

# Health and Environmental Impact of Particulate Matter - Overview Fugitive Dust Workshop



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# Dictionary Definition

## **Dust** *dəst/noun*

1. Dust are fine particles of matter. It generally consists of particles in the atmosphere that come from various sources such as soil, dust mechanically lifted or lifted by weather, volcanic eruptions, and pollution.

*"the car sent up clouds of dust"*



# We Are All Familiar With This!





# But There are Many Sources of Dust, Including...





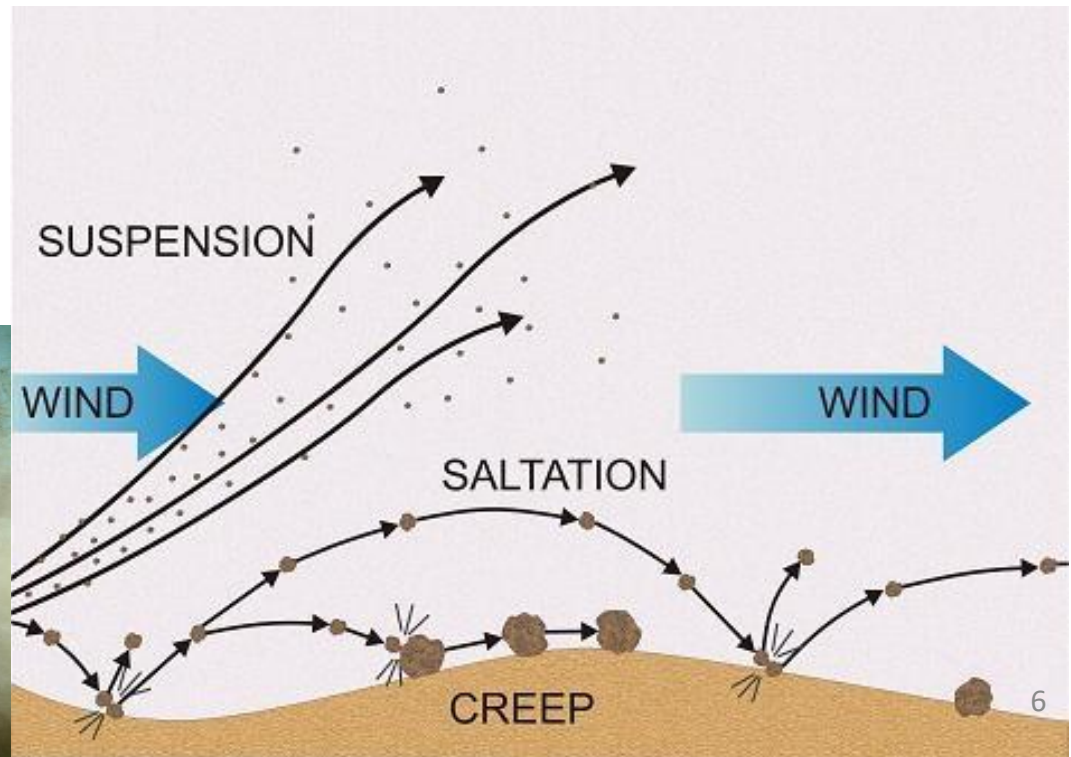
# Dust

1. Indoor dust is usually composed of carpet and clothing fragments, flakes of skin, use of aerosols, hygiene products, cooking smoke and smoke from cigarettes, candles, and wood burning.

2. Outdoor dust normally consists of agitated soils, industrial activity, wood burning, automotive activity and other air pollution sources, pollen, sea spray, and even volcanic activity.

# Dust Propagates!

- Dust moves with air currents until the particle's weight overcomes the wind's ability to lift the particle.
- Strong winds keep particles aloft longer.





# How Far can Dust Go?

- Large dust often travels short distances.
- But, smaller dust travels farther.
- Dust propelled higher from ground also travels farther.



