Managing Fugitive Dust

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Road Map

- Understanding fugitive dust
- Methods to manage dust
- What we have learned from our field Research
- What we have learned from our laboratory Research

Unpaved Roads in the US

- 1.3 million miles of unpaved road in US
- 97% located in rural areas
- Source of 10.5 million tons particulate matter <10μm (PM10)

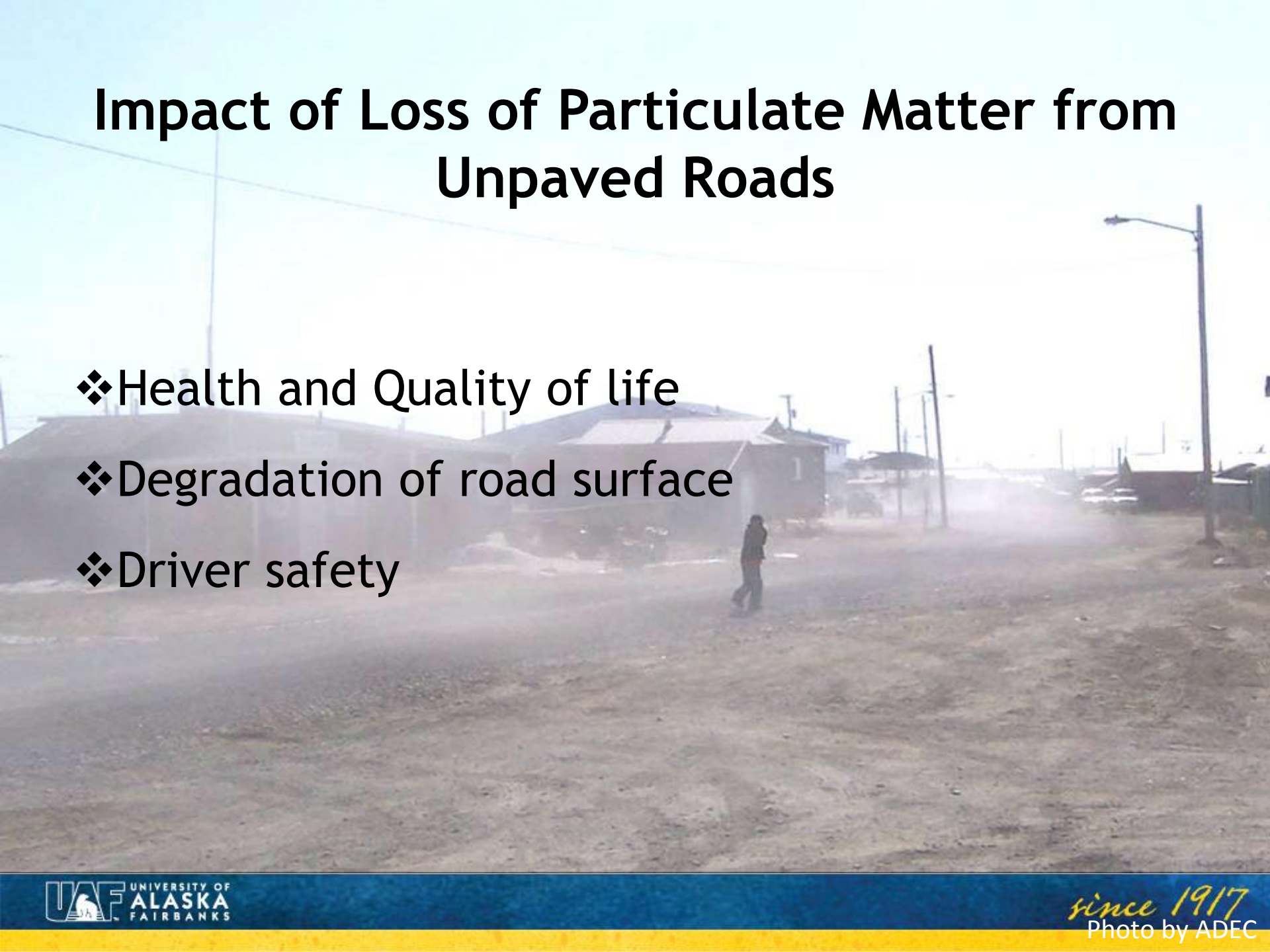
An Example of the Magnitude of the Problem

Consider: -> 2-mile stretch of unpaved road,
-> 20 vehicles/day,
-> average speed= 30 mph.

Result: 10,920 lbs of dust (PM10) per month

(Roberts et al., 1975)

