Control Dust; Control Unpaved Road Quality and Costs

A report on unpaved road maintenance with LIQUIDOW calcium chloride

Why dust control is becoming a higher priority

Most road officials *want* to provide an ongoing dust control program for well-traveled unpaved roads, certain sections of less-traveled roads, and the majority of intersections where unpaved roads meet paved roads.

Dust is a terrible nuisance road officials would like to eliminate for their citizens. More important, they know dust in the air signals two safety concerns; reduced driver visibility and the beginning of surface deterioration.

Unfortunately, a dust control program has often remained on the *wants* list instead of the *needs* list. It is typically practiced when all other maintenance and repair jobs are completed. At least this is the case when it is seen as an expense, rather than as the money-saving investment it really can be.

Increasingly, road officials are documenting dramatic savings from the practice of dust control and moving it higher on their priority list. They are reducing unpaved road maintenance costs while treating their neighbors to cleaner, more comfortable, and safer unpaved roads and surroundings.

Here's a closer look at why dust control is now on the *needs* list of so many road maintenance officials.

Consistently cutting costs by 30% or more

Studies show an untreated, unpaved road with moderate traffic will lose as much as 300 tons (272.73 metric tons) of aggregate per mile per year. And, as aggregate is lost, the quality of the road deteriorates quickly. Users of LIQUIDOW* liquid calcium chloride consistently report a reduction in aggregate losses of up to 75–80%.

To put this in an economic perspective:

- It is the difference between 20 trips with a 15-ton (13.64 metric ton) truck compared to just four.
- It is the difference between a major renovation job and a minor one.
- It is also the difference in frequent spot repairs and patrol bladings between renovations versus an ever-decreasing number.

In fact, the longer a scheduled program of calcium chloride applications continues, the better an unpaved road becomes and the less attention it requires. Users consistently report a 30–33% reduction in total unpaved road maintenance costs.

Why LIQUIDOW calcium chloride is a very effective dust control agent

When reviewing calcium chloride's unique combination of properties you might think it was specifically designed and manufactured to control dust and improve the quality and durability of unpaved roads. In fact, calcium chloride is a naturally occuring type of salt that is found in underground brine deposits. Dow processes this brine, by removing impurities, to make a purified, "high-strength" liquid calcium chloride product.

Calcium chloride is hygroscopic, meaning it attracts moisture from the air and surroundings. This helps keep unpaved surfaces damp and dust down. It also resists evaporation. As a result, a single application lasts a long time.

Calcium chloride also exhibits a strong moisture film, high surface tension and low vapor pressure. These characteristics and calcium chloride's thirst for moisture help bind aggregate particles together. As a result, unpaved surfaces become compact. Over time, the chemical penetrates the surface several inches, adding a stabilizing effect to reduce frost damage and overall wear.

How do other dust control products compare

Magnesium chloride—In 1984, District No. 1, Boulder County, Colorado compared the dust control performance of magnesium chloride ($MgCl_2$) and calcium chloride ($CaCl_2$) and found that more $MgCl_2$ solution was needed to provide the same dust control effectiveness as 38% $CaCl_2$. This differential in application rate resulted in $MgCl_2$ costing 32% more than $CaCl_2$ on a dollar per mile basis. Treatment with $CaCl_2$ also helped stabilize the test sections, resulting in a 50% reduction in the need for blading and generating more maintenance cost savings. See Figure 1.

It is a misconception that $MgCl_2$ performs better than $CaCl_2$ in hot, dry weather. $CaCl_2$ has the ability to remain liquid to 104 °F and 20% humidity. $MgCl_2$ solutions will dry completely to a solid salt when humidity drops lower than 31%. Therefore, $CaCl_2$ continues to provide dust control protection under conditions where $MgCl_2$ loses all effectiveness. See Figure 2.

For dust control applications, $MgCl_2$ solutions are usually supplied at concentrations between 28-30% and may contain significant levels of sulfates and nitrates as impurities, (possibly 4-5% each). In contrast, 38% LIQUIDOW liquid calcium chloride supplies more active ingredient and is manufactured to meet or exceed the quality requirements specified by ASTM D 98. Typically, the total level of salt impurities in LIQUIDOW is less than 2%.

