2005 National Air Toxics Assessment (NATA): Training Class

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Training Agenda

- Class Introductions (1:00)
- NATA Overview (1:15 - 2:15)
  - Presentation
  - The website tour
- Break (2:15 - 2:30)
- Accessing the Data (2:30 – 3:45)
  - Emissions inventory
  - The concentration, exposure, and risk data
  - Google Earth Maps
- Model-to-monitoring comparison (4:00 – 4:30)
- Questions and answers (4:30 – 5:00)

What is NATA?

- **Characterization of air toxics across the nation**
  - Nationwide assessment with *census tract* resolution for 177 Hazardous Air Pollutants (HAPs) plus Diesel Particulate Matter (DPM)
  - Emissions, modeled ambient concentrations and estimated *inhalation exposures* from *outdoor sources*
  - *Cancer and noncancer* risk estimates for the 139 HAPs with health data based on *chronic exposures*

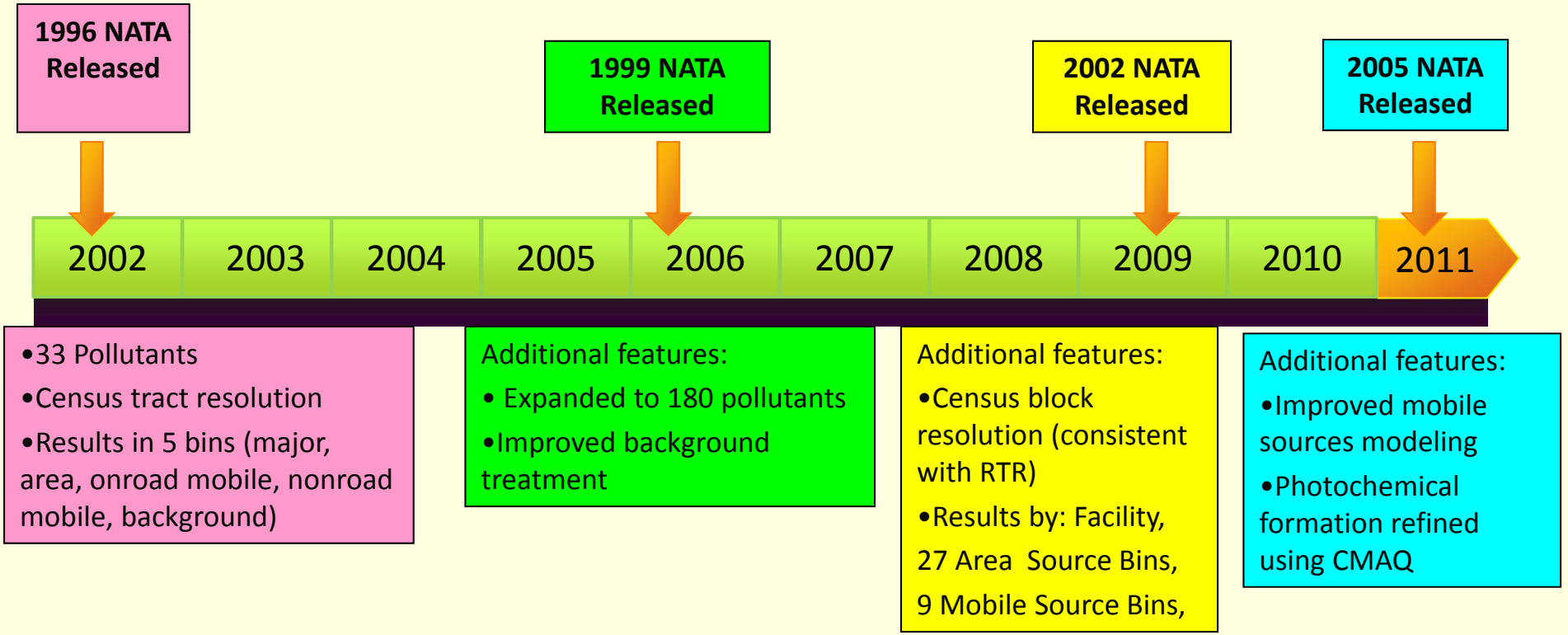
- **Tool for EPA as well State/Local/Tribal Agencies to prioritize pollutants, emission sources and locations of interest**

Why is NATA Important?

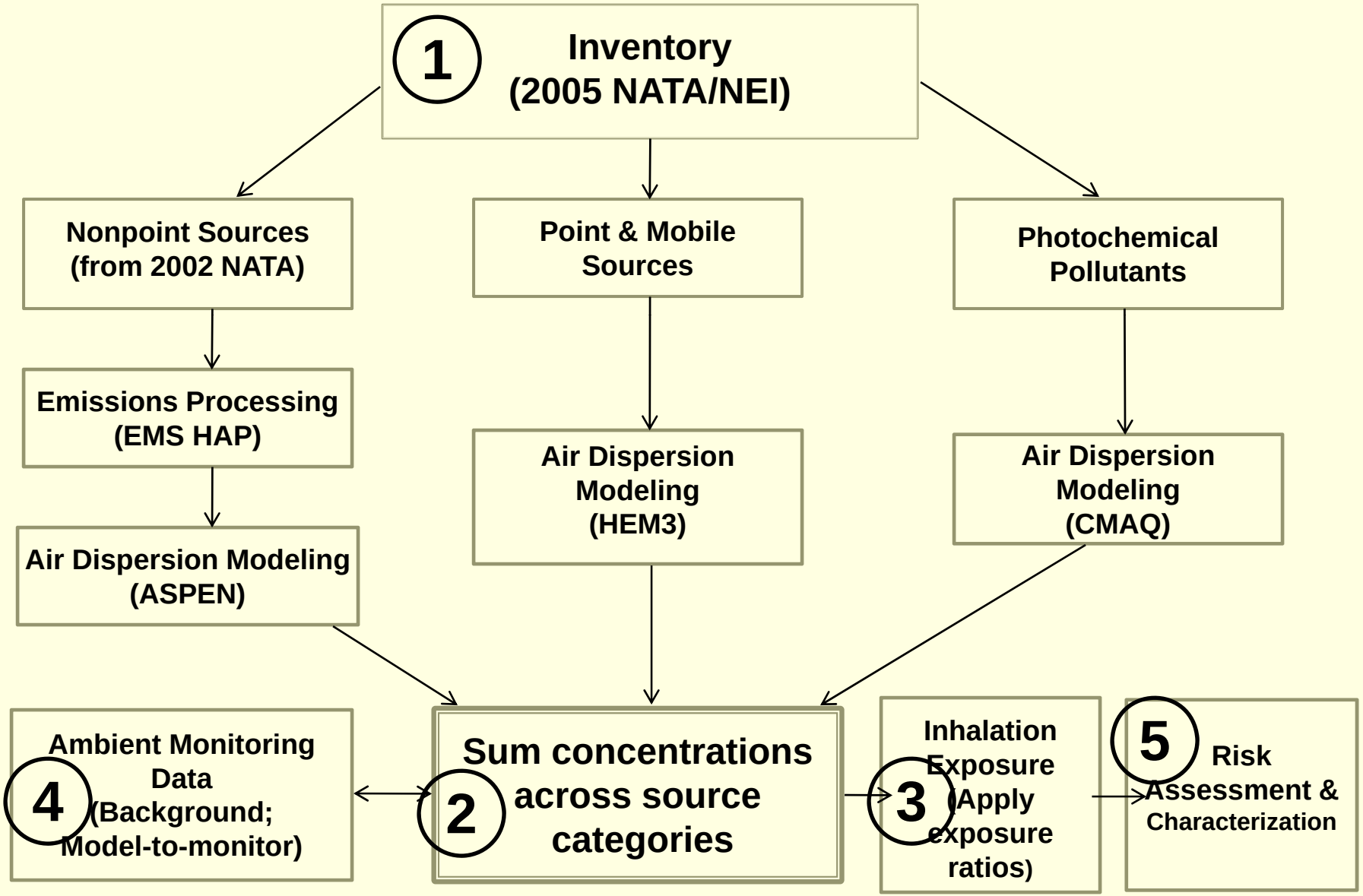
- Only comprehensive understanding of hazardous air pollutant (HAP) impacts and risks nationwide
- Data source for state and local agencies: helps them target monitoring; community studies; state air toxic regulations
- Supports EPA efforts to reduce air toxics
  - Informs rules including:
    - Residual risk – whole facility risks
    - Recent mobile and area source rules (e.g., RFS2 rule)
  - Monitor placement (e.g., schools, NATTS)
  - Inputs for EJ assessments
  - Grant allocations
  - Helps us improve emissions inventory
    - This round of NATA resulted in inventory improvements to over 5000 facilities