# Who Get Exposed?



**People Passing Nearby**



**Workers**

**Travelers**



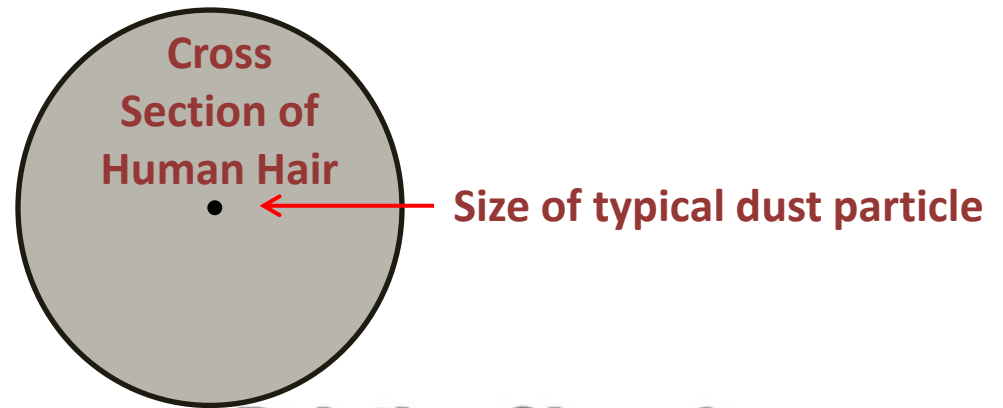
**People Living Nearby**

**Only a partial list.**

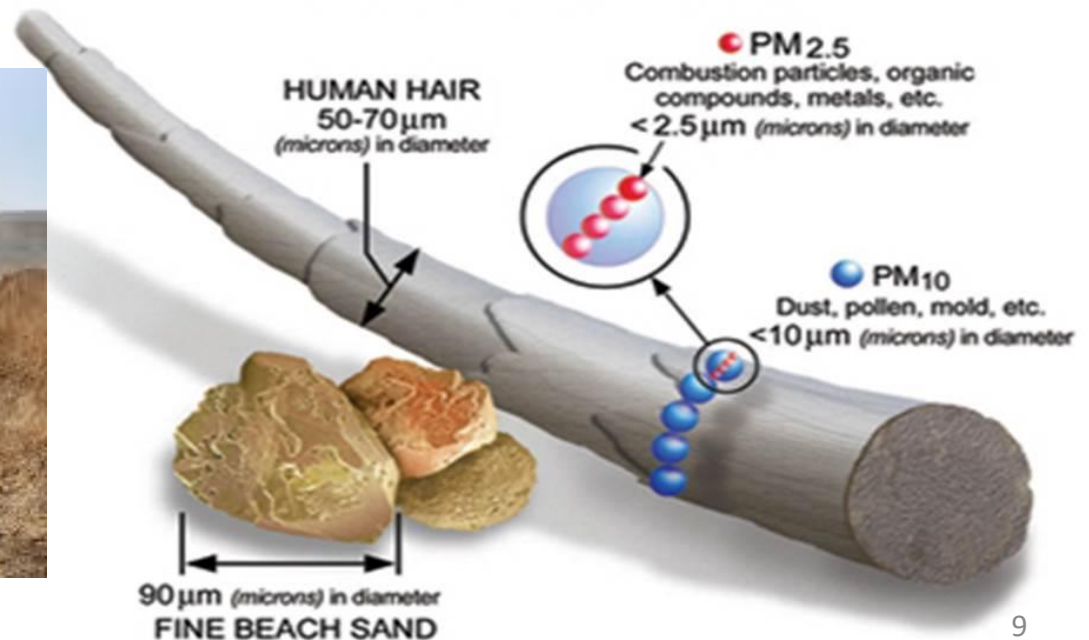


# Why is Dust a Problem?

- Dust can be very small.
- And can have variety of composition.

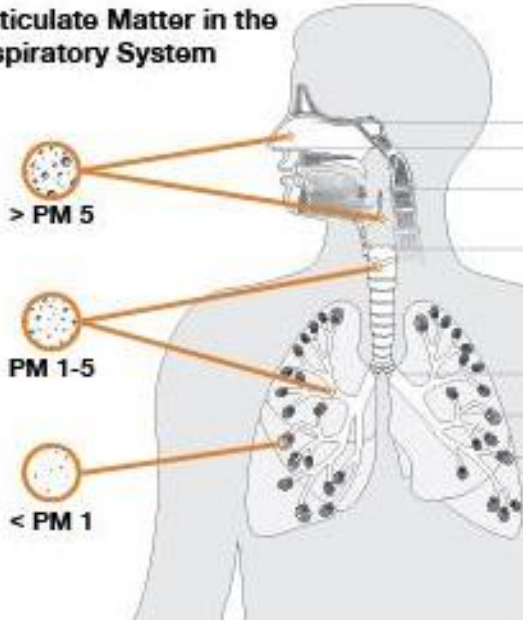


## Relative Size of Particulate Matter

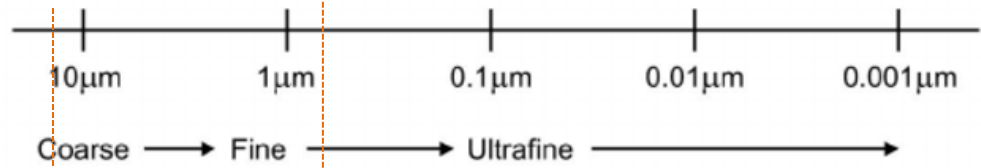


# Dust is Small Enough to Get Deep Into Lungs

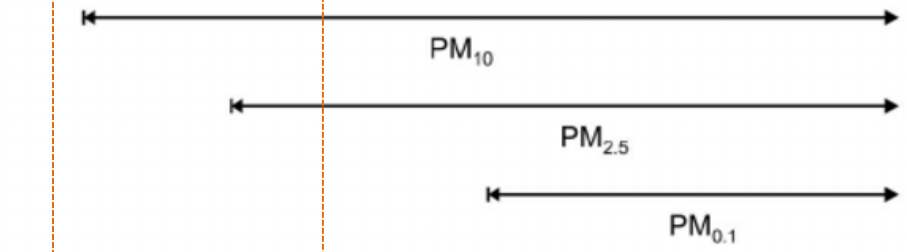
Particulate Matter in the Respiratory System



