

# **PARTICULATE AIR POLLUTION IN THE CENTRAL VALLEY: EFFECT ON CARDIAC AND RESPIRATORY HOSPITALIZATIONS**

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**Results from a Recent ARB-Funded  
Epidemiologic Study**

**June 26, 2003**

**Air Resources Board  
California Environmental Protection Agency**



## (Slide 1) INTRODUCTION

Thank you Ms. Witherspoon and good morning Chairman Lloyd and members of the Board.

In today's Health Update we will focus on the results of an ARB-funded study recently completed in the Central Valley of California under the direction of Dr. Stephen Van den Eeden of the Kaiser Permanente research team.

This is an important study that contributes to our understanding of the effects of particulate matter pollution, especially the fine particle fraction, on the respiratory health of this population.

## **REASONS FOR CONDUCTING THE STUDY**

- **Evaluate the effects of particulate pollution on health in California**
- **Look at the relative effects of PM by size**
- **Take advantage of ambient PM monitoring network**



### (Slide 2) REASONS FOR CONDUCTING THE STUDY

Surprisingly, there are relatively few studies that have examined the health effects of particulate matter on a California population. There are even fewer that have focused on the effects of PM<sub>2.5</sub>, due to the fact that ambient exposure data for PM<sub>2.5</sub> was rarely available until now.

This study provided us with an important opportunity to evaluate the usefulness of the PM monitoring network for daily ambient exposure assessment—and the results I will present today will demonstrate the importance of this monitoring effort.

# STUDY DESIGN

- Kaiser Permanente patients residing in four cities within the Central Valley
- Ambient monitoring of PM and other pollutants
- Daily admission or emergency room data for selected acute and chronic heart and lung conditions
- Statistical analyses with control for climate and co-pollutants



## (Slide 3) STUDY DESIGN

This study was designed to evaluate the effect of increasing ambient particulate matter and other gaseous pollutants such as nitrogen dioxide, on the rate of hospitalizations or emergency room visits for cardiac and respiratory conditions. The study was conducted between January 1996 and December 2000 and focused on approximately 500,000 members of the Kaiser Permanente Health Care Plan in Sacramento, Stockton, Modesto and Fresno. Approximately 77% of the study participants resided in the Sacramento area.

Daily hospitalizations and emergency room visits for acute respiratory conditions such as croup, acute bronchitis and pneumonia, and chronic respiratory conditions such as asthma, COPD and emphysema were evaluated in relation to daily ambient pollutant concentrations.

Statistical analysis was used to examine daily changes in air pollution based on 24-hour average concentrations and incorporated controls for confounding effects such as major co-pollutants and climate.

# FINDINGS

- **PM 2.5 and PM 10 results were statistically significant**
- **Gaseous pollutants such as NO<sub>2</sub> were associated to a lesser extent**
- **Small elderly population in the study contributed to lack of findings for cardiovascular effects**



## (Slide 4) FINDINGS

The study was successful in finding statistically significant associations between particle air pollution and respiratory conditions, and to a lesser extent between gaseous co-pollutants such and respiratory and cardiovascular conditions.

We believe that the small percentage of the very elderly in the population—less than 12% in the over 65 age category--may have contributed to the lack of findings related to pollutant levels and cardiac conditions.

We will focus our discussion today on the results of the respiratory health effects and particulate pollution levels.

# RESULTS

(per 10  $\mu\text{g}/\text{m}^3$ )

	ACUTE		CHRONIC	
	Hospitalizations	ER Visits	Hospitalizations	ER Visits
PM 10	2.3%	3.4%	5.5%	3.8%
PM 2.5	4.1%	5.2%	7.5%	6.5%



