



# Air Toxics Data Analysis

## Plan for 2006-2007 National Assessment

National Monitoring Conference

November 8, 2006

## Introduction/Background

- EPA is coordinating the fifth national assessment of ambient air toxics data
- Funded through air monitoring grant monies as has been the case in the previous four efforts
- Intended to serve as a vehicle for incorporating the broad spectrum of assessment interests at the federal, state, local and tribal levels
- Designed to:
  - build on the successes of the four previous efforts;
  - continue addressing key and high priority policy relevant questions; and
  - ensure broad involvement in the analysis effort through open and frequent communication of intentions, results and conclusions

## Introduction/Background

- Phase I (2001): Analyses and Network Design Recommendations
  - Battelle/STI used historical (1990-2000) data
- Phase II (2003): Analyses and Network Design Recommendations
  - Battelle/STI used Pilot City (2001-2002) data
- Phase III (2004): Air Toxics Data Analysis Workbook
  - STI used historical and Pilot City data (1990-2002)
- Phase IV (2005): Temporal and Spatial Variability papers
  - STI used historical and Pilot City data as well as available NATTS (1990-2003)

# Introduction/Background

- National assessment of ambient air toxics measurements to be conducted Fall 2006 through Summer 2007
- Effort divided into two parts
  - The first focuses on enhancing modeling and other assessment tools
    - NATA02 - as part of the Risk and Technology Review Rule (RTR)
    - Also supporting new modeling platform (CMAQ) development
    - Work underway, began in September
  - The second will focus on more traditional air quality analyses
    - Exercising ambient monitoring data to characterize air toxics as well as perform trends and accountability analyses.
    - Scheduled to begin in January 2007

## Part I: Enhancing modeling and other assessment tools

This work addresses one of the primary monitoring objectives of the air toxics monitoring program:

*Air Quality Modeling Evaluation -- Provide data to support and evaluate dispersion and deposition models*

Source: "National Monitoring Strategy Air Toxics Component", U.S. EPA, 2004

# Part I: Enhancing modeling and other assessment tools

- Estimates for CMAQ boundary conditions
  - Examine utility of ambient measurements from domestic rural sites;
  - Incorporate ambient measurements at remote locations from NOAA's Climate Modeling and Diagnostics Laboratory\*; and
  - Supplement with data from literature

\*Significant assistance re data provision and interpretation from Steve Montzka, NOAA CMDL Global Monitoring Division

## Domestic ambient data (2001-2003)

NAME	CMDL	Literature	Available	# sites outside CBSA	# sites outside CBSA & 25%+ obs above MDL	Notes
Acetaldehyde		Yes	Yes	8	8	
Carbon Tetrachloride	Yes	Yes	Yes	8	5	
Chloroform	Yes	Yes	Yes	8	1	
1,3-Butadiene			Yes	9	2	
1,2-Dichloropropane			Yes	8	2	
Ethylene Dibromide			Yes	7	0	
Ethylene Dichloride		Yes*	Yes	7	1	Literature dated
Vinyl Chloride			Yes	8	1	
Quinoline			No			
Benzene	Yes	Yes	Yes	11	10	
Dichloromethane	Yes	Yes	Yes	8	2	
Formaldehyde		Yes	Yes	8	8	
Tetrachloroethylene	Yes	Yes	Yes	8	1	
Trichloroethylene	Yes*	Yes	Yes	8	1	some samples
1,1,2,2-Tetrachloroethane			Yes	7	2	
1,3-Dichloropropene(Total)			Yes	0	0	
Acrolein			Yes	2	0	
Acrylonitrile			Yes	3	1	
Ethylene Oxide			Yes	1	1	
Naphthalene			Yes	0	0	

## Part I: Enhancing modeling and other assessment tools

- Background concentrations for NATA02
  - Review/refine the methodology developed and executed for NATA99 to estimate “background” concentrations
  - For NATA, background estimates are concentrations reflecting natural sources, nearby sources (farther than 50km), and unidentified sources
- Model evaluation for NATA02
  - Investigate specific instances in which NATA99 results diverge from available monitoring data, where not already understood.
    - Identify probable and possible reasons, and recommend better NATA methods, and better monitoring approaches that may allow more insight through future model-to-monitor comparisons.
  - Conduct assessment of NATA02 model results.
    - Review/refine as necessary the model-to-monitor techniques used in NATA99 to evaluate results of ambient air quality simulations.