Impact of Loss of Particulate Matter from Unpaved Roads



- Health and Quality of life
- Degradation of road surface
- Driver safety

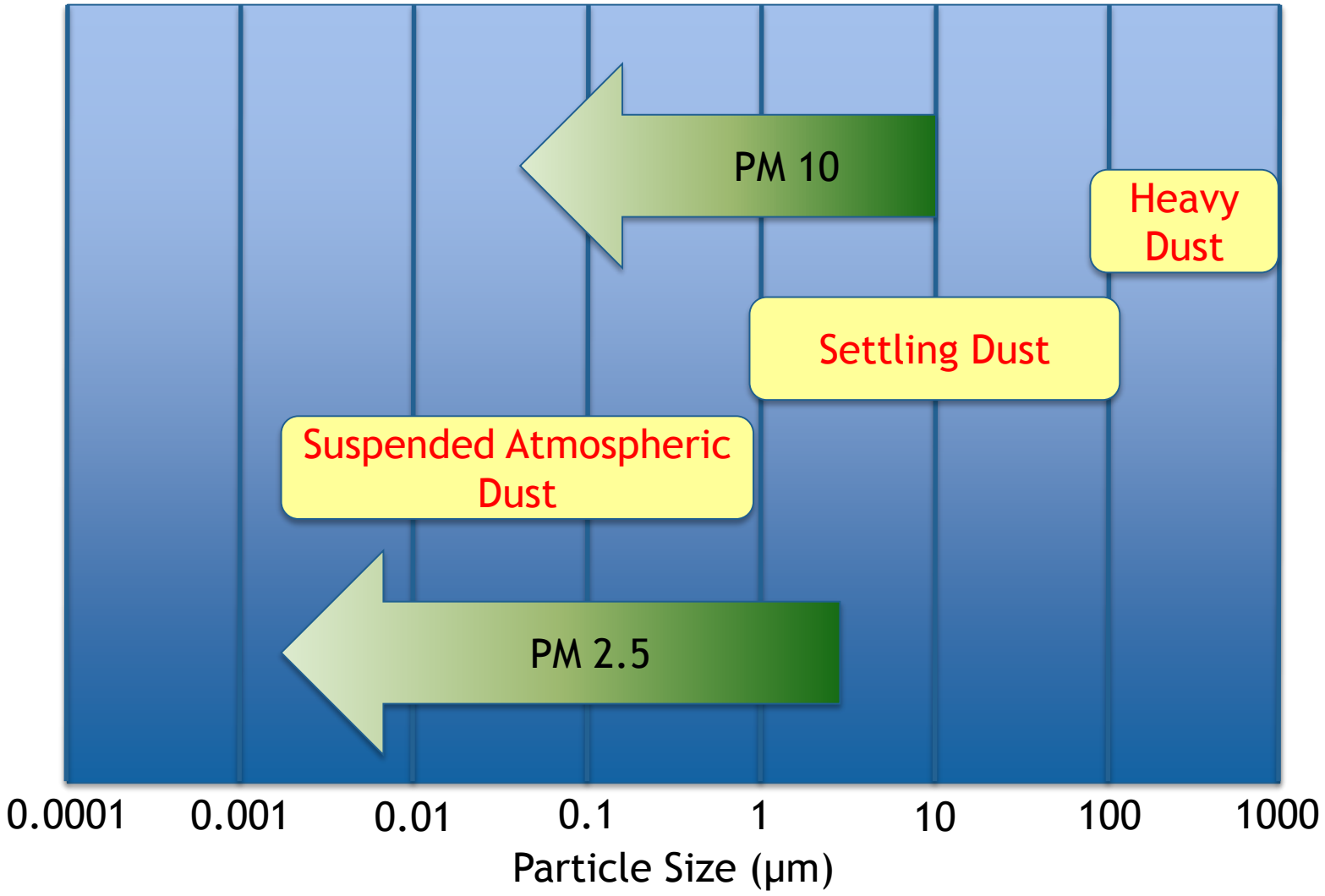
Photo by ADEC

Let's Do A Simple Dust Fall Test

Method

- Aggregate from Kalskag, AK
- 1st drop will be 2 grams (0.07 ounces) of untreated sample
- 2nd drop will be same amount of sample treated with a synthetic fluid at 30 ft^2/gallon
- Compare the results

How Small are These Particles We Are Working With?



Really Small!

