

IPRO 320: Community Air Monitoring

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Problem Statement

The Center for Neighborhood Technology (CNT) is working to develop an air quality monitoring device and reporting system in the Bronzeville community over the next three to four years. This IPRO group is to provide technical background information to project leaders in the community, investigate some approaches to air quality monitoring that have yet to be considered, and get involved with the community.

Objectives

This Semester:

- Emphasis on information gathering
- ○ -Current monitors and pollution standards
- ○ -Chemical irritants in particulate matter and air
- ○ -Who to contact among local, state, and federal regulatory agencies
 - Mapping Bronzeville and investigating placement of monitors
- Preserving information in useful form for the future IPRO class.

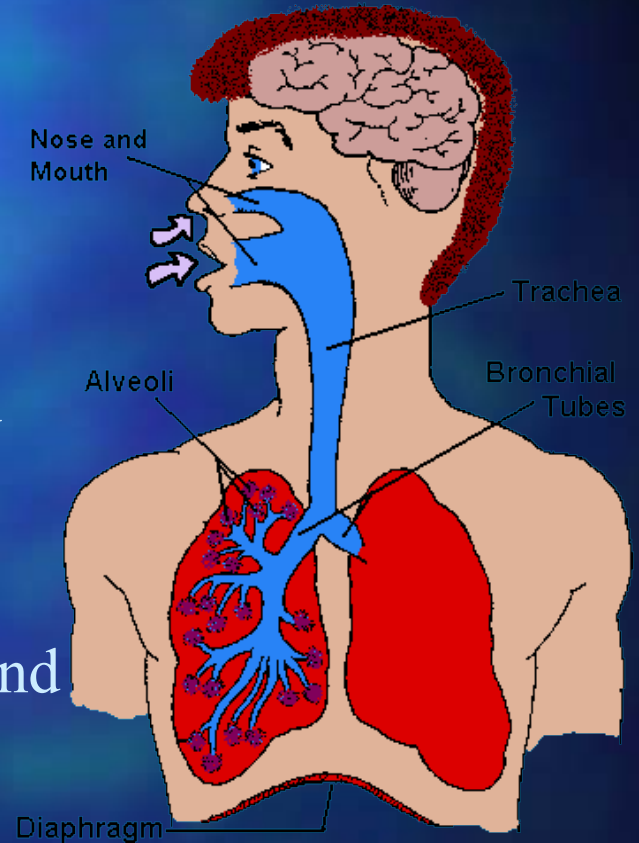
Health Effects

Immediate Health Problems:

- Aggravated cardiovascular and respiratory illness
- Added stress to heart and lungs
- Damaged cells in the respiratory system

Long-Term Health Problems:

- Accelerated aging of the lungs and loss of lung capacity
- Asthma, bronchitis, emphysema, and cancer
- Shortened life span



Air Pollution Components

- Ozone

- CO₂

- Particulate Matter

 - PM_{2.5}: Diameter <2.5μ m

 - Lodges in the alveoli

 - PM₁₀: Diameter <10μ m

 - Caught in bronchial tubes, cleaned by body

Demolitions

The Chicago Housing Authority (CHA) is proposing to demolish numerous units for several housing developments in the Bronzeville area due to condemned conditions and safety hazards.

			Proposed Timeline for Demolition				
			Existing Units	Occupied Units	2000	2001	2002
Robert Taylor A	1734	661	473	316	631	314	
Robert Taylor B	2050	532	1104	315		631	
Stateway Gardens	1644	611	230	690	362		362
Washington Park Homes	468	164	158	155	155		

GIS Modeling

Goals:

- Make a detailed map of the area of Bronzeville
- Determine optimum sites for monitors base on wind flow
- Highlight areas of poor air quality

Progress:

Obtained detailed map of the region
Consulted with meteorologists

Results:

Due to the variability of wind flow throughout Chicago, detailed modeling would prove to difficult. However, annual wind information from Midway Airport could be applied in addition to Gaussian dispersion theory to roughly model airborne particulates after demolitions.

Regulations

The EPA enforces both daily and annual national air quality standards for particulate matter based on the particle diameter (40 CFR 1 § 50.7).

PM₁₀

Within one 24-hour period the average particulate matter concentration should not exceed $150 \mu\text{g}/\text{m}^3$, and over a year the daily mean should not exceed $50 \mu\text{g}/\text{m}^3$.