NATA Timeline/Features

We released the 2005 NATA with a much shorter turnaround time than previous NATA releases



2005 NATA Approach



① NATA Emission Inventory

- Point source inventory based on 2005 NEI
  - 130,000 point sources modeled at actual locations
    - Quality and quantity of emissions vary from state to state
  - Updates include RTR updates:
    - Lead NAAQS updates
    - Addition of 2005 state data files not submitted for CO
    - Complete replacement of state data files for AL, ME, and Mn
    - Addition of 19,000 airports;
    - 4 rounds of state review resulting in over 5000 changes
    - Enhanced QA and revision of coordinates
- Nonpoint source
  - County-wide inventories allocated to census tracts using surrogates
  - Inventory remained unchanged from 2002 NEI
  - Does NOT include forest fires and wildfires nationwide
  - Major Change
    - Removed formaldehyde and benzene from pesticides (Final NATA)
  - Other minor changes: Revisions from state and local agencies
- Mobile Sources
  - County-wide inventories allocated to census tracts using surrogates
  - Updated inventory for 2005 includes use of new “MOVES” model for some HAPs

② NATA - Ambient Concentrations Modeling

- Point Sources
  - HEM3 (AERMOD)
    - 130k facilities modeled nationwide
    - Ambient impacts at census **block** resolution
    - Ambient results modeled at facility level but aggregated on public website under point source bin
- Nonpoint Source
  - EMSHAP / ASPEN Model
    - Same approach as previous NATA
    - 27 area source bins
- Mobile Sources
  - HEM3 (AERMOD)
  - County inventory allocated to 66,000 census tracts
    - 9 mobile source bins
- Photochemical Modeling
  - Community Scale Air Quality Model (CMAQ)
    - Secondary formation of formaldehyde, acetaldehyde, and acrolein
    - Accounted for transformation of 1,3 butadiene

③ NATA - Exposure Model

- Utilized “Exposure Ratios” developed from national HAPEM5 runs
  - People do not live at census tract centroids!
  - Accounts for time spend indoor vs. outdoor
  - Commuting to work
  - Example exposure/ambient ratios:

Pollutant	Point	Nonpoint	Onroad	Nonroad	Background
Benzene	0.87	0.88	1.21	0.99	0.76
Chromium VI	0.43	0.23	0.60	0.52	0.23

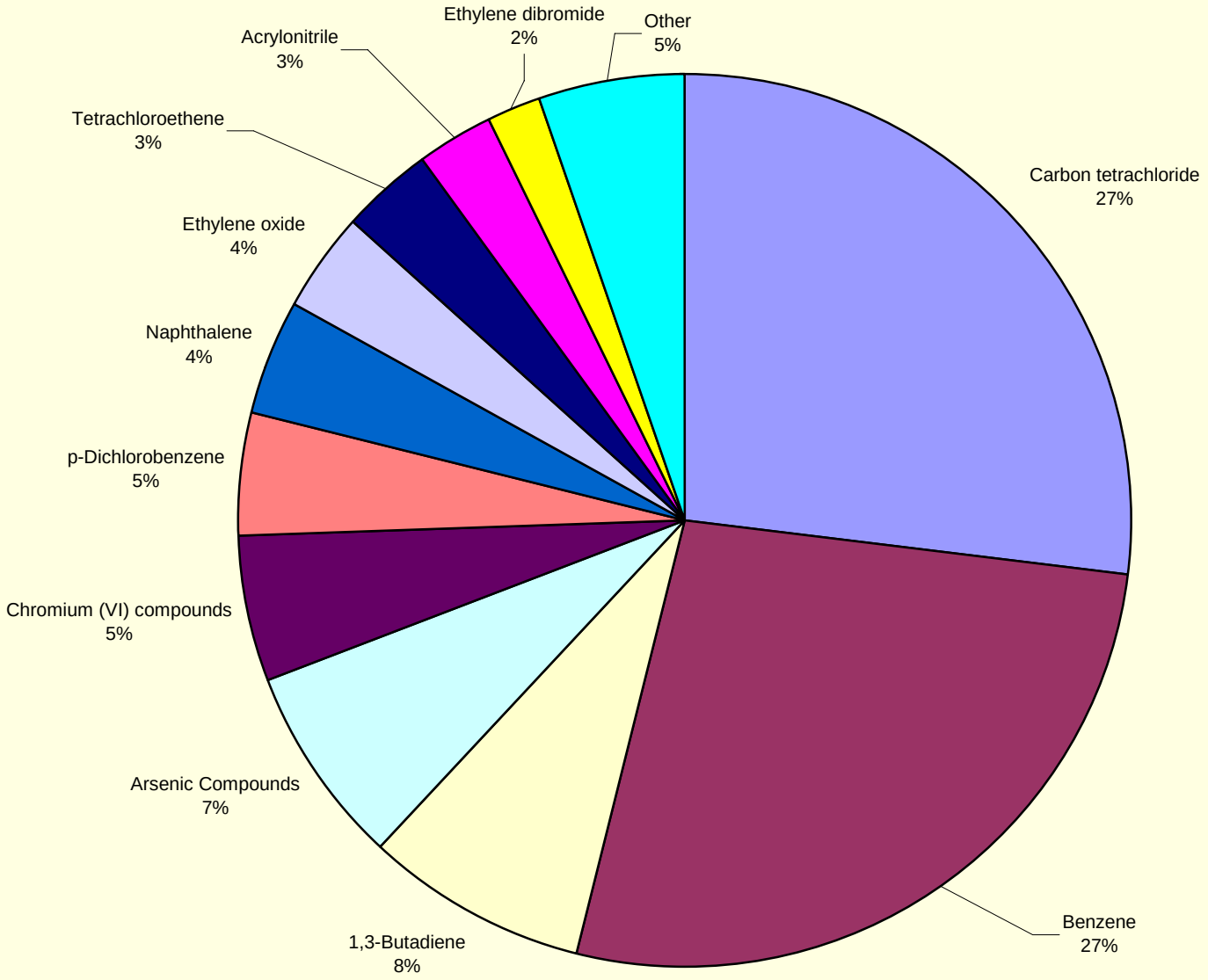
④ NATA - Ambient Monitoring Data

- Monitoring data used to predict background as well as model to monitor comparison
  - Background calculations utilized larger more current ambient network including NATTS sites as well as proximity approach using inventory for difficult to measure HAPs
  - Model-to-monitor comparison including more pollutants and more sites