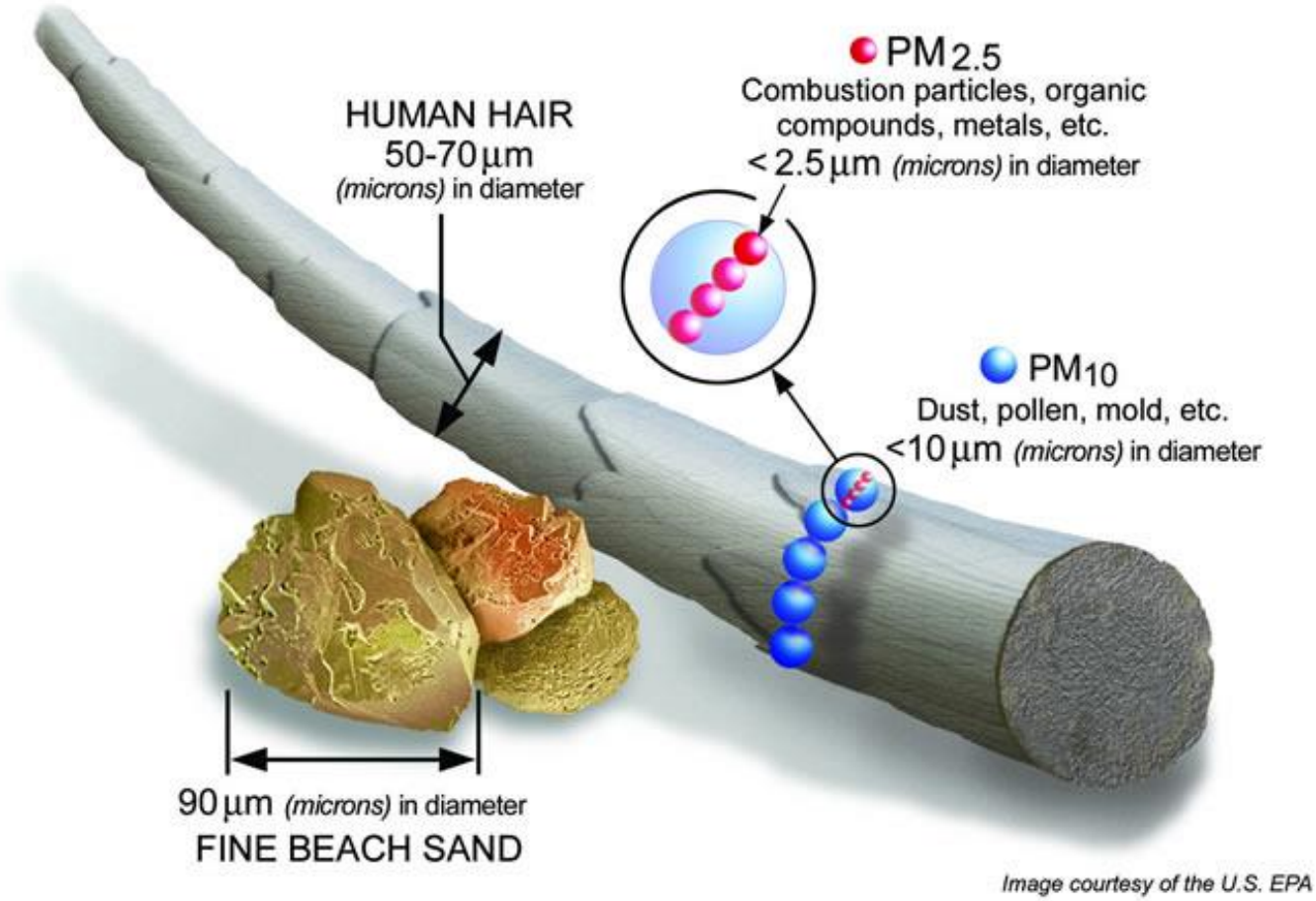
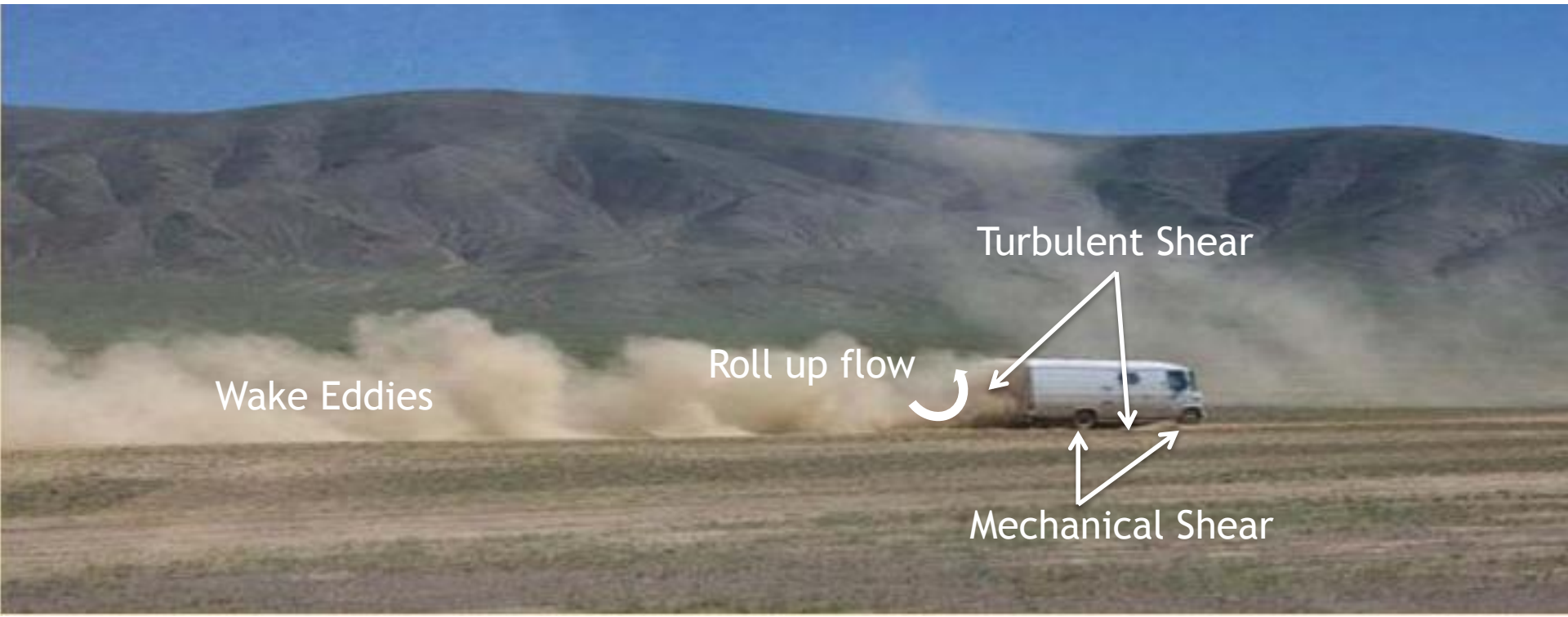


