

**Metro Louisville  
8-Hour Ozone NAAQS  
Past, Present, and Future**

**Trends  
Projections**

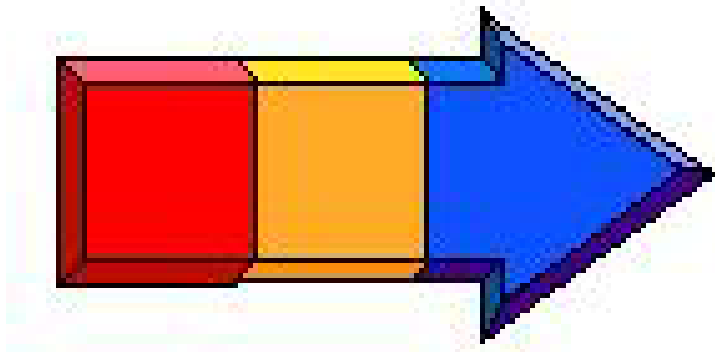
# Pervasive Problems



- Acid Rain
- Urban Air Pollution
  - O<sub>3</sub> & CO
- Toxic Air Emissions



# **1990 - Clean Air Act Amendments**



***8-Hour Ozone***

# What is ozone?

- **Ozone irritates the respiratory system, reduces lung function, aggravates asthma and chronic lung diseases.**
- **Repeated ozone damage to children's developing lungs may lead to reduced lung function later in adulthood.**
- **Ozone is typically not emitted, but formed from other pollutants**
  - Nitrogen Oxides (NO<sub>x</sub>)
  - Volatile Organic Compounds (VOCs)
- **Ozone is a concern in the summer months when weather conditions needed to create**
- **Ozone is more prevalent**
  - Sunlight
  - Heat

# Isn't there "good" and "bad" ozone?

- The ozone layer in the upper atmosphere is considered "good" ozone because it filters harmful ultraviolet radiation from the sun and reduces the amount that reaches the earth's surface.

- On the other hand, high concentrations of ozone in the air we breathe at ground-level can be harmful to people, animals, crops, and many common materials.



## LIKE CHOLESTEROL...

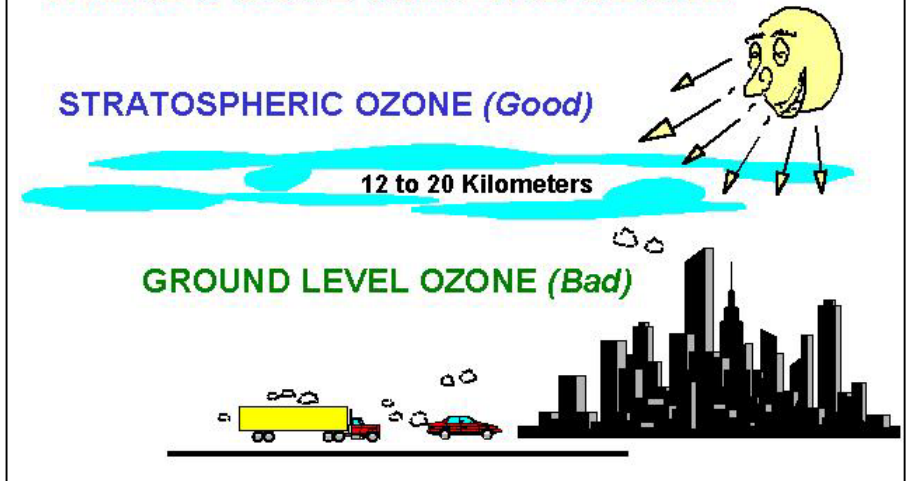
WITH IT'S GOOD AND BAD COMPONENTS..

**THERE'S GOOD AND BAD OZONE.**

STRATOSPHERIC OZONE (*Good*)

12 to 20 Kilometers

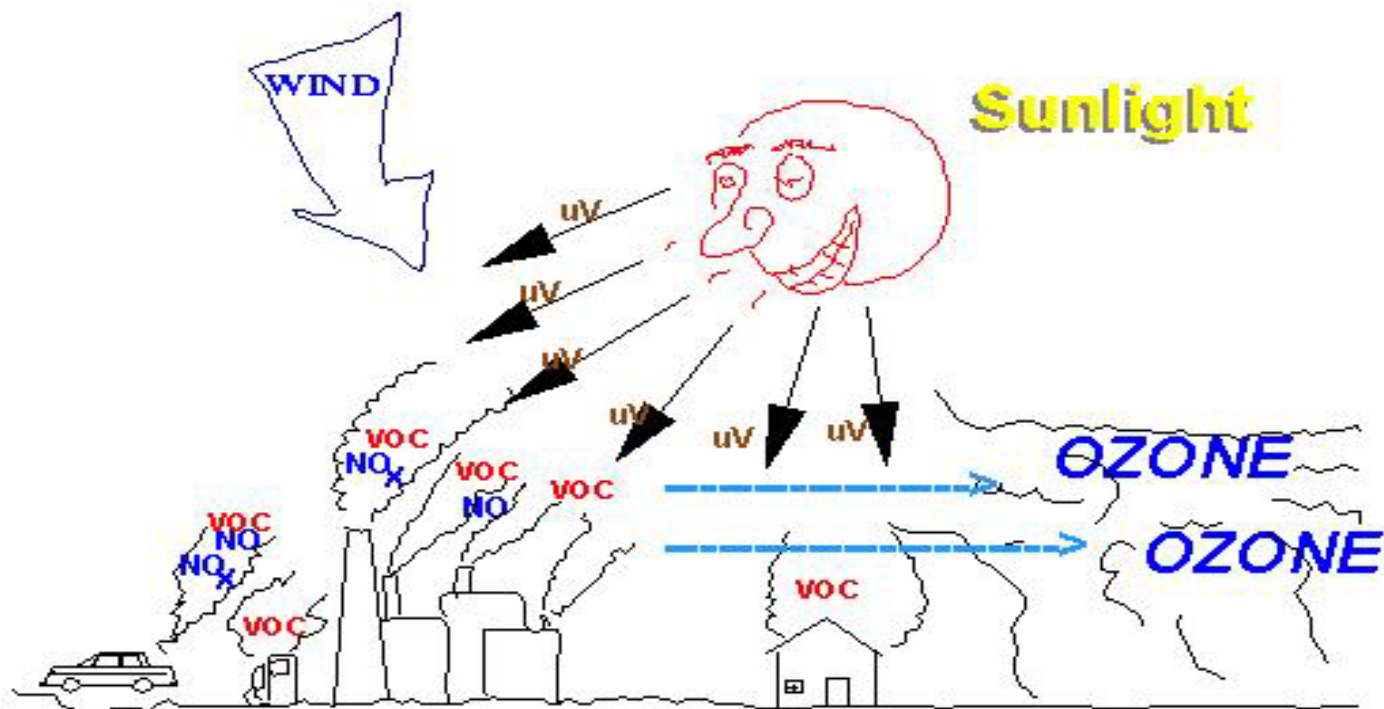
GROUND LEVEL OZONE (*Bad*)



