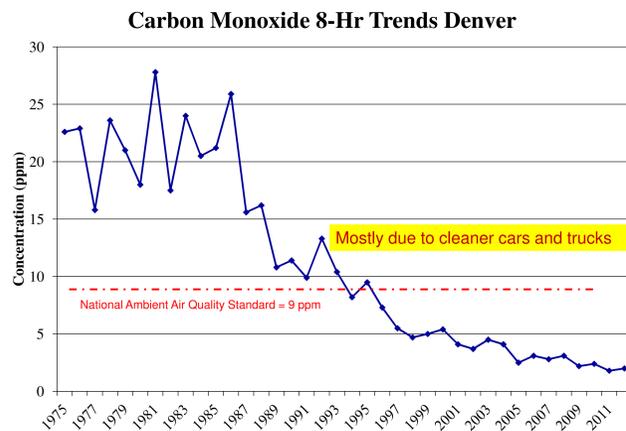# Air Pollution in Denver, Globeville and Elyria-Swansea

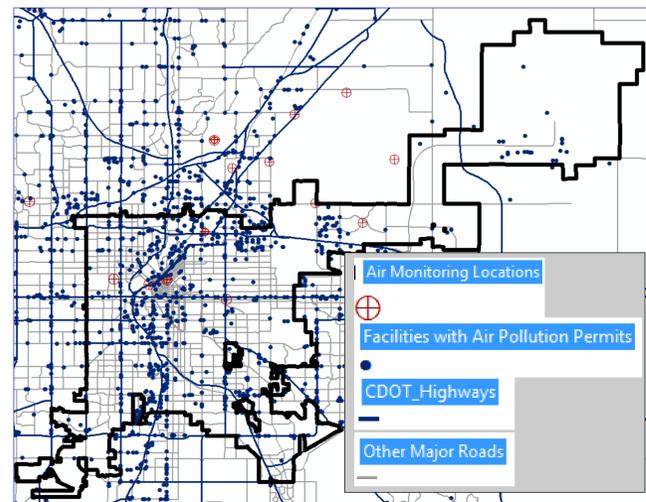## Air Pollution Trends in Denver:

Denver has made great progress in reducing air pollution since the 1980's. Much of this progress is due to cleaner cars and trucks, cleaner fuels, reduced wood burning, and cleaner factories. During the same time, Denver has seen a significant increase in population and vehicle miles traveled.

Carbon Monoxide 8-Hr Trends Denver

Mostly due to cleaner cars and trucks

National Ambient Air Quality Standard = 9 ppm

How Do We Measure Air Pollution?

The State Health Department and EPA perform regular sampling of various pollutants throughout Denver and the Metro area. The State and Denver also collect specialized air samples every few years as questions arise.

Finally, Denver is one of only a couple local governments in the world who have done citywide air pollution modeling to "fill in the gaps" between air sampling locations.

Air Monitoring Locations
Facilities with Air Pollution Permits
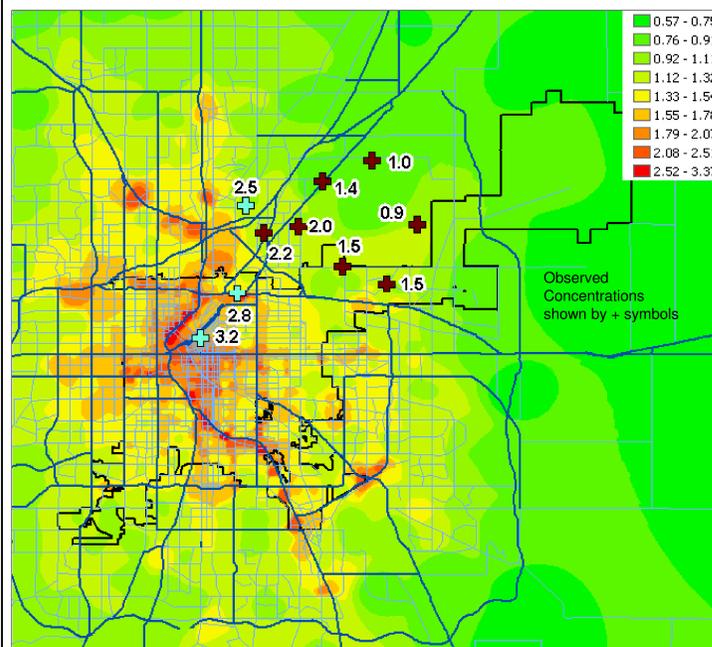CDOT_Highways
Other Major Roads

What Do the Data Tell Us about Air Quality?