## (Slide 5) RESULTS

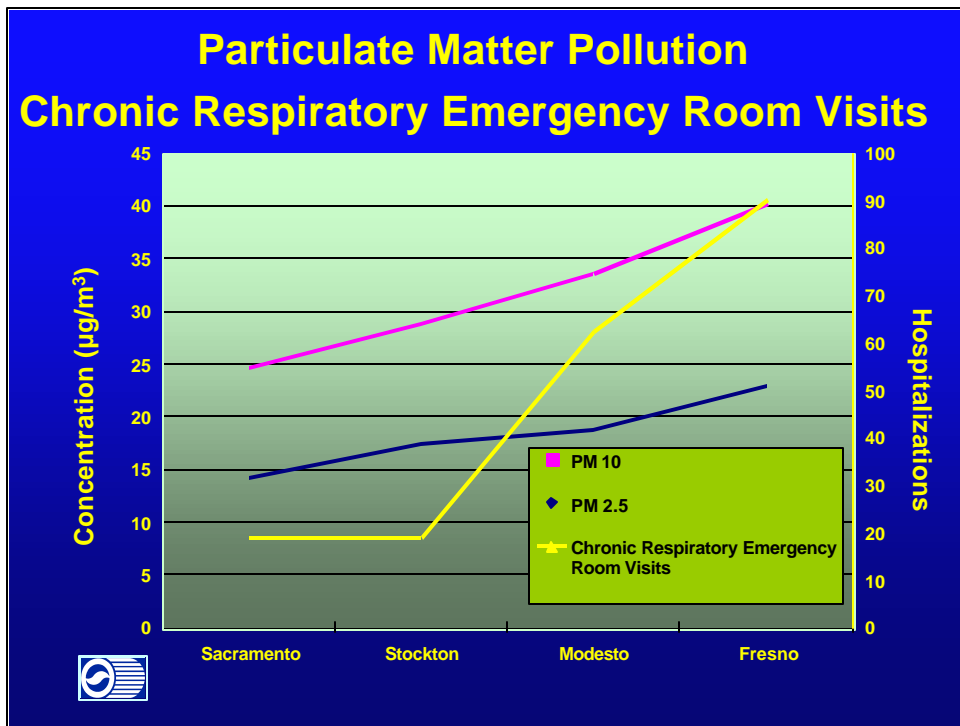
The association between fine particulate matter pollution and respiratory conditions was the most important finding of this study. As stated previously, very few studies have focused on this relationship due to a lack of exposure data. We found a significantly stronger association between health effects and PM<sub>2.5</sub> compared to the effects observed for PM<sub>10</sub>.

### (mouse click)

For PM<sub>10</sub> we observed a range of increases from 2.3% for acute respiratory hospitalizations to 5.5% for chronic respiratory hospitalizations.

### (mouse click)

For PM<sub>2.5</sub> the effects were 35 to 50% higher across the board. With the greatest effect seen in chronic respiratory hospitalizations. This is consistent with other studies that have compared these two size fractions of particulate matter, and is believed to be due to a greater intrinsic toxicity for PM<sub>2.5</sub>, greater indoor infiltration rates, lower exposure measurement error or other, as yet, unknown factors.



(Slide 6) PARTICULATE MATTER POLLUTION: CHRONIC RESPIRATORY EMERGENCY ROOM VISITS

Another interesting finding of this study was the relative increases observed in emergency room visits or hospitalization rates as they relate to increasing particulate matter pollution, which varies significantly by geographic location.

(mouse click)

In this slide we compare the emergency room visits for chronic respiratory conditions in the four different cities which have increasing rates of particle pollution.

(mouse click)

For PM10 we observe an increase in levels as we move down the Central Valley from Sacramento to Fresno.

(mouse click)

For PM2.5 we also observe an increase in concentration from Sacramento to Fresno.

(mouse click)

And, interestingly, the rates of emergency room visits per 1,000 population increased in association with increasing pollution from city to city with the highest rates observed in Fresno. Although, the study did not separate specific admission diagnoses in each area, Fresno has a much higher rate of asthma, at least 25% higher in the pediatric population, than the rest of California and this may play a part in these increased emergency room visits.

# Implications

- Reduction of particulate pollution is of great importance to the health of this Central Valley population
- Further study on vulnerable populations is needed
- PM 2.5 monitoring network is contributing valuable information



## (Slide 7 ) IMPLICATIONS

The results of this study confirm our belief that reduction of particulate matter pollution in the Central Valley is of great importance to the health and well being of this population. The F.A.C.E.S. project currently underway in Fresno will help us further refine our understanding of the health impacts of particle pollution on asthmatic children, however, additional studies will be needed to evaluate the effects of this pollution on the very elderly and those with pre-existing conditions.

The information we obtained from this research can be used to support the need to maintain and improve fine particulate monitoring, while at the same time looking for further pollution reduction measures in this small size fraction.

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## (Slide 8) Conclusion

Thank you for your attention today, I would be happy to answer any questions you have about this study.