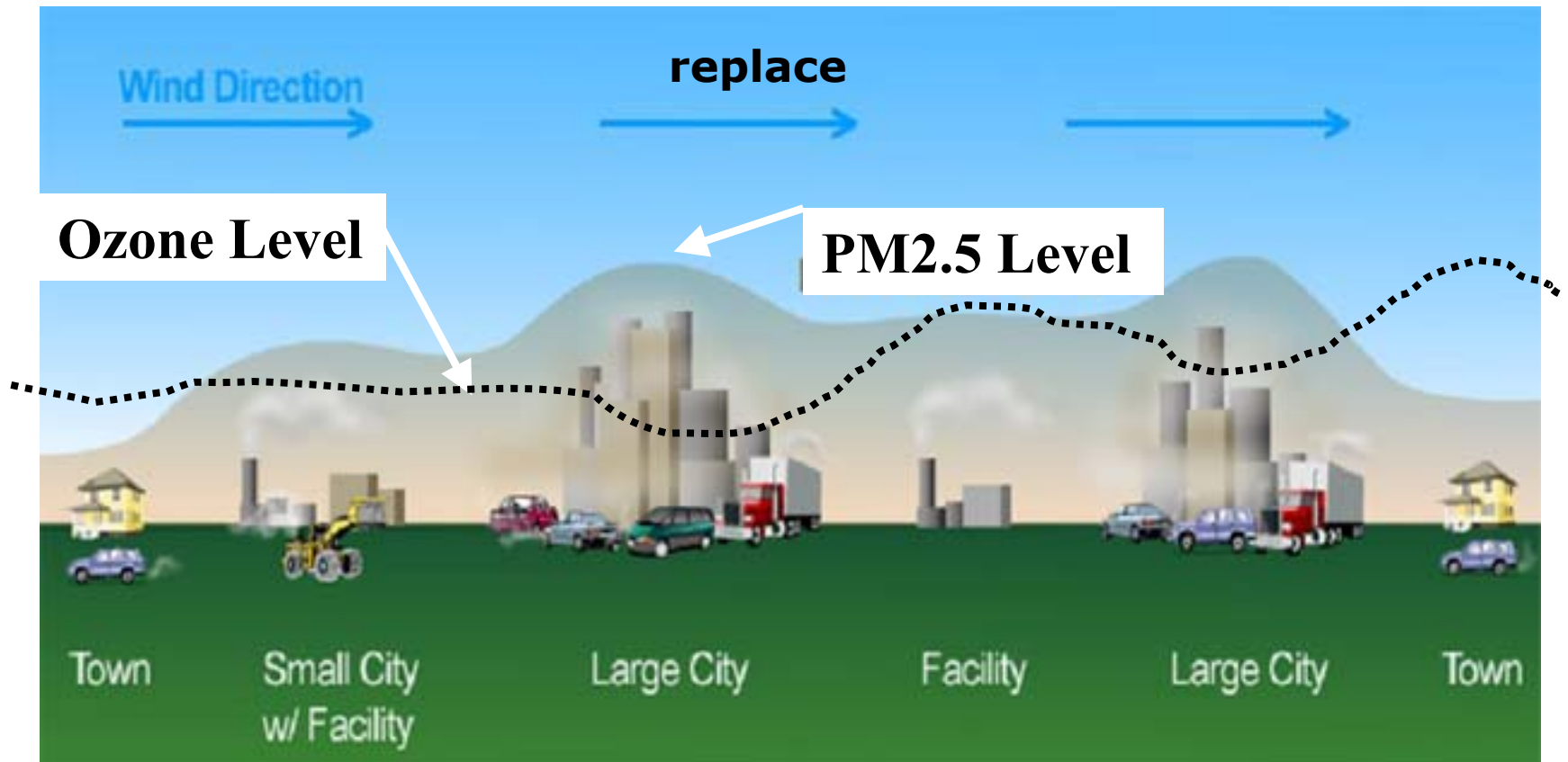
Where does  
ozone  
come  
from?



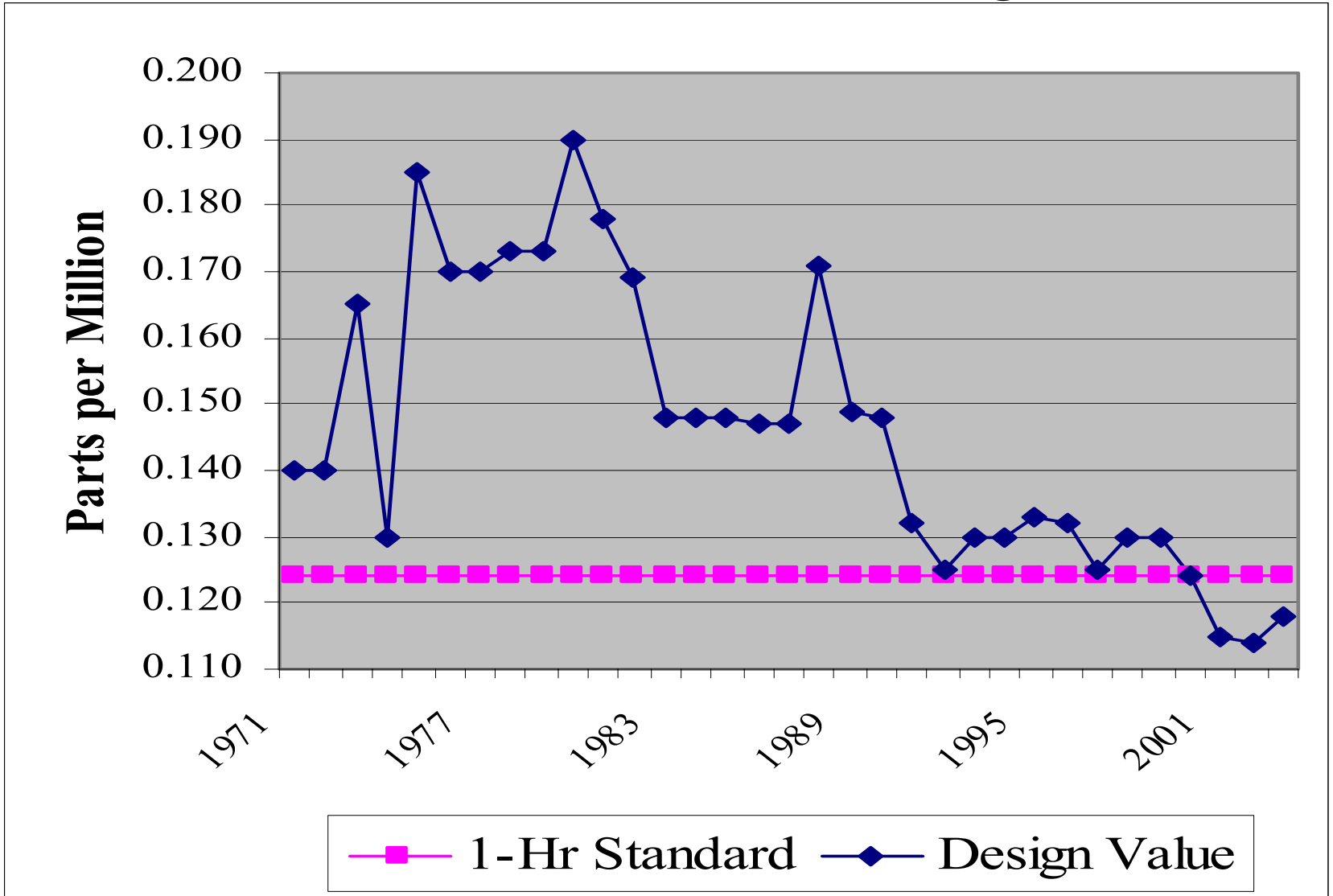
## HOW VOCs AND NO<sub>x</sub> FORM GROUNDLEVEL OZONE



