WASHINGTON STATE DEPARTMENT OF ECOLOGY

ALTERNATIVES TO HAZARDOUS MATERIALS

# Techniques for Dust Prevention and Suppression

*Publication Number 96-433, Revised March 2003*

The Department of Ecology developed this publication to help owners and operators of areas with fugitive dust sources comply with laws pertaining to dust emissions and the use of dust suppressants. It provides guidance for road maintenance departments, road construction and general contractors, real estate developers, as well as government agency technical assistance providers, dust abatement product and service vendors, and the general public.

Common dust sources include:

- agricultural fields
- construction and demolition sites
- feed lots
- hauled materials
- storage piles.
- paved and unpaved roads
- parking lots
- waste cleanup sites
- industrial facilities

This publication describes methods, techniques, and products designed to prevent or suppress dust emissions. Environmental considerations relating to the use of chemical dust suppressants in Washington State are also discussed. The methods outlined here help you apply effective, economical, and environmentally safe dust control techniques.

## Benefits of a dust control program

Controlling dust emissions:

- Reduces dust-related human respiratory health problems like asthma, bronchitis, emphysema, hay fever, and allergies.
- Reduces vehicle accidents and human injuries due to poor visibility and road conditions.
- Reduces impacts on fish and other aquatic life, vegetation, agricultural crops, and water quality due to dusting, turbidity, and sedimentation.
- Reduces vehicle and equipment wear and damage due to mechanical abrasion and road impact.

**Table of Contents**

- Reduces unpaved road maintenance costs, by:
  - reducing frequency of blading by 25 to 75 percent,
  - decreasing loss of fine-grained road surface material, and
  - lowering regraveling costs.
- Reduces cleaning costs for homes and vehicles.
- Reduces liability for damage caused to property or people
- Improves property values and quality of life.
- Reduces complaints from the public.

# Dust Emission Prevention and

Dust emissions can be prevented or reduced in four basic ways:

- Limiting the creation or presence of dust-sized particles.
- Reducing wind speed at ground level.
- Binding dust particles together.
- Capturing and removing dust from its sources.

All of the following techniques rely on one or more of these strategies.

## Techniques Applicable to Many Sources:

- Vegetate or mulch areas that won't receive vehicle traffic.
- In areas where planting, mulching or paving is impractical, apply gravel or landscaping rock.
- Clear vegetation only from those areas where you will work right away.
- Construct natural or artificial wind breaks or wind screens. These may be designed as enclosures for small dust sources.

- Apply water to reduce emissions from temporary sources. Limited use of water-absorbing (hygroscopic) salts with water will reduce how often you must water trafficked areas.
- Surface-apply chemical suppressants to untrafficked areas to form a less erodible soil surface.

## Techniques for Unpaved, Trafficked Areas:

- Lower speed limits. High vehicle speed increases the amount of dust stirred up from unpaved roads and lots. Lowering the speed of a vehicle from 45 miles per hour to 35 miles per hour can reduce emissions by up to 22 percent.
- Upgrade the road by:
  - Increasing surface strength by improving particle size, shape, and mineral types that make up the surface and base materials.
  - Adding surface gravel to reduce the source of dust emission. Limit the amount of fine particles (those smaller than .075 mm) to 10 to 20 percent.
  - Improving drainage and crown.
- Use geotextile fabrics to increase the strength of new roads or roads undergoing reconstruction.
- Encourage use of alternate, paved routes, if available. Dust emissions from paved surfaces are up to 90 percent less than from unpaved surfaces.
- Restrict use by tracked vehicles and heavy trucks to prevent damage to road surface and base.
- Apply chemical dust suppressants using the admix method, blending the product with the top few inches of surface material. Suppressants may also be applied as surface treatments. Chemical treatment can reduce emissions by 30 to 80 percent.
- Pave unpaved permanent roads and other trafficked areas.
- Pave or treat permanent unpaved haul roads, construction sites, and parking or staging areas at commercial, municipal, or industrial facilities.

## Techniques for Paved, Trafficked Areas:

- Improve material specifications for and reduce usage of skid control sand or salt. Use coarse material that isn't easily crushed into powder during snow and ice season.

- Vacuum or wet sweep fine dirt and skid control materials from paved roads soon after winter weather ends and at other times, when needed.