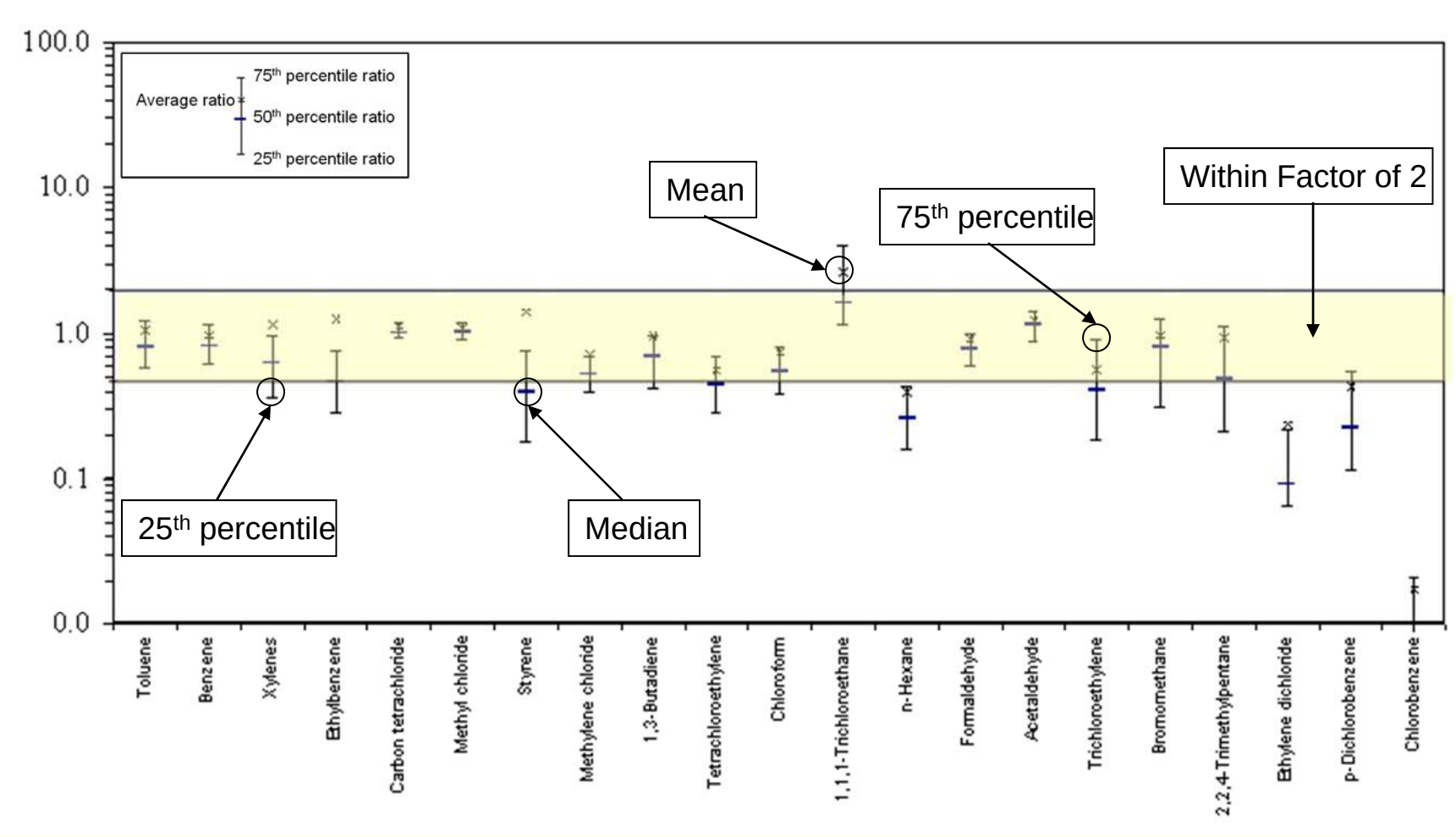
2005 NATA Background Pollutants

Ambient-based Method	Emissions-based Method	Assigned Concentrations
1,3-Butadiene	Hydrazine	Carbon tetrachloride
1,4-Dichlorobenzene	Chromium (VI)	Methyl Chloride
Acetaldehyde	Ethylene Dichloride	Methyl Bromide
Arsenic	Naphthalene	Methyl Chloroform
Benzene	Propylene Dichloride	
Chloroform	Ethylene Oxide	
Chromium	Acrylonitrile	
Dichloromethane	Cadmium	
Formaldehyde	Beryllium	
Lead	Ethylene Dibromide	
Manganese	Benzidine	
Nickel	Quinoline	
Tetrachloroethylene	Bis(2-Ethylhexyl)Phthalate	
Toluene	1,2-Dibromo-3-Chloropropane	
	Trichloroethylene	
	1,1,2,2-Tetrachloroethane	

