

National Ambient Air Quality Standards (NAAQS) for Particle Pollution

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Overview

- **Clean Air Act Requirements for Preventing and Controlling Air Pollution**
- **Standards for Particulate Matter (PM)**
- **What is PM**
- **What are the Health Effects**
- **Benefits and Costs**
- **Regulatory Framework for Attaining the NAAQS**
- **Upcoming Regulations**
- **Darby PM_{2.5}**
- **Control Strategies**
- **Summary**

Particulate Matter NAAQS

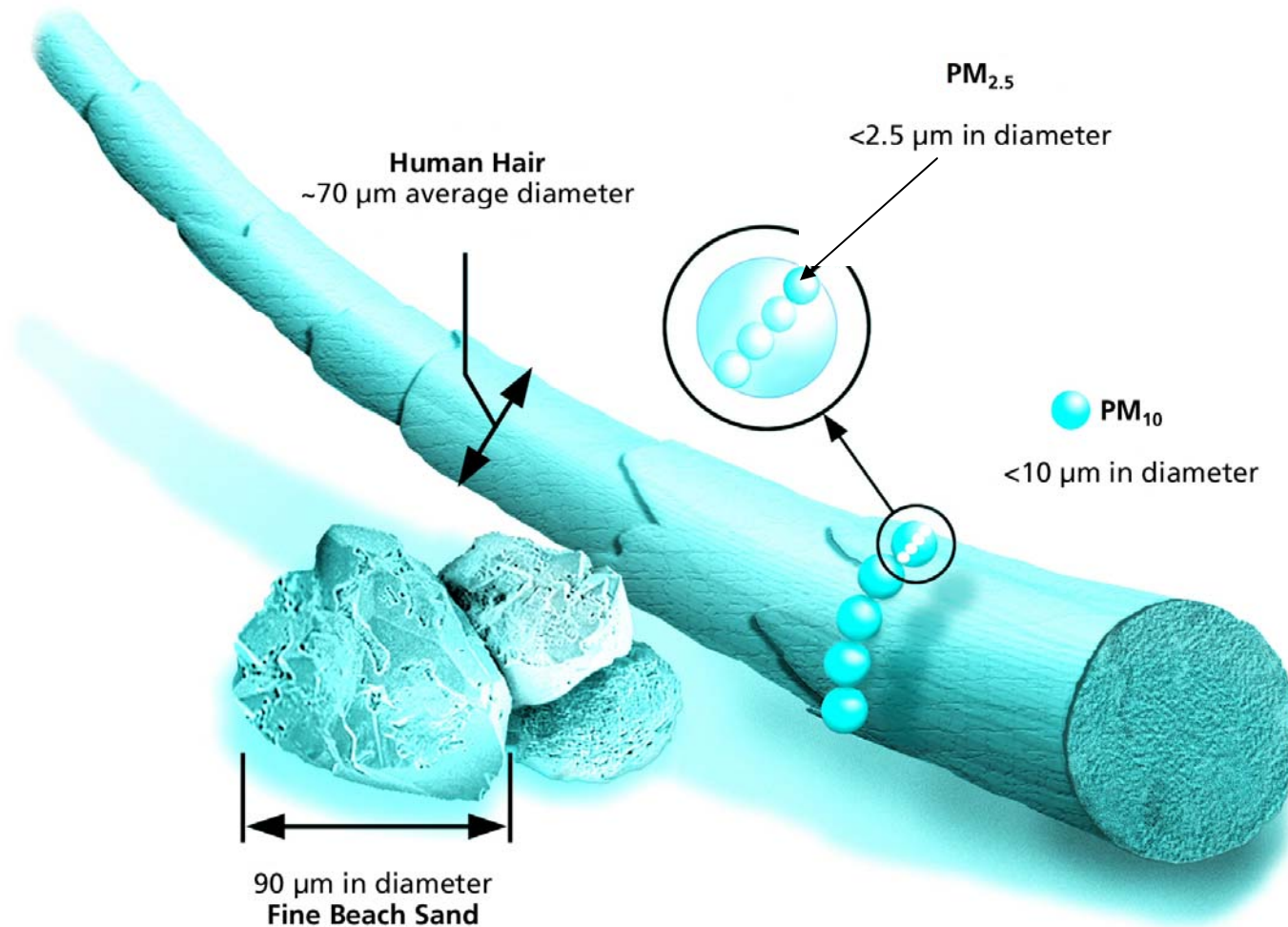
- **On December 18, 2006 EPA revised the National Ambient Air Quality Standards (NAAQS) for particle pollution.**
- **The revisions address two categories of particle pollution:**
 - ***fine particles* (PM_{2.5}), which are 2.5 micrometers in diameter and smaller; and**
 - ***coarse particles*, which are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.**
- **The revised standard strengthened the fine particle standards to protect both health and visibility and retained the 24-hour coarse particle to protect public health.**
- **PM_{2.5} is comprised of carbon, and secondary particles such as : SO_x, NO_x, VOCs, Ammonia and Hazardous Air Pollutants (HAPS)**