- Minimize vehicle "track-out" material by:
  - Filling in muddy areas with gravel or other surface material.
  - Installing "grizzlies." These rough-surfaced areas, such as lengths of gravel or cattle guards, scrub soil and mud from vehicle tires.
  - Building vehicle tire/underbody wash stations near unpaved road junctions at project sites.

- Pave or stabilize shoulders of paved roads with gravel and vegetation.

- Provide for stormwater drainage and construct curbing to prevent water erosion onto paved roads.

## Techniques for Other Specific Sources:

- For *agricultural fields*: use strip cropping, increase soil surface roughness, plant wind breaks, rotate crops, reduce tillage, plant cover crops, limit burning, and apply mulch.

- Apply *load* control measures like load covering, freeboard, bedliners, and watering. Require prompt clean up of spills.

- Cover *piles* with wind-impervious fabric.

- Limit use of *off-road recreational vehicles* on open land. Confine operations to specific areas, require permits, or prohibit use.


# Applicable Regulations

Help protect public health and the environment by assuring that your dust control practices comply with federal, state, and local laws. Contact your local Air Pollution Control Authority and county Health Department to find out about requirements in your area. In Washington State, the following laws apply:

## Chapter 70.94 RCW Washington Clean Air Act and Chapter 173-400 WAC

These statutes require owners and operators of fugitive dust sources to prevent fugitive dust from becoming airborne and to maintain and operate sources to minimize emissions.

## Chapter 70.95I RCW Used Oil Recycling

This law prohibits the use of used oil as a dust suppressant. Used oil includes any oil that has been refined from crude oil, used, and as a result of such use, is contaminated by physical or chemical impurities. If you plan to use a chemical suppressant, verify that it does not contain any used oil as an ingredient. Also be certain that if the product contains fuel oil ingredients, that the fuel oil does not contain used oil. Note that federal regulation 40 CFR Part 279, Standards for the Management of Used Oil, Subpart I prohibits the use of used oil as a dust suppressant in all 50 states.

## Chapter 90.48 RCW, Water Pollution Control

Section .080 prohibits the discharge of any material into surface or ground waters that could cause pollution as defined in WAC 173-200-020(22). If your site is near surface or ground water, use dust control measures that have zero or minimal aquatic impact. If you decide to use a chemical dust suppressant, select a product with no aquatic toxicity.

Note that Ecology's General Permit for Sand and Gravel Operations prohibits the use of lignin sulfonate products for dust suppression in *excavated* areas due to the risk of groundwater pollution.

## Chapter 70.105 RCW, Hazardous Waste Management

This statute prohibits the disposal to the ground of any dangerous (hazardous) waste. If you are planning to use a chemical dust suppressant, make sure it does not contain any dangerous waste ingredients.

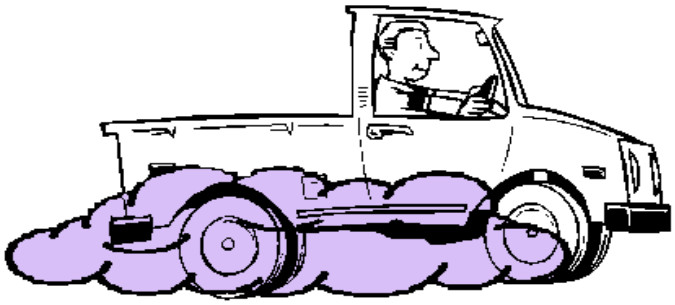
## Chapter 70.105D RCW Hazardous Waste Cleanup - Model Toxics Control Act (MTCA)

This law requires the identification and cleanup of hazardous sites. The Department of Ecology can investigate reports of releases or the presence of hazardous substances. If a hazardous product is used as a dust suppressant and Ecology later receives a complaint of contamination, a site assessment may be conducted. A cleanup may be required if it is determined that there is a potential threat to human health or the environment. This determination depends on the hazardous substance(s) present, their concentration(s), the environmental characteristics of the site including proximity to surface and groundwater, as well as the current or proposed future use of the property.

Anyone considering the use of products containing hazardous substances for dust abatement should carefully weigh the risk of possible future cleanup costs or loss in property value which could occur, particularly if land use is likely to change toward more unrestricted uses such as residential housing.