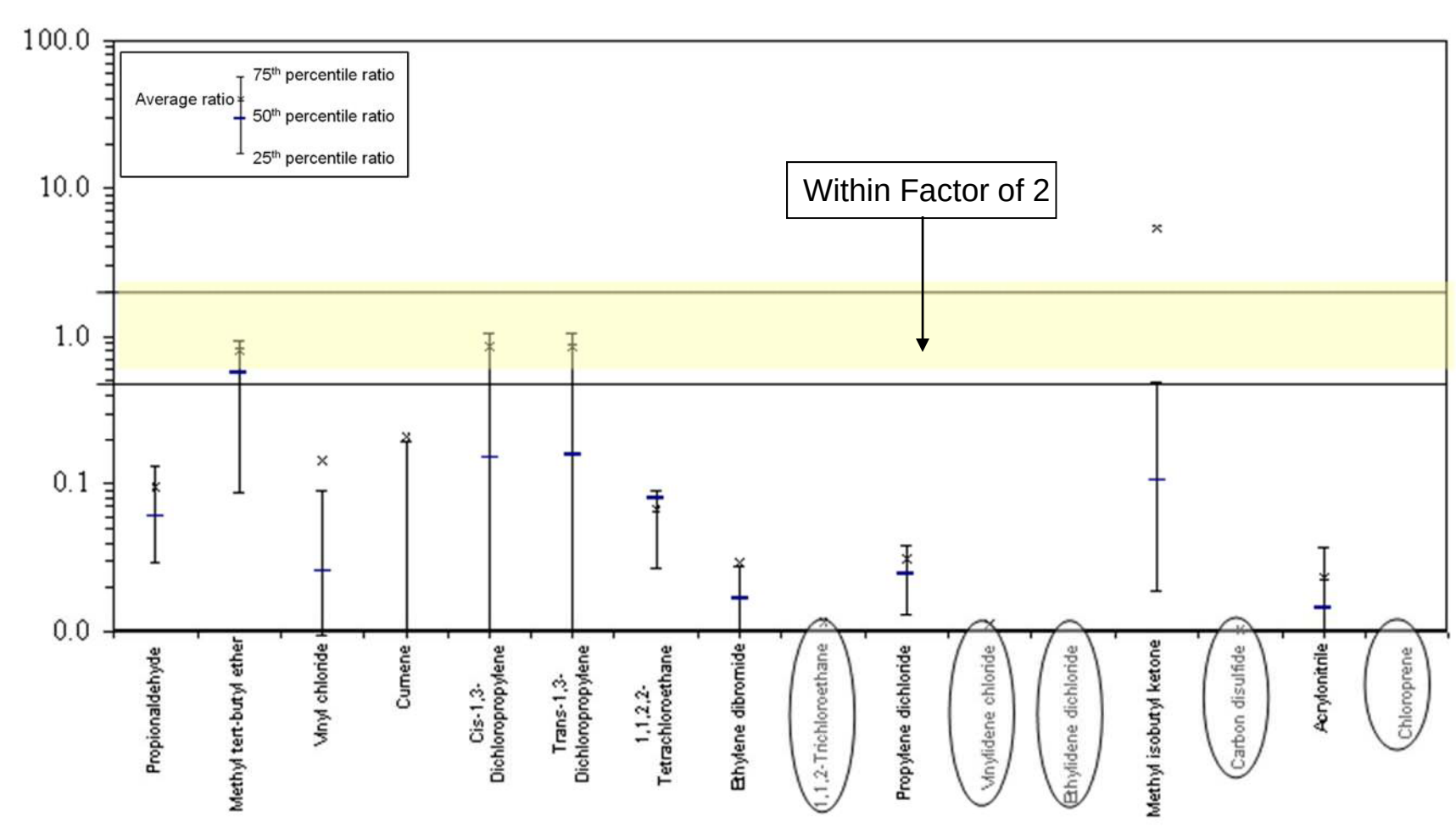
Pollutant Background Risk Contributions



Gaseous HAPs (>100 monitors)

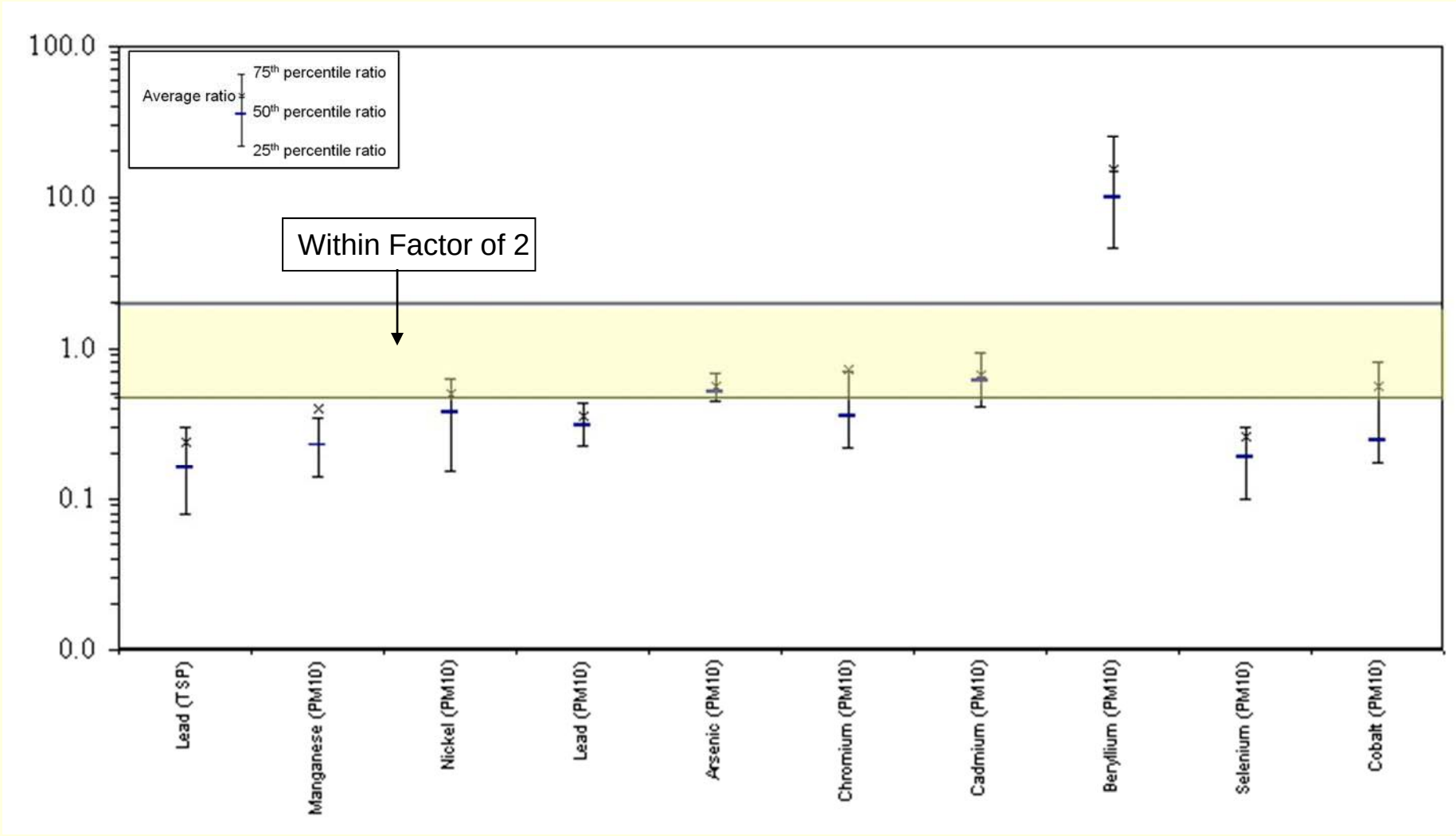


Gaseous HAPs (25-100 monitors)



Upper ends and interquartile ranges of the model-to-monitor ratios are below 0.010 and not presented.