Image courtesy of the U.S. EPA

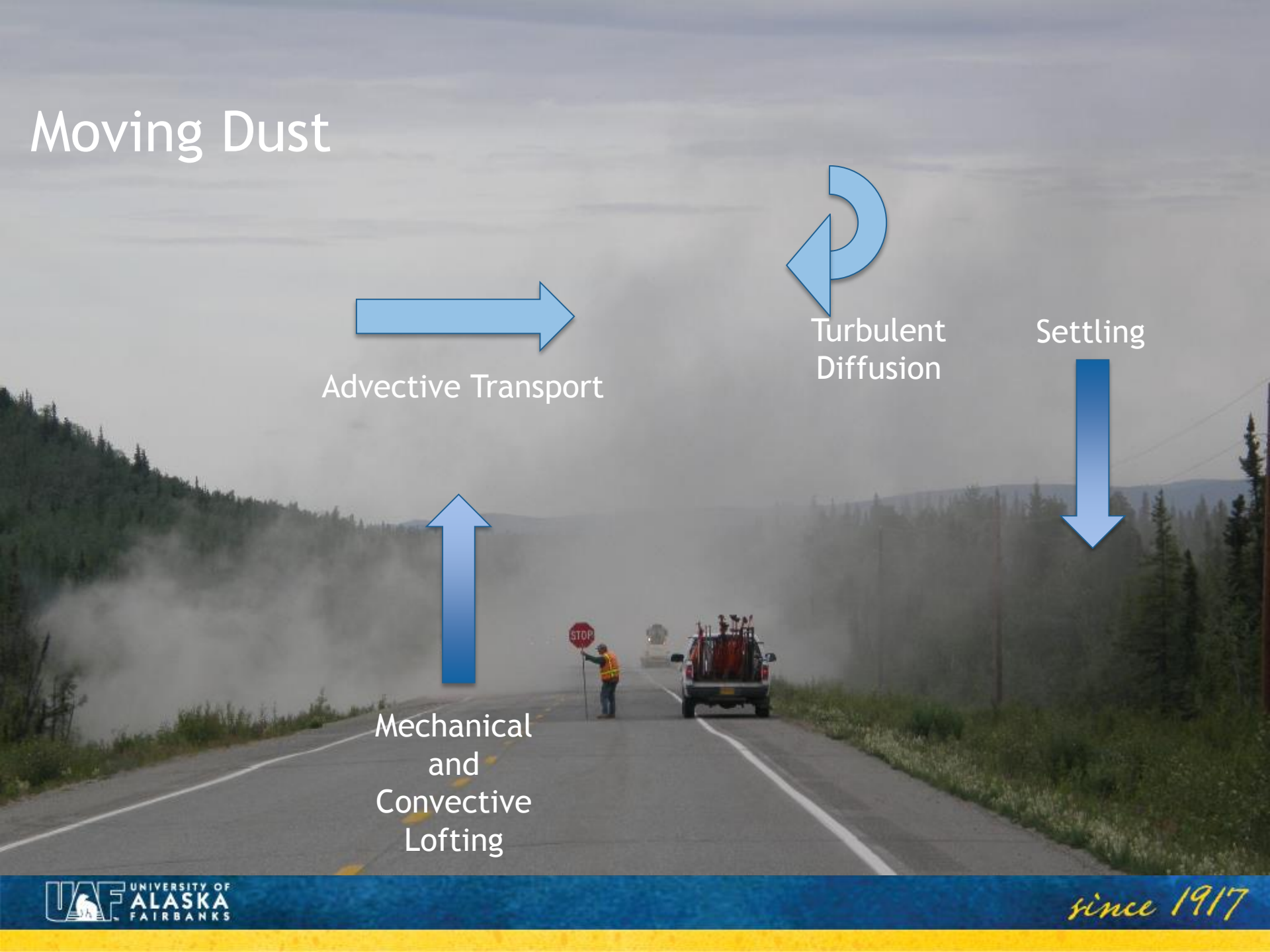

What Causes This?

We Need a Source of Dust

Next We Need a Mechanical Means of Lofting Particles into The Air



Moving Dust


Advective Transport
Turbulent Diffusion
Settling
Mechanical and Convective Lofting
STOP