## Chapter 90.03 RCW Surface Water Code and Chapter 90.44 RCW Regulation of Public Ground Waters (wells)

This regulation requires a water right permit for **all** surface water withdrawal and for any water from a well that will exceed 5,000 gallons per day. If you plan to use water for dust suppression at your site, be sure that you have a legal right to that water. If in doubt, check with the Department of Ecology's Water Resources Program. Temporary permits are usually obtainable in a short time period. In some instances, water may need to be obtained from a different area and hauled in, or from an existing water right holder.



# Chemical Dust Suppressants

Chemical dust suppressants are commercially available for use on most types of emission sources. Keep in mind that most of the products designed for trafficked areas are primarily intended for moderately traveled, low cost roads, typically surfaced with gravel. Dust suppression and periodic unpaved road maintenance are normally combined.

The performance of any dust suppressant is directly related to many factors. These include:

- application method and rate,
- road surface moisture content during application,
- hydrological conditions, like site precipitation and drainage,
- mechanical stability of the road surface aggregate,
- percent of fines in the aggregate mix, and
- the properties of the road base and subgrade.

Don't expect a chemical suppressant to compensate for deficiencies in road design, material composition, local site, or climatic factors.

For unpaved road applications, products applied using the admix method usually work better than if simply surface applied. Table 1 on page 16 lists the common dust suppressant product types and their attributes. Vendors can provide detailed product-specific information.

## Product Performance

The literature on road dust suppression includes a number of comparative studies of dust control products; consult these references for detailed product comparisons. A number of them, marked "C", appear in the ***References*** section on page 14. Several of the references also contain detailed information on application methods, performance-related measurement techniques, comparative costs, and related road engineering topics. These references are recommended for further reading, and are marked with a "◆."

Results of comparative studies indicate that for unpaved road sites the most consistently effective suppressant products are the lignin sulfonate and calcium and magnesium chloride types. In Washington State, sixty road managers working in various governmental and private jurisdictions reported using:

- lignin sulfonate products (41 percent),
- water (33 percent),
- magnesium chloride products (8 percent),
- emulsified asphalt products (8 percent),
- petroleum oil products (4 percent),
- calcium chloride products (4 percent), and
- other products (2 percent).

## Human Health and Environmental Impacts

Only a few studies have evaluated the human health and environmental impacts of chemical dust suppressants. Any suppressant product or its ingredients may migrate from a treated site due to carelessness in application, runoff, leaching, volatility, dusting, or adhesion to vehicles.

The risk to human health and the environment from chemical dust suppression depends on many factors, including the hazardous characteristics of product ingredients, application practices, and the environmental characteristics of the site. In areas where surface water or groundwater is nearby and where streamflows are very low, adverse environmental impacts are possible.

During preparation or application, chemical dust suppressants may exhibit hazardous characteristics such as corrosivity or ignitability. Some products may produce excessive heat when mixed with water. Others may contain toxic or carcinogenic ingredients. Be sure to carefully review the product literature, Material Safety Data Sheet, and manufacturer's instructions before purchase and prior to use. Observe all safety precautions and follow manufacturer's directions when handling, mixing, and applying chemical suppressants.

A number of studies have looked at the effects of road deicing salts. Calcium chloride, magnesium chloride, and sodium chloride are commonly used for both deicing and dust suppression. When applied to roads and streets these salts can potentially contribute substantial amounts of the chloride ion to groundwater, surface water, and nearby soils. Deicing salt impacts to roadside and nearby vegetation, ground water (including wells) and, to a much lesser degree, surface waters, have been reported.

The results of deicing studies are not directly applicable to dust suppression. Salts applied to unpaved roads remain mostly in the road surface or underlying layers in the short term. Deicing compounds, however, applied to paved roads, quickly wash away as snow and ice melts.

Water quality analysis for the above-referenced dust suppression study conducted at Colorado State University found significant dust suppressant concentrations (from chloride and lignon products) in runoff samples from treated test sections. This study concluded that the total product mass going into the environment was small and would have negligible impact.

# Total Cost Accounting for Dust Suppression Projects

Developing an effective and cost-efficient dust control program means accurately identifying and accounting for the true costs and savings of any new alternative, compared to your current practices. For unpaved roads, the costs can be grouped into the categories listed below:

## Road Improvement Costs

Drainage improvements, geometric improvements, repairing of failed areas, excavation and removal of substandard material, and addition of surface material. (Note: These costs are not part of dust suppression program costs if they would be required anyway, without dust suppression.)