A couple of things:

1. Traffic related emissions are the main source of air pollution in Denver County. The closer you live to heavy traffic, the higher your outdoor concentrations.
2. Modeling and monitoring match closely. Therefore, we can rely on modeling in areas where we have little or no data.

Modeled versus Measured Concentrations

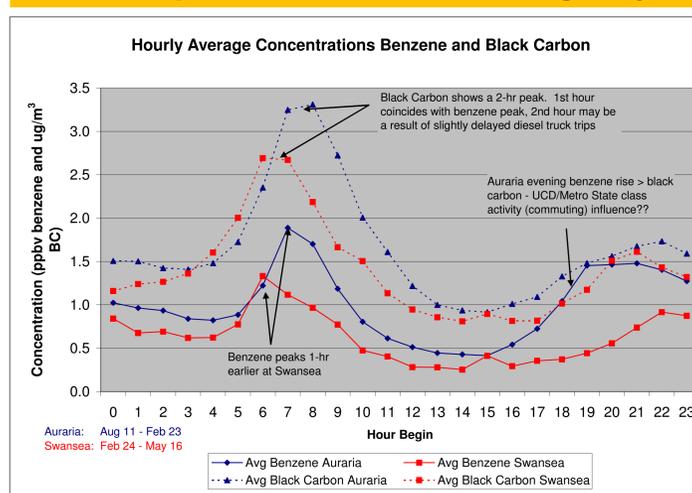|	
0.57 - 0.75	1.33 - 1.54
0.76 - 0.91	1.55 - 1.78
0.92 - 1.11	1.79 - 2.07
1.12 - 1.32	2.08 - 2.51
	2.52 - 3.37

Observed Concentrations shown by + symbols

Is North Denver Air More Polluted?

Averaged over a year, no. But, North Denver neighborhoods are located closer to major point sources of pollution, and occasional upsets are noticeable and measurable, both for air quality and odors.

Previous air sampling indicates the highest concentrations near downtown. Mobile source emissions are highest along I-25 near downtown. Traffic density is highest in this area.

Denver Environmental Health performed specialized sampling in 2005-06 to better understand differences in air pollution. We looked mainly at hazardous air pollutants like benzene and soot (black carbon). These are both largely emitted by cars and trucks. We also conducted more detailed computer modeling.

2005-06 Specialized Air Monitoring Project

Hourly Average Concentrations Benzene and Black Carbon

Black Carbon shows a 2-hr peak. 1st hour coincides with benzene peak, 2nd hour may be a result of slightly delayed diesel truck trips

Auraria evening benzene rise > black carbon - UCD/Metro State class activity (commuting) influence??

Benzene peaks 1-hr earlier at Swansea

Auraria: Aug 11 - Feb 23
Swansea: Feb 24 - May 16

Avg Benzene Auraria — Avg Benzene Swansea — Avg Black Carbon Auraria — Avg Black Carbon Swansea

What About Short Term or Upset Emissions?

Collecting hourly data allowed us to see some unique events. For example, the chart below shows a high benzene event…

Notice midnight spike in carbon monoxide and benzene; Rockies game ended at 10pm the night before; car and truck pollution signature; computer models don't capture these events.

Predicted vs Observed Benzene Concentrations Sunday April 23, 2006

AERMOD — AutoGC — Carbon Monoxide

Here benzene spiked but carbon monoxide did not. Winds were from the north all day. In this case, an industrial plume is suspected. This is likely what you would see with odors if we could measure them accurately. These events are infrequent and are hard to capture.