Dust Settling

Settling time from a 2m loft

~3 sec

0.1 mm

~11 sec

0.05 mm

~4 minutes

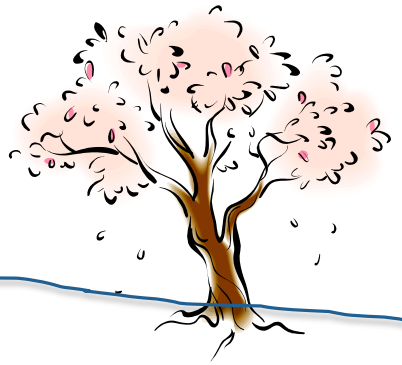
0.01 mm
PM10

~1 hour

0.0025 mm
PM2.5

5.9 hours

0.001 mm



Optical Haze


Methods to Manage Dust


Good Dust Management
Starts with a Good Road

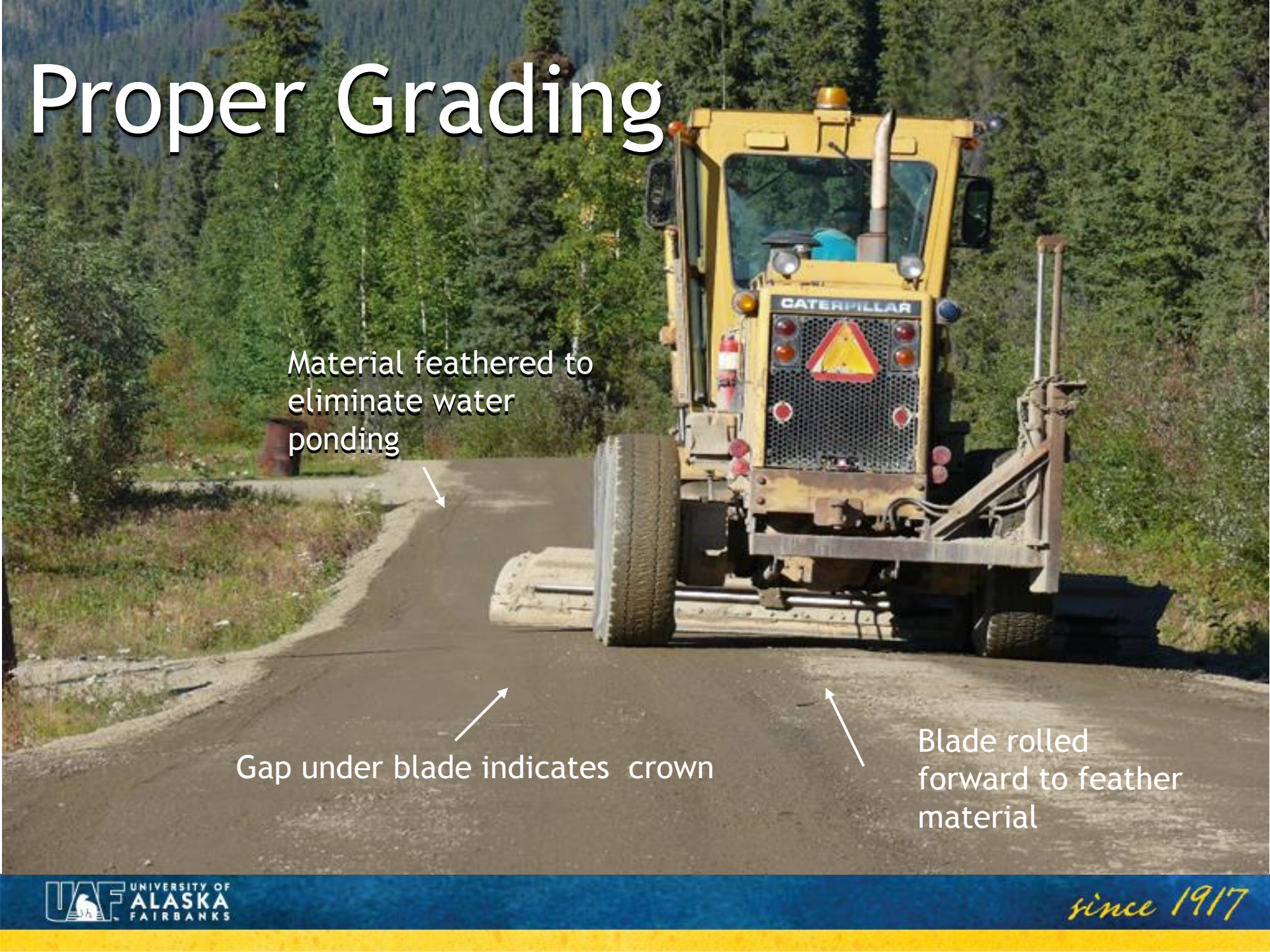
Too Many Fines Causes Muddy Roads

Too Few Fines

A Good Crown is Critical

Should be between 4% and 5%

Proper Grading



Applying Palliative in the Village

It has to be done right


2006 05 11 10 59

Good Equipment is Not Expensive

Limiting Fugitive Dust by Limiting Speed

Dust and Speed

15 MPH

30 MPH

Types of Palliatives

- **Water**
- **Water Absorbing Products (deliquescent/hydroscopic)**
  - **calcium chloride, magnesium chloride, brine**
- **Organic Nonpetroleum Products**
  - **vegetable oils**
  - **animal fats**
  - **lignosulfonate**
  - **tall oil emulsions**
- **Electrochemical Products**
  - **enzymes**
  - **ionic products**
  - **sulfonated oils**

Types of Palliatives

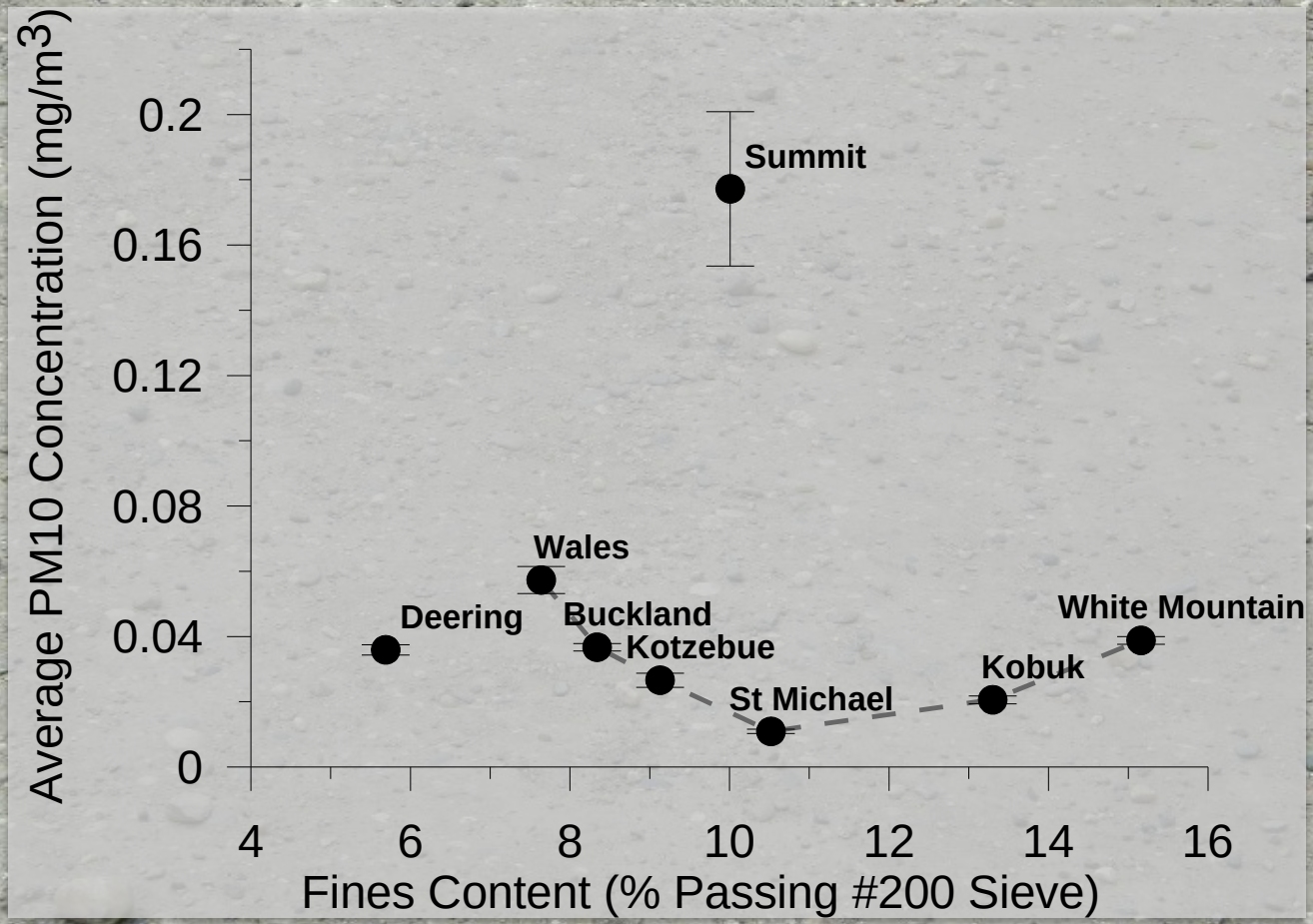
- Synthetic Polymer Products
  - polyvinyl acetate
  - vinyl acrylic
- Organic Petroleum Products
  - asphalt emulsions
  - dust oils
- Synthetic Fluids
  - With or without “binders”
  - Clay Additives