EPA's PM Standards: Old and New

	1997 Standards		2006 Standards	
	Annual	24-hour	Annual	24-hour
PM2.5 (Fine)	15 $\mu\text{g}/\text{m}^3$ Annual arithmetic mean, averaged over 3 years	65 $\mu\text{g}/\text{m}^3$ Annual arithmetic mean, averaged over 3 years	15 $\mu\text{g}/\text{m}^3$ Annual arithmetic mean, averaged over 3 years	35 $\mu\text{g}/\text{m}^3$ Annual arithmetic mean, averaged over 3 years
PM10 (Coarse)	50 $\mu\text{g}/\text{m}^3$ Annual average	150 $\mu\text{g}/\text{m}^3$ 24-hr average (99 th percentile)	Revoked	150 $\mu\text{g}/\text{m}^3$ 24-hr average (singled expected exceedance)

Particulate Matter: What is It?

A complex mixture of extremely small particles and liquid droplets



PM Components: *fine and coarse*

Fine Particles

Combustion, gases to particles

Sulfates/acids

Nitrate

Ammonium

Organics

Carbon

Metals

Water



Sources:

Coal, oil, gasoline, diesel, **Wood Combustion**

Transformation of SO_x, NO_x, organic gases

including biogenics

High temperature industrial processes

(smelters, steel mills)



Exposure/Lifetime:

Lifetime days to weeks, regional distribution over urban scale to 1000s of km

Inhalable Coarse Particles

Crushing, grinding, dust

Resuspended dusts

(soil, street dust)

Coal/oil fly ash

Aluminum, silica,

iron-oxides

Tire and brake wear

Inhalable Biological

Materials

(e.g., from soils,

plant fragments)

Sources:

Resuspension of dust tracked onto roads

Suspension from disturbed soil (farms, mines, unpaved roads)

Construction/demolition

Industrial fugitives

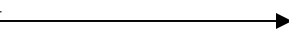
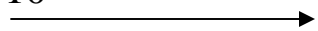
Biological sources

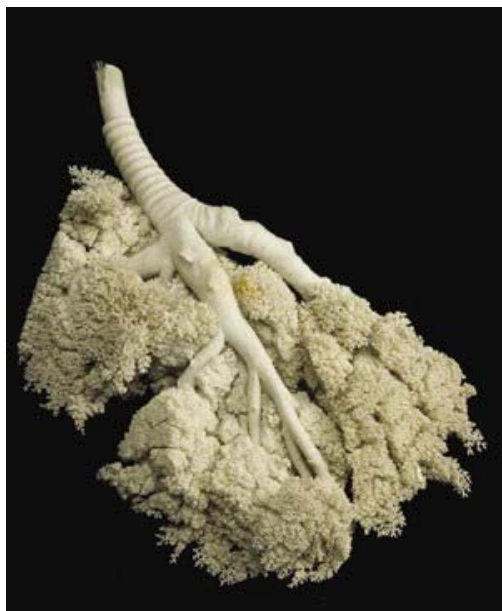
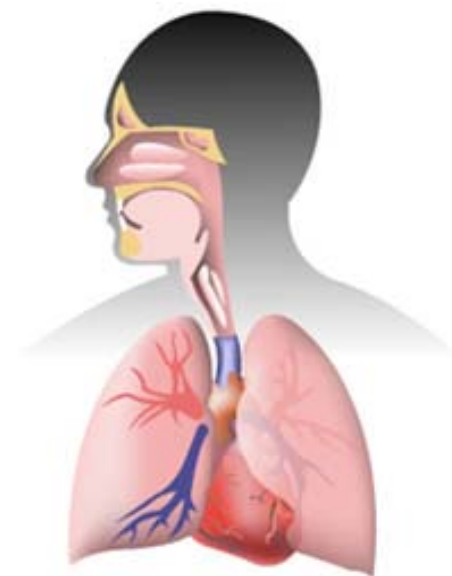
Exposure/Lifetime:

