# 2011 National Air Toxics Assessment (NATA)

NACAA
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# Briefing Overview

- Background
- Methods
- National Results
- Website/Map App

# Background

- 2011 NATA is the 5th National-scale assessment (1996, 1999, 2002, 2005) and was released to the public Dec 17, 2015

- Concentrations, exposures, and risks based on air quality modeling of emissions from the 2011 National Emissions Inventory (NEI) for Clean Air Act Hazardous Air Pollutants (HAP) and diesel PM (DPM)

- NATA is a screening-level characterization of air toxics across the nation
  - Nationwide assessment with *census tract* resolution
  - Cancer and noncancer risk estimates for about 140 HAPs with health data based on chronic exposures
  - Ambient concentration estimates for 180 CAA HAPs plus DPM
- NATA Uses
  - To identify locations of interest for further study
  - To prioritize pollutants and emission sources
  - To inform monitoring programs

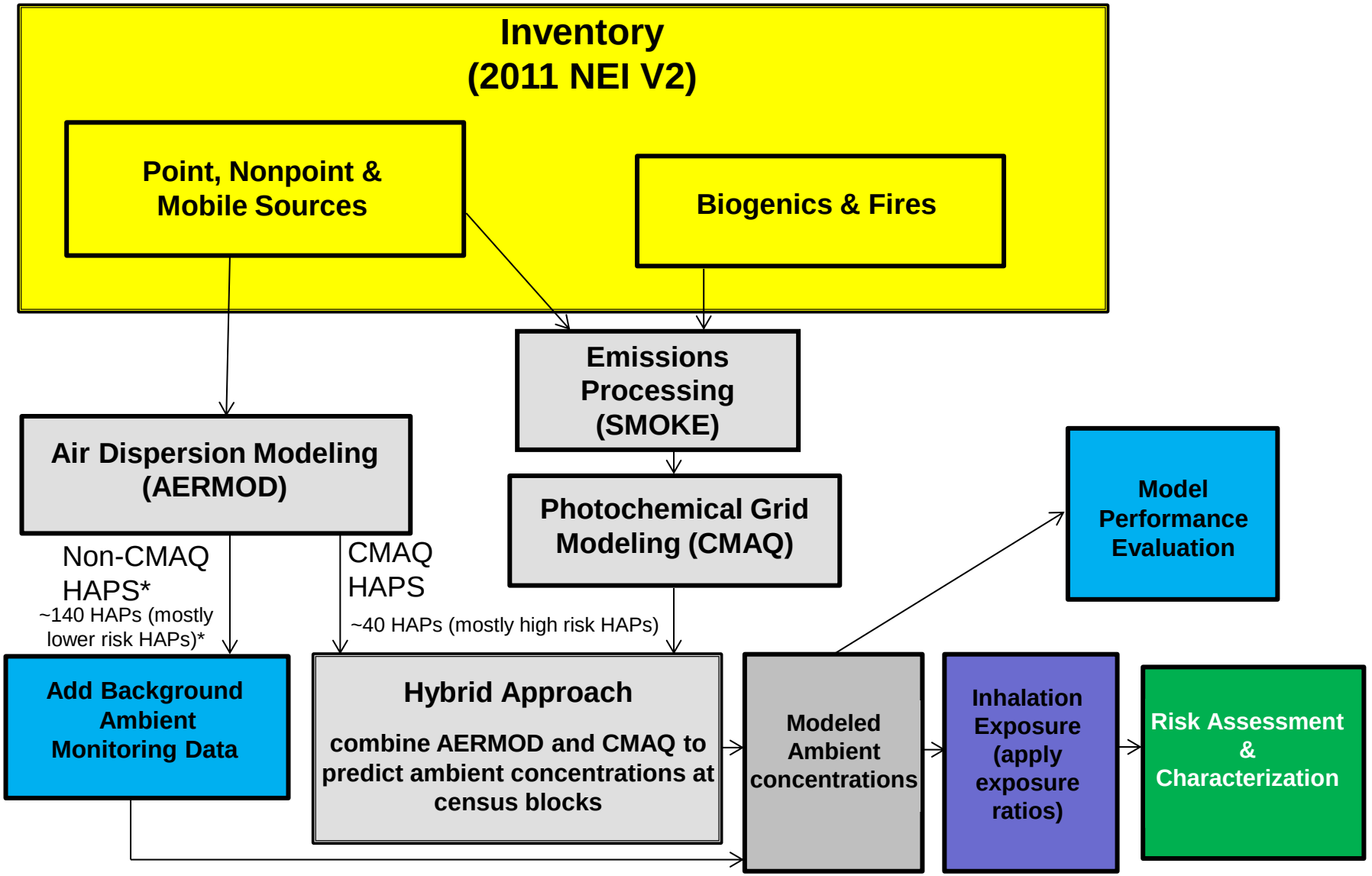
# Limitations

- Emissions, modeled ambient concentrations and estimated inhalation exposures from outdoor sources and inhalation route of exposure only
- Results more uncertain at finer geographic scales
  - Surrogates used to allocate mobile and nonpoint source emissions
  - Results based on modeled data, not ambient monitoring data
- Results should not be used to compare risks among different areas of the country
  - Underlying emissions data vary in level of detail from state to state
- 2011 NATA results should not be compared to previous NATAs
  - Changes in results are due to both actual emission changes and the use of different modeling and emissions processing techniques.

# Who Uses NATA?

- **EPA**
  - Office of Air Quality Planning and Standards (OAQPS)
    - Report to Congress, Monitoring, Grants, Risk and Technology Review (RTR)
  - Office of Transportation and Air Quality (OTAQ)
    - National Rules
  - Office of Research and Development (ORD)
    - Research agenda, field studies, community tools (Community-Focused Exposure and Risk Screening Tool) – expected release later this year
