxic • oil in products might be toxic • need product specific analysis • potential concerns with spills and leaching prior to the product “curing”
Organic Nonpetroleum: Lignin Derivatives	• binds surface particles together • greatly increases dry strength of material under dry conditions • retains effectiveness during long dry periods with low humidity • with high amounts of clay, it tends to remain slightly plastic permitting reshaping and additional traffic compaction	• may cause corrosion of aluminum and its alloys • surface binding action may be reduced or completely destroyed by heavy rain, due to solubility of solids in water • becomes slippery when wet, brittle when dry • difficult to maintain as a hard surface, but can be done under adequate moisture conditions	• generally 1 to 2 treatments per season • 10 to 25% residual @ 2.3 to 4.5 L/m^2 (0.5 to 1.0 g/y^2), typical application is 50% residual concentrate applied undiluted @ 2.3 L/m^2 (0.50 g/y^2) or 50% residual concentrate applied diluted 1:1 w/water @ 4.5 L/m^2 (1.0 g/y^2) • may be advantageous to apply in two applications • also comes in powdered form that is mixed 1 kg to 840 liters (1 lb to 100 gallons) of water and then sprayed	• water liquor product of sulfite paper making process, contains lignin in solution • composition depends on raw materials (mainly wood pulp) and chemicals used to extract cellulose; active constituent is neutralized lignin sulfuric acid containing sugar	• water quality impacts: none • fresh water aquatic impacts: BOD may be high upon leaching into a small stream • plant impacts: none • potential concern with spills

Table 1—Road dust suppressants (continued).

Dust Suppressant Category	Attributes	Limitations	Application	Origin	Environmental Impact
Organic Nonpetroleum: Molasses/Sugar Beet Extract	• provides temporary binding of the surface particles	• limited availability	• not researched	• by-product of the sugar beet processing industry	• water quality impact: unknown • fresh water aquatic impact: unknown • plant impact: unknown, none expected
Organic Nonpetroleum: Tall-Oil Derivatives	• adheres surface particles together • greatly increases dry strength of material under dry conditions	• surface binding action may be reduced or completely destroyed by long-term exposure to heavy rain, due to solubility of solids in water • difficult to maintain as a hard surface	• generally 1 treatment every few years • 10 to 20% residual solution @ 1.4 to 4.5 L/m^2 (0.3 to 1.0 g/y^2); typical application is 40 to 50% residual concentrate applied diluted 1:4 w/water @ 2.3 L/m^2 (0.5 gal/y^2)	• distilled product of the kraft (sulfate) paper making process	• water quality impact: unknown • fresh water aquatic impact: unknown • plant impact: unknown
Organic Nonpetroleum: Vegetable oils	• agglomerates the surface particles	• limited availability • oxidizes rapidly, then becomes brittle	• generally 1 treatment per season • application rate varies by product, typically 1.1 to 2.3 L/m^2 (0.25 to 0.50 g/y^2) • the warmer the product, the faster the penetration • follow-up: apply at reduced initial dosages	• some products: canola oil, soybean oil, cotton seed oil, and linseed oil	• water quality impact: unknown • fresh water aquatic impact: some products have been tested and have a low impact • plant impact: unknown, none expected

Table 1—Road dust suppressants (continued).

Dust Suppressant Category	Attributes	Limitations	Application	Origin	Environmental Impact
Electrochemical Derivatives	• changes characteristics of clay-sized particles • generally effective regardless of climatic conditions	• performance dependent on fine-clay mineralogy • needs time to “set-up,” i.e. react with the clay fraction • difficult to maintain if full strengthening reaction occurs • limited life span	• generally diluted 1 part product to anywhere from 100 to 600 parts water • diluted product also used to compact the scarified surface	• typical products: sulfonated oils, ammonium chloride enzymes, ionic products	• need product specific analysis • some products are highly acidic in their undiluted form
Synthetic Polymer Derivatives	• binds surface particles because of polymer’s adhesive properties	• difficult to maintain as a hard surface	• generally 1 treatment every few years • 5 to 15% residual solution @ 1.4 to 4.5 L/m^2 (0.3 to 1.0 g/y^2); typical application is 40 to 50% residual concentrate applied, diluted 1:9 w/water @ 2.3 L/m^2 (0.50 gal/y^2)	• by-product of the adhesive manufacturing process • typically 40 to 60% solids	• water quality impact: none • fresh water aquatic impact: generally low • plant impact: none • need product specific analysis
Clay Additives	• agglomerates with fine dust particles • generally increases dry strength of material under dry conditions	• if high fines content in treated material, the surface may become slippery when wet	• generally 1 treatment every 5 years • typical application rate is at 1 to 3% by dry weight	• mined natural clay deposits	• water quality impact: unknown • fresh water aquatic impact: none • plant impact: none

Table 2—Suppressant manufacturers.