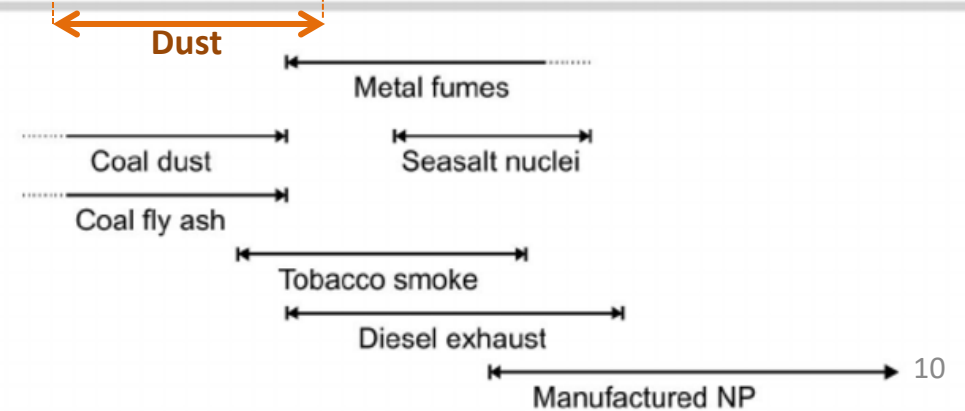
Scale



PM definitions



Dust



Particle Origin



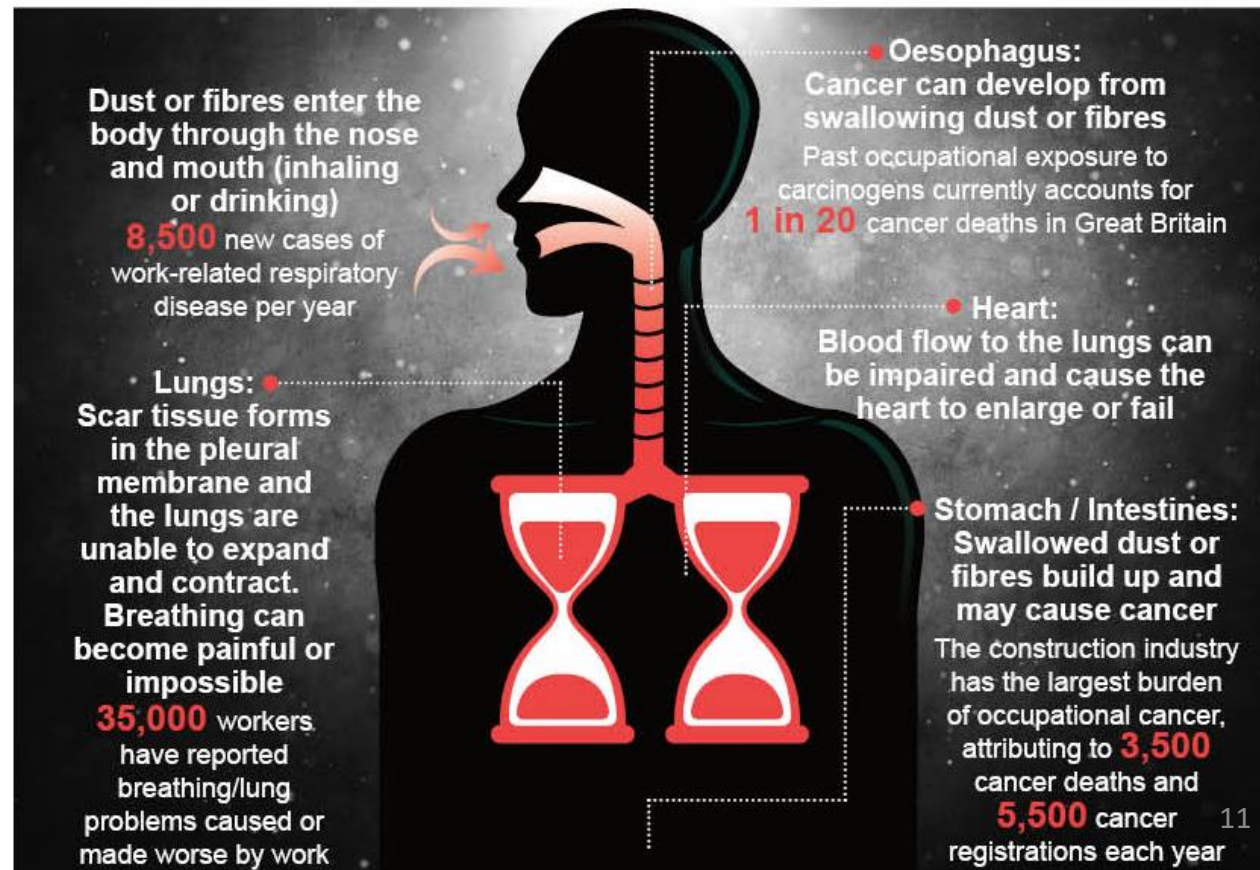
# Health Impacts

- Respiratory disease
- Scar tissue development limits free breathing
- Blood flow to heart compromised
- Swallowing dust can lead to cancer of esophagus, stomach or intestines.

## Construction Dust: THE SILENT KILLER

**\*23 NEW CASES OF WORK RELATED  
RESPIRATORY DISEASE DIAGNOSED EVERY DAY**

**Protect yourself before it's too late**





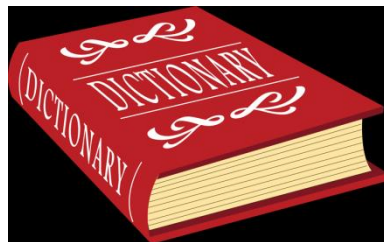
# Small Particles and Big Words

Pneumonoultramicroscopicsilicovolcanoconiosis

Huh???

A lung disease  
caused by breathing  
silica or quartz dust.

It's also the  
longest word  
in most major  
dictionaries.



How about  
Pneumoconiosis?

A condition where  
dust accumulation  
in the lungs and  
the body reacts to  
its presence.

# Different Dusts

- Sand and concrete dust inhalation can lead to Silicosis, an irreparable form of lung damage.
- Wood dust inhalation can lead to allergic reaction or even lung cancer.
- General dusts can lead to Chronic Obstructive Pulmonary Disease (COPD) [*Clogging of the lungs*].



# Excess Exposure Risk

## Symptoms

- Shortness of breath
- Fatigue
- Fever
- Bluish lips or ear lobes
- Loss of appetite
- Chest pain