## Surface Preparation Costs

Addition of select material (fines or coarse material), breaking up and loosening the road surface (scarifying), watering, shaping, and compacting.

## Product Supply and Application Costs

Material cost, transportation cost, application cost, and contract supervisor cost (if a project supervisor is provided by the contractor).

## Miscellaneous Costs

Traffic control, detour, inspection, crew supervision, material storage (if inventory is maintained) and liability costs.

Dust program savings or benefits can be grouped as follows:

## Road Improvement Costs Avoided

Listed above, these costs are avoided or reduced over time due to greater road stability and durability resulting from chemical treatment.

## Road Maintenance and Repair Savings

These savings are due to less frequent regrading and less frequent need to add supplementary road materials. They accumulate due to reduced loss of gravel and fines, along with greater durability of the road surface.

## Savings from Non-road and Off-site Benefits

These are the savings that accrue from the many dust control program benefits not specifically related to the road itself, i.e., human health, vehicle-related, and environmental.

# Recommendations

Approach your dust control problem systematically, looking first at prevention options. The decision-making flowchart printed on page 18 provides a general framework.

## Prepare a dust control plan

Refer to the general and source-specific guidelines and control measures described in the documents *Control of Open Fugitive Dust Sources* (EPA-450/3-88-008) or *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures* (EPA-450/2-92-004). Also, be sure to consult with your local Air Pollution Control agency (see page 11). At a minimum your plan should include:

- Identification of all fugitive dust sources.
- A description of the dust control method(s) to be used for each source.
- A schedule, rate of application, calculation or some other means of identifying how often, how much or when the control method is to be used.
- Provisions for monitoring and record-keeping.
- A backup plan in case the first control plan does not work or is insufficient.
- The name and phone number of the person responsible for making sure the plan is implemented and who can be contacted in the event of a dust complaint.

## Selecting Chemical Suppressants

Comparative studies of dust suppression products have been conducted. Some of these are listed in the ***References*** section. Evaluate the available products against your own specific emission source, site, performance, and cost criteria.

The burden of proof for product safety lies with the chemical manufacturers, distributors and users. Obtain Material Safety Data Sheets and review them carefully. Ask the vendor whether their product has characteristics or meets criteria that would cause it to designate as a Washington State dangerous waste as it is applied to the ground, after drying or curing, or as a result of biochemical decay.

While hazardous characteristics or criteria or the presence of hazardous ingredients do not prevent the use of a product, they are factors in evaluating worker safety and potential environmental hazards. Beware of the possible presence of contaminants in any product. Ask the product manufacturer to provide you with toxicity test results including mammal and fish bioassay tests. For Washington State, the test methods are referenced in WAC 173-303-110, and are available through any Ecology office. Results of standard tests that measure biological oxygen demand (BOD) and leachability after application (i.e., water solubility) should also be available.

The Department of Ecology does not approve, recommend, or endorse specific products or service providers. However, we can help you in evaluating the environmental safety of specific products. Contact your regional office of Ecology's Hazardous Waste and Toxics Reduction Program for assistance.

# Contacts for Further Information or Assistance

## Local Air Pollution Control Authorities

### Olympic Air Pollution Control Authority

*(Clallam, Grays Harbor, Jefferson, Mason, Pacific, and Thurston Counties)*
909 Sleater-Kinney Road Southeast, Suite 1
Lacey, Washington 98503-1123
Vacant, Executive Director
**Telephone:** (360) 438-8768 or 1-800-422-5623
**Fax:** (360) 491-6308
**Website:** www.oapca.org

### Department of Ecology Northwest Regional Office

(San Juan County)
3190 - 160th Avenue Southeast
Bellevue, Washington 98008-5452
**Telephone:** (425) 649-7000
**Fax:** (425) 649-7098
**Website:** www.ecy.wa.gov

*continued on page 12*

### Northwest Air Pollution Authority
(Island, Skagit, and Whatcom Counties)
1600 S Second St
Mount Vernon, Washington 98273-5202
James Randles, Air Pollution Control Officer
**Telephone:** (360) 428-1617 **or** 1-800-622-4627 ( Island and Whatcom)
**Fax:** (360) 428-1620
**Website:** www.nwair.org/