Suppressant Category		Product Name	Manufacturer or Primary Distributor	Phone Number	Web Site
Water Absorbing	Calcium Chloride				
	Magnesium Chloride				
	Blend of Calcium and Magnesium Chloride				
	Sodium Chloride				
Organic Petroleum	Asphalt Emulsion				
	Cutback				
	Dust Oil/Dust Fluids				
	Modified Asphalt Emulsion				
Organic Nonpetroleum	Lignosulfonate				

Table 2—Suppressant manufacturers (continued).

Suppressant Category		Product Name	Manufacturer or Primary Distributor	Phone Number	Web Site
	Molassas/Sugar Beet				
	Tall Oil Emulsion				
	Vegetable Oils				
Electro-chemical	Enzymes				
	Ionic				
	Sulfonated Oils				
Synthetic Polymer Emulsions	Polyvinyl Acetate				
	Vinyl Acrylic				
	Combination of Polymers				

Table 2—Suppressant manufacturers (continued).

Suppressant Category		Product Name	Manufacturer or Primary Distributor	Phone Number	Web Site
Clay Additives	Bentonite				
	Montmorillonite				

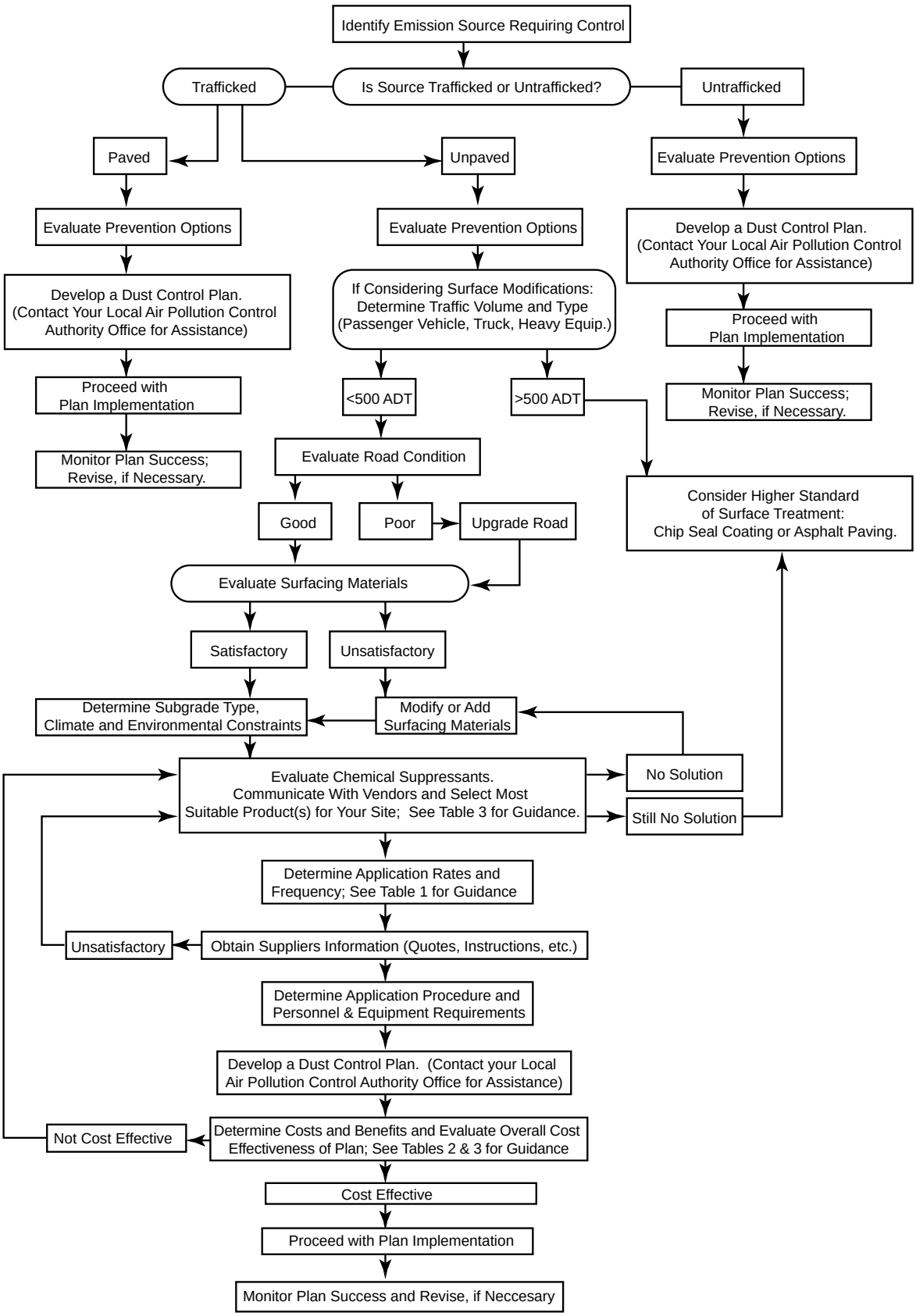

Figure 1—Guidelines for cost-effective selection and use of dust palliatives.

Table 3—Product selection chart.

Dust Palliative	Traffic Volumes, Average Daily Traffic			Surface Material								Climate During Traffic		
				Plasticity Index			Fines (Passing 75μm, No. 200, Sieve)							
	Light <100	Medium 100 to 250	Heavy >250 (1)	<3	3–8	>8	<5	5–10	10–20	20–30	>30	Wet &/or Rainy	Damp to Dry	Dry (2)
Calcium Chloride	✓✓	✓✓	✓	✗	✓	✓✓	✗	✓	✓✓	✓	✗ (3)	✗ (3,4)	✓✓	✗
Magnesium Chloride	✓✓	✓✓	✓	✗	✓	✓✓	✗	✓	✓✓	✓	✗ (3)	✗ (3,4)	✓✓	✓