Synthetic Fluids

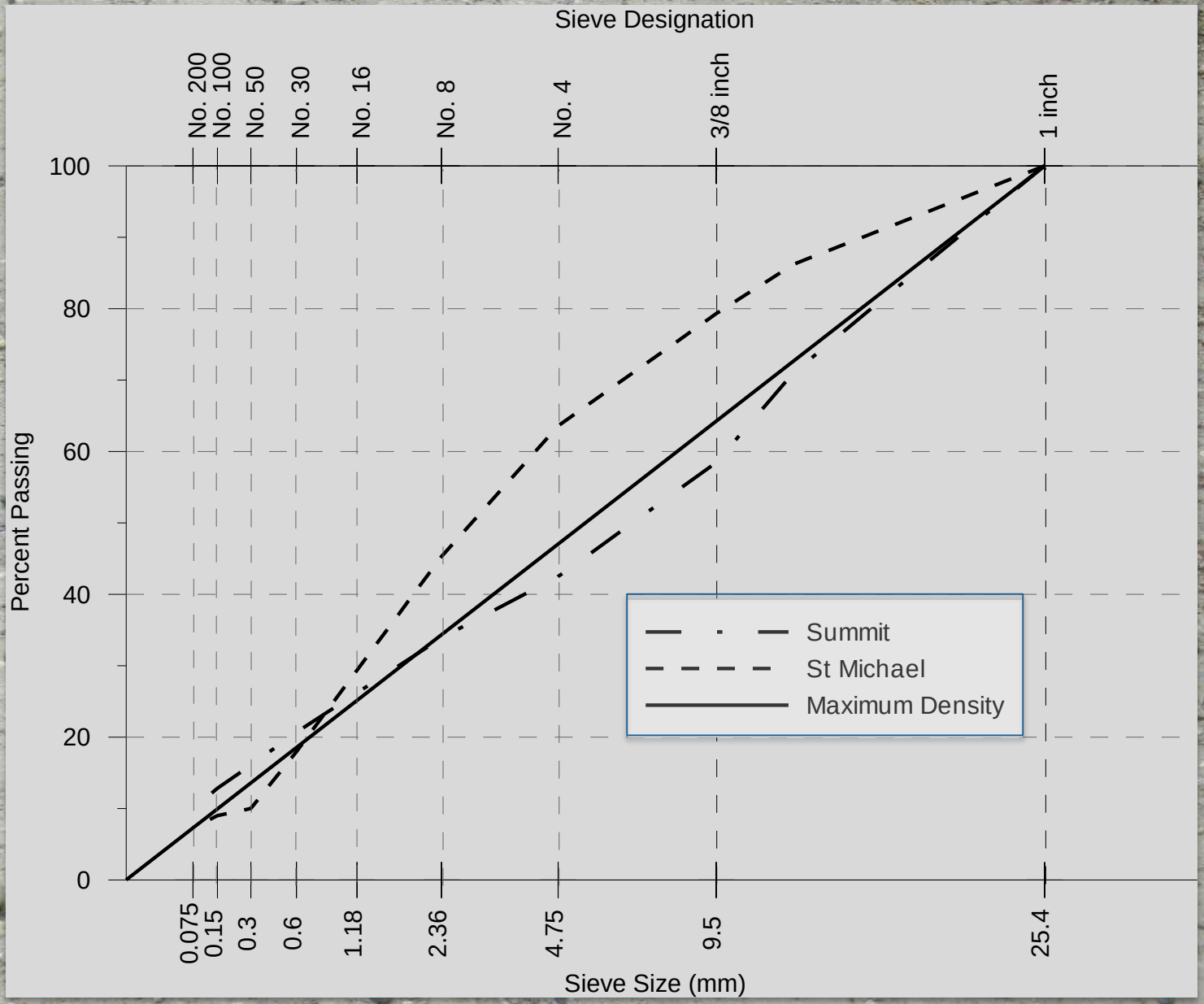
- Petroleum Products
- Meet all EPA/DEC toxicity requirements
- Naturally clear liquid but may have additives
- Non-corrosive
- Considerably more expensive than $CaCl_2$
- Liquid below -40 F

