Identifying sustainable dust control for low-volume roads: Phase Three field tests of the USGS/USFWS collaboration

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Introduction

- More than 1.5 million miles of roads in the U.S. are unpaved.
- Fugitive dust from unpaved roads creates human health concerns in the form of inhalable particulate matter, decreases visibility and driver safety, and compromises road surface integrity through the loss of fine particles.
- Few studies have investigated potential environmental impacts of dust suppressant application.
- Our previous work (Phases One and Two) identified several products with a low risk of environmental harm when used under recommended conditions.

Overall objective

To provide scientifically defensible information on environmental impacts of dust suppressant products, with the goal of identifying products for use in sensitive habitats such as wildlife refuges

Phase Three objective

To evaluate product performance and verify environmental safety of selected products under real-world conditions

Study site and test layout

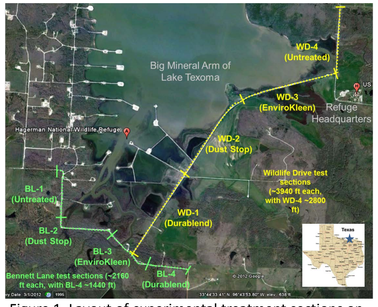


Figure 1. Layout of experimental treatment sections on Wildlife Drive and Bennett Lane.

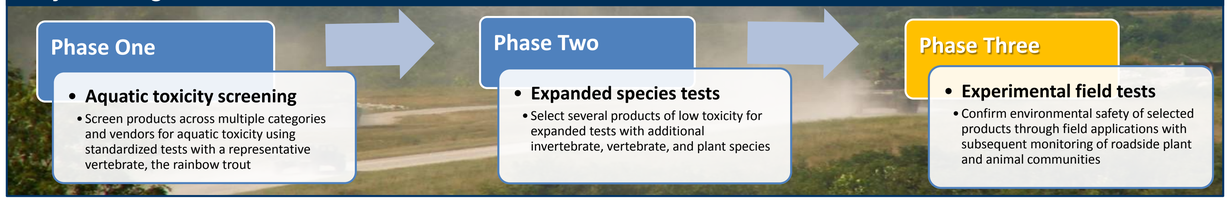
Hagerman National Wildlife Refuge, Texas

- ~12,000 acres (upland, wetland, open water and cropland)
- Migratory birds and other wildlife
- 150 active oil and gas wells
- Roads receive heavy equipment traffic in addition to 175,000 visitors/year
- Moderate-to-severe issues with dust


Dust from one passenger vehicle on Wildlife Drive


Dust accumulation on roadside vegetation

Project design



Methods

Central goal

Perform realistic applications and measure relevant endpoints with minimal disruption to normal Refuge activities

Product choice

Products showing low toxicity to aquatic organisms in previous tests were evaluated for compatibility with conditions at Hagerman

Test products were chosen collaboratively by Refuge staff, product vendors, and USGS biologists

Initial applications

Three products applied to replicated sections of Wildlife Drive and Bennett Lane (**Fig. 1**)

- **Durablend**—Enhanced magnesium chloride from EnviroTech Services, CO, USA
- **Dust Stop**—Cellulose-based powder from Cypher Environmental, MB, Canada
- **EnviroKleen**—Synthetic fluid from Midwest Industrial Supply, OH, USA

Road sections were prepared and products were applied according to vendor instructions

- Durablend and Dust Stop—one application
- EnviroKleen—initial application and maintenance dose after ~2 months


Road preparation


Durablend mix-in application


Dust Stop hydroseeder application


EnviroKleen topical application

Initial observations

Applications observed for overspray or runoff

Aggregate samples taken in each section for analysis by CFLHD Lab

Vegetation transects established adjacent to each section

Performance and biological monitoring (2, 4, 8, 16 and 52 weeks post-application)

Replicated dust measurements made with mobile-mounted DustTrak DRX

Road surfaces assessed and documented

Vegetation sampling

Roadside aquatic habitat monitoring

Preliminary results

Product performance

- All three products resulted in smoother, harder surfaces relative to untreated sections on Wildlife Drive (**Fig. 2**)
- All three products reduced dust levels relative to the untreated sections on Wildlife Drive through the first three monitoring periods when exposed to normal Refuge traffic. The dust suppressant effect of Durablend and EnviroKleen continued through the fourth monitoring period (4 months post-application; **Fig. 3**). Overall, dust levels in all sections varied with weather conditions, and variability among replicates increased over time.

Figure 2. Representative photos of treated road surfaces.

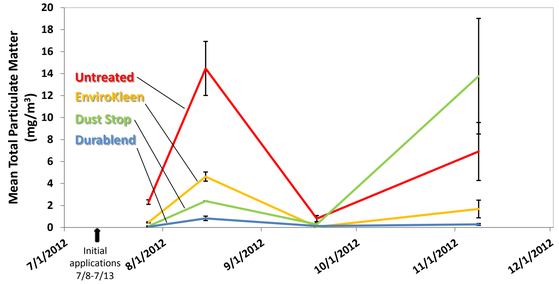


Figure 3. Total particulate matter measured while driving on treated sections of Wildlife Drive under standard conditions on four sampling dates. Points are means ± standard deviation (n=3 trips/section).

Preliminary results continued

Biological monitoring

- Vegetation transects adjacent to treated sections were not compatible with normal Refuge management activities (**Fig.4**)

Figure 4. Representative vegetation transect showing planned sampling locations (yellow arrows) at the time of product applications (left) and a later monitoring visit (right).

- Roadside aquatic habitats were highly variable both spatially and temporally

Preliminary Conclusions

- **All three low-toxicity products chosen for field tests improved the road surface and generally suppressed dust thus far on Wildlife Drive, relative to the untreated section**
- **The mobile-mounted DustTrak DRX aerosol monitor provided practical, replicated measurements of particulate matter mass and size fraction of road dust for comparisons among sections**
- **Dynamic biological monitoring plans were required for compatibility with Refuge activities and site-specific conditions**

Ongoing work

- Final monitoring visit planned July 2013 (52 weeks post-application)
- Aggregate sample analysis (fines content, etc.)
- Analysis of particulate matter including size fraction
- Semi-field tests
  - Treated aggregate samples in leaching tests
  - Experimental dusting tests
- Compilation of Refuge staff observations
- Final comparisons and report, including analysis of product performance, longevity, cost, application procedure, and effect on biological endpoints

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