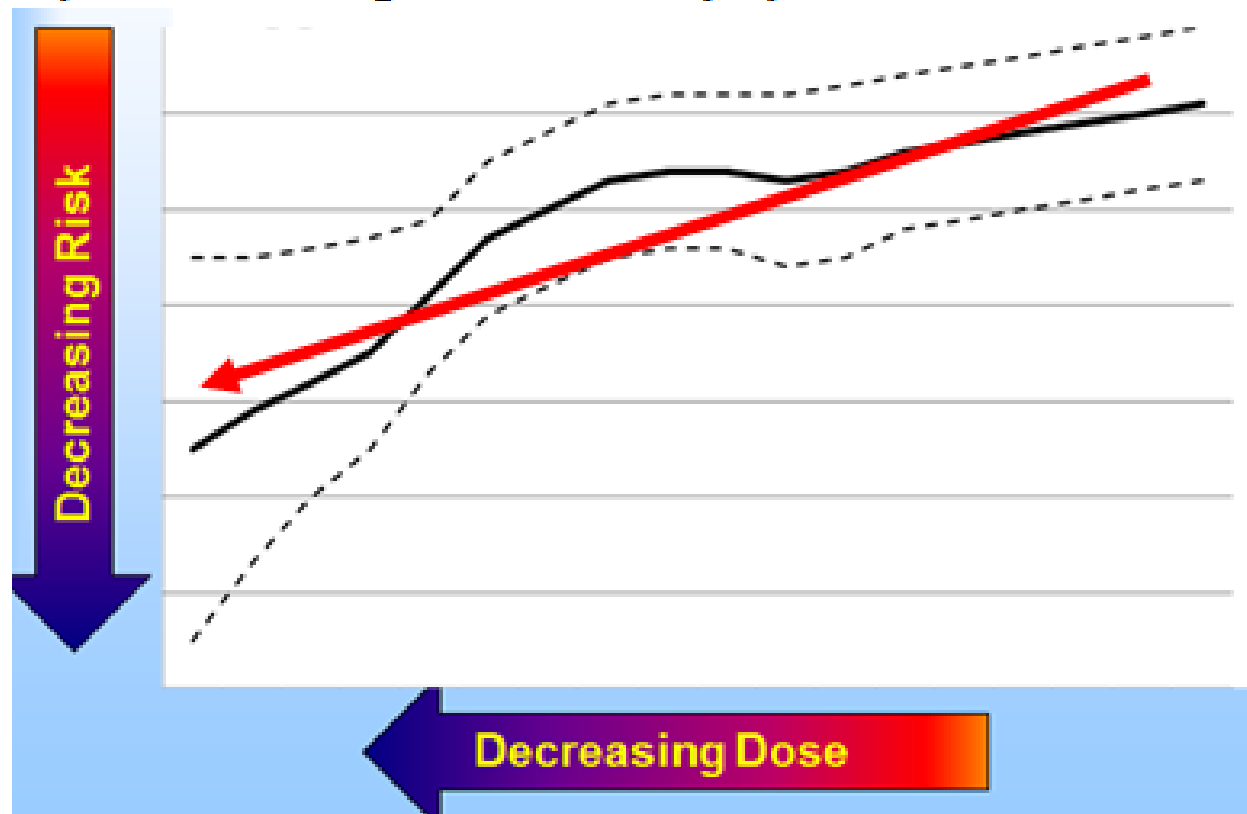
## At Risk Occupations

- Construction
- Sandblasting
- Mining
- Demolition
- Painting
- Masonry
- Industrial activities



# Fewer Health Impacts with Lower PM<sub>2.5</sub> Air Pollution Concentrations

**Figure 4.36: Health Statistical Relationship between PM<sub>2.5</sub> Exposure and Negative Health Symptoms**



Source: NHDES, 2003

# Wearing a Mask Protects Me

- True, it protects you, but often only to a degree.
  - Useful life of filter may get exceeded.
  - Sometimes doesn't filter out the smallest particles.



- But not everybody is wearing a mask.



# Breathing Protection

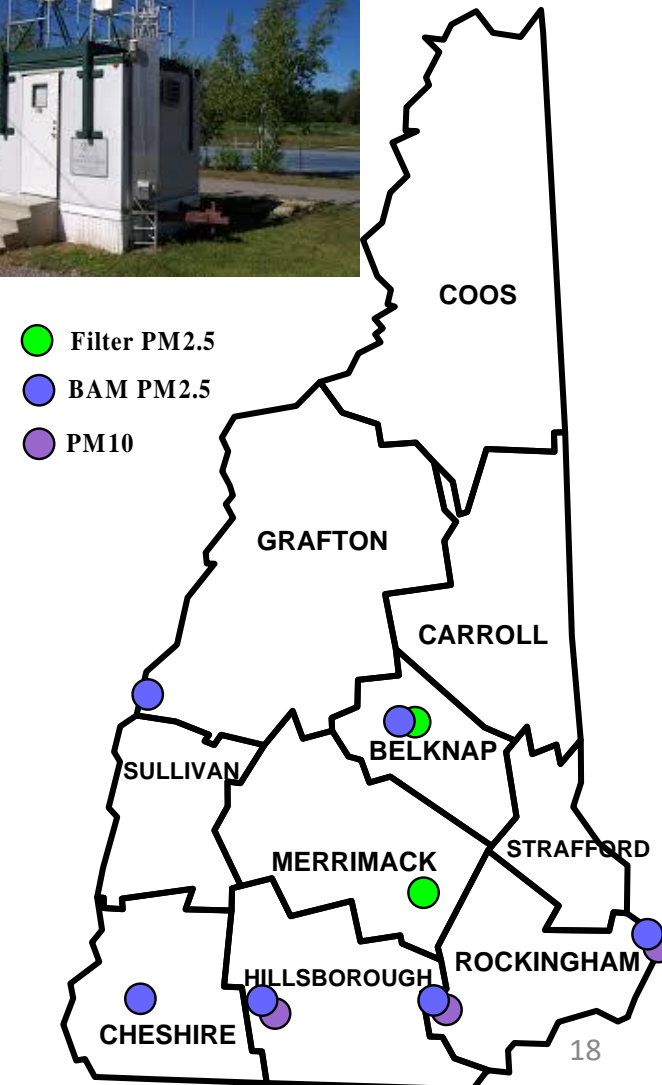
- Face Mask
  - Provides no meaningful filtration
- Dust Mask
  - Can provide protection but must fit snugly on face (no air gaps).
  - Minimal protection for  $PM_{2.5}$ .
  - Should be replaced after use for task.
- Filter Mask/Respirator
  - Good protection with proper fit and when filter correctly selected for task.





# NHDES Monitors Particulate Matter

- Typically measure ambient air exposure in communities.
- Often wood smoke is the greatest concern.
- But have monitored at industrial locations where dust propagation presented public health and nuisance concerns.