What We Have Learned from our Field Research

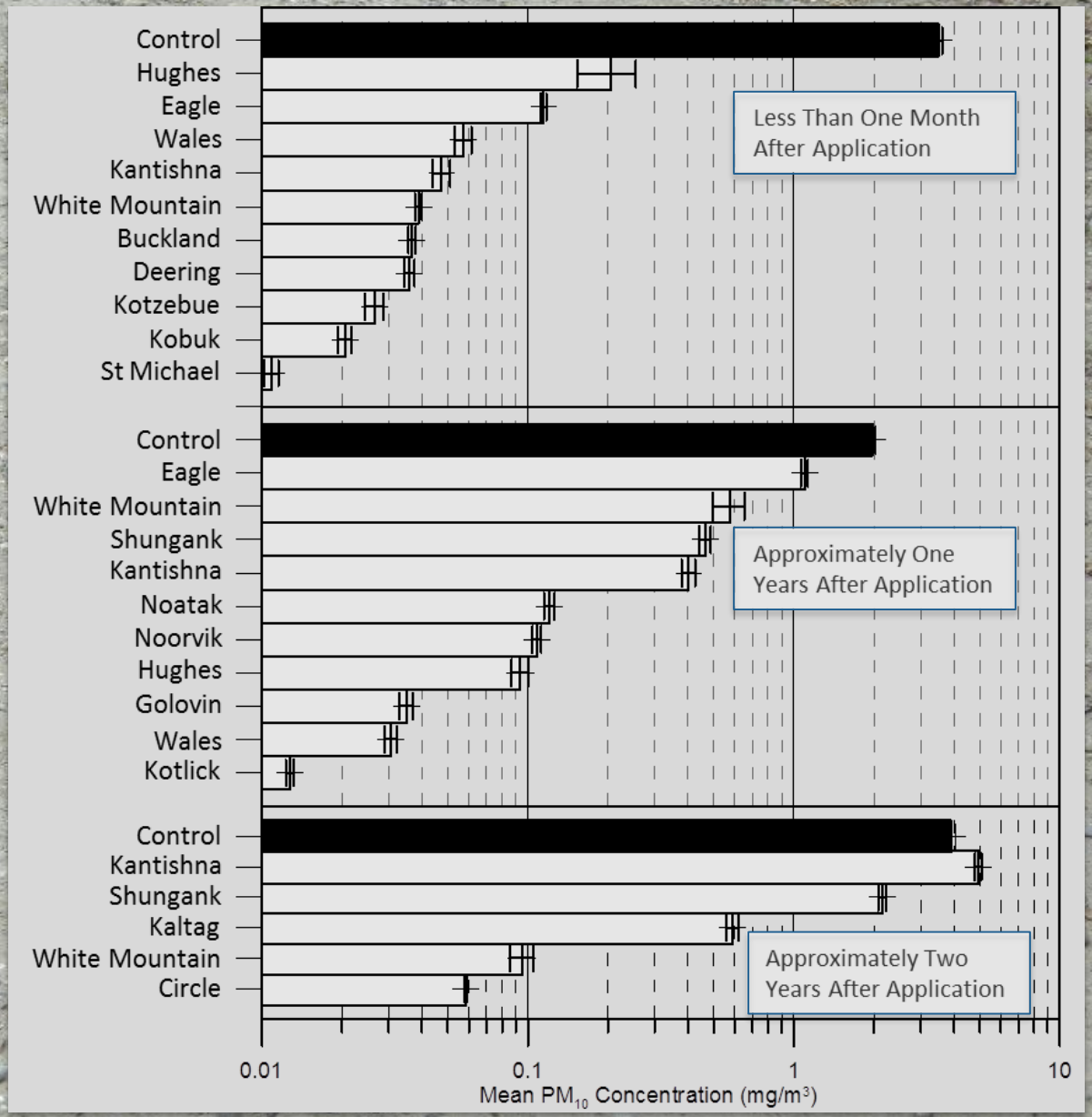
What we Have Learned so Far About Synthetic Fluid Performance