Oil and Resin Emulsions—dust control is achieved from the adhesive nature of these materials. Soil particles covered with asphalt or resinous material are weighed down and tend to stick together. Under dry conditions, these materials may lose their resilience, forming a crust that may fragment under traffic loads. Some products may be effective at controlling dust, however road stability is not enhanced, which results in pitting, pothole and washboard problems. Reworking the road surface to cure these problems destroys most of the benefits of the treatment and a new application of

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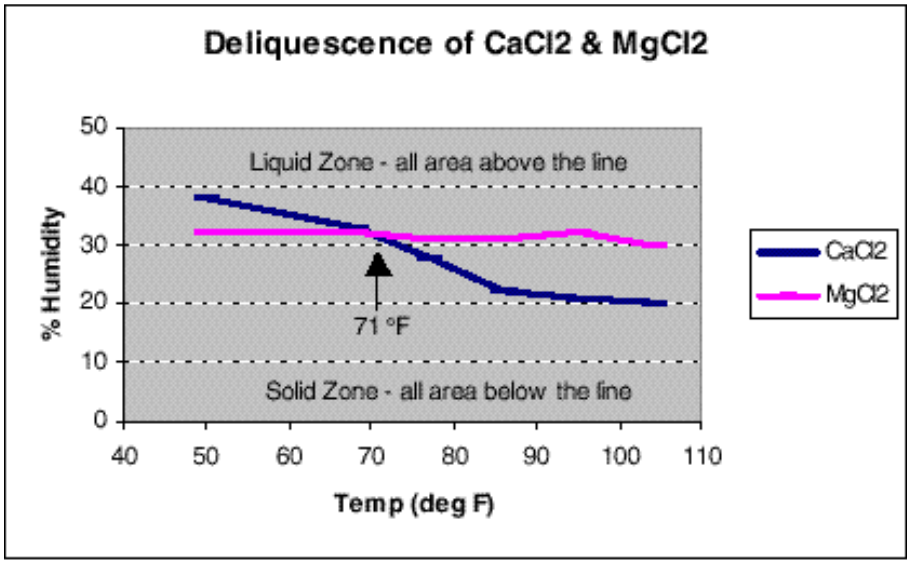
Figure 1.

	Cost per Gallon (in place)	Application Rate (gal/sq.yd.)	Gallons Spread Per Mile (14')	Total Cost Per Mile (14')
38% $CaCl_2$	$0.68	0.27	2,218	$1,497
$MgCl_2$ brine	$0.48	0.50	4,107	$1,988

Figure 2.



palliative is required. In general, these materials are also quite expensive.

Lignin Derivatives—a waste product associated with paper manufacture. In some areas, these products have been given away free so the producer can avoid waste disposal costs. Negative environmental impact has been a concern with lignin products, with some found to contain dioxins and other harmful substances. These products can be effective when road surface is high in fines content with no loose gravel, but may become slippery when wet. Under dry conditions, lignin derivatives may shear and, unlike calcium chloride, the shear is not self-repairing. Surface binding action may be reduced or completely destroyed by heavy rain, because polymers that provide the binding action are water-soluble.

Other Brines—natural and oil well brines are available in some locations across North America. These brines are attractive because they are generally inexpensive. However, the old saying, "you get what you pay for" seems to apply. Natural brines will vary in quality and vary in results. With fewer active ingredients, the most likely results will be less dust control and less driver safety and comfort. Natural brines probably do provide more of some things; more impurities, more frequent applications and more blading and aggregate replacement. More impurities may mean a greater risk of undesirable pollutants entering the environment. Oil well brines in particular may be susceptible to organic and/or heavy metal contamination. Sometimes, the option with the lowest initial cost ends up costing more in the long run. A careful assessment that considers the total cost picture (aggregate replacement, labor, equipment maintenance) as well as the "soft" issues (environmental impact, driver comfort/safety) is necessary to choose the right product.

The final analysis

Environmental—an independent study of the environmental impact of calcium chloride used as a dust suppressant in the Yukon reported no observed instance of roadside vegetation injury or die-off in areas where calcium chloride had been applied.

Performance—not only does calcium chloride control dust under hot, dry conditions, but the cumulative effect of multiple applications over time improves road stability and reduces frost heave, which lowers overall road maintenance costs.