Coarse fraction (2.5-10) lifetime of hours to days,6 distribution up to 100s km



Particulate Matter

- Larger particles ($> PM_{10}$) deposit in  the upper respiratory tract
- Smaller, inhalable particles ($\leq PM_{10}$)  penetrate deep into the lungs



- Both coarse particulate matter and fine particulate matter can penetrate to lower regions of the lung
- Deposited particles may accumulate, react, be cleared or absorbed

Health Effects of Particle Pollution

- **Scientific studies have linked breathing particle pollution to a series of significant health problems including:**
 - **Increases in respiratory symptoms like coughing and difficult or painful breathing; aggravated asthma; chronic bronchitis.**
 - **Premature death in people with heart and lung disease.**
 - **Increased emergency room visits and hospitalizations.**

Benefits and Costs

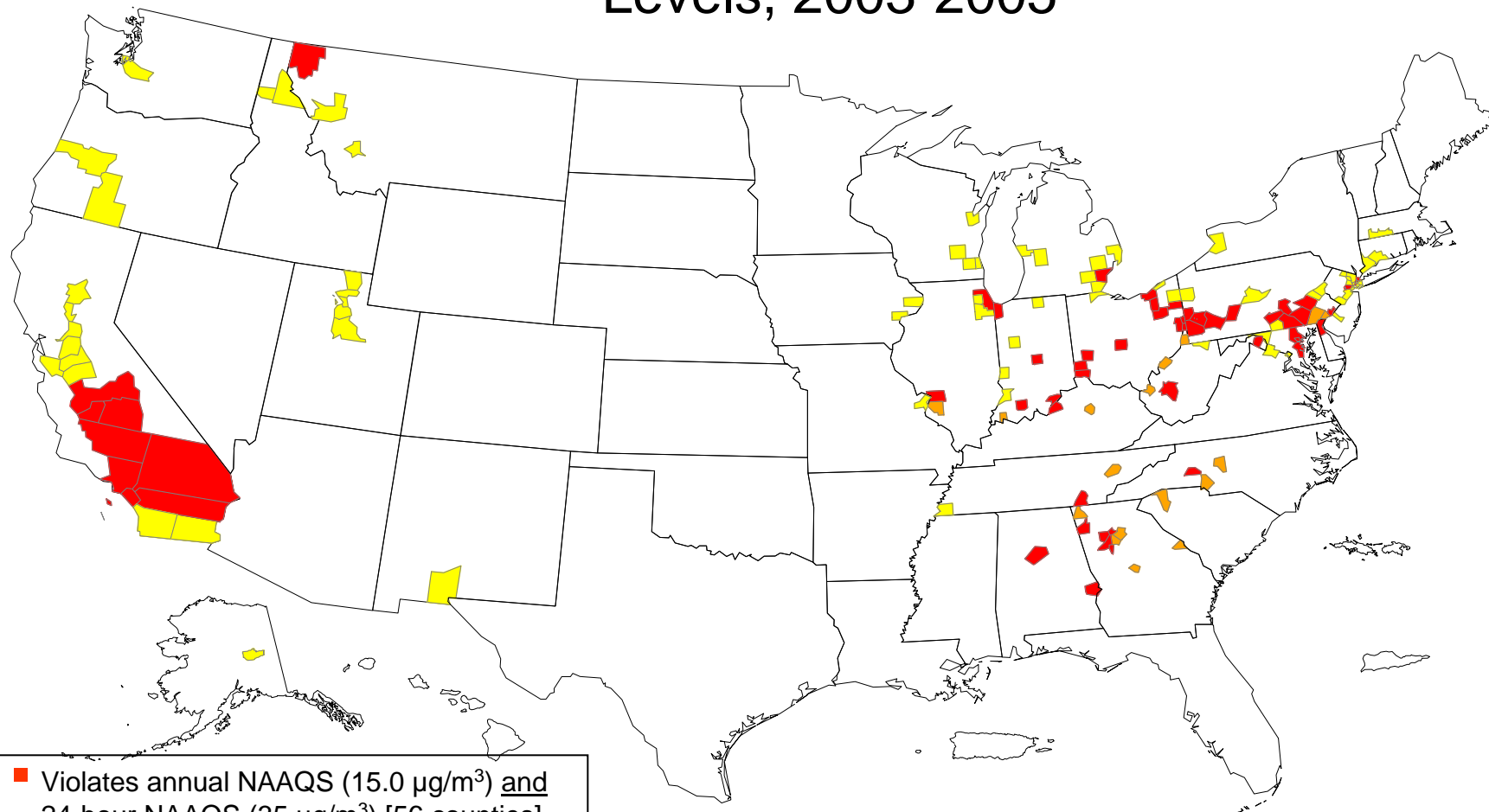
- **The benefits of meeting the revised 24-hour PM_{2.5} standards include estimated annual *reduction* in:**
 - **2,500 to 5,700 premature deaths in people with heart or lung disease,**
 - **2,600 cases of *chronic* bronchitis; 7,300 cases of *acute* bronchitis,**
 - **5,000 nonfatal heart attacks,**
 - **1,630 hospital admissions for cardiovascular or respiratory symptoms,**
 - **1,200 emergency room visits for asthma; 51,000 cases of aggravated asthma,**
 - **97,000 cases of upper and lower respiratory symptoms,**
 - **350,000 days when people miss work or school, and**
 - **2 million days when people must restrict their activities because of particle pollution-related symptoms**