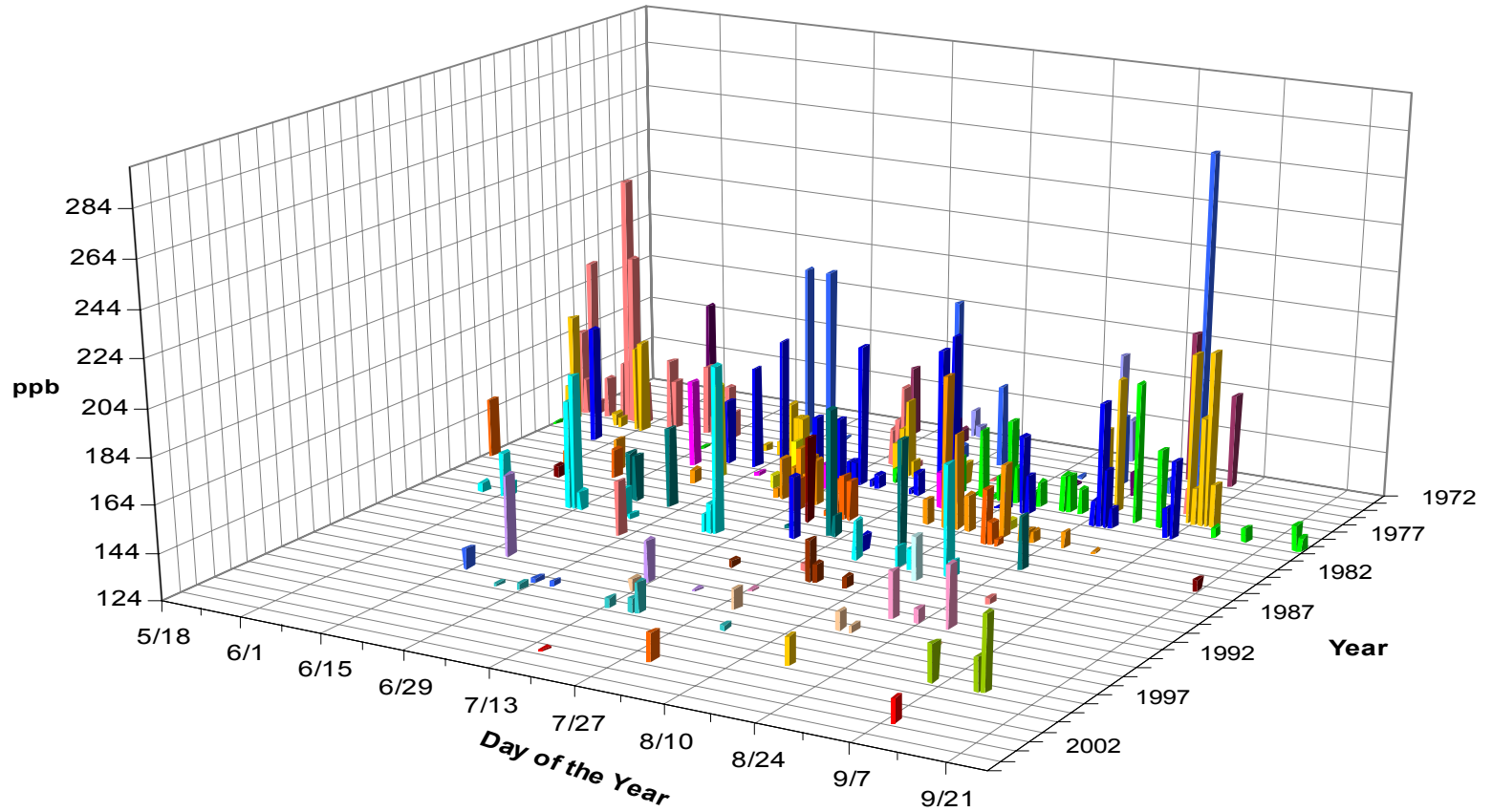
# Air Pollutants That Cause or Contribute To Elevated **Ozone** and **PM<sub>2.5</sub>** Can Be Transported Long Distances