# National Ambient Air Quality Standard

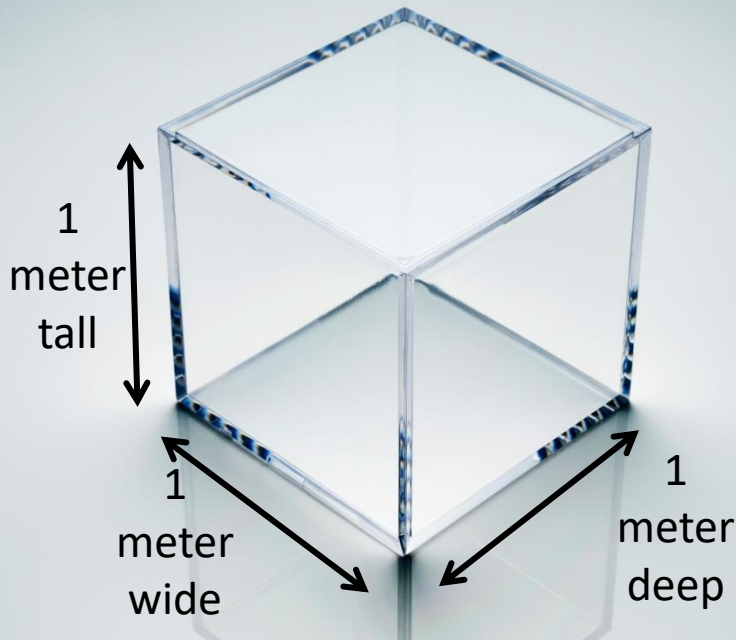
PM<sub>10</sub> 150 $\mu\text{g}/\text{m}^3$  Average 24-hour exposure

PM<sub>2.5</sub> 35 $\mu\text{g}/\text{m}^3$  Average 24-hour exposure

PM<sub>2.5</sub> 12 $\mu\text{g}/\text{m}^3$  Annual exposure

New Hampshire currently meets particle air quality standards, but there are problem areas!

