Particulate Matter Standards and Health Effects

Health Effects Research Subgroup Meeting
NIOSH, Morgantown, WV 6 September 2005

Coleen Baird Weese, MD, MPH
US Army Center for Health Promotion and Preventive Medicine

Particulate Health Effects

Particulate matter included in EPA NAAQs

Generic term for a broad class of physically and chemically diverse substances that exist in ambient air as discrete particles (liquid or droplets) over a wide range of sizes

Originate from a variety of stationary and mobile sources

Physical and chemical properties vary greatly with time, region, meteorology and source category

These differences must be considered in any study interpretation

Particulate Health Effects

1971: TSP (25 to 45 ums)
260 ug/m3 24 hour average (not to be exceeded....)
75 ug/m3 Annual geometric mean

1987: PM 10 Chosen to protect against adverse health effects of inhalable airborne particles deposited in the thoracic region

150 ug/m3 24 hour average (not to be exceeded...)

50 ug/mm3 expected annual arithmetic mean averaged over three years

Particulate Health Effects

1994 Meta analysis: Dockery and Pope

1% increase in total deaths with 10 ug/m3 increase in PM10

Mass and concentration of particle mix rather than chemical species

1% increase in inpatient admissions for respiratory/10 ug/m3

Decreases in FEV and peak flow

Particulate Health Effects

EPA National Ambient Air Quality Standards: 2004

Epidemiological studies show consistent positive associations of exposure of ***ambient*** PM to with health effects including mortality and morbidity (numerous caveats)

Public health impact large due to large number of individuals exposed

Variation in PM composition acknowledged

PM 2.5 Standards included

Particulate Health Effects

Health Effects Institute Research Report May 2004

NMMAPS (20 cities)

"***No threshold*** for all cause and cardio/respiratory mortality as low as 10 ug

Probable threshold for all other cause mortality"

PM 10 measurements

- NAAQS PM 10 24 Hr 150 ug/m3
  PM 10 Annual 50 ug/m3
- 1 Year MEG 70 ug/m3
- Revision to TG 230 reverts to the NAAQs—this also provides a 24 hour value

US Studies reviewed by the EPA

- EPA - What studies and what endpoints?
- Asthma admissions: PM 10 42.5 ug/m3
- Respiratory symptoms/adults PM 10 44 ug/m3
- Mortality PM 10 Up to 365 ug/m3
- In AQI, EPA separates out sensitive subgroups and identifies levels hazardous for them... as levels rise, they are hazardous for all populations.....

PM 10 measurements

1408/1672 samples exceed PM10 MEG (84%)

360 ug/m3 is the mean for OIF locations (Iraq, Kuwait, Qatar)
Recent roll-ups with means from (151-248 but high SDs)

EPA Hazardous cut point is 425 ug/m3

46,000 ug/m3 is the highest concentration recorded at LSA Viper in Iraq in April 2003

The next highest value is 17,000 ug/m3 at the same location the next day

TG 230 GOAL:
Characterize chemical risks in Operational Risk Management (ORM) terms

HAZARD SEVERITY	HAZARD PROBABILITY				
	Frequent (A)	Likely (B)	Occasional (C)	Seldom (D)	Unlikely (E)
Catastrophic (I)	Extremely High	Extremely High	High	High	Moderate
Critical (II)	Extremely High	High	High	Moderate	Low
Marginal (III)	High	Moderate	Moderate	Low	Low
Negligible (IV)	Moderate	Low	Low	Low	Low
	RISK ESTIMATE				

Hazard Severity Assessments

- < 425 ug/m3 Negligible???
- > 425 ug/m3 Moderate??
- 3-10 mg/m3 Critical
  - (Occupational levels-Excessive for sustained periods)
- Unlikely that catastrophic effects relating to deaths and severe disabling incapacitating casualties would occur

PM 10 measurements

Few controls to reduce exposure:

- Reduce dust
- Reduce exposure time during dust storms
- Personal protective equipment impractical
- Administrative controls: Move !

Shuiba Port PM 10 Levels

- 0-155 No expected health effects (7%)
- 155-354 Increased likelihood of aggravation of lung conditions?? Minor respiratory effects? (73%)
- 355-424 Increased aggravation pre-existing conditions, minor respiratory effects.... (5%)
- >425 Significant risk of aggravating existing conditions, respiratory effects likely especially after increased activity, prolonged durations (16%)

Particulate Health Effects

Is there sufficient information to identify hazard severity levels?

Are there implications to current policy, and what levels should these actions occur?

What recommendations should be made to Commanders?