  - Office of Environmental Information (OEI)
    - Environmental Justice /Community Tool– EJ SCREEN – NATA is one of several environmental layers in the soon to be released EJSCREEN model developed by OEI/OEJ – possible release later this spring
- **States**
  - Many State Air Toxics Programs set priorities using NATA (Oregon, New York, New Jersey)
  - Identify gaps in emissions inventories, encourage inventory improvements
- **Academia**
  - NATA referenced in over a hundred papers and numerous health studies

# 2011 NATA Approach




*includes all HAPs in AK/HI/PR/VI since not part of CMAQ modeling domain

# Features of the NEI for the 2011 NATA

- Complete national HAP/CAP inventory based on 2011 emissions
- Data reported through EIS by State/Local/Tribal Agencies
  - Inventory includes:
    - Point emissions
    - Nonpoint
    - Mobile model inputs
  - Facility configurations (facility/unit/process/release point)
- Estimated/Gap filled by EPA
  - TRI data, including range data
  - Compute HAPs from CAPs
  - Speciate chromium (TRI and State data)
  - Many nonpoint categories and Fires

# Source Attribution – Concentrations/Risks by These Groups

## Onroad and Nonroad

| |
|---|
| Refueling |
| Light duty gas |
| Light duty diesel |
| Heavy duty gas |
| Heavy duty diesel |
| Nonroad construction |
| Nonroad pleasurecraft |
| Nonroad gas other |
| Nonroad diesel other |

## Nonpoint nonroad

| |
|---|
| CMV-Ports |
| CMV-Underway |
| Locomotives |

## Nonpoint stationary

| |
|---|
| Bulk gasoline terminals |
| Chemical manufacturing |
| Mining |
| Industrial not elsewhere classified |
| Nonferrous metals |
| Oil and gas |
| Refineries |
| Storage and transfer |
| Gas stations (Stage 1) |
| Industrial, commercial institutional fuel combustion |
| Landfills |
| Surface coating and industrial solvent |
| Waste disposal other |
| Commercial Cooking |
| Miscellaneous nonindustrial |
| Residential wood combustion |
| Residential fuel combustion except wood |
| Consumer & commercial solvent |
| Solvent degreasing |
| Solvent dry cleaning |
| Non-industrial surface coating |