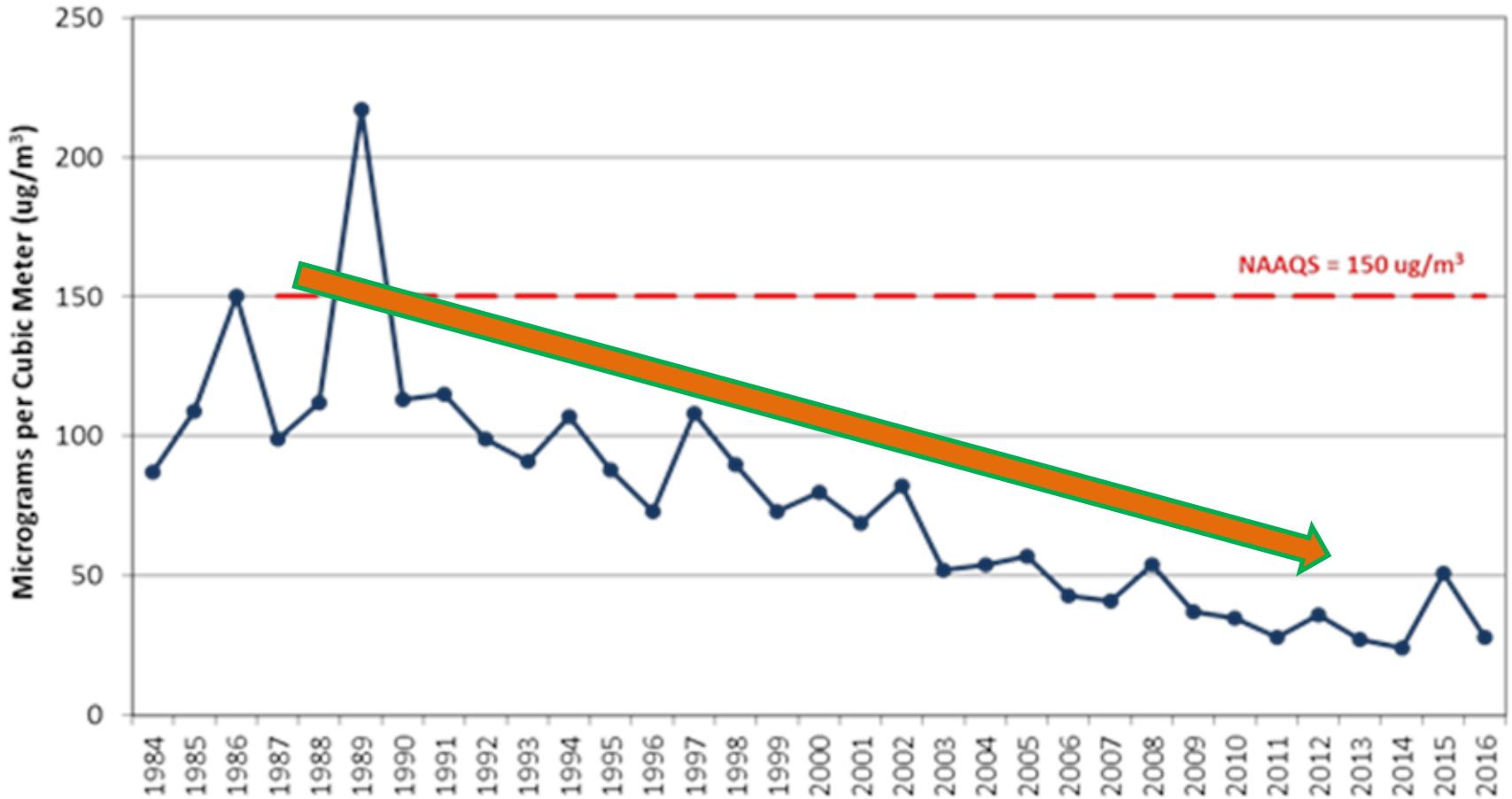
Consider a box with 1 meter dimensions



Even short term exposure to PM<sub>2.5</sub> has been shown to trigger asthma, worsen existing breathing difficulties and trigger heart attacks.

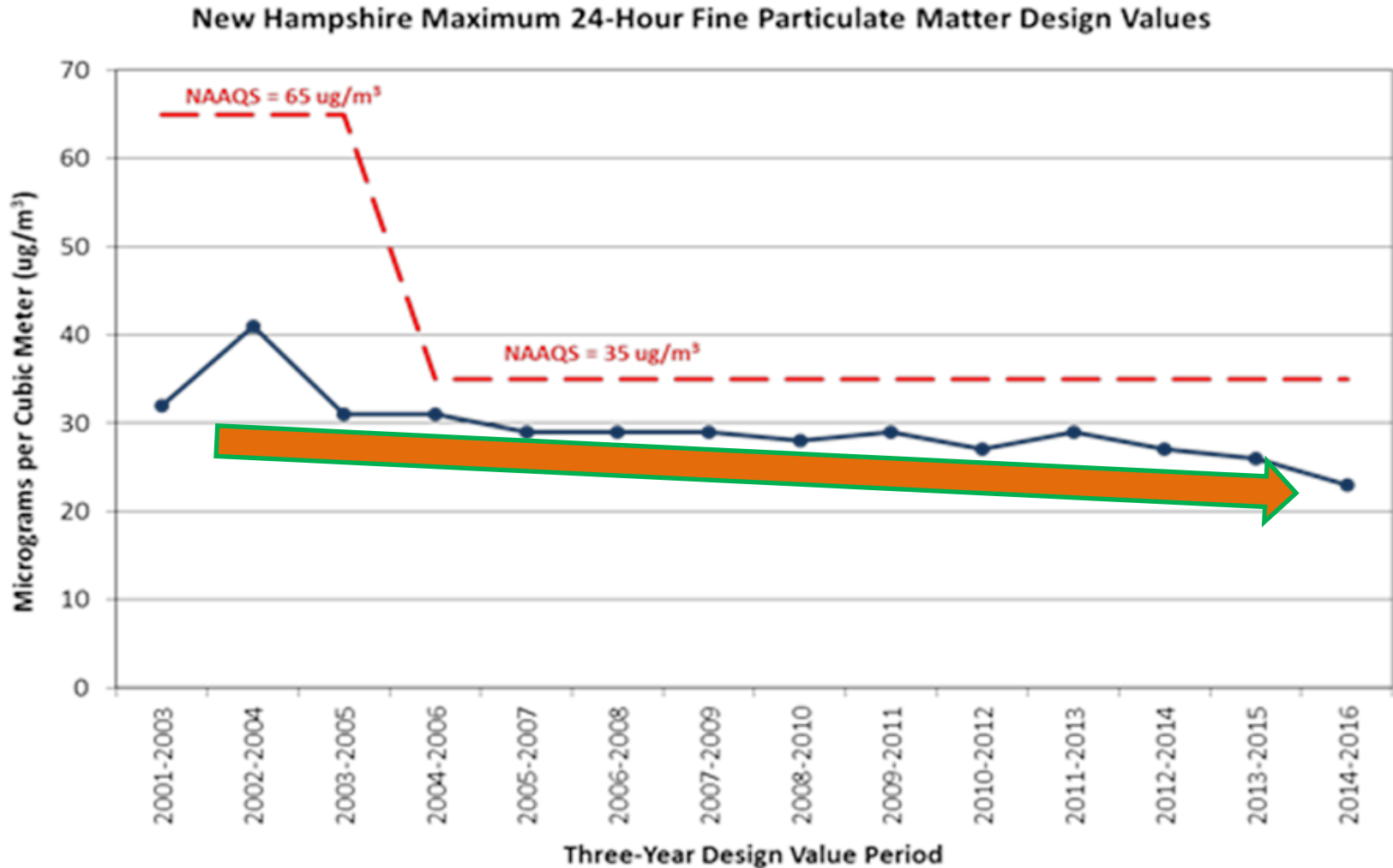
# PM<sub>10</sub> Monitored Trends

New Hampshire Maximum 24-Hour PM<sub>10</sub> Averages





# PM<sub>2.5</sub> Monitored Trends



# Environmental Effects

- Dust has been scientifically shown to impact crops, grasslands, heathlands, trees and woodlands, and lichen communities.
- Dust may affect photosynthesis, respiration, transpiration of plants and allow the penetration of phytotoxic gaseous pollutants.
- Visible injury symptoms may occur and generally there is decreased productivity.