Predicted vs Observed Benzene Concentrations Saturday April 29, 2006

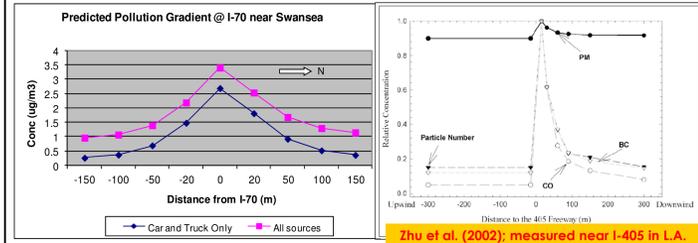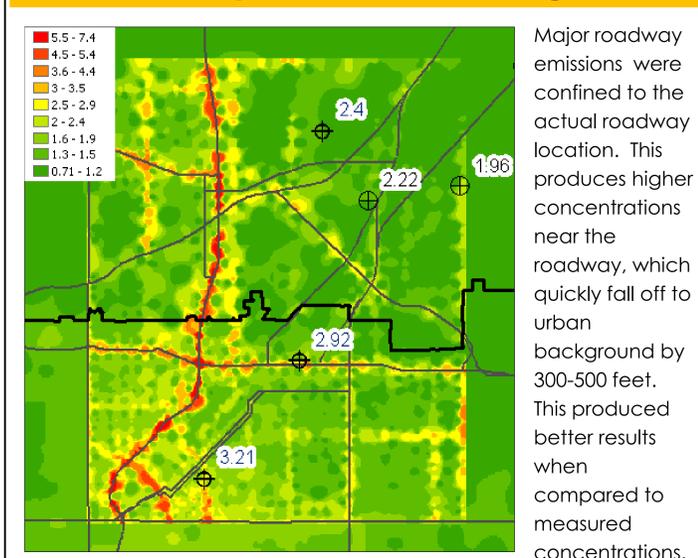AERMOD — Auto-GC — Carbon Monoxide
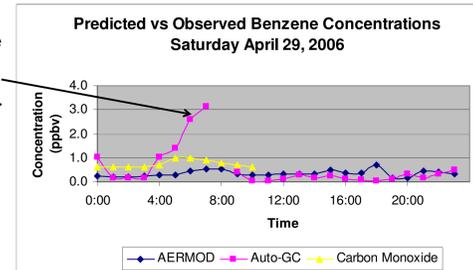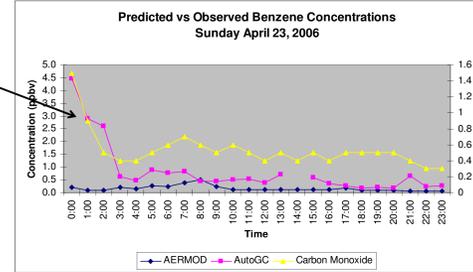
What about Near-Highway Air Pollution?

This has been the focus of much research over the past 10 years. Denver conducted specialized modeling to compare with some real-world data.
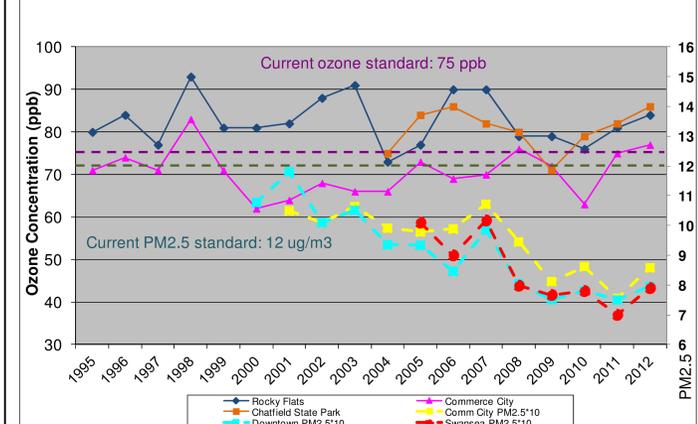
We refined our methodology somewhat and focused on Globeville and Elyria-Swansea for our case study.

DEH Specialized Modeling

5.5 - 7.4
4.5 - 5.4
3.6 - 4.4
3 - 3.5
2.5 - 2.9
2 - 2.4
1.6 - 1.9
1.3 - 1.5
0.71 - 1.2

Major roadway emissions were confined to the actual roadway location. This produces higher concentrations near the roadway, which quickly fall off to urban background by 300-500 feet. This produced better results when compared to measured concentrations.

Predicted Pollution Gradient @ I-70 near Swansea

Car and Truck Only — All sources

Zhu et al. (2002); measured near I-405 in L.A.

Where Do We Go From Here?

Ozone and PM2.5 Trends in Metro Denver 1995-2012

Current ozone standard: 75 ppb

Current PM2.5 standard: 12 ug/m3

Rocky Flats — Commerce City — Chatfield State Park — Comm City PM2.5*10 — Downtown PM2.5*10 — Swansea PM2.5*10

Successes:
- Large reductions in most criteria and hazardous air pollutant emissions (benzene, diesel soot).
- Our understanding of air pollution and health effects is improving (short- and long-term).

Challenges:
- Odors and the link to air quality
- Ozone remains a problem despite reductions in pollutants that form ozone.
- Continue declining trends against increasing population and vehicle miles traveled.

Department of Environmental Health
Geographic Information Systems

DENVER
THE MILE HIGH CITY

Agency: Denver Department of Environmental Health

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