TSP/PM_{10} HAPs



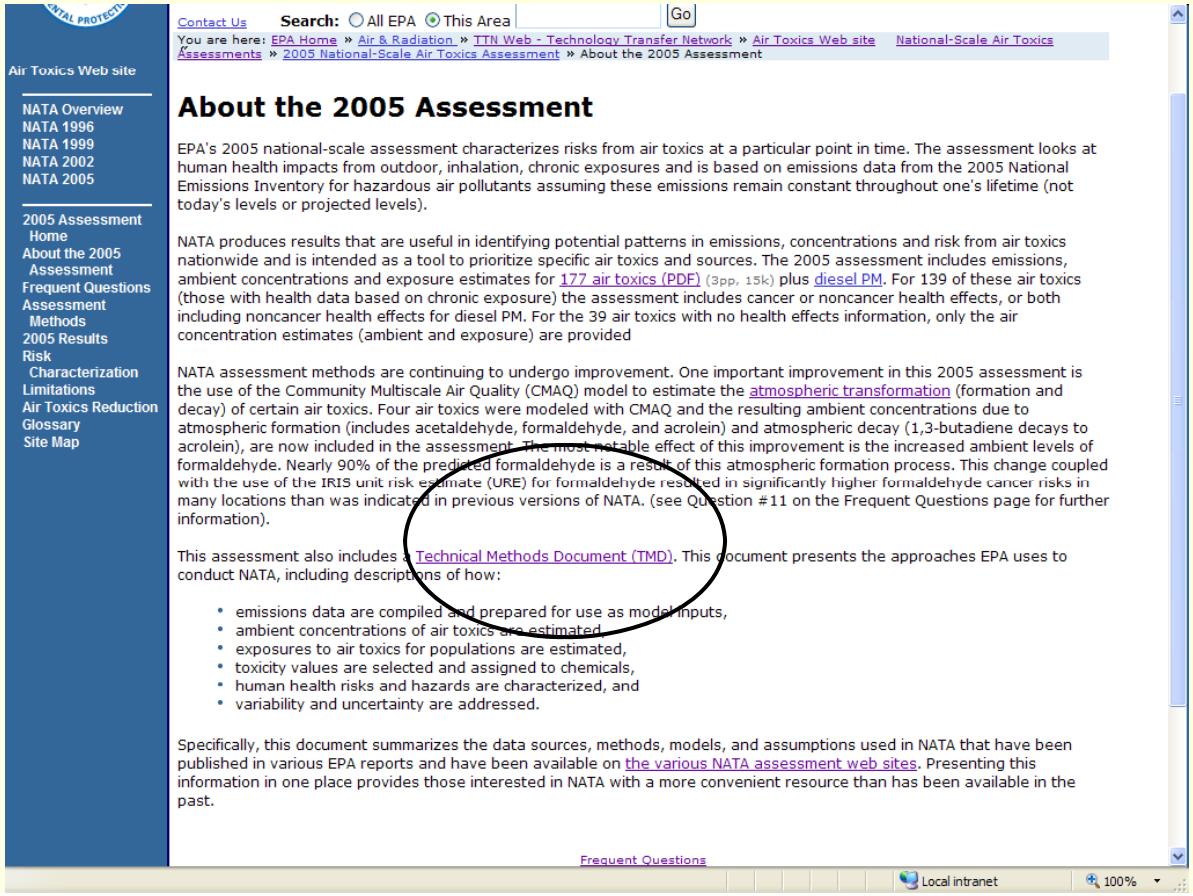
⑤ NATA- Risk Characterization

- Utilizes most current health data available for 139 HAPs (out of 177 included in assessment) from OAQPS website (04/27/10)
  - Cancer risks
    - Formaldehyde using 1991 IRIS
  - Noncancer risks by target organ
    - Respiratory and Neurological summarized at national level
    - Other Target organs in pollutant specific files
- Risk summaries in tabular formats at census tract level
- Google Earth Maps also available at census tract level
- Risk results at census block will not be made available to public, available to S/LT and other researchers upon request

NATA Approach Details

- Technical Methods Document is on website

http://www.epa.gov/ttn/atw/nata2005/aboutassess.html



2005 NATA Results - Air Toxics Emissions

- Overall, national air toxics emissions lower in 2005 by about 7% from 2002 levels
  - 2002 – 4.5 million TPY
  - 2005 – 4.2 million TPY
- Projections show national air toxics emissions in 2010 may be reduced even further than 2005 levels
  - 2010 (projection) – 3.7 million TPY
- Air toxics rule compliance between 2002 and 2005
  - 37 MACT standards
  - 12 mobile source standards
- Air toxics rule compliance between 2005 and today
  - 37 MACT/NESHAP/NSPS/Section 129 standards
  - 34 area source standards
  - 7 mobile source standards

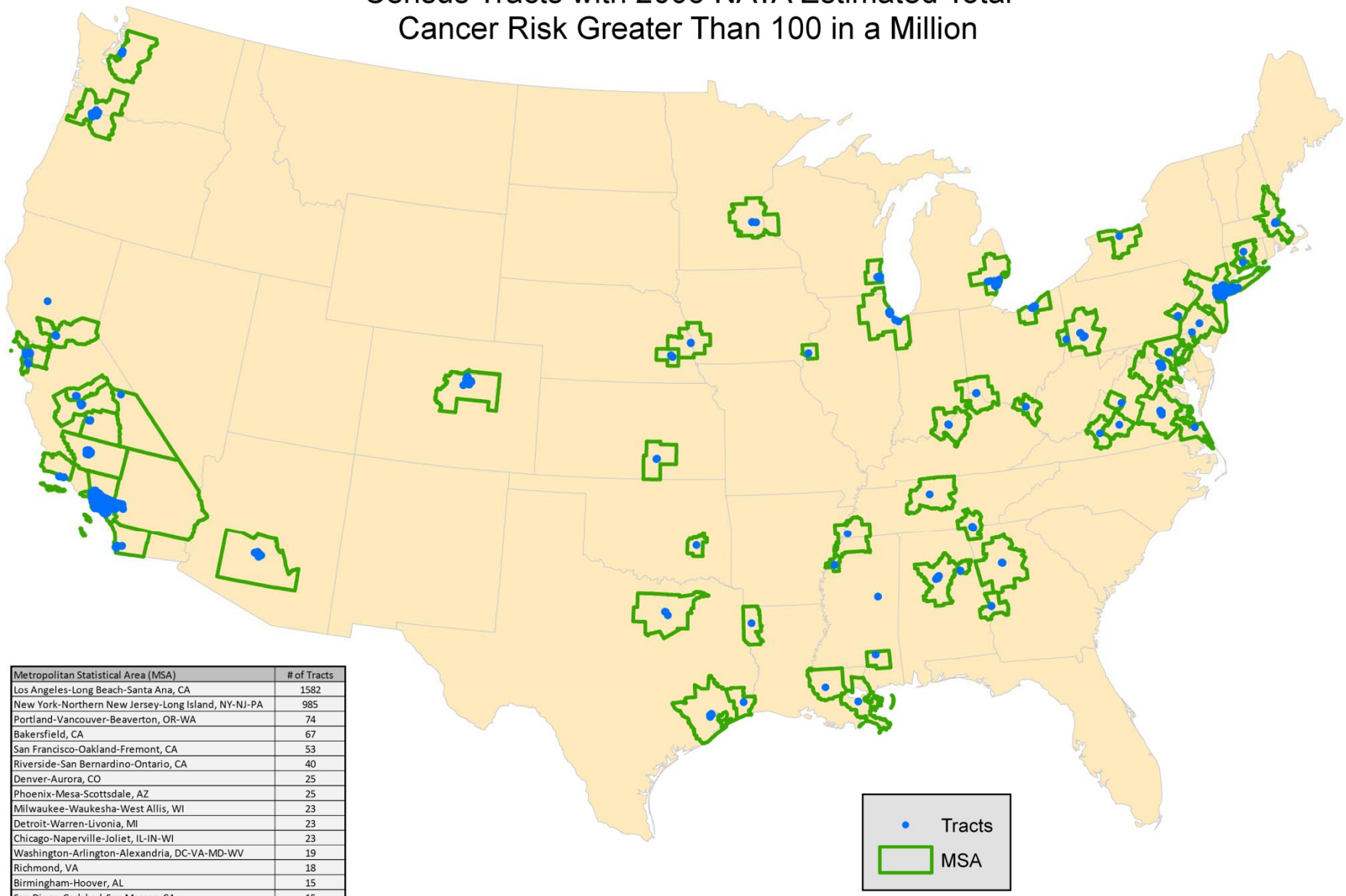
2005 NATA Results - National Cancer Risks