## Point

| |
|---|
| Airports |
| Railyards |
| Other point |

## Other (CMAQ only)

| |
|---|
| Fires |
| Biogenics |
| Secondary formation |

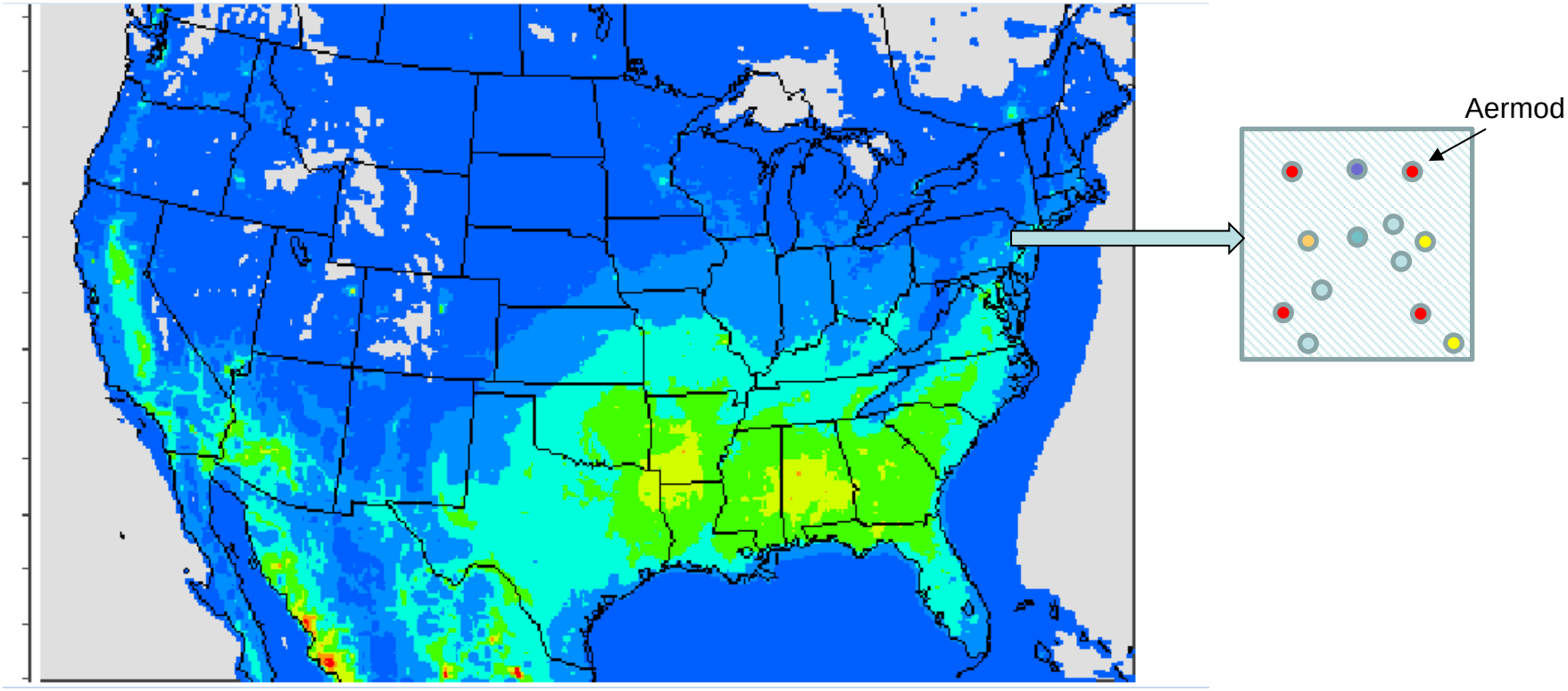
# 2011 NATA General Approach Spatial Allocation

| Category | Inventory Resolution | Spatial Approach for AERMOD | Spatial approach for CMAQ |
|---|---|---|---|
| **Point (non Airports)** | Point | Point – vertical stack and fugitive | 12km by 12 grid cells, Vertical based on plume calculations |
| **Airports** | Point | Point – runways & 10mX10m areas | 12km by 12 grid cells |
| **Locomotives** | Point (railyards) and County/Shape | Nonpoint - Tracts<br>Point - Point Fugitives | 12km by 12 grid cells |
| **Commercial Marine Vessels** | County/Shape | Shapes | 12km by 12 grid cells |
| **Onroad, Nonroad Equipment and other nonpoint** | County | Tracts | 12km by 12 grid cells |
| **Fires (prescribed and wild)** | Point | Not Modeled | 12km by 12 grid cells, Vertical based on plume calculations |