Regulatory Framework

Clean Air Act Requirements

- **Attainment - Rules for areas that meet or attain the NAAQS.**
- **Nonattainment- Rules for areas that do not meet or attain the NAAQS.**
- **EPA will be designating in December of 2008 many new areas in Montana and Utah as Nonattainment for PM_{2.5}.**
- **Areas designated Nonattainment must prepare a plan for meeting the standard.**
- **The plan contains federally enforceable regulations such as controls on *any* and *all* sources of air pollution.**

Counties Exceeding New 24 hour NAAQS Levels, 2003-2005



- Violates annual NAAQS ($15.0 \mu\text{g}/\text{m}^3$) and 24-hour NAAQS ($35 \mu\text{g}/\text{m}^3$) [56 counties]
- Violates only 24-hour NAAQS ($35 \mu\text{g}/\text{m}^3$) [70 counties]
- Violates only annual NAAQS ($15.0 \mu\text{g}/\text{m}^3$) [17 counties]

- Data from AQS 7/10/2006
- Completeness criteria: 2006 CFR or 11+ samples per quarter

Around the Next Bend

What to Expect

- **The Clean Air Act mandate is to “Prevent” air pollution in attainment areas and to “Reduce” it in nonattainment areas.**
- **Nationwide there are 87 Counties violating either annual or the 24-hour PM_{2.5} NAAQS.**
- **If necessary, EPA will require the States to address PM_{2.5} emissions by adopting regulations on all sources of uncontrolled emissions of PM_{2.5} including wood fired boilers either thru new technology or retrofits.**
- **The planning for PM_{2.5} nonattainment areas will begin in earnest in early 2009 if not before.**
- **“Prevention is the best medicine” by proactively identifying PM_{2.5} controls for these boilers before they are subject to EPA mandates.**

Upcoming Regulations for Boilers

TWO NEW RULES

- **New rule for small boilers will control “hazardous air pollutants” HAPs that emit less than 10 tpy of one HAP or less than 25tpy of total HAPs**
 - EPA expects this rule in 2010.

