A Quantitative Decision-Based Voluntary Benzene Reduction Plan for Ambient Air in the Houston Region

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The Problem: Benzene

- Class A, human carcinogen
- Tumor Type: Leukemia
- Test Species: Human
  - Route: Inhalation,
  Occupational exposure:
Study: Urgent action needed to cut air toxics
– Risk is higher in Houston area than in other big cities, new report says—By DINA CAPPIELLO
Houston Chronicle

How much data is that?

Auto GC data in a year:

– 8760 hourly data points for one constituent at one monitor
– 438000 data points per monitor
– 87600 data points of one constituent across all monitor
Air Toxic Data

1 hr Canister:
- 3 sites
- Monitors for around 100 compounds, event triggered.

24 hr Canister Sites:
- 16 sites
- Monitors for around 100 compounds, every sixth day.

Auto GC Sites:
- 10 Sites
- Monitors for around 50 compounds,
- samples for 45 minutes, analyzes for 15 minutes, data represented as hourly averages.
Annual Mean Benzene Concentration

(95th UCL Canister Data)
Cancer risk of 20-53 in one million
The Benzene Air Toxic Framework

- No current ambient standards
- Monitor sample data indicate that concentrations pose a health risk
- Models indicate that the air toxic posing the most threat to health in Houston is
  - benzene and
  - the largest sources include emissions from cars, industry, and gas stations
- Air does not respect city boundaries
The Air Toxic Framework

1. What we can’t directly do?
   - regulate cars, trucks, trains, ships, planes or
   - industries polluting from outside the City Limits

2. Where does the majority of our air pollution come from?

3. What can we do?
Regulation alone is not the answer

Voluntary
Multi-sector Benzene Reduction Plan
Promote Voluntary Reductions of Emissions

1. Citizens and businesses
2. Industry sources
3. Lead by example
Benzene Goals for Ambient Air in Houston

Goal: to improve air quality in the Houston region by reducing the ambient air concentrations of hazardous air pollutants, such as benzene.
Benzene Goals for Ambient Air in Houston

- **Long term (10 years):** 1 case per 1 million people (0.14 ppb or 0.45 µg/m³)

- **Intermediate (5 years):** 5 cases per 1 million people (0.7 ppb or 2.2 µg/m³)

- **Short term (3 years):** 10 cases per million people (1.4 ppb or 4.5 µg/m³)
Boxplots of Houston Benzene Concentration (trimmed scale)

Benzene Concentrations 2005 (ppbV)

Monitors

Cesar Chavez

Channelview

Clinton

Deer Park

HRM-3 Haden

Lynchberg Ferry

Concentrations (ppbV)
The Approach

1. Identify the largest source contribution by census tract

2. Develop strategies by census tract

3. Engage in a partnership within the community to voluntarily reduce emissions
Identify Emission Sources by Census Tract

Identify source types contributing the majority of the emissions by census tract (NATA)

- Onroad mobile
- Major source
- Area source
Measured vs. Modeled Benzene

Benzene concentration (µg/m³):
Onroad Mobile Sources
The majority of the benzene concentration within many census tracts is from cars, trucks and SUVs along the freeways.
Onroad Mobile Reduction Strategy

1. Calculate benefit from mobile source reduction scenarios
2. Educate citizens and business with respect to onroad mobile issues and how to reduce emissions
3. Ask for, quantify and verify reductions
Onroad Mobile Reduction Strategy: Calculations

MOBILE6
- base case and four future years assuming traditional regulatory emission controls
- reformulated gasoline and Tier 2 vehicle fleet turnover

NATA model emission and concentration to Mobile 6 output estimate
- concentration for each census tract and model run year.
Onroad Mobile Reduction Strategy: Calculations

0.45 µg/m³
Status Quo Onroad Mobile Vehicle emissions and the Goal

Our models indicate that in 1999:
- 96% of the census tracts met the short term goal,
- 60% met the intermediate goal and
- 0% met the long term goal.

We estimate that in 2007:
- 100% of the census tracts will meet the short term goal,
- 100% will meet the intermediate goal and
- 71% will meet the long term goal.
Voluntary Reductions of Onroad Mobile Vehicle emissions and the Long Term Goal

- Quicker fleet turnover = + 5% of the census tracts will meet goal (total of 76%).

- Reduction of the total vehicle miles traveled in 2007 by 10% = + 4% of the census tracts will be below goal (total of 80%).

- Both fleet turnover acceleration and the total vehicle miles traveled is reduced by 10% = 96% of the census tracts will be below goal by 2010.
Emission Reduction Strategies

1. Pledge to make a difference in reducing air toxics
2. Drive an environmentally friendly car.
3. If you are eligible, participate in the LIRAP program.
4. Drive fewer miles.
5. Encourage employees to drive fewer miles.
6. Use less gasoline.
Major Industrial Sources
Short term: 1.4 ppb or 4.5 µg/m³
2004 Houston-Galveston-Brazoria Area
Reported Point Source Benzene
Emissions (tons-per-year)
**Benzene Goals**

**Long term (10 years):** air toxic cancer risk limit of 1 case per 1 million people
(1.4 ppb or 0.45 µg/m³)

**Intermediate (5 years):** air toxic cancer risk limit of 5 cases per 1 million people
(0.7 ppb or 2.2 µg/m³)

**Short term (3 years):** air toxic cancer risk of 10 cases per million people
(0.14 ppb or 4.5 µg/m³)
Case Study: Reduction Measures

- Flare gas recovery
- FTIR open path monitoring along the north and south fence lines
- LDAR leak definition reduced from 500 ppm to 250 ppm
- Attempt to correct leak within one day for leaks monitored at concentrations above 100 ppm
- IR Camera used at least quarterly and during startups
Area Source Investigation

• IR Camera survey of phase I/II vapor recovery

• Stratified random sample pilot study
  
  • 10% of gas stations

  • Stratification – Mom and Pop vs large industry
MAYOR BILL WHITE USES "FRESH AIR FRIDAY" TO ANNOUNCE IMPLEMENTATION PLAN FOR HYBRID VEHICLES IN CITY FLEET
Conclusion

- A clean air legacy
  - Short term priorities
  - Intermediate Goals
  - Long term vision