# Historical 1-Hour Ozone Design Values



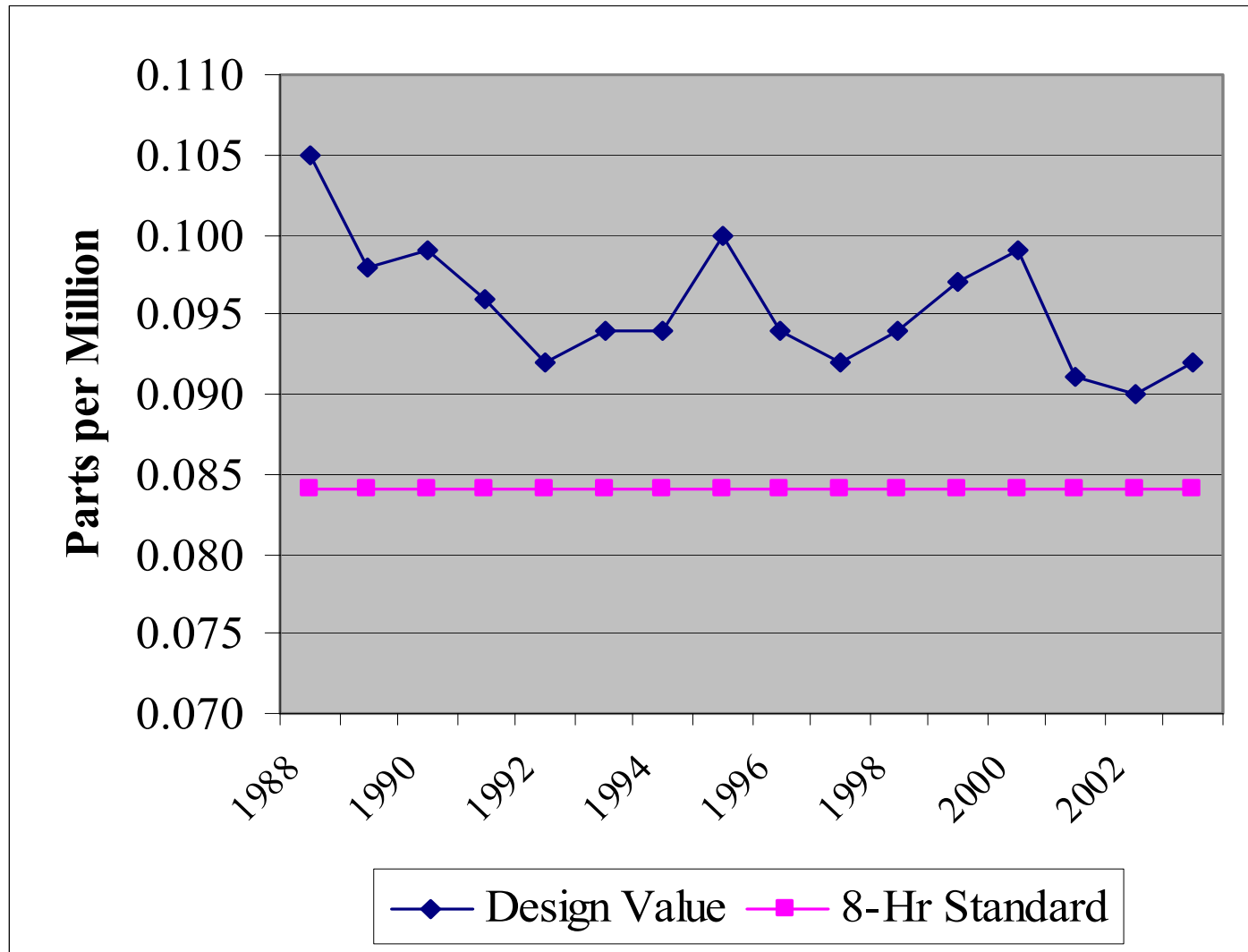
# 1-Hour Ozone Exceedances



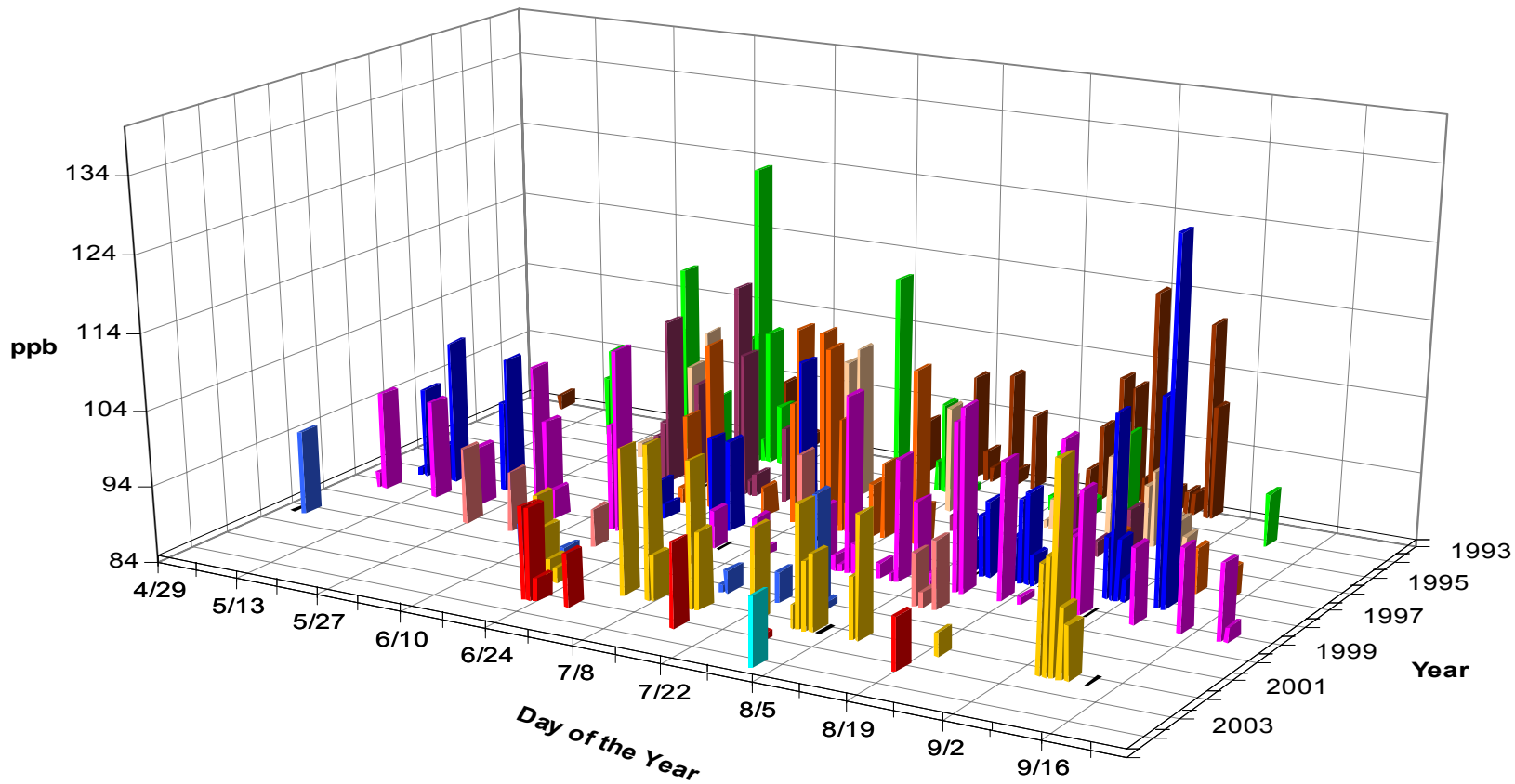
# Ozone Standard

- 8-hour standard adopted in 1997
- More stringent than previous standard
  - 0.08 ppm (84 parts per billion)
  - 3 years of monitoring data
  - 4th highest 8 hour value / each year
- violation exists if average = 0.085 ppm or greater
- EPA mandated by the Clean Air Act to protect human health within an adequate margin of safety