# 2011 NATA Modeling - Commercial Marine Vessels (CMV)

- Modeled in AERMOD as ~370 port shapes and ~3500 underway shapes
- CMV emissions assigned to shapes by EPA, reported to these shapes by S/L/T
- PM from diesel and residual oil vessels modeled as diesel PM
- Key pollutants: nickel, hexavalent chromium, arsenic, formaldehyde, diesel PM (noncancer only)

# Hybrid – combine CMAQ & AERMOD in each grid cell




consistent MET and emissions across CMAQ and AERMOD

# Air Toxics in CMAQ

## Gas Phase – stationary & mobile

| Pollutant | Inhalation Health Impacts |
|---|---|
| BENZENE | Cancer, Noncancer |
| FORMALDEHDYE | Cancer, Noncancer |
| ACETALDEHYDE | Cancer, Noncancer |
| 1,3 BUTADIENE | Cancer, Noncancer |
| NAPHTHALENE | Cancer, Noncancer |
| ACROLEIN | Noncancer |
| METHANOL | Noncancer |
| XYLENES (M, O, P) | Noncancer |
| TOLUENE | Noncancer |
| PAHs (9 Groups) | Cancer |

## Particle and multi-phase – stationary & mobile

| Pollutant | Inhalation Health Impacts |
|---|---|
| NICKEL | Cancer, Noncancer |
| HEX CHROMIUM | Cancer, Noncancer |
| ARSENIC | Cancer, Noncancer |
| CADMIUM | Cancer, Noncancer |
| BERYLLIUM | Cancer, Noncancer |
| MANGANESE | Noncancer |
| LEAD | Noncancer |
| DIESEL PM | Noncancer |
| MERCURY | Noncancer |

## Gas Phase – stationary

| Pollutant | Inhalation Health Impacts |
|---|---|
| ACRYLONITRILE | Cancer, Noncancer |
| CARBON TETRACHLORIDE | Cancer, Noncancer |
| CHLORINE | Noncancer |
| CHLOROFORM | Noncancer |
| 1,4-DICHLOROBENZENE | Cancer, Noncancer |
| 1,3-DICHLOROPROPENE | Cancer, Noncancer |
| ETHYLENE DIBROMIDE | Cancer, Noncancer |
| ETHYLENE DICHLORIDE | Cancer, Noncancer |
| ETHYLENE OXIDE | Cancer, Noncancer |
| HEXAMETHYLENE-1,6-DIISOCYANATE | Noncancer |
| HYDROCHLORIC ACID | Noncancer |
| HYDRAZINE | Cancer, Noncancer |
| MALEIC ANHYDRIDE | Noncancer |
| METHYLENE CHLORIDE | Cancer, Noncancer |
| PROPYLENE DICHLORIDE | Noncancer |
| QUINOLINE | Neither |
| 1,1,2,2-TETRACHLOROETHANE | Neither |
| 2,4-TOLUENE DIISOCYANATE | Cancer, Noncancer |
| TRICHLOROETHYLENE | Cancer, Noncancer |
| TRIETHYLAMINE | Noncancer |
| VINYL CHLORIDE | Cancer, Noncancer |

Hybrid Equation:

$$C_{hybrid,\,REC} = AERMOD_{REC} \times \frac{CMAQ_{P,\,NFB}}{AERMOD_{AVG}} + CMAQ_{SEC,} + CMAQ_{FIRE} + CMAQ_{BIOG}$$

Adjusted AERMOD concentration from primary non-fire, non-biogenic sources

CMAQ secondary concentration

CMAQ concentration from fires (primary only)