### Puget Sound Clean Air Agency
(King, Kitsap, Pierce, and Snohomish Counties)
110 Union Street, Suite 500
Seattle, Washington 98101-2038
Dennis J. McLerran, Air Pollution Control Officer
**Telephone:** (206) 343-8800 or 1-800-552-3565
**Burn Ban Recording:** 1-800-595-4341
**Fax:** (206) 343-7522
**Website:** www.pscleanair.org/

### Southwest Clean Air Agency
(Clark, Cowlitz, Lewis, Skamania, and Wahkiakum Counties)
1308 NE 134th Street
Vancouver, Washington 98685-2747
Robert D. Elliot, Executive Director
**Telephone:** (360) 574-3058 or 1-800-633-0709
**Fax:** (360) 576-0925
**Website:** www.swapca.org

### Department of Ecology Central Regional Office
(Chelan, Douglas, Kittitas, Klickitat, and Okanogan Counties)
15 West Yakima Avenue, Suite 200
Yakima, Washington 98902-3401
**Telephone:** (509) 575-2490
**Fax:** (509) 575-2809
**Website:** www.ecy.wa.gov

### Yakima Regional Clean Air Authority
6 S Second Street, Room 1016
Yakima, Washington 98901
Les Ornelas, Director
**Telephone:** (509) 574-1410
**Fax:** (509) 574-1411
**Website:** http://co.yakima.wa.us/cleanair/default.htm

### Department of Ecology Eastern Regional Office
(Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla, and Whitman Counties)
4601 N Monroe Street, Suite 202
Spokane, Washington 99205-1295
**Telephone:** (509) 329-3400
**Fax:** (509) 329-3529
**Website:** www.ecy.wa.gov

### Spokane County Air Pollution Control Authority
1101 W College Avenue, Suite 403
Spokane, Washington 99201
Eric Skelton, Director
**Telephone:** (509) 456-4727
**Fax:** (509) 459-6828
**Website:** www.scapca.org

### Benton County Clean Air Authority
650 George Washington Way
Richland, Washington 99352
Dave Lauer, Director
**Telephone:** (509) 943-3396
**Burn Ban Recording:** (509) 946-4489
**Fax:** (509) 943-0505 or 943-2232
**Website:** www.bcaa.net/

## Department of Ecology

Ecology has environmental experts available to advise you on dust prevention and suppression techniques and issues. Direct your questions to the Ecology regional office nearest you.

### Central Regional Office (509) 575-2490
Counties: Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan and Yakima

### Eastern Regional Office (509) 329-3400
Counties: Asotin, Garfield, Columbia, Walla Walla, Grant, Adams, Whitman, Spokane, Lincoln, Ferry, Franklin, Stevens, and Pend Oreille

### Northwest Regional Office (425) 649-7000
Counties: Whatcom, Skagit, San Juan, King, Kitsap, Snohomish, and Island

### Southwest Regional Office (360) 407-6300
Counties: Skamania, Clark, Cowlitz, Wahkiakum, Pacific, Lewis, Pierce, Thurston, Mason, Grays Harbor, Jefferson, and Clallam

# References

"**C**" = Comparative study
◆ = Recommended for further reading


1◆ UMA Engineering Ltd. Engineers, Planners and Surveyors, *Guidelines for Cost Effective Use and Application of Dust Palliatives*, Roads and Transportation Association of Canada (RTAC), 1987.

2◆ Addo, Jonathan Q. and Sanders, Thomas G., *Effectiveness and Environmental Impact of Road Dust Suppressants*, MPC Report No. 95-28 A, Department of Civil Engineering, Colorado State University, Ft. Collins, CO, March 1995.

3**C** Monlux, Stephen. "Dust Abatement Product Comparisons in Region One", USDA Forest Service, February 17, 1993.

4**C** Bolander, Peter. U.S. Forest Service, *A Guide to Liquid Spray Applications for Erosion Control, Dust Abatement, and Tackifiers*, February 1996.

5◆ Palmer, James T., Edgar, Thomas V. and Boresi, Arthur P. *Strength and Density Modification of Unpaved Road Soils Due to Chemical Additives*, MPC Report No. 95-39 University of Wyoming, Department of Civil and Architectural Engineering, Laramie, WY, January 1995.

6 Scholen, Douglas E., *Non-Standard Stabilizers*, FHWA-FLP-92-011, U.S. Department of Transportation, Federal Highway Administration, July 1992.