- **The rule for CISWI units was published on December 1, 2000 (See 65 FR 75338). The definition of "commercial and industrial solid waste" for this rule stated that materials burned in a boiler for energy recovery was *NOT* solid waste.**
 - The definition was recently *vacated* by the court i.e. sent back to EPA.

- **Small wood-fired boilers could be covered by the CISWI rule if the revised definition of solid waste includes wood waste materials. This may only apply to those located at commercial or industrial facilities. This may mean more strict requirements.**

- **Small wood fired boilers that are located at institutional facilities such as schools or government facilities are NOT subject to CISWI rule. The rule that may apply is OSWI**

Existing Regulations

Solid Waste Rules (Needs case specific applicability determination)	Regulation may apply	Regulates PM	Regulates PM2.5
Boiler MACT - 40 CFR Part 63 Subpart DDDDD	Vacated. Expected new rule by 2010 for large & small boilers	Not at this time	Not at this time
CISWI - Commercial & Industrial Solid Waste Incinerator	Possible. New definitions to be published	Yes	Not at this time
OSWI - Other Solid Waste Incinerator	Yes - (if not burning clean lumber with energy recovery)	Yes	Not at this time
HMIWI - Hospital, Medical, and Infectious Waste Incinerator	Yes - (if burning hospital, medical, or infectious waste)	Yes	Not at this time
Small MWC - Small Municipal Waste Combustor	No - if burning clean lumber	Yes	Not at this time
Large MWC - Large Municipal Waste Combustor	No	Yes	Not at this time

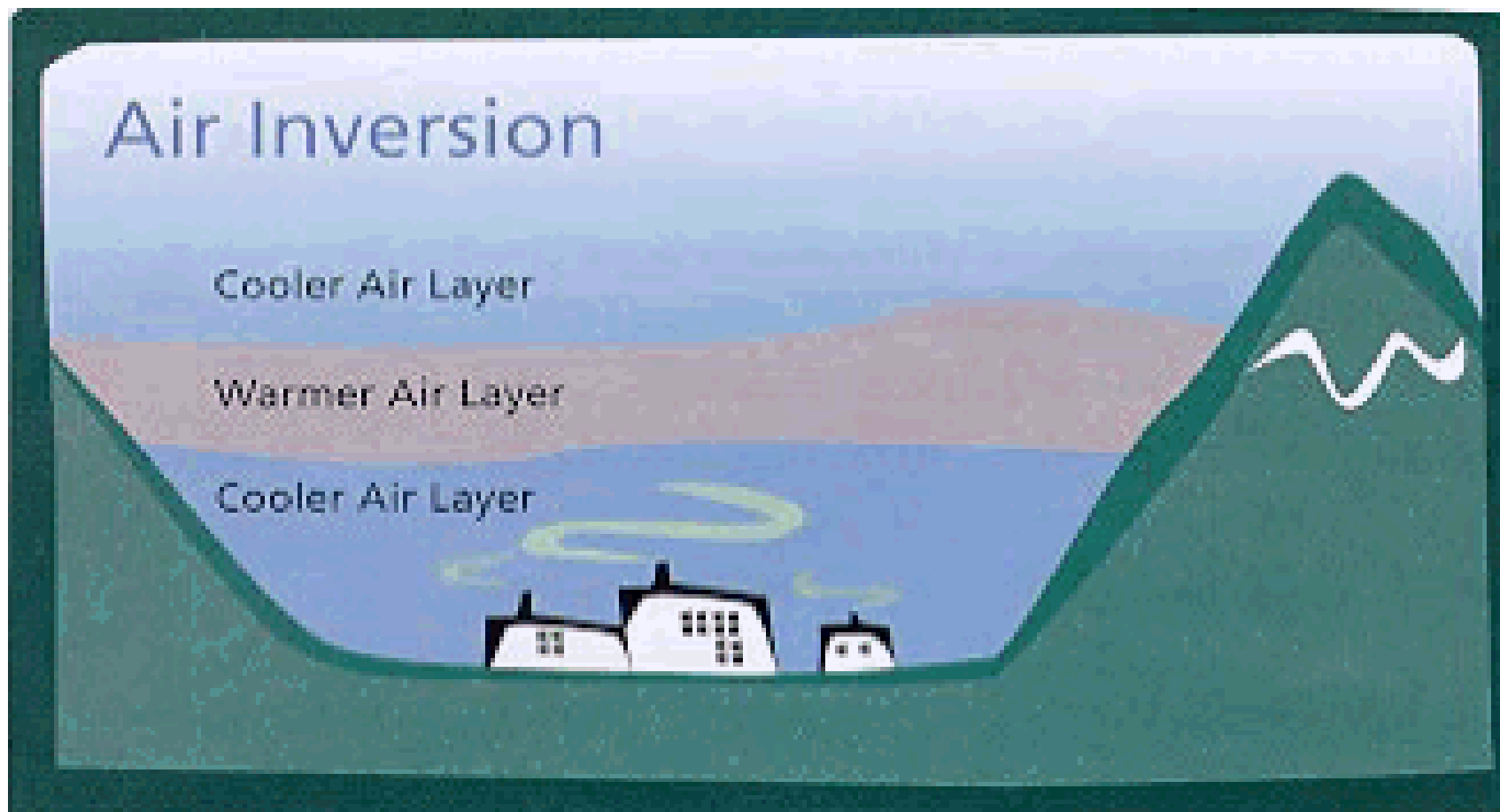
*Clean Lumber = wood or wood products that have been cut or shaped and include wet, air-dried, and kiln-dried wood products. Clean lumber does not include wood products that have been painted, pigment-stained, or pressure treated by compounds such as chromate copper arsenate, petrachlorophenol, and creosote, or manufactured wood products that contain adhesives or resins (e.g., plywood, particle board, flake board, and oriented strand board).