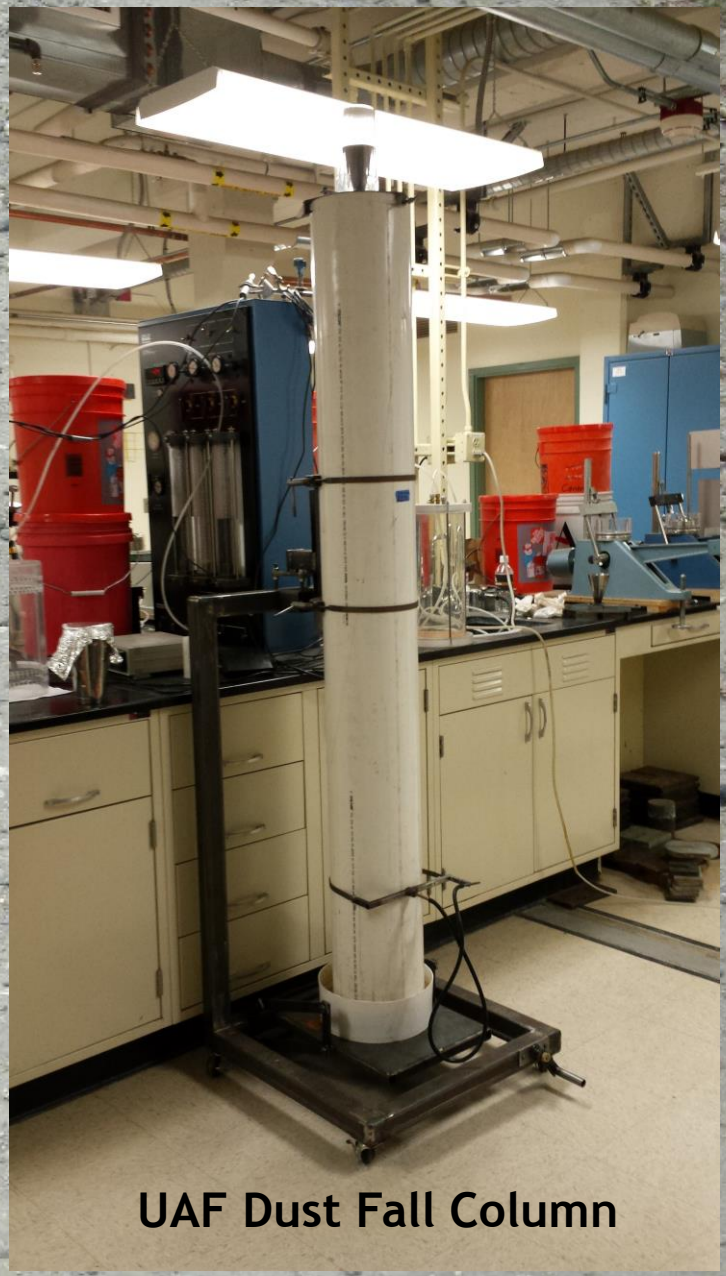
Influence of Bulk Density?



Synthetic Fluid Effectiveness Longeviety

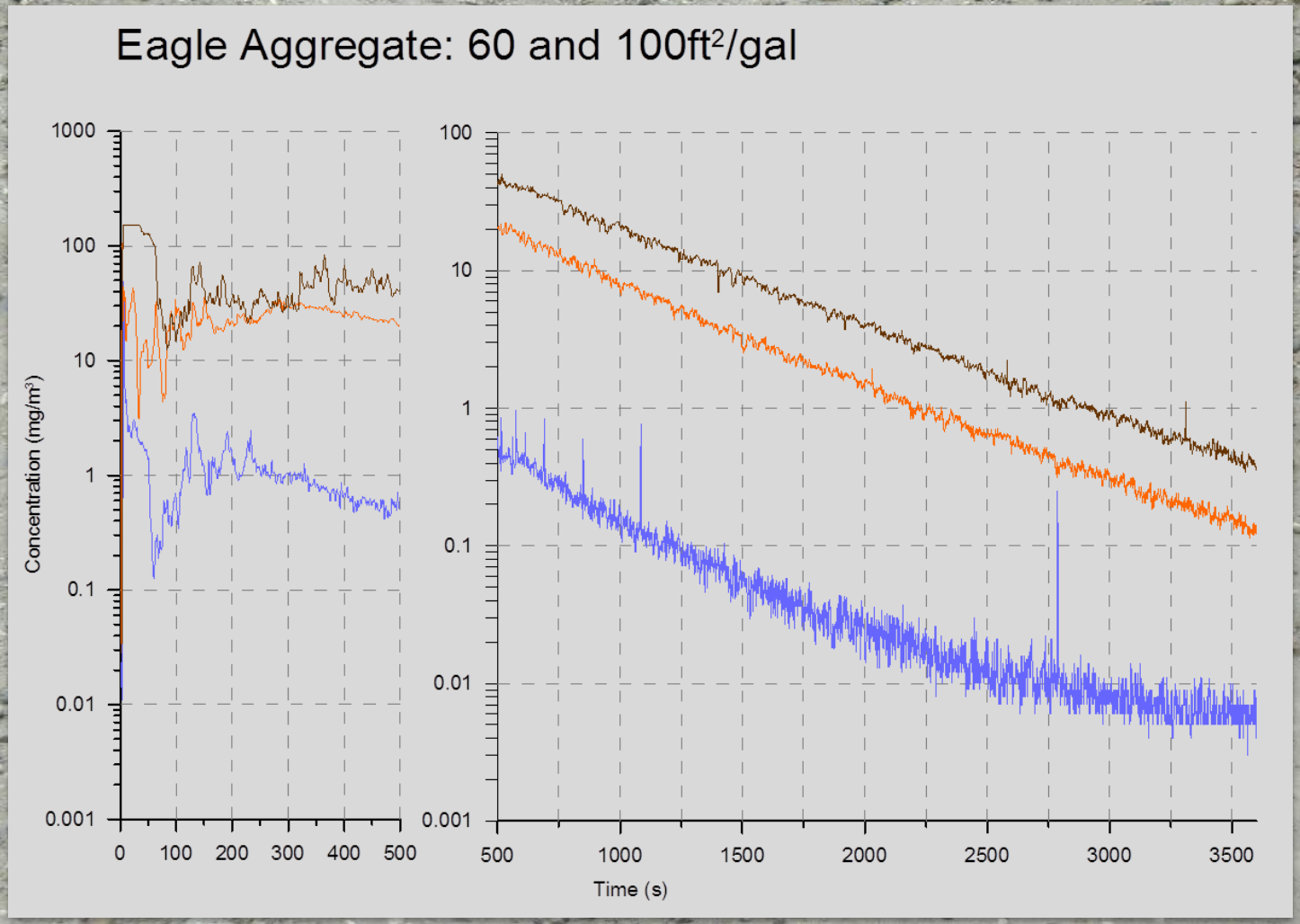


What we Have Learned from our Laboratory Research



UAF Dust Fall Column

Mix Designs for Road Dust Palliatives



Acknowledgements

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