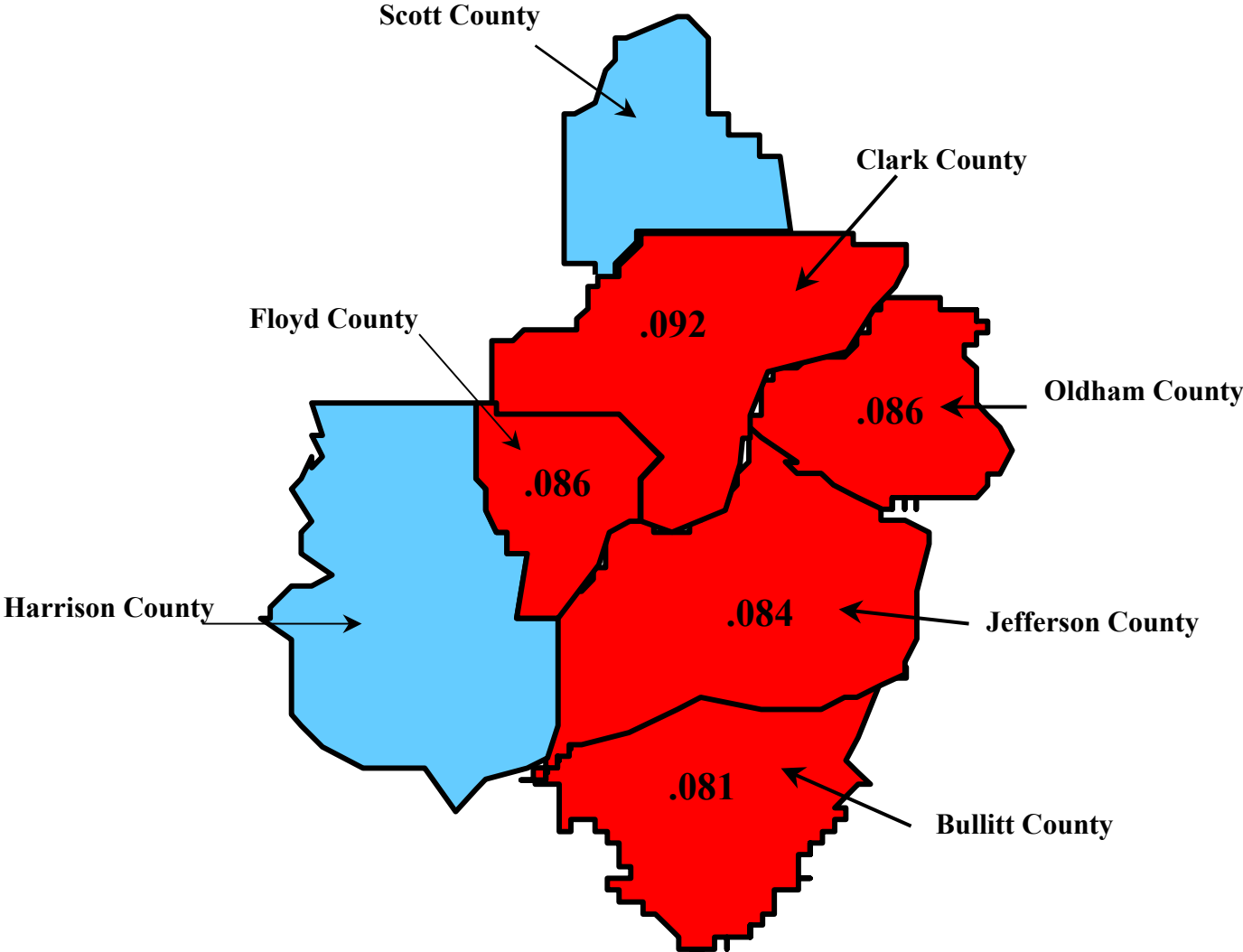
# Historical 8-Hour Ozone Design Values



# 8-Hour Ozone Exceedances



# Louisville 8-Hour Ozone Nonattainment Area



# Louisville 2001-2003

## 8-Hour Design Value

**0.092 ppm (Charlestown)**

- 2000 0.085
- 2001 0.086
- 2002 0.100
- **2003** 0.090
- $0.276 / 3 = 0.092$  ppm