7**C** Bolander, Peter, U.S. Forest Service, *Dust Abatement, Street Maintenance and Collection Systems Short School*, April 1995

8 Cowherd, C., Muleski, G. E. and Kinsey, J. S., *Control of Open Fugitive Dust Sources*, Midwest Research Institute, EPA Report No. 450/3-88-008, September 1988.

9**C** Brown, Dr. Dan A. and Elton, Dr. David J., *Guidelines for Dust Control on Unsurfaced Roads in Alabama*, Alabama Highway Research Center, Harbert Engineering Center, Auburn University, Alabama, June 1994.

10 "Dust Control, Road Maintenance Costs Cut With Calcium Chloride", *Public Works*, Vol. 121. No. 6, (May 1990) pp. 83-84.

11 Washington State Department of Ecology, *State Implementation Plan for Particulate Matter in the Spokane Study Area*, November 1991.

12C Kirchner, Henry W, P.E. . "Road Dust Suppressants Compared", *Public Works*, Vol. 119, No. 13 (December 1988), pp.27-28.

13 *Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures*, EPA Office of Air Quality, EPA-450/2-92-004, September 1992.

14**C** Bolander, Peter. Draft (August 1996): "Chemical Additives for Dust Control - What We've Used and What We've Learned", USDA Forest Service, Portland, Oregon.

# Table 1. Chemical Dust Suppressants

| Types | Source | Functional Mechanism |
|---|---|---|
| **Freshwater** | From surface or groundwater sources (need Water Right permit). | Moisture wets particles, increasing their mass and binding them together. |
| **Seawater** | Puget Sound, Pacific Ocean. | Moisture stabilizes fines. Contains small quantities of deliquescent (water retaining) chemicals (mostly $MgCl_2$,) which retain moisture in road surface. |
| **Calcium chloride** (Generically available as flakes or pellets) | By-product of ammonia-soda (Solvary) process; also produced from natural salt brine. | Deliquescent and hygroscopic; i.e., attracts and retains moisture at a relative humidity equal to or greater than 29 % (77 °F). |
| **Magnesium chloride** | Produced from natural salt brine; by-product of potash production; produced from the reaction of magnesium hydroxide (from seawater or dolomite) with hydrochloric acid. | Deliquescent and hygroscopic; i.e. attracts and retains moisture at a relative humidity equal to or greater than 32 % (77 °F). |
| **Lignin derivatives** | Paper-making industry by-product containing lignin and carbohydrates in solution. Specific composition depends on chemicals and processes used to extract cellulose. | Act as adhesives, binding soil particles together. |
| **Tree Resin Emulsions** | Emulsions produced from pine tree resins. | Act as adhesives, binding soil particles together. |
| **Synthetic Polymer Emulsions** | Synthetic formulations composed of polyvinyl acetates, vinyl acrylic copolymers, copolymer methacrylates, polybutadiene, et. al. | Bind soil particles together by forming a polymerizing matrix, function similar to adhesives. |
| **Bituments, Tars, and Resins**<br>*-Residual Fuel Oil*<br>*-Technical White Oils*<br>*-Fuel oils #4, #5, #6* | Petroleum, coal, and plastics industry by-products. | Asphalt and resinous products are adhesive, binding soil particles together. Petroleum oil products coat soil particles, increasing their mass. |
| **Geotextiles** | Manufactured polypropylene and polyethylene fabrics. | Provide and maintain drainage; improve load supporting properties; prevent upward migration of subgrade fines; separate road layer materials. |