CMAQ concentration from primary biogenic emissions

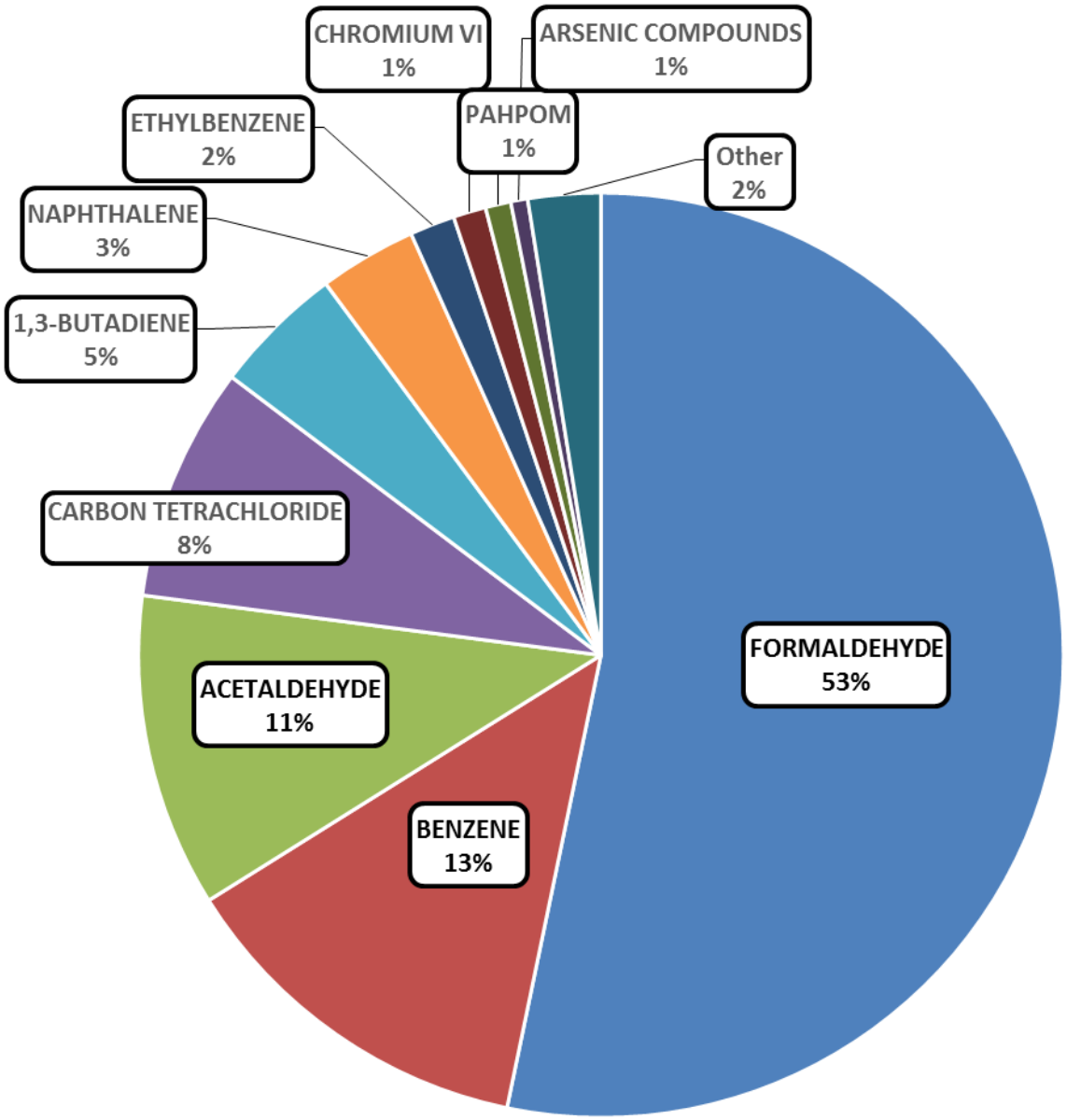
6.6 million receptors (census) block centroids + evenly placed receptors