PM_{2.5}

Within one 24-hour period the average particulate matter concentration should not exceed $65 \mu\text{g}/\text{m}^3$, and over a year the daily mean should not exceed $15.0 \mu\text{g}/\text{m}^3$.

Contacts

Key Contacts Developed:

- US EPA
- Illinois EPA
- CHA
- Illinois Institute of Technology
- Fox News Chicago & College of Dupage

Environmental Justice

A region whose population is made up of more than 50% minority groups. The specific goal of the environmental justice department is to coordinate the efforts of community action groups so that the EPA can respond more readily to the needs of residents.

Total Population	35,897
Racial/Ethnic Composition	
Non-Hispanic Black	99.1%
Non-Hispanic White	0.30%
Hispanic	0.40%
Non-Hispanic Other	0.20%
Socio-Economic Status	
Median Household Income	\$ 7,146
Below Poverty Level	64.7%

Monitoring: Ambient Levels

Monitoring on IIT's Farr Hall

Particles are collected for 24 hours, and samples are collected once a week. The EPA standard for PM_{10} and $PM_{2.5}$ is used.

State/Local Air Monitoring Station (SLAMS) Determines:

- Highest concentrations expected
- Concentrations in areas of high population density
- Air quality impact of significant sources
- General background levels



Monitoring: On-Site Levels

Monitoring by Capitol Construction

NIOSH Standard is used to monitor particles less than $5 \mu\text{m}$ in diameter. One monitor is placed upwind, and another downwind. The samples are taken over the workday.

At the beginning of the demolition, monitoring occurs everyday for two weeks. As the project continues, monitoring occurs twice a week, depending on the previous sample results.

Chemical Analysis

Inorganic Matter:

- HNO_3 used as a solvent to extract metals like calcium, lead, and potassium
- Ion chromatography used to analyze residual constituents

Semi-Volatile Organic Compounds:

- Deposits dissolved in organic solvent
- Organic solution is analyzed with gas chromatograph

Volatile Organic Compounds:

- Air is sucked into a vacuum chamber and analyzed with cryogenic gas chromatography

Community Monitoring

Problem: Building and maintaining a monitor to meet EPA guidelines is expensive and time-consuming. Chemical analysis of the deposits is even more difficult.

Possible Solution: Build inexpensive monitors that the community could use to determine the general air quality level.

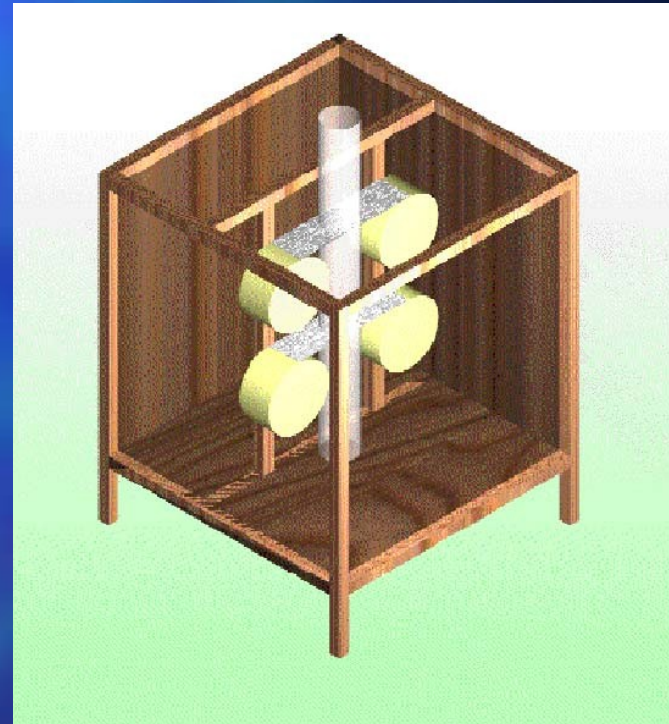
This would:

- Increases public awareness
- Draw media attention
- Demonstrate that there is an air quality concern
- Elicit help from the EPA

Community Monitoring

Possible Monitor Specifications:

- Collects particulate matter by filtering
- Upper filter blocks PM_{10}
- Lower filter collects remainder
- Stationary or variable filter position
- Easily built with standard household tools



Future Goals

- Develop an innovative air quality monitoring device and reporting system in the Bronzeville/ Grand Boulevard community over the next three to four years

Provide technical background to project leaders in the community

Investigate some approaches to air quality monitoring that have yet to be considered

Questions?