# Louisville 2002-2004 8-Hour Design Value \* 0.088 ppm (Charlestown)

- 2002 0.100
- 2003 0.090
- **2004** 0.074

$$0.264 / 3 = 0.088 \text{ ppm}$$

\* Preliminary

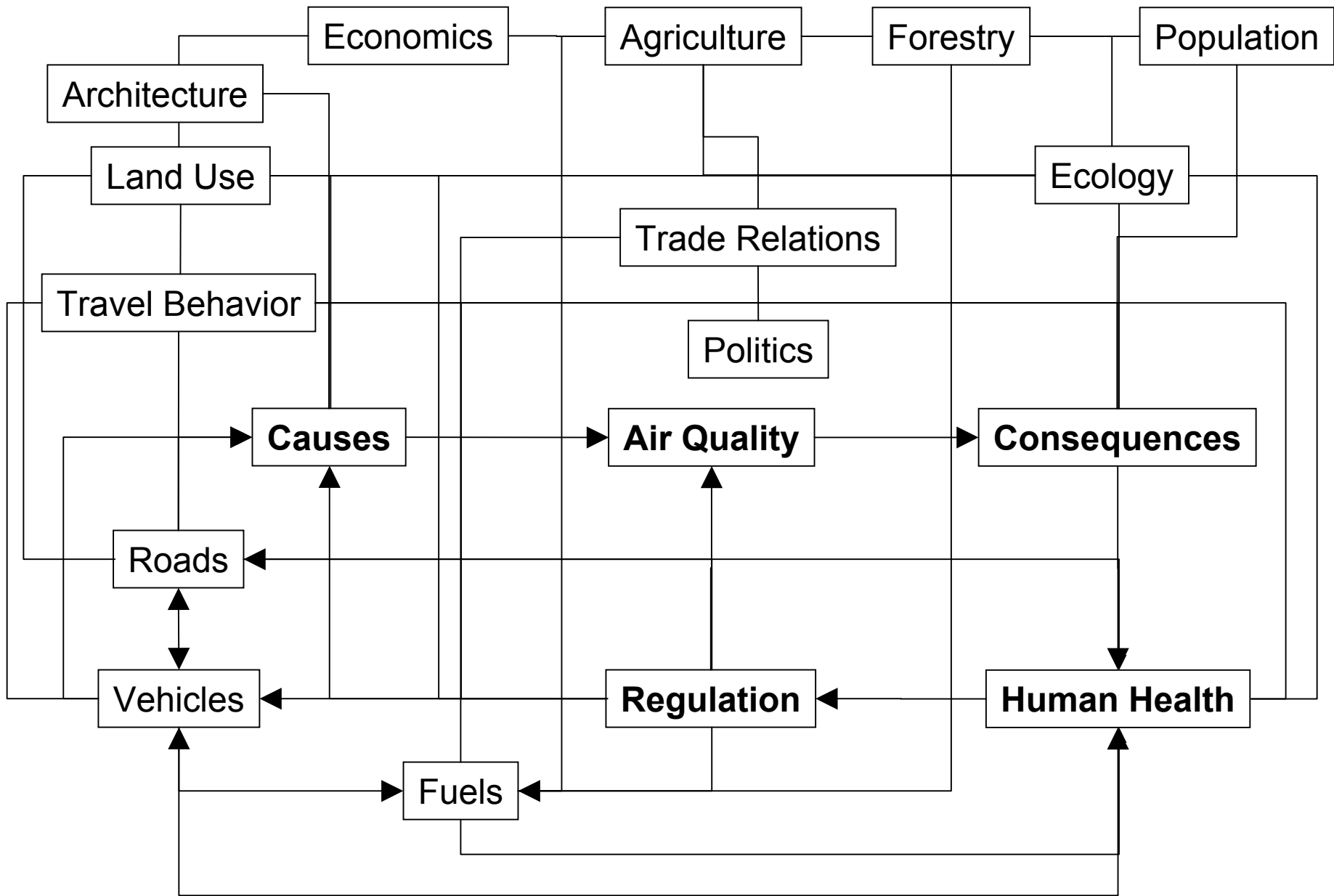


# **Air Quality Strategies for the Future**

## **Managing Complex Systems**

- **Michael Chang**
- **April 23, 2004**

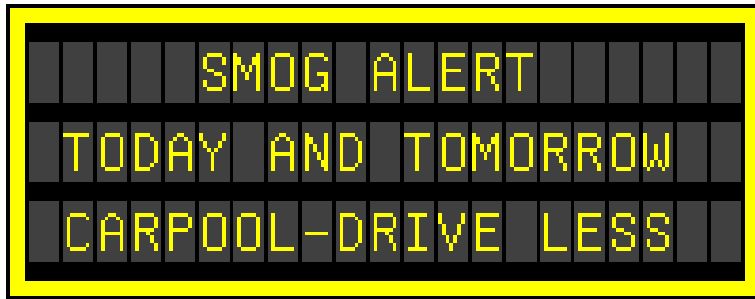




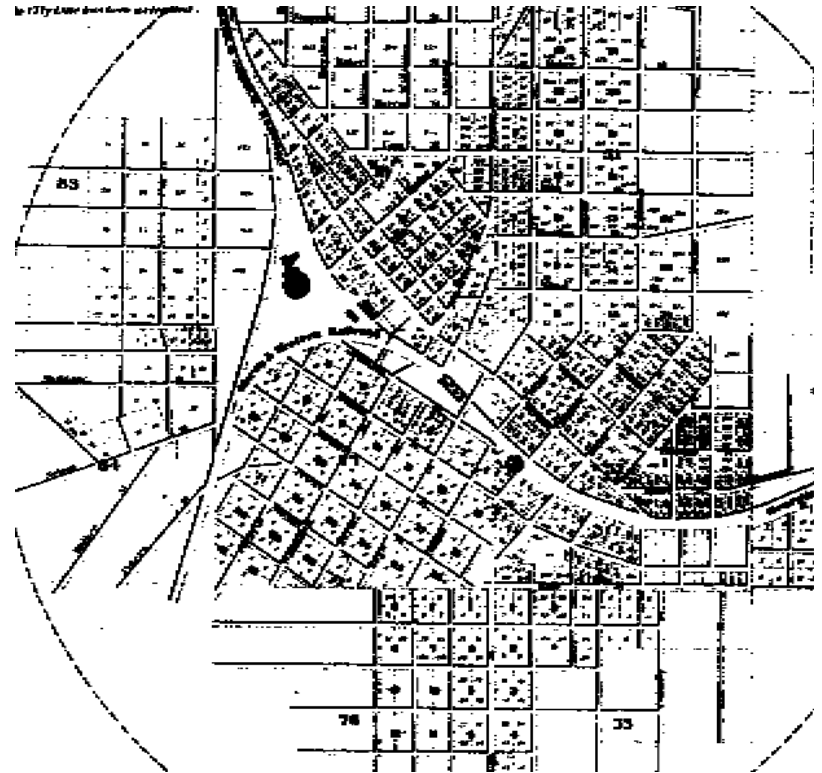
# Air Quality Management: software vs. hardware

- Historically we have addressed air quality problems only on time scales that range from a few hours (e.g. smog alerts) to a few years (e.g. State Implementation Plans).
- Metropolitan areas evolve on time scales of decades to centuries.
- Systems Thinking: Cause and effect may not be closely related in time and space.
- Do we have the appropriate perspective to treat the underlying disease of poor air quality, or are we merely treating the symptoms?

**Can this...**



**...ever fix this?**

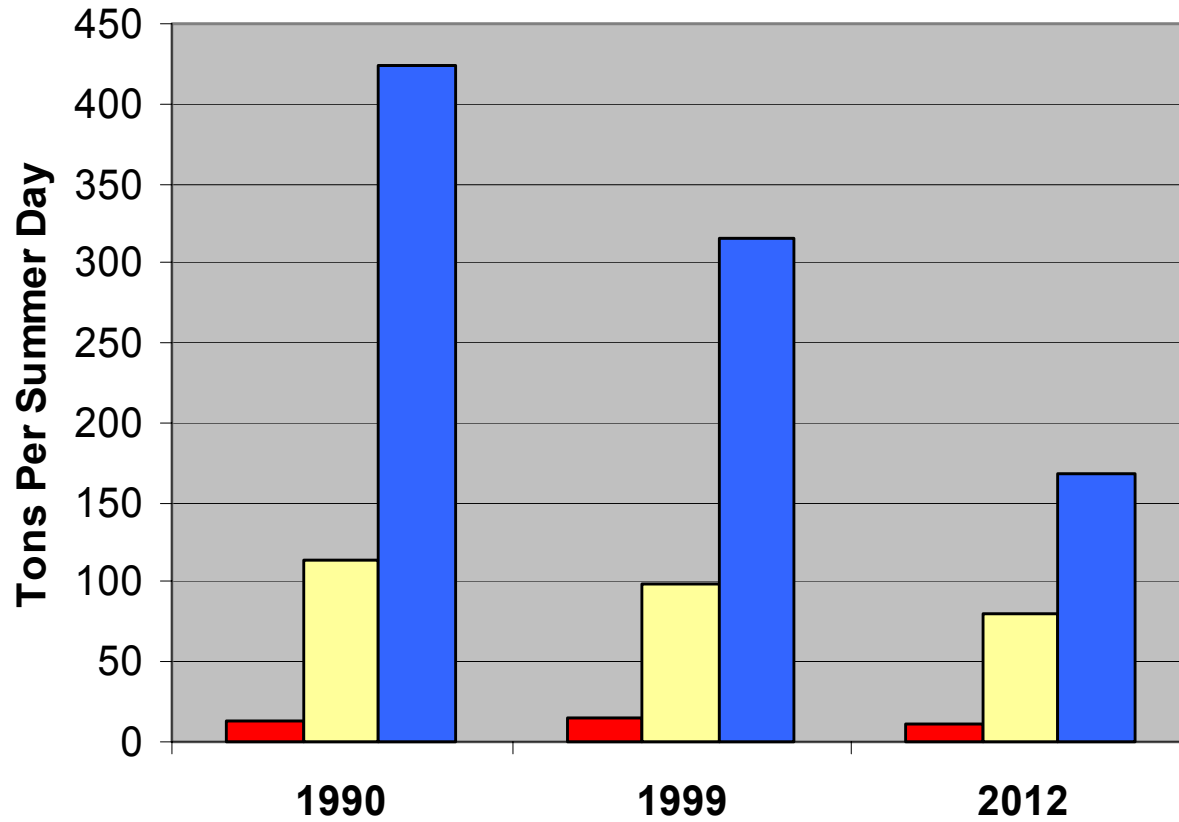


# The take home message

- Direct controls are becoming less effective and less efficient.
- The future of air quality control hinges on our ability to learn about and manage dynamic and complex systems involving nature, transportation, energy, land use, demographics, economics, social norms/values/beliefs, public health, and many other elements across many temporal and spatial scales.
- **We don't yet know how to do this.**