- While overall air toxic emissions are lower in 2005, improvements in methodology have resulted in the 2005 NATA estimating higher risks than were estimated by the 2002 NATA
- There are 13.8 million people living in areas with cancer risks estimated to be more than 100-in-a million, as compared to 22 million in 2002
- The 2005 NATA estimates that about 1 in every 20,000 people nationwide have an increased likelihood of contracting cancer. This corresponds to a national average cancer risk of about 50-in-a million (compared to 36-in-a million in 2002)
  - Formaldehyde risk is about 22-in-a million (45% of 2005 national average risk)
  - Benzene risk is about 7-in-a million (15% of 2005 national average risk)
    - Benzene risks about 11-in-a million in 2002
    - 2005 emissions of benzene are 25% lower than 2002 emissions
    - Some of this reduction may be attributable to improved mobile source emissions modeling
  - Carbon tetrachloride risk is about 3-in-a million (7% of 2005 national average risk)
    - Carbon tetrachloride risks about 7-in-a million in 2002
    - Current US emissions are very low
    - Stays in environment over 90 years, so most of risk is due to historical emissions and international transport

2005 NATA Results - National Cancer Risks (continued)

- Highest overall risks in large metropolitan areas (New York, NY and Los Angles, CA)
  - Risks driven by mobile and nonpoint emissions and, secondarily, the formation air toxics (formaldehyde)
- There are approximately 3100 census tracts with cancer risks greater than 100-in-a million
  - Majority of these risks are a result of mobile and non-point risks contributions
  - Only a few tracts with risks greater than 100-in-a million resulting from point source emissions alone

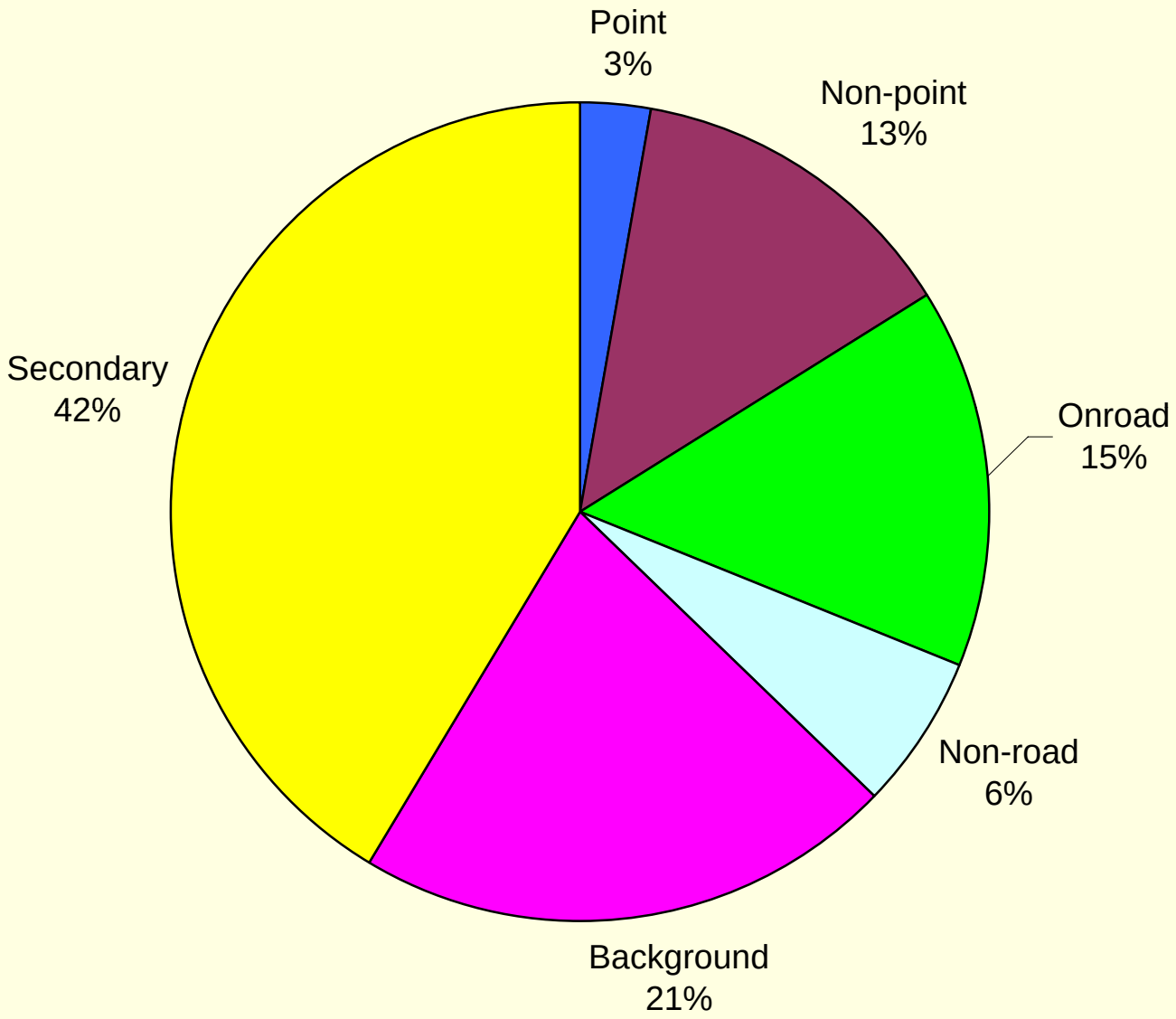
Census Tracts with 2005 NATA Estimated Total Cancer Risk Greater Than 100 in a Million