## Part I: Enhancing modeling and other assessment tools

- Other modeling platforms (e.g., 1-atmosphere CMAQ)
  - Evaluate new air toxics modeling platform results (e.g., CMAQ HAP results)
  - Historic ambient data already provided for inclusion in ORD/NOAA Atmospheric Model Evaluation Tool (AMET)

# Part I: Enhancing modeling and other assessment tools

- Other related tasks:
  - Database development
    - Update analysis dataset through 2005
      - NATTS
      - UATMP and other programs measuring toxics (e.g., STN for particles, PAMS)
      - non-HAP species (e.g., O<sub>3</sub>, PM<sub>2.5</sub>, CO)
      - Legacy air toxics archive (ATA)
  - Investigate and apply range of available statistical treatments of values below detection levels and compare to standard substitution methods.
  - Develop approach to and guidance for estimating uncertainties of air toxics concentrations important for application of source apportionment techniques

## Part II: Characterization & Accountability

This work addresses primary and secondary objectives of the air toxics monitoring program:

*Trends and Program Accountability – Establish trends and evaluate the effectiveness of HAP reduction strategies*

*Problem Identification -- Characterize ambient concentrations (and deposition) in local areas*

Source: “National Monitoring Strategy Air Toxics Component”, U.S. EPA, 2004

## Part II: Characterization & Accountability

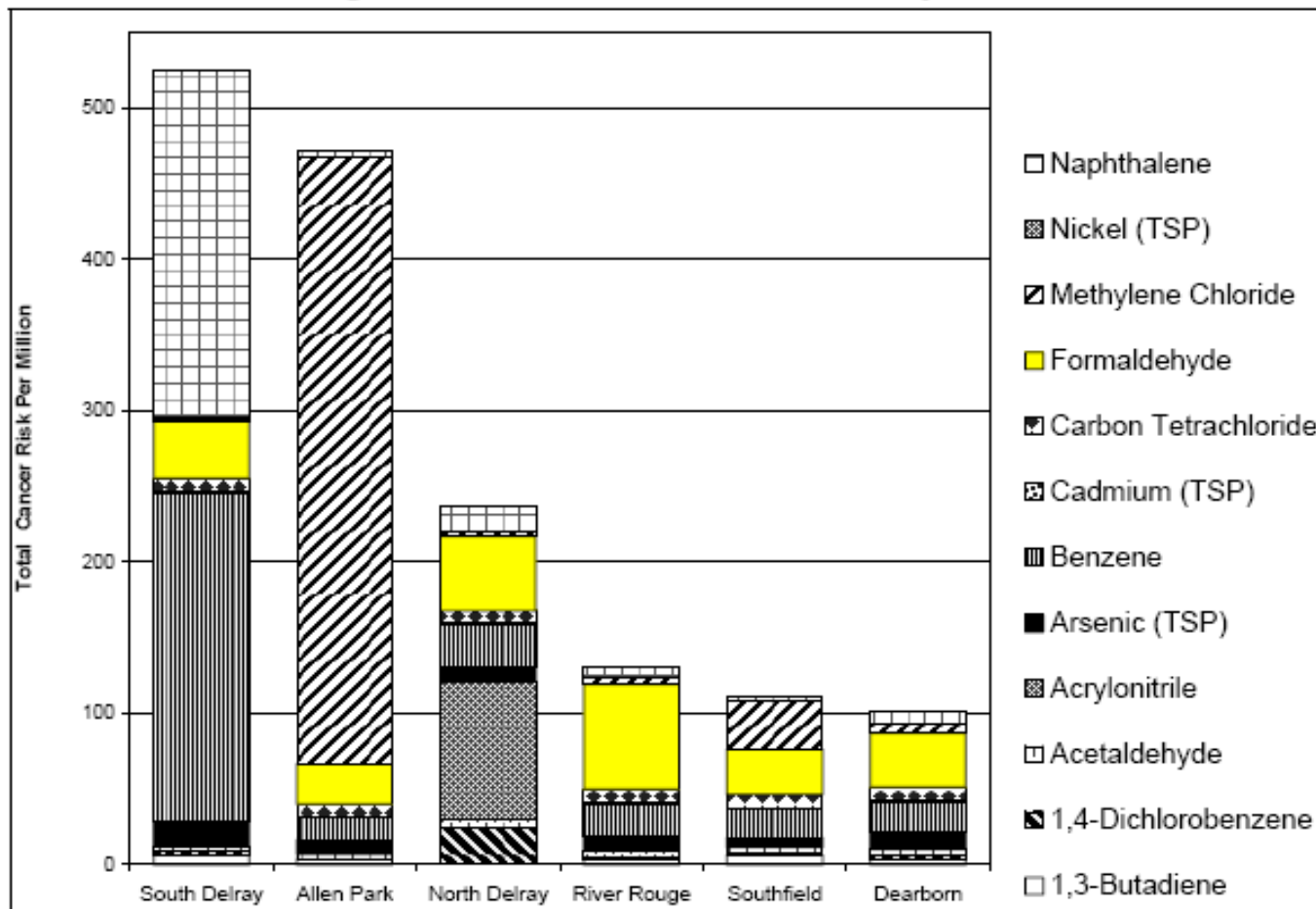
- Characterization
  - Update the earlier assessments of the magnitude of the air toxics issue and its spatial variation
    - Take advantage of new sites and more recent data
    - Characterize spatial variability for pollutants not yet assessed
    - Supplement previously used techniques to assess spatial variability (e.g., coefficient of variation) with additional approaches
    - Employ site level metadata to understand spatial differences