- 56,500 12km x12km grid cells that cover the continental US

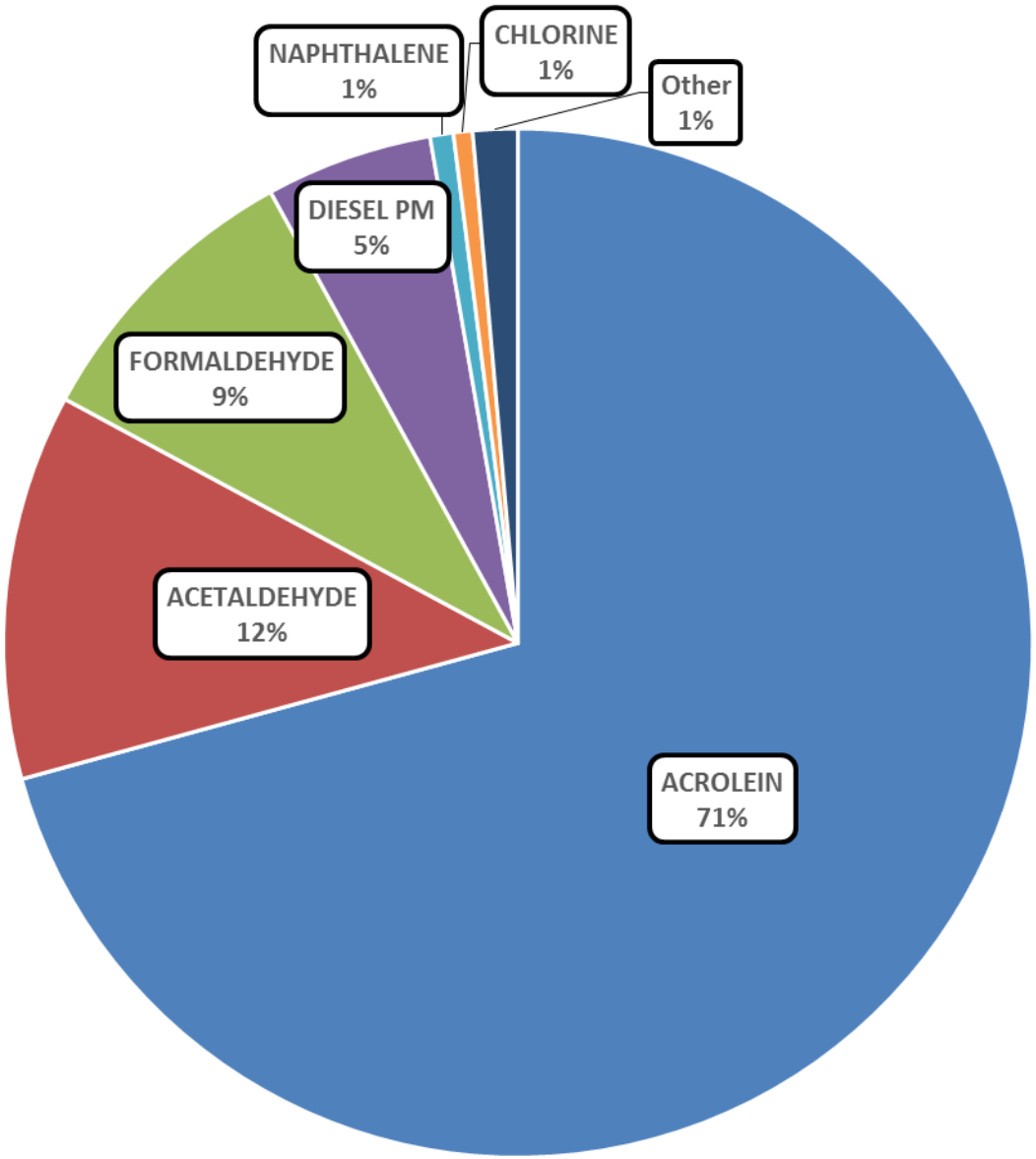
# National Level Results

- Pollutants of Interest
- Sources of Interest
- Areas of Interest