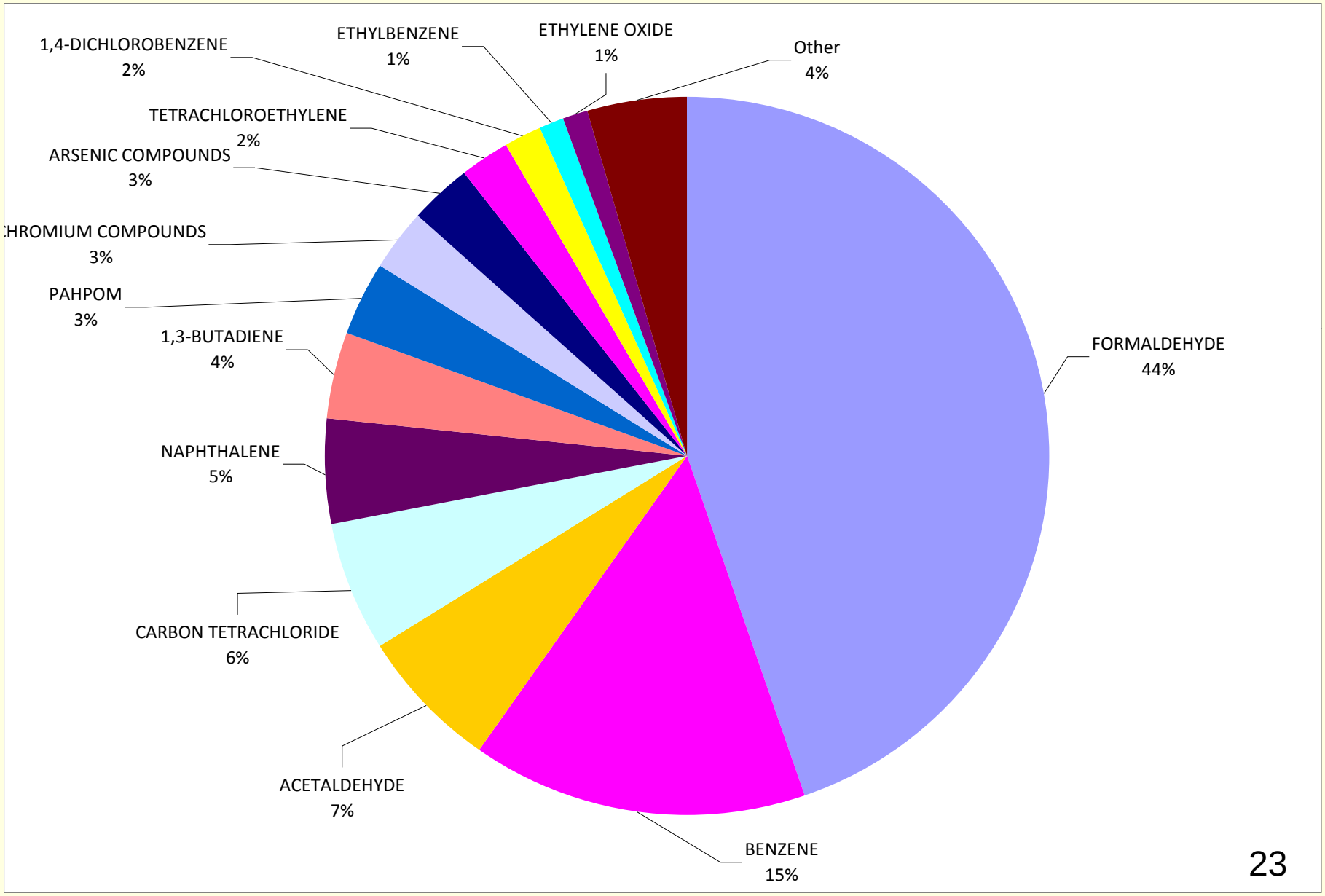
Metropolitan Statistical Area (MSA)	# of Tracts
Los Angeles-Long Beach-Santa Ana, CA	1582
New York-Northern New Jersey-Long Island, NY-NJ-PA	985
Portland-Vancouver-Beaverton, OR-WA	74
Bakersfield, CA	67
San Francisco-Oakland-Fremont, CA	53
Riverside-San Bernardino-Ontario, CA	40
Denver-Aurora, CO	25
Phoenix-Mesa-Scottsdale, AZ	25
Milwaukee-Waukesha-West Allis, WI	23
Detroit-Warren-Livonia, MI	23
Chicago-Naperville-Joliet, IL-IN-WI	23
Washington-Arlington-Alexandria, DC-VA-MD-WV	19
Richmond, VA	18
Birmingham-Hoover, AL	15
San Diego-Carlsbad-San Marcos, CA	15
Seattle-Tacoma-Bellevue, WA	13
Cleveland-Elyria-Mentor, OH	11
Pittsburgh, PA	11
Fresno, CA	8

There are a total of 3141 tracts with estimated risk greater than 100 in a million

2005 NATA National Cancer Risks (50 in a million)



2005 NATA Pollutant Contributions to National Average Cancer Risk (50-in-a Million)



2005 NATA Results - National Noncancer Risks

- The national average noncancer respiratory hazard index is 2.3 compared to 4.4 in 2002
  - Lower risks primarily a result of not including forest and wildfires
  - Acrolein comprises more than 75% of this risk
    - 2005 NEI emissions of acrolein are 11% higher than 2002 NEI; however, “Forest and Wildfires” comprised 2/3 of emissions
    - Now including photochemical formation of acrolein
- More than 48,000 census tracts with a respiratory hazard index greater than 1
- Highest census tract noncancer risks
  - Portland, Oregon, respiratory hazard index of 27; primary driver is from usage of solvent from a small area source

Why is Formaldehyde Important ?

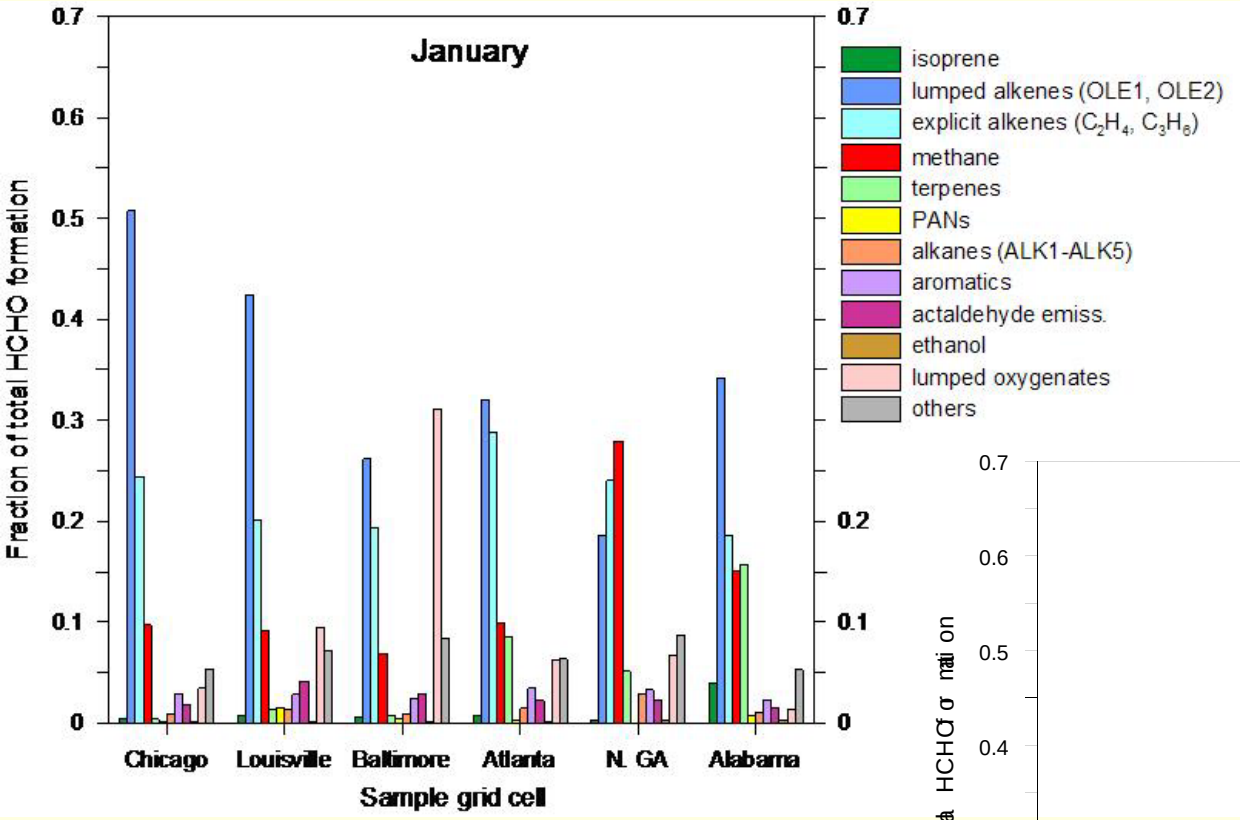
- URE Choices:
  - 5.5E-09 (CIIT)
  - 6.0E-06 (CALEPA)
  - **1.3E-05 (1991-IRIS)**
  - 1.1E-04 (Draft(2010) IRIS)
    - National Academy of Sciences (NAS) just completed review of draft
  - 2005 NATA Nationwide risk and % national risk
  - 0.01 in a million or <1% of total risk(CIIT)
  - 11 in a million or 24% (CALEPA)
    - Max tract 200 in a Million (3 tracts >100)
  - **22 in a million or 44% (1991-IRIS)**
    - Max Tract 119 in a Million (7 tracts >100)
  - 200 in a million or 84% (Draft(2010) IRIS)