| | Performance Advantages | Performance Limitations | Environmental considerations |
|---|---|---|---|
| | Usually readily available, low material cost, easy to apply. | Frequent light applications may be necessary during hot, dry, weather; therefore, potentially labor intensive. Over-application may result in loss of traction, erosion, or points of road failure. | Minimal environmental hazard. If applied excessively, may result in erosion and sediment runoff. Supply may be limited in some areas. |
| | Low material cost. Performs somewhat better than fresh water. Need for re-application is less than with fresh water. | Only available in coastal areas. Over application may result in loss of traction, erosion, or points of road failure. Salt (MgCl2, NaCl) is corrosive to metals. | Repeated applications and long-term use may harm adjacent and nearby vegetation. |
| | Reduces evaporation rate of surface moisture 3.4 times; lowers freezing point of water to -60 degrees F (30% solution) minimizing frost heave and reducing freeze-thaw cycles; increases compacted density of road material; effectiveness retained after reblading. | Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to aluminum alloys; slightly corrosive to steel. Solubility results in leaching during heavy precipitation. Releases heat when mixed in water. | Repeated applications and long-term use may harm adjacent and nearby vegetations. |
| | Reduces evaporation rate of surface moisture 3.1 times; lowers freezing point of water to -27 degrees F (22% solution) minimizing frost heave and reducing freeze-thaw cycles; increases compacted density of road material, more so than $CaCl_2$; effectiveness retained after reblading. | Effectiveness in arid and semi-arid regions may be limited due to low relative humidity; very corrosive to steel, though inhibitors can be added. Solubility results in leaching during heavy precipitation. | Repeated applications and long-term use may harm adjacent and nearby vegetations. |
| | Greatly increases dry strength of soil; not humidity-dependent; imparts some plasticity to road surfaces; lowers freezing point of road surface and base; effectiveness retained after reblading. | High solubility results in leaching during heavy precipitation; corrosive to aluminum alloys due to acidity ($CaC0_3$ added ingredient, can neutralize acidity). Proper aggregate mix (4 - 8% fines) important to performance. Becomes slippery when wet, brittle when dry. | Lignin products have a high BOD (biological oxygen demand) in aquatic systems. Spills or runoff into surface or groundwaters may create low dissolved oxygen conditions resulting in fish kills or increases in groundwater concentrations of iron, sulfur compounds, and other pollutants. |
| | Low solubility after curing minimizes leaching and provides degree of surface waterproofing. Imparts some plasticity to road surfaces. High bonding strength; non-corrosive. | Require proper weather and time to cure. No residual effectiveness after reblading. Equipment requires prompt cleanup to avoid curing of resin in hoses and pipes. | |
| | Applicable to a range of emission sources; function well in sandy soil conditions. Some types allow seeded vegetation to grow through the polymer matrix. | Require proper weather conditions and time to cure; may be subject to UV (sunlight) degradation; application equipment requires timely cleaning; no residual effectiveness after reblading. | |
| | Water insoluble when dry; provide a degree of surface waterproofing. Good residual effectiveness. | Surface crusting, fracturing and potholing may develop; long-term application may cause road to become too hard for reblading; won't lower freezing point; petroleum oil products lack adhesive characteristics. | Use of used oils is prohibited. See MTCA discussion on page 6. Some petroleum-based products may contain carcinogenic polycyclic aromatic hydrocarbons (PAHs). |
| | Flexible, durable, water permeable, and resists soil chemicals; reduces amount of aggregate required during initial construction; lower maintenance | High material cost; material degrades in sunlight, if exposed. | |