## Part II: Characterization & Accountability

- Characterization (continued)
  - Identify ‘compounds of potential concern’ at the site level using risk based approach
    - Using methods and toxicity values from EPA’s “Air Toxics Risk Assessment Reference Library, Volumes I-III” 2004, 2004, 2006
    - Patterned after “Detroit Air Toxics Initiative - Risk Assessment Report”, November 2005, State of Michigan Department of Environmental Quality
    - Derive potential risk estimates for cancer and noncancer effects (inhalation only) based on ambient monitoring data at the site level.
    - Focus on 22 NATTS areas but incorporate data from other nearby sites

# Illustrative Example from Detroit Air Toxics Initiative Risk Assessment Report, Michigan DEQ, November 2005

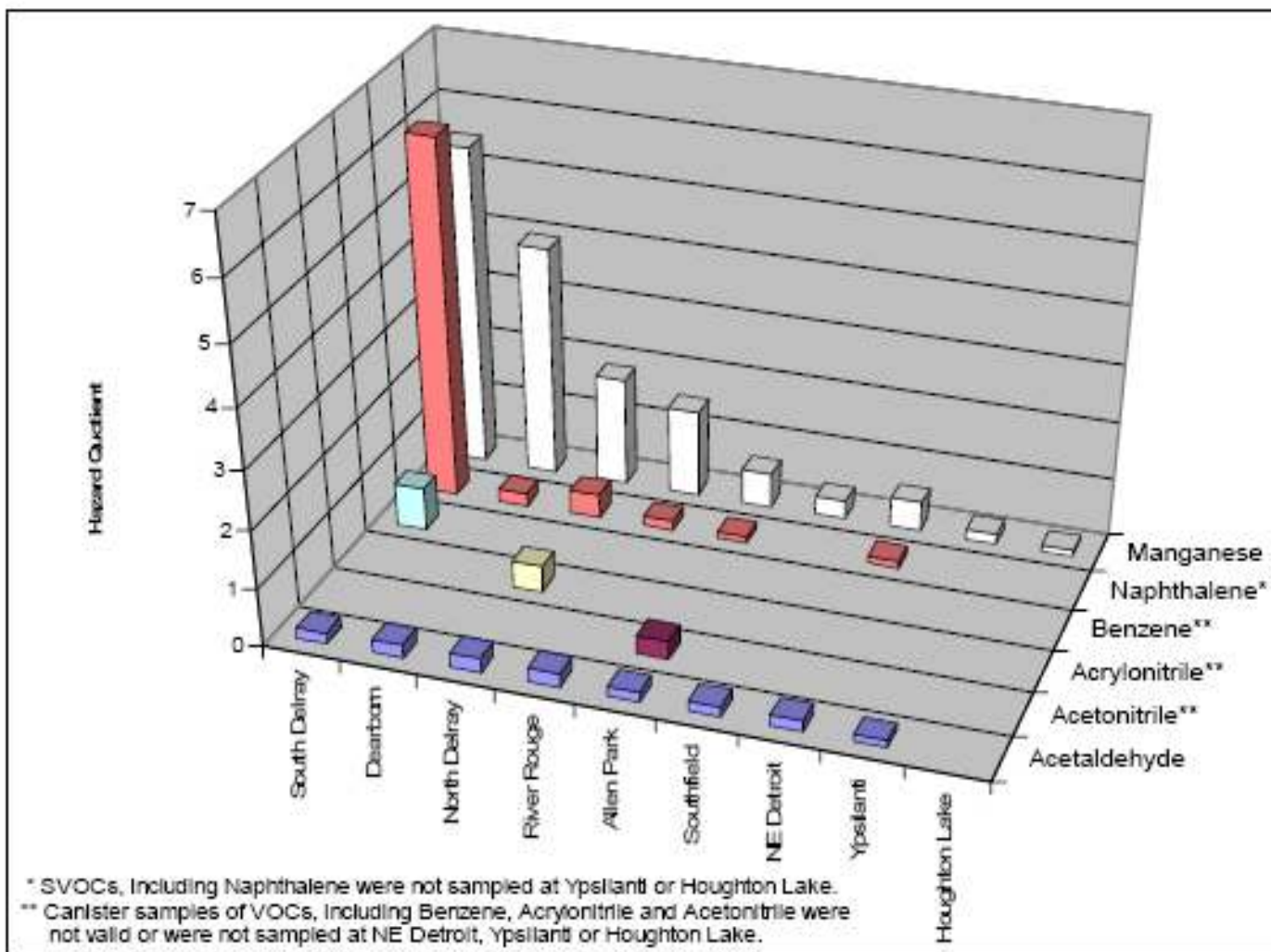
Figure ES-1: Additive Cancer Risk by Site\*