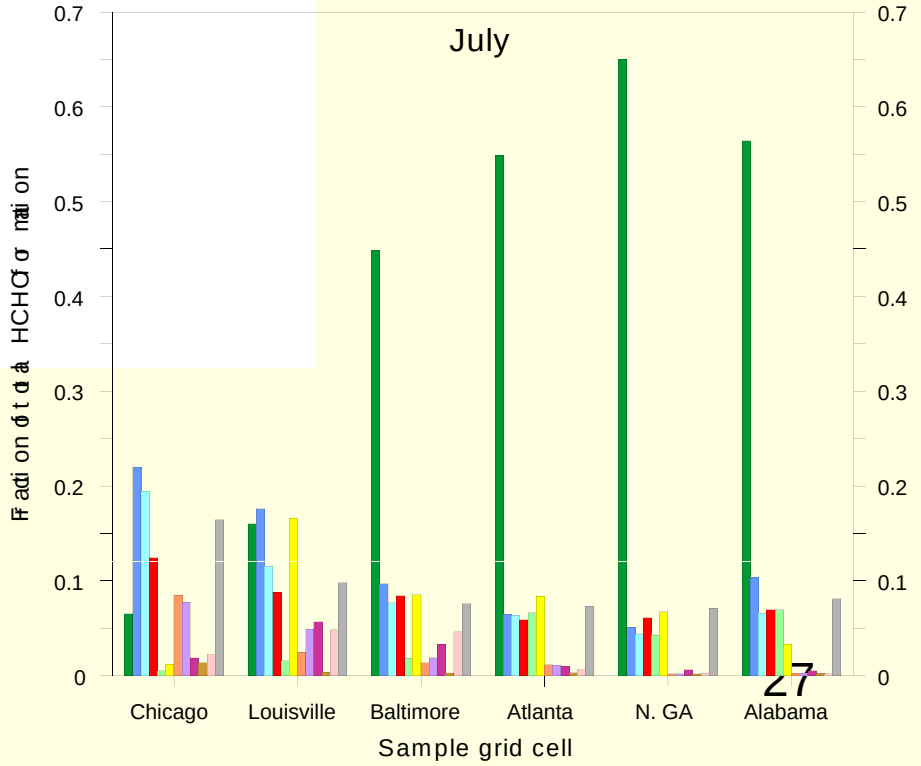
Sources of Formaldehyde

- Primary Emissions
  - 4% Major
  - 10% Area
  - 43% Fires
  - 28% On road mobile
  - 15% Non road mobile

- The primary precursors of formaldehyde are
  - Isoprene
    - The yearly natural production of isoprene emissions by vegetation is around 600 MTons, with half that coming from tropical broadleaf trees and the remainder coming from shrubs. 0.8 Mtons from industry
  - Alkenes: ethene, propene, butene, etc.
    - In rural areas, a lot of these can be biogenic in the summer. In urban areas less than 20% is from biogenic sources)
  - Methane (about 10-20%)

Fraction of total formaldehyde attributed to primary VOC classes





Reference:
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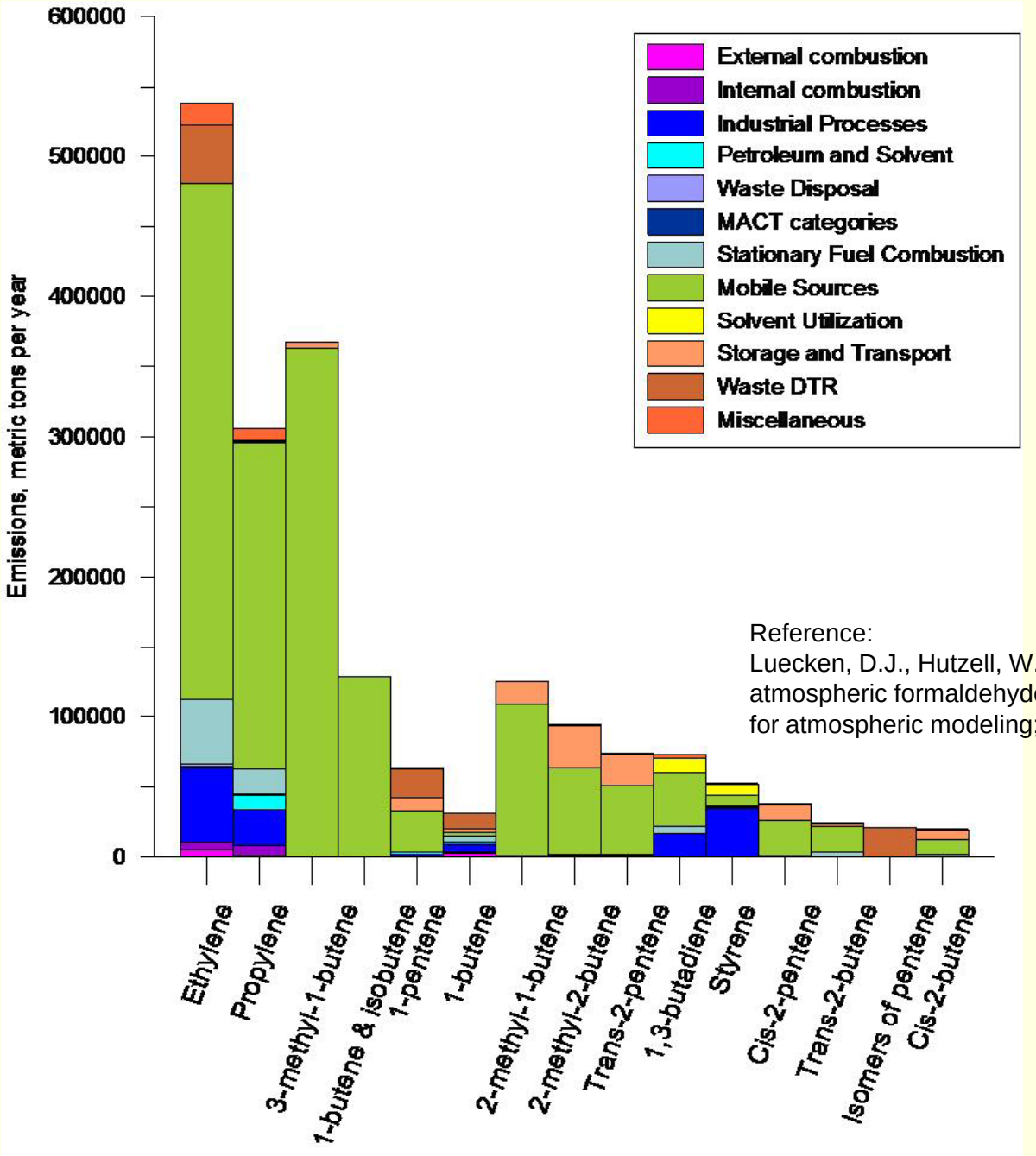

Annual anthropogenic alkene emissions allocated to source categories

Reference:
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2005 NATA
Formaldehyde Cancer Risk
Using IRIS URE