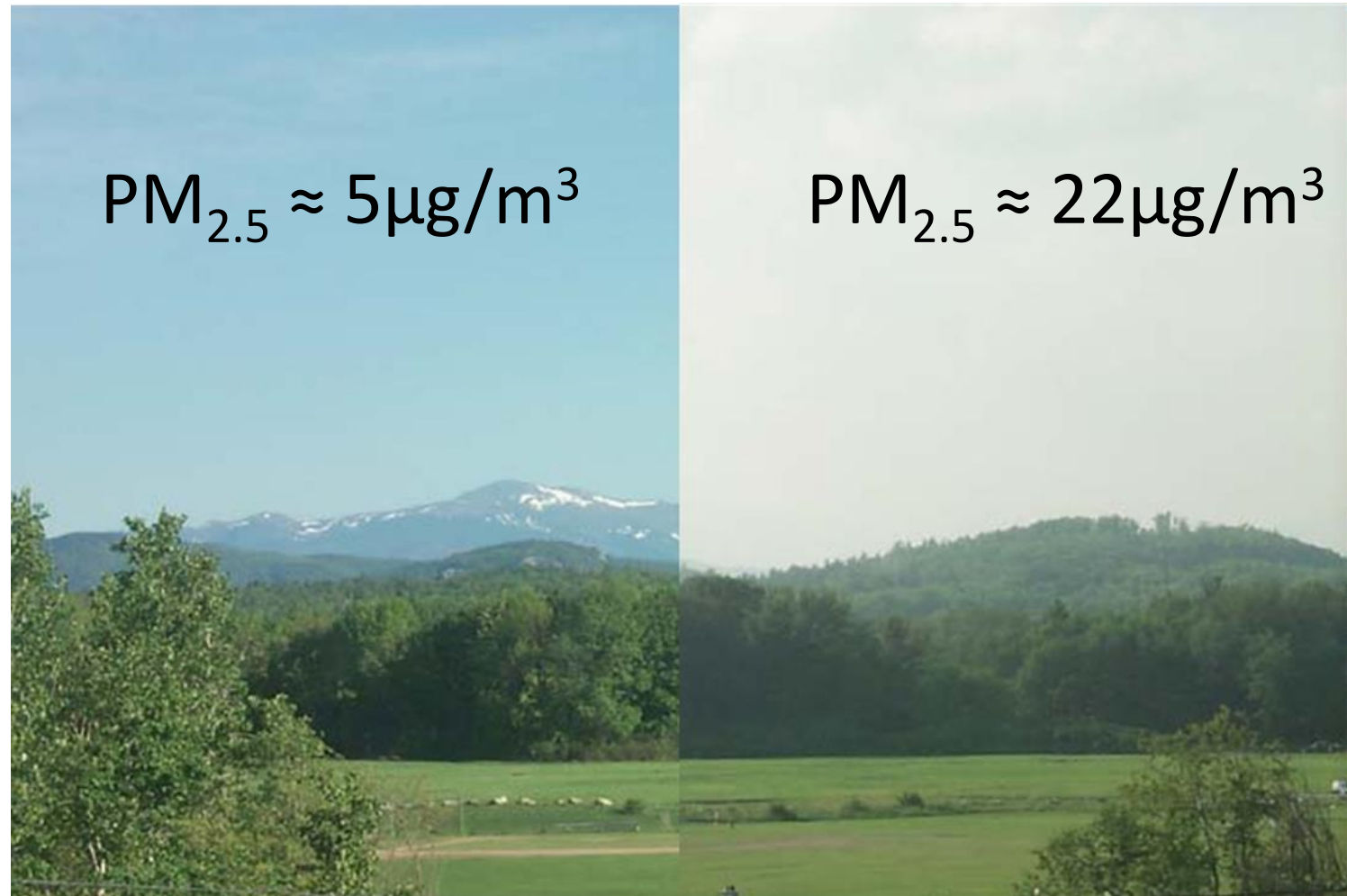
# Environmental Effects

- A layer of dust on the leaves of plants will block sunlight and reduce the plant's ability to photosynthesize.
- In order to protect the health of plants near dirt roads, construction sites and areas of loose dirt, plant leaves should be cleaned if coated.



# Dust and Particles Also Impairs Visibility

## (Regional Haze at Mt. Washington)



**Which view would a tourist find most rewarding? Would you come back after a bad view?**





Questions?