

Indoor Air Quality in Immigrant Housing in Commerce City, CO

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Motivation for the Study

- Indoor air has not been studied as thoroughly as outdoor air
- Not much research has been done on the living conditions of immigrants
- If Hispanic immigrants live in substandard housing, then what effect does this have on air quality?

What Are We Doing?

- Commerce City is very industrial with heavy vehicle traffic
- Comparing health effects with indoor and outdoor air quality
- Also comparing the relationship between indoor and outdoor air

HUD Healthy Homes

- 250 homes are being inspected and surveyed by UCHSC
- 100 of these homes will receive air and vacuum sampling
- Air samples analyzed for $PM_{2.5}$ with 24-hour CO and CO_2 monitoring
- Vacuum samples analyzed for allergens

Allergens

- Allergic asthmatics are sensitized to specific allergens
- Subsequent exposure to allergens can trigger asthma attacks
- Young children most at risk for developing allergic asthma [2]



Carbon Monoxide

- Result of combustion
- Fastens to red blood cells and prevents them from carrying oxygen
- Vision, ability to work and learn, and ability to physically function can be impaired
- Acute exposure can be fatal
- 15 PPM average over 8 hours or 22 PPM average over 1 hour is acceptable [3]



Particulate Matter

- Particles suspended in the air
- Dust, dirt, soot, smoke, and liquid droplets [4]
- Breathing can be impaired, asthma aggravated, and immune system can be weakened
- Can also transport bacteria, viruses, and toxins [2]

Particulate Matter con't

- Long term exposure linked to reduced lung function, chronic bronchitis, and premature death
- $PM_{2.5}$ main concern in this study because they can become lodged in the lungs easily
- Suitable level is less than $65 \mu\text{g}/\text{m}^3$ in a 24 hour period [5]



ELISA

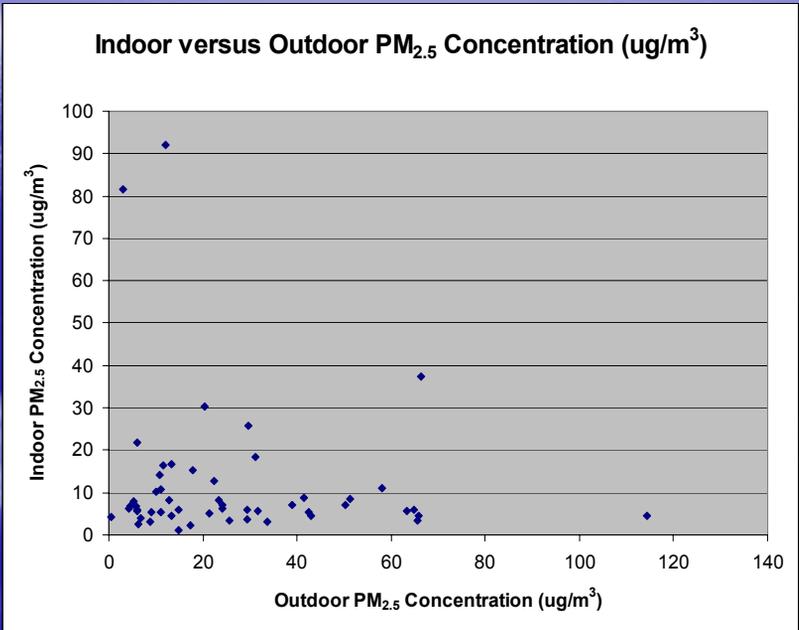
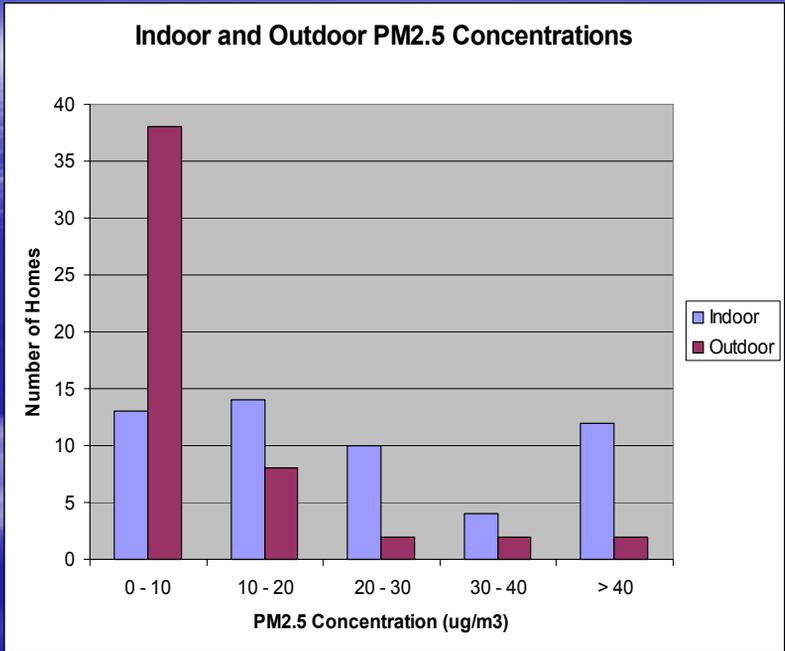
- Enzyme-linked immunosorbent assays
- Once the allergen standard has reacted with the antibodies, the samples (which have reacted with the same antibodies) are compared to the standard
- The plate is read in an optical density machine
- Calibration curves are made from the allergen standard