\*The high-end estimated cancer risk is the incremental lifetime (70 years) risk by inhalation to the individual. The estimates of cancer risks should not be viewed as actual cancer cases resulting from air pollution but as upper bound estimates so the agency can prioritize its efforts to reduce exposures. It should also be noted that these risk estimates are based on 2001-2002 monitoring data, and the unusually high levels of methylene chloride at Allen Park and naphthalene and benzene at South Delray during that period have not persisted in subsequent monitoring.

## Illustrative Example from Detroit Air Toxics Initiative Risk Assessment Report, Michigan DEQ, November 2005

**Figure ES-2: HQs by Chemical and Site**



## Part II: Characterization & Accountability

- Characterization (continued)
  - Assess spatial difference in ‘pollutants of potential concern’, and their relative contribution to the site-level estimate of potential risk
  - Evaluate factors influencing variation between sites:
    - Suite of pollutants measured
    - Sampling and analysis methods
    - Detection limits and associated data reporting conventions (e.g., treatment of data below the MDL)
    - Site-level metadata including monitoring scale, siting, and objectives
    - Emissions and proximity of sources
  - Compare to model results



## Part II: Characterization & Accountability

- Characterization (continued)
  - What will we learn/gain from these characterization efforts:
    - Severity/magnitude of air toxics issues including the identification of ‘hot spots’;
    - Pollutants’ relative contribution to problem;
    - The degree to which severity/magnitude, and pollutants contributing to risk vary spatially;
    - Insights into how to best examine the spatial character of HAPs relative to those of CAPs (ozone and particles);
    - Identified opportunities for improvement in monitoring program (e.g., siting, pollutants, detection limits)
    - Basis for collaboration at federal, state and local levels

## Part II: Characterization & Accountability

- Trends/accountability
  - Estimate site-level trends
    - 18 core HAPs plus
      - Any additional species identified as contributing substantially to an area's overall risk burden; and
      - Include comparisons to nearby ozone and particle monitors
    - Assess diurnal and seasonal patterns as well as annual trends
    - Inter-annual assessments of varying time periods but focus on recent six year period
    - Evaluate spatial patterns in inter-annual changes in HAP levels within and across urban areas, and rural versus urban areas
    - Expand and refine the methodologies used previously in earlier phases of air toxics data analysis

## Part II: Characterization & Accountability

- Trends/accountability (continued)
  - Interpreting the temporal trends & evaluating program effectiveness
    - Use case studies of trends in pre-control ‘hot spots’ to provide anecdotal evidence of control program results.
    - Compare ambient concentration and emissions trends (mass and toxicity-weighted emissions) to provide context for changes in HAP levels.
    - Analyze patterns in ambient trends for significant decreases in concentrations and attempt to connect to controls
    - Compile/leverage control program database for systematic comparison with ambient trend data
    - Continue to explore the meteorological adjustment for specific air toxics

## Part II: Characterization & Accountability

- Trends/accountability (continued)
  - Using insights gained from the above analyses, make recommendations regarding the formulation and application of program performance measures based on ambient air toxics data.

## Part II: Characterization & Accountability

- Develop guidance for assessing and analyzing ambient air quality data for HAPs
  - Manual/workbook
    - Data access (mechanisms for retrieving data from AQS and supplementing these data);
    - Data validation (screening criteria, approaches, treatment of data below MDL);
    - Data analysis, visualization and interpretation (characterization, trends and spatial variability analyses), and eventually more advanced analytic topics (source apportionment, meteorological adjustment, model-to-monitor comparisons, etc.)
  - Training based on data analysis guidance manual to be offered at data analysis workshops beginning 2007

# Collaboration

- Data set with documentation will be made available upon completion of analyses
- All analysis plans, work plans, and results to be posted on the web
- Data analysis workshop tentatively planned for late Summer/early Fall 2007
- Other ideas/suggestions?

*THANK YOU FOR YOUR ATTENTION*

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