Petroleum	✓	✓	✓	✓✓	✓	✗	✓ (5)	✓	✓ (6)	✗	✗	✓ (3)	✓✓	✓
Lignin	✓✓	✓✓	✓	✗	✓	✓✓ (6)	✗	✓	✓✓	✓✓	✓ (3,6)	✗ (4)	✓✓	✓✓
Tall Oil	✓✓	✓	✗	✓✓	✓	✗	✗	✓	✓✓ (6)	✓ (6)	✗	✓	✓✓	✓✓
Vegetable Oils	✓	✗	✗	✓	✓	✓	✗	✓	✓	✗	✗	✗	✓	✓
Electro-chemical	✓✓	✓	✓	✗	✓	✓✓	✗	✓	✓✓	✓✓	✓✓	✓ (3,4)	✓	✓
Synthetic Polymers	✓✓	✓	✗	✓✓	✓	✗	✗	✓✓	✓✓ (6)	✗	✗	✓	✓✓	✓✓
Clay Additives (6)	✓✓	✓	✗	✓✓	✓✓	✓	✓✓	✓	✓	✗	✗	✗ (3)	✓	✓✓

Legend

✓✓ = Good ✓ = Fair ✗ = Poor

Notes:

(1) May require higher or more frequent application rates, especially with high truck volumes
(2) Greater than 20 days with less than 40% relative humidity
(3) May become slippery in wet weather
(4) or with only clean, open-graded aggregate
(6) Road mix for best results

Forest _____ Date _____

Road Name _____ Estimated ADT _____

Road Number _____ Average Road Width _____

Project Location From _____ To _____ Length _____

Dust Palliative Product _____ First Application Rate _____

Second Application Rate _____

Item	Total Cost	Cost/km
A. Road Improvement Costs • Drainage improvements • Geometric improvements • Repair of failed areas • Addition of gravel surfacing		
B. Surface Preparation Costs • Addition of select material (fines, etc.) • Break up and loosen, watering, shaping, compacting		
C. Product Supply and Application Cost • Material supply • Diluting with water (if necessary) • Transportation & application		
D. Miscellaneous Costs • Traffic control, detours • Inspection, supervision • Other costs		
TOTAL COST OF PROGRAM		
COST EXCLUDING ITEM "A" ABOVE		

Figure 2—Cost record for dust control programs.