Quality—LIQUIDOW is produced to meet or exceed the quality requirements specified by ASTM D 98. Consistent high quality means consistent high performance.

Cost—cost comparisons may differ from place to place and from year to year, however, after looking at a few examples from reputable sources, a trend emerges showing calcium chloride as the most cost effective product.

Dust Abatement Application Costs*	
Treatment Type	**Dollars Per Mile (14' wide)**
38% Calcium Chloride	$1,700
DOPE-30 Emulsion	$1,850
Magnesium Chloride Brine	$2,000
Lignin Sulfonate	$2,200
Coherex Emulsion	$2,400
PennzSuppress D Emulsion	$3,900

*Cost includes purchasing, hauling, mixing with water (if applicable) and application
Adapted from unpublished material from the 34th Roads and Streets Maintenance Supervisors School, USDA Forest Service, Portland, Oregon

With these thoughts in mind, why not contact us today to help you develop a dust control program for your most critical roads and intersections? We offer more than 85 years of experience and a network of authorized distributors which can help you implement the most cost-effective program.

Application rates and guidelines

Unpaved surfaces should be treated with calcium chloride in the spring after seasonal rains while moisture remains in the ground. Applications should not be started during heavy rainfall or if rain is threatening. A second application in late summer will maintain dust control throughout the fall months and will help protect the road from frost heave during winter. Consistent application year after year builds a cumulative effect that improves road stability and provides frost protection deeper into the road base.

LIQUIDOW liquid calcium chloride can make a good road better, but it cannot make a bad road good. Proper drainage and well-graded aggregate are important. Good drainage can be achieved when the road is constructed with a "Type A" crown. Ideally, well-graded aggregate in the wearing course includes an adequate quantity of fines that are slightly plastic. It is the interaction between these fines and the calcium chloride that stabilizes the road, reducing both dust and aggregate loss.

Traditionally, LIQUIDOW has been applied at a concentration of 38% for dust control applications. However, several current users are finding advantages associated with applying 42% solution. Applying at higher concentration allows a reduction in application rate. Therefore, each truckload can treat more miles of road. More miles per load translate to less time to complete a job and lower overall cost.

Application Procedures for LIQUIDOW liquid calcium chloride

	Road Preparation	Application Rate – 38%	Application Rate – 42%	Maintenance
Unpaved roads, construction sites and other unpaved surfaces	Blade and shape the surface to a "Type A" crown. This will permit water to drain properly, eliminating ponding.	0.27 gal/sq. yd. (1.2 liters/ sq. meter); 2,850 gal/mile – 18' wide liters/km – 5.5 meters wide	0.24 gal/sq. yd. (1.1 liters/ sq. meter); 2,500 gal/mile – 18' wide liters/km – 5.5 meters wide	Minimal attention is necessary. A second treatment is recommended in late summer/early fall. Reblade, if necessary.
Mine haul, logging, and other industrial roads	Same as unpaved roads	0.35 gal/sq. yd. (1.6 liters/sq. meter)	0.31 gal/sq. yd. (1.4 liters/sq. meter)	Same as unpaved roads
Trucking terminals and parking lots	Blade and shape the surface in a manner that will permit proper drainage and eliminate ponding	0.30 gal/sq. yd. (1.4 liters/sq. meter)	0.26 gal/sq. yd. (1.2 liters/sq. meter)	Same as unpaved roads

PLEASE NOTE: Calcium chloride will not mix with petroleum or emulsion products, so unpaved surfaces previously treated with these materials require special attention. For dust control, first scarify the surface (6" [15.2 cm] depth should suffice) to break up impregnated crust and expose untreated soil. Then windrow or pulverize the soil to break up clumps and provide a thorough mix. After this has been done, follow the preparation, application and maintenance steps outlined above for unpaved roads. Optimum base stabilization of previously treated roads requires a total of 1.0 gallons of liquid calcium chloride per square yard (3.8 liters/square meter); 0.75 gallons/square yard (2.8 liters/square meter) for stabilization, applied after the surface has been scarified; 0.25 gallons/square yard (1.0 liter/square meter) top dressing, applied after pulverization, blading, shaping, and compaction have been completed. All application rates are given for 38% calcium chloride. If not using 38% calcium chloride, adjust rates accordingly.

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