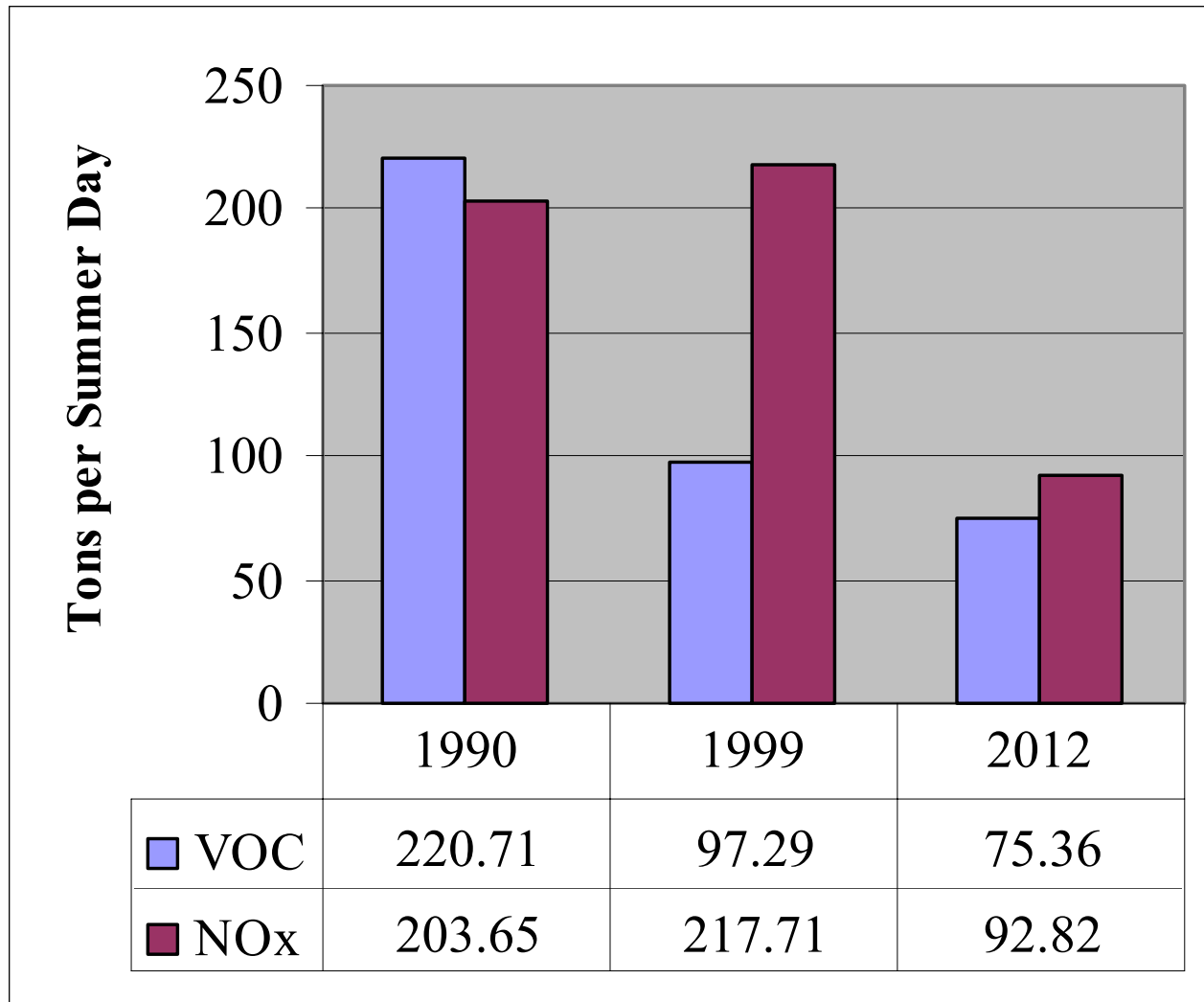


## Total VOC and NOx by Area



■ Bullet & Oldham ■ Clark & Floyd ■ Jefferson

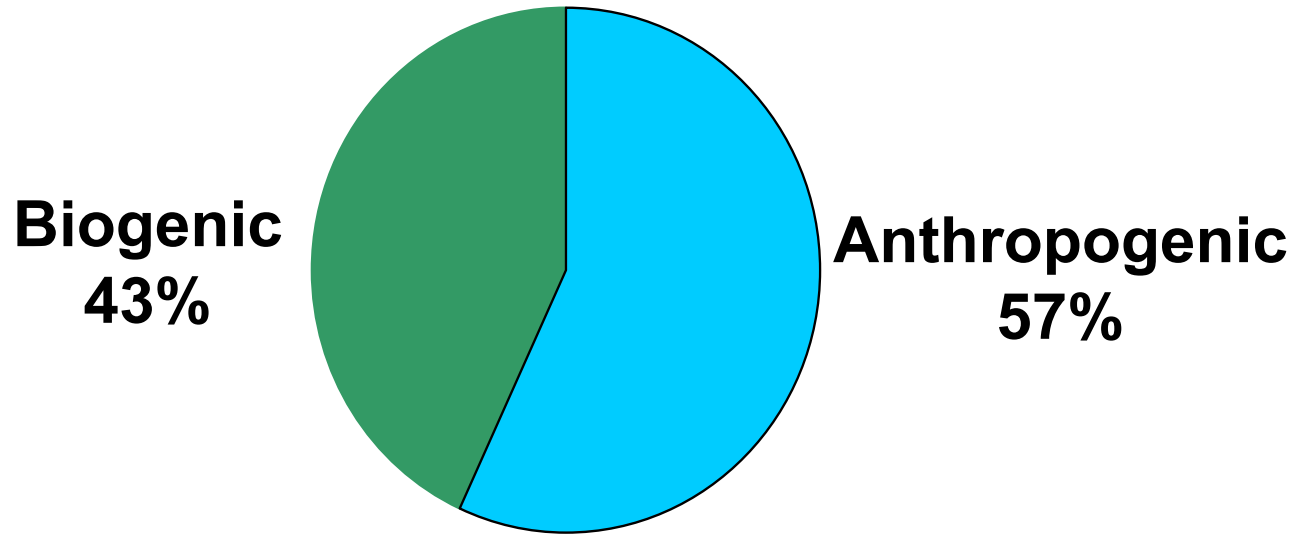
# Jefferson County VOC and NO<sub>x</sub> Emissions