Forest _____ Date _____

Road Name _____ Estimated ADT _____

Road Number _____ Average Road Width _____

Project Location From _____ To _____ Length _____

Dust Palliative Product _____ First Application Rate _____

Second Application Rate _____

Benefits	Estimated Savings per Year
A. Reduced Maintenance costs • Estimate 25 to 75% savings over previous blading costs. Use local figures, if available.	
B. Reduced Regravelling • Estimate based on traffic volume and climate. Use local figures, if available.	
C. Other (intangible) • Reduced vehicle accidents • Reduced vehicle damage • Higher quality of life and property values • Reduced cleaning costs • Reduced dust induced respiratory problems • Reduced sedimentation in water bodies • Reduced impact on dust sensitive vegetation • Reduced complaints from public	
TOTAL TANGIBLE BENEFITS OF PROGRAM	

Figure 3—Benefits of dust control programs.

SUPPRESSANT APPLICATION TIPS

Once a suitable product is selected, the next step is to determine the appropriate application rate and frequency. Table 1 lists broad ranges of application rates for various products and can be used as a guideline. Manufacturer's literature, past experience, and field or laboratory test plots over a square meter (1 square yard) can also be used to help determine the appropriate application rate.

Generally, higher application rates or increased frequency is required when the following conditions are present:

- High traffic volumes with high speeds and a larger percentage of truck traffic
- Low humidity conditions, especially when using calcium chloride
- Low fines content in road surface, typically when there is less than 10 percent passing through the 75 μm (No. 200) sieve
- Poorly bladed surface and/or loose wearing surface.

General Application Tips

The performance of any dust suppressant is related to many application factors. Application method, rate, frequency, and product concentration are a few of these factors. A stable, tight surface that readily sheds surface water is another. If properly applied and constructed, a longer life and higher level of service can be expected from the dust abatement efforts (Foley et al. 1996; UMA 1987; Washington Dept. of Ecology 1996; Giummarra, Foley, and Cropley 1997). Since dust suppression and road maintenance efforts are usually combined, it is prudent to include the following practices in the maintenance and rehabilitation of road surfaces prior to applying a dust palliative:

- Repair unstable surfacing and/or subgrade areas
- Adequately drain (crown and crossfall) the road surface
- Remove boney (poorly graded) surface material
- Grade sufficient depth of roadway to remove ruts, potholes, and erosion gullies
- Compact the roadway (depending on treatment and sequence of operations).

Maximum benefits can also be achieved by adequate penetration of the liquid dust suppressant. This penetration should be on the order of 10 to 20 millimeters (3/8 to 3/4 inches). Proper penetration mitigates loss of the palliative resulting from surface wear. Adequate penetration also resists leaching, imparts cohesion, and resists aging (Langdon 1980).

Application tips that apply to all liquid dust suppressant products include:

- Apply suppressants, especially salts, immediately following the wet season.
- If possible, apply after rain so materials are moister (aids mixing) and more workable. If applied just before a rain, the material may wash away.
- Adhere to manufacturers' recommendations on minimum application rate, compaction and curing time prior to allowing traffic.
- If the surface material is dry, dampen, except when using cut-back asphalt products.
- If a hard crust is present, break up and loosen the surface.
- Use a pressure distributor to uniformly distribute the dust suppressant.
- Ensure that the necessary "residual" of the product is obtained. The residual is the amount of product that remains after the evaporation of water from the concentrate, as well as that used to dilute the product prior to application. The residual (sometimes called solids or binder) is the portion of the product that is responsible for the binding and/or agglomeration of the particles.

Water Application Tips

Regular, light watering is more effective than less frequent, heavy watering.

Chloride Application Tips

Light compaction is recommended after a chloride brine application.

Petroleum Application Tips

Soil type and density greatly affect the rate and amount of penetration. In all instances, it is desirable to attain a 12 to 25 millimeter (1/2 to 1 inch) penetration. Most products (with the exception of and) will penetrate and coat most soils if they have been loosened by scarification. For surfaces which have not been scarified, only those products with low viscosities will penetrate.

Organic Nonpetroleum Application Tips

Remove loose material prior to application unless the road surface will be mixed and/or compacted after the spray application. When applying vegetable oils, the top 25 to 50 millimeter (1 to 2 inches) of the surface should be loose to improve penetration.

Electrochemical Application Tips

Typically these products are mixed into the road surface.

Polymer Application Tips

Light compaction is recommended after a polymer application, unless the polymer is mixed into the road surface.