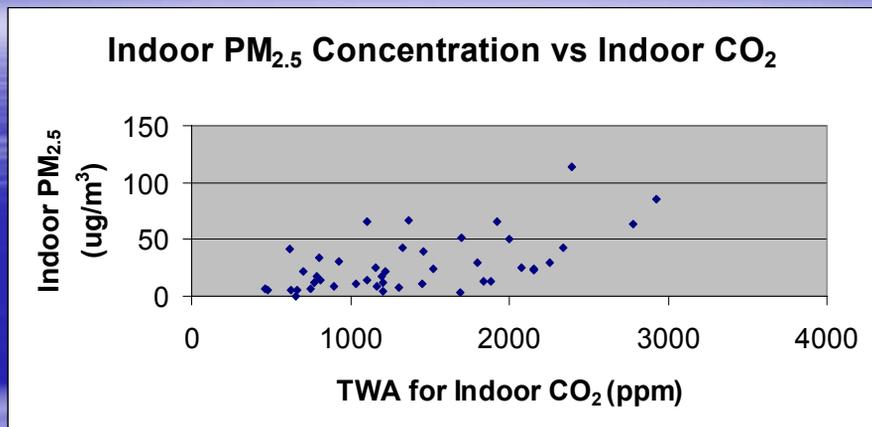
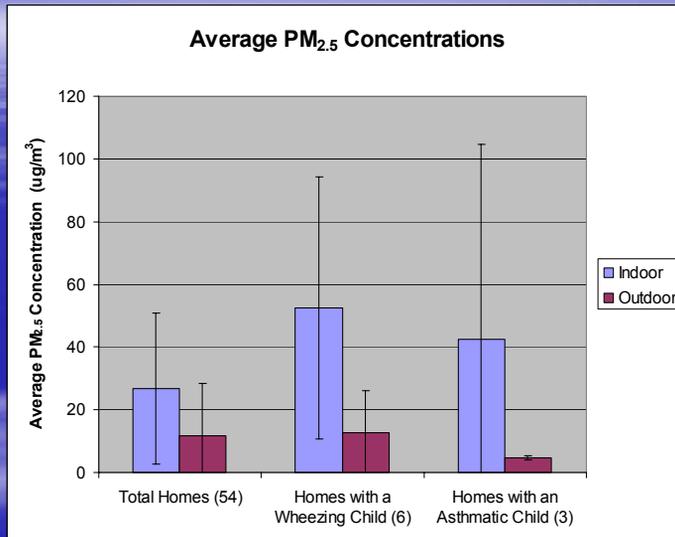
Difficulties with Indoor Air Assessments

- Confounding factors: PM_{2.5} and allergens can both exacerbate asthma
- Quantitatively describing allergen concentrations
- Carpeting acts as an allergen reservoir, but does not represent personal exposure.
- Dust mites and feline allergens found in most homes, even if they do not have cats

Results

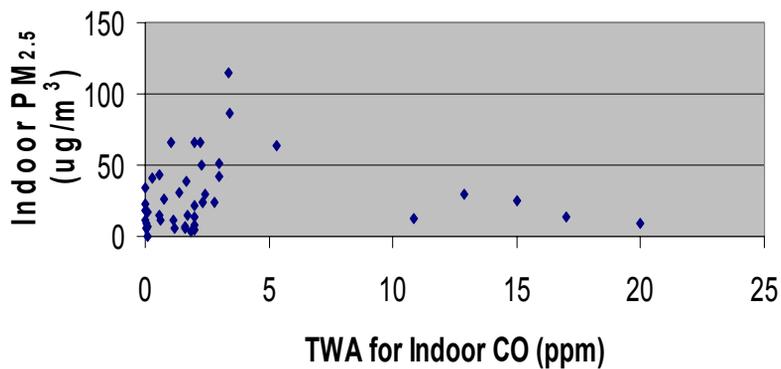
- About half of the homes are complete
- Have not found many dangerous levels
- Have only sampled a few homes with wheezing or asthmatic children, so we cannot draw any conclusions yet
- No correlation between PM_{2.5} concentrations and CO
- Suggested correlation between PM concentrations and CO₂
- ELISA analysis is still pending





R Squared = 0.3716

Indoor PM_{2.5} Concentration vs Indoor CO



Conclusions

- Much research is being performed on similar subjects
- This particular project will continue through December 2006
- ELISA analysis will be performed and the families will be notified of the results



References

- [1] DW Dockery, CA Pope, X Xu, et al., "An Association Between Air Pollution and Mortality in Six US Cities," *New England Journal of Medicine*, vol. 339, pp. 1753-1759, 1993.
- [2] P. Scaramella, "Investigator's Manual for Air and Vacuum Sampling in a Study of Immigrant Housing in Conditions in Commerce City, Colorado," University of Colorado at Boulder, Summer REU, 2006.
- [3] "Carbon Monoxide Safety," http://www.mass.gov/dfs/osfm/pubed/firesafetytopics/carbon_monoxide_safety.htm Accessed July 17, 2006.
- [4] "Fine Particle (PM2.5) Designations: Frequent Questions," <http://www.epa.gov/pmdesignations/faq.htm#0> Accessed July 17, 2006.
- [5] "Fine Particle (PM2.5) Designations: Basic Information," <http://www.epa.gov/pmdesignations/basicinfo/htm> Accessed July 17, 2006.
- [6] P. Scaramella et. al. "An Assessment of Indoor Air Quality in Hispanic Immigrant Housing in Commerce City, CO," University of Colorado at Boulder, Spring, 2006.
- [7] *Procedures for Preparation of Dust Samples for Allergen Determination*. Charlottesville, VA: Indoor Biotechnologies, 2006.
- [8] "ELISA Protocol for (Allergen): Product Code (Allergen)," Charlottesville, VA: Indoor Biotechnologies, 2006.