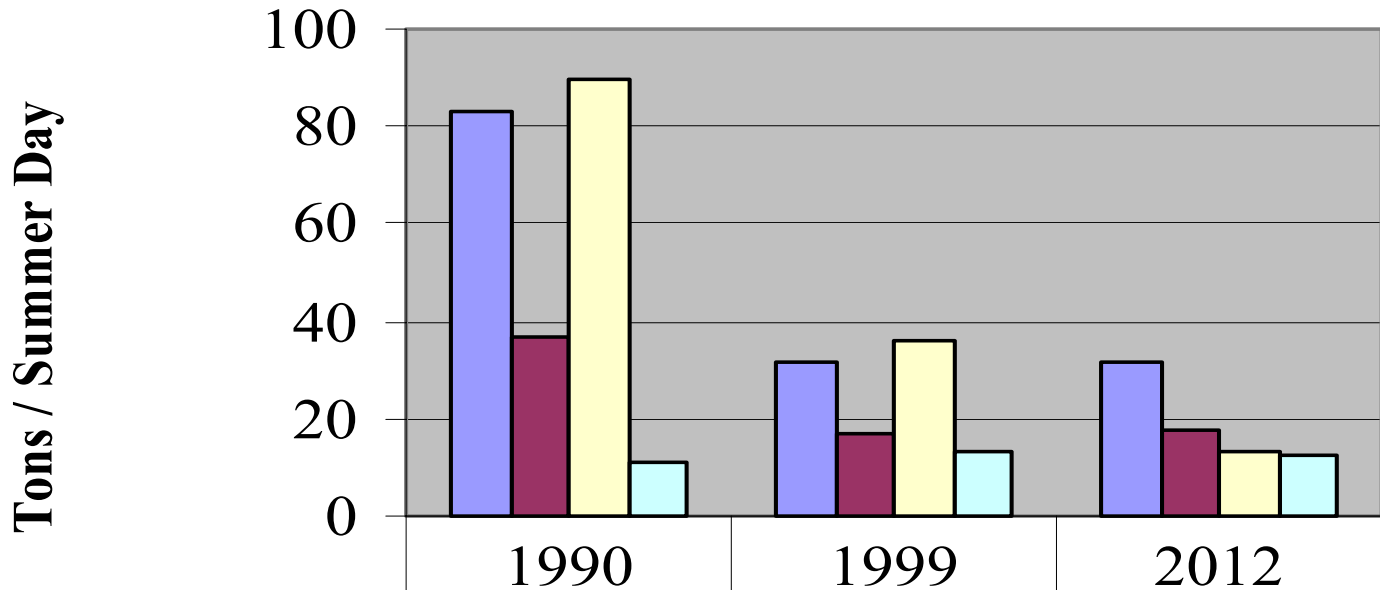
# Source Categories

- Point
- Area
- Mobile
- Nonroad

# Louisville Area VOC Emissions

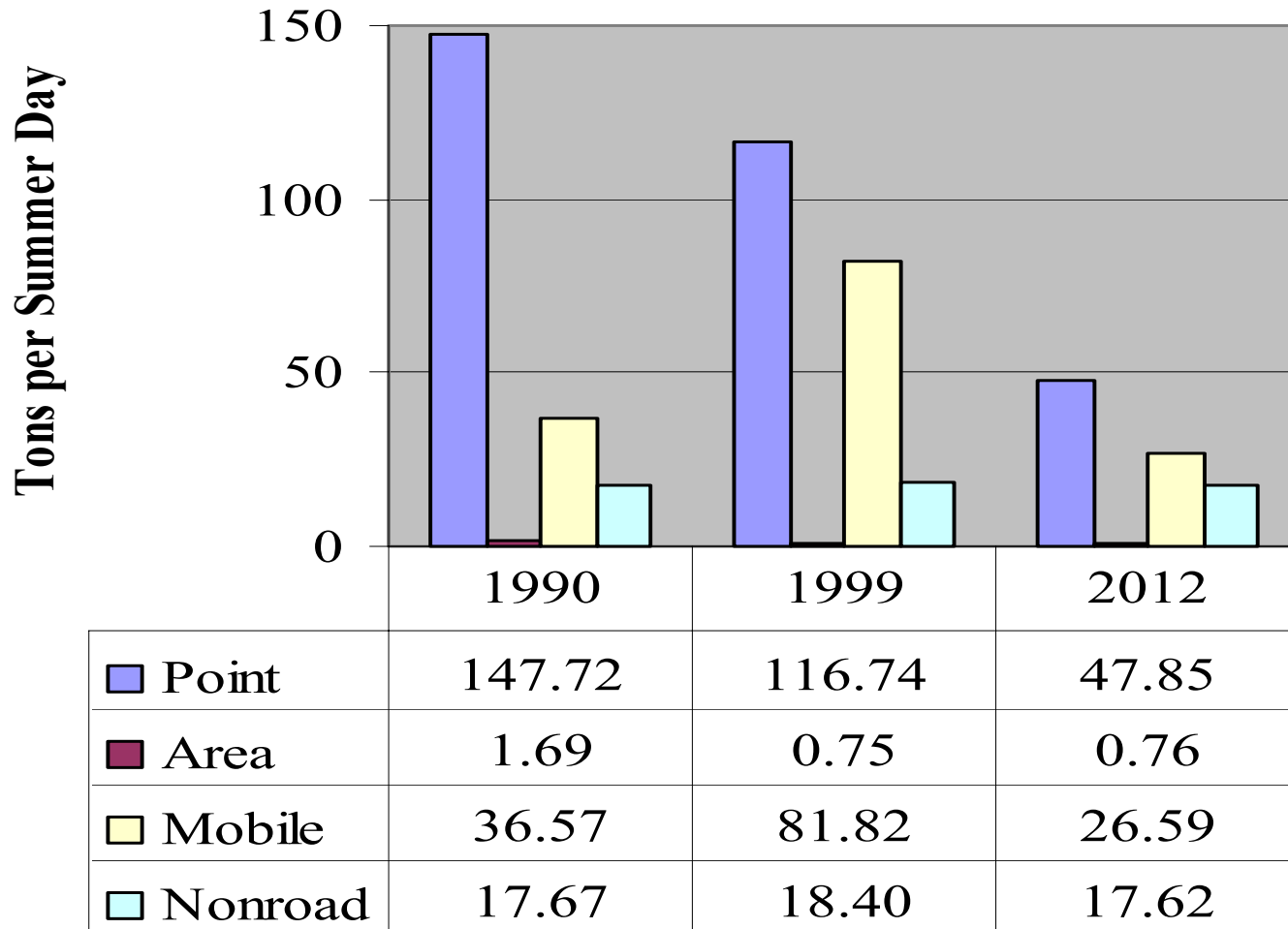


# Jefferson County VOC Emissions by Source Category



	1990	1999	2012
Point	83.42	31.32	31.31
Area	36.78	17.18	17.62
Mobile	89.43	35.76	13.57
Nonroad	11.08	13.03	12.86

# Jefferson County NO<sub>x</sub> Emissions by Source Category



**LADCO**  
**Ozone Modeling for**  
**Southern Indiana/  
Louisville Area**

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**Mark Derf**

**IDEM**

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**July 23, 2004**

# LADCO Projections

Monitor	2001-3 Design Value	Relative Reduction	2007 Design Value
Charlestown	92	0.8857	82
New Albany	86	0.8914	77
Shepherdsville	82	0.8603	71
Bates	79	0.8918	71
Watson	84	0.8929	75
WLKY	79	0.8946	71
Buckner	86	0.8678	75

2001-3 and 2007 Design Values are in parts per billion

# EPA's Modeling Predictions

County	8-Hr Ozone ppb	8-Hr Ozone ppb	
	<b>2001-3 D.V.</b>	<b>2010</b> Base	IAQR Case
Jefferson – KY	<b>85</b>	76	75
Bullitt – KY	<b>85</b>	75	73
Oldham – KY	<b>87</b>	73	73
Clark – IN	<b>90</b>	<b>79</b>	78
Floyd - IN	83	75	74

# Subpart 1

## *Nonattainment Areas in General*

### General Requirements

#### Phase I Implementation Rule

- Attainment date: 5 yrs / 5-yr extension

#### Phase II Implementation Rule

- Reasonably Available Control Measures
- Reasonable Further Progress (RFP)
- Attainment Demonstration??

# General Advice from EPA Region 4

- Keep it simple (KISS)
- Attainment demonstration required for Basic classification
- Must meet all EPA guidance
- Phase 2 guidance ... fall?
- Modeling protocol is required
- Work with Regional office

# Key Consideration #1

- Is regional modeling platform appropriate for local detailed analysis?

# Key Consideration #7

- Does design value appropriately reflect:
  - Current emissions
  - Typical meteorological conditions?

# Regional Modeling Deficiency #1

- Key considerations are not met

# If Regional Modeling is Deficient ...

- Local modeling is required
- **START SOON**

**Draft**

**Guidance on the Use of  
Models and Other Analyses  
in Attainment  
Demonstrations for the  
8-Hour Ozone NAAQS**

... No action

should be taken to implement  
this draft guidance until ...  
final guidance has been  
issued

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# Goal for Recommended Action

- Why have a growth margin?
- Should a growth margin be recommended?
- How much of a growth margin is appropriate?