Darby, Montana Wood Boiler PM_{2.5} Emissions

NAAQS 24 Hour Standard is 35 ug/m³

- **Stack Test: 1.9 lbs/ton of wood burned - total particulate**
- **Total Particulate is 6.7 lbs/day or 0.5 tons/year (School Year)**
- **January 2004 average 3.53 tons of wood burned per day**
- **Dispersion Modeling with building downwash**
- **Results based on modeling**
 - **Concentration of 35 ug/m³ of PM_{2.5} for 24 hours with background included.**

Temperature Inversions Traps Pollution



Tall stacks can remain below Inversion

CONTROL TECHNOLOGY	PM10	PM2.5	COSTS	ISSUES
Tall Stacks	Ineffective	Ineffective	Low	Will not control particulate of any size
Cyclones	Effective	More effective with multiple cyclones	Low	Single cyclone will not control PM2.5
Scrubbers	Effective	Effective	High	Water waste
Baghouses	High Efficiency	High Efficiency	Medium	Potential baghouse fires
Electrostatic Precipitators	High Efficiency	High Efficiency	Very High	Economically infeasible
Core Separators	High efficiency	Less Efficient	Low	Recirculates exhaust – collecting particulates. Manufacturers needed
Multiple Cyclone plus Baghouse	High Efficiency	High Efficiency	Medium	Cyclone removes particulate before exhaust to Baghouse. Lowers fire danger

Summary

- **PM_{2.5} is a regional pollutant with serious health effects. It is comprised of HAPs and secondary particulates: NO_x, SO_x, Ammonia, VOCs.**
- **Nationwide many areas will be designated Nonattainment and will need to control PM_{2.5} in order to show attainment of the standard.**
- **EPA strongly encourages the States to *preemptively* consider regulatory action to control woody biomass boilers before controls are required by the Clean Air Act.**
- **Opportunity for boiler manufacturers to develop technology to control PM_{2.5}.**
- **Options for addressing this issue could include a workgroup of interested parties to find solutions – EPA will participate**
- **Need your ideas for accomplishing the goals of both reducing forest fires as well as minimizing health impacts from using woody biomass boilers.**

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