Clay Additive Application Tips

Ensure that the clay and the associated water used for compaction is uniformly distributed throughout the surface material. This method requires a minimum of 8 passes with a motor-grader or use of a cross-shaft rotary mixer.

All dust suppressants have a limited lifespan and require regular applications to satisfactorily control dust on a long-term basis. Subsequent applications should be made if and when dust levels exceed acceptable levels. These subsequent applications may be lighter than the initial application.

ENVIRONMENTAL IMPACTS

Any suppressant ingredient may migrate due to carelessness in application, run-off, leaching, dust particle migration, or adhesion to vehicles. Carefully review the product literature, Material Safety Data Sheet, and manufacturer's instructions before purchase and use. Observe all safety precautions and follow manufacturer's directions when handling, mixing, and applying dust suppressants. Application of all dust suppressants must comply with federal, state, and local laws and regulations. These vary by locality and need to be checked prior to implementing the dust abatement program.

The primary environmental concern with dust palliatives is how they impact the groundwater quality, freshwater aquatic environment, and plant community. Take all necessary precautions to keep dust palliative material out of water drainages and roadway ditches leading to streams.

The impact of dust palliatives on groundwater quality is based on how the suppressant migrates to the local groundwater table in conjunction with the chemicals used in the suppressant. Chemical analysis of the suppressant will assist in determining if harmful constituents are present. Knowing the depth to groundwater and the permeability of the native soil will assist in determining how and if the chemicals will leach to the groundwater table. A direct way to evaluate the contamination of harmful constituents to the groundwater is to conduct water quality sampling of the surrounding area before and after dust palliative application.

The impact of dust palliatives on the freshwater aquatic environment is measured by both the toxicity to fish and the availability of oxygen. Each state sets its own standards and they may vary by watershed and the type and age of the fish population. The test to determine toxicity is the LC50 test and the test to determine available oxygen is the BOD (Biochemical Oxygen Demand) test. The LC50 test measures the lethal concentration (LC) of product, expressed in parts per million (ppm), that will produce a 50 percent mortality rate in the test group in 96 hours. The larger the concentration, the less toxic the material. Typically, less than 100 ppm is considered toxic, 1,000 ppm is considered practically nontoxic, and greater than 10,000 ppm is considered nontoxic. The BOD test measures the oxygen used by microbes as it digests (feeds on) the product in water. Typically, the products that are derived from organic nonpetroleum suppressants are the most likely to have high BOD results.

There are no standard tests for measuring how dust palliatives impact the plant community; however, some tests have been performed that simply observe the impact on plant life.

Addo and Sanders (1995) summarize a number of environmental impact studies on the use of various chlorides on water quality, plants, and animals. Heffner (1997) updates the work by Schwendeman (1981) concerning the environmental impacts of some of the most common dust palliatives used by the Forest Service. Based on their efforts, the following is recommended when using these palliatives once or twice a year at their typical application rates:

Lignosulfonate - Determine prior to application if significant migration (water drainage) might occur from the treated area into local streams, ponds, and lakes. Ensure that migration will not impact the oxygen needs of the aquatic community.

Calcium and Magnesium Chlorides - Restrict the use of chlorides within 8 meters (25 feet) of a body of water. In areas of shallow groundwater, determine if significant migration of the chloride would reach the groundwater table. Restrict the use of chlorides if low salt tolerant vegetation is within 8 meters (25 feet) of the treated area. Typical low-tolerant vegetation includes various varieties of alder, hemlock, larch, maple, ornamentals, and pine.

Evaluations of other dust palliatives have not been made. If there is concern regarding the impact of a dust palliative on the environment, then, as a minimum, the LC50 and BOD tests should be performed. Results can be used to estimate the potential impact of the dust palliative in question on the local aquatic and plant communities.

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Library Card
Bolander, Peter, ed. 1999. Dust palliative selection and application guide. Project Report. 9977-1207-SDTDC. San Dimas, CA: U.S. Department of Agriculture, Forest Service, San Dimas Technology and Development Center. 20 p.

This publication helps practitioners understand and correctly choose and apply the dust palliative that is appropriate for their particular site, traffic conditions, and climate. Describes the expected performance, limitations, and potential environmental impacts of various palliatives. It is recommended that this guide be used as a starting point for determining which palliative would be most appropriate for a given situation.

Keywords: dust abatement, palliatives, suppressants

Additional single copies of this document may be ordered from:
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