# 2011 NATA CANCER RISKS ENTIRE US (40-IN-1 MILLION) POLLUTANT CONTRIBUTIONS



# 2011 NATA RESPIRATORY RISKS ENTIRE US (HI= 2)
# POLLUTANT CONTRIBUTIONS

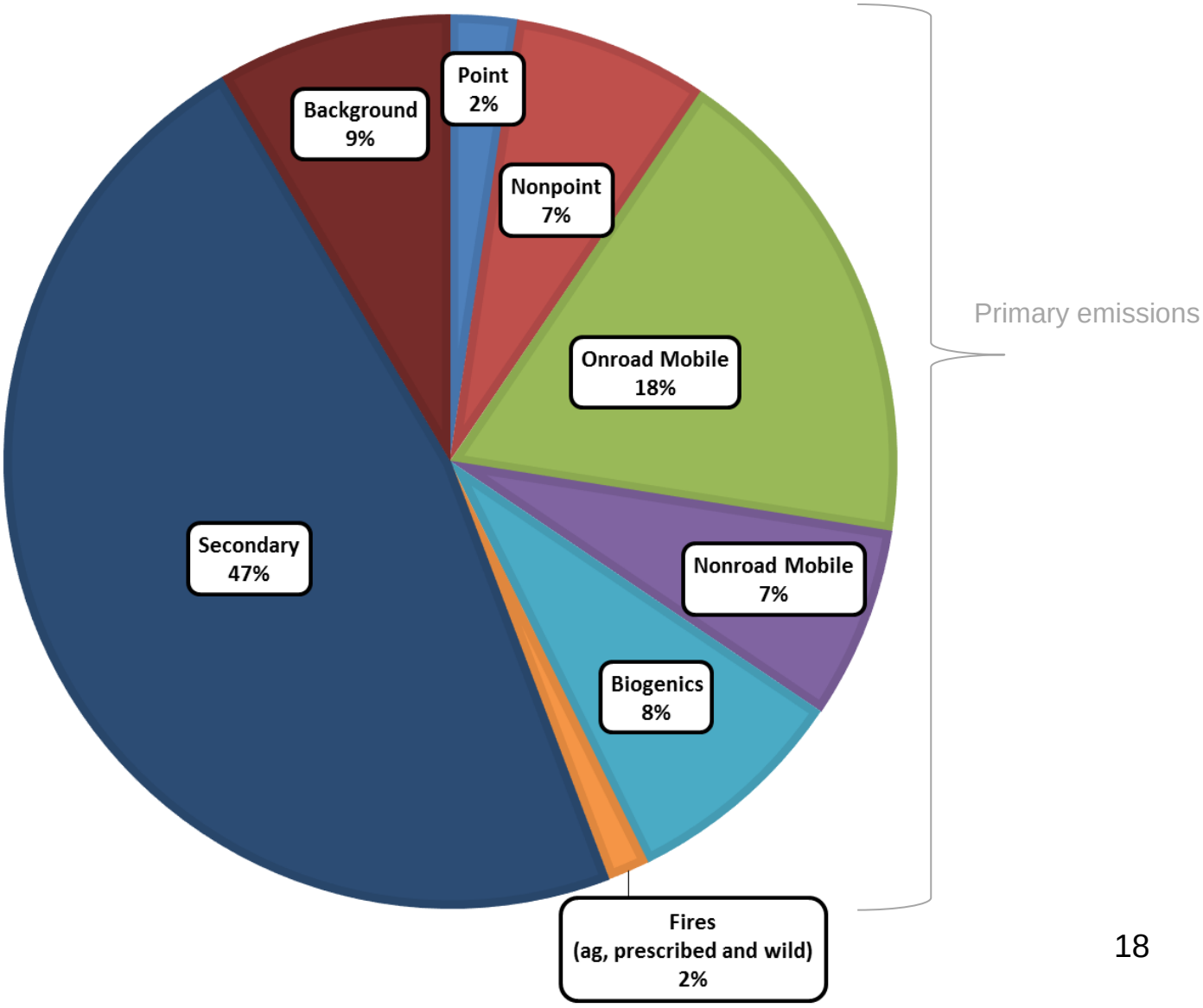


# Cancer Drivers and Contributors