# Dust Prevention Methodology

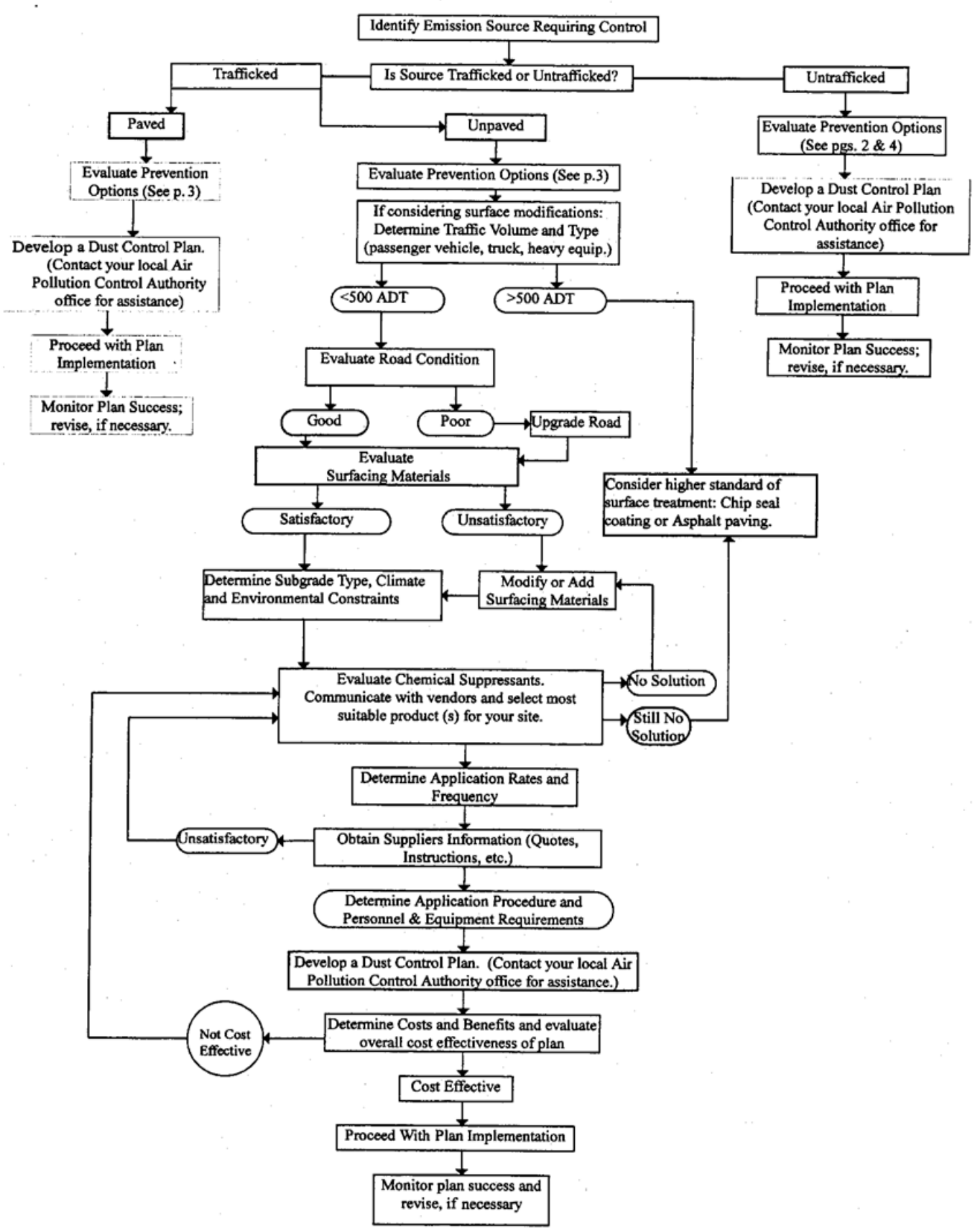
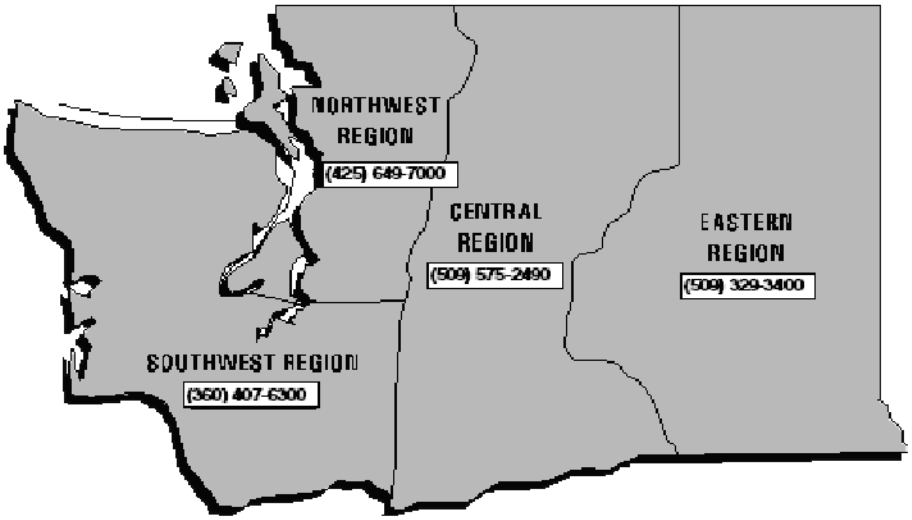



Figure 1. Adapted from "Guidelines for Cost Effective Use and Application of Dust Palliatives," Figure 1.1, p.11.

*The Department of Ecology is an equal opportunity agency and does not discriminate on the basis of race, creed, color, disability, age, religion, national origin, sex, marital status, disabled veteran's status, Vietnam Era veteran's status or sexual orientation.*

If you have special accommodation needs or require this document in alternative format, please contact the Hazardous Waste and Toxics Reduction Program at (360) 407-6700 (voice) or 711 or (800) 833-6388 (TTY).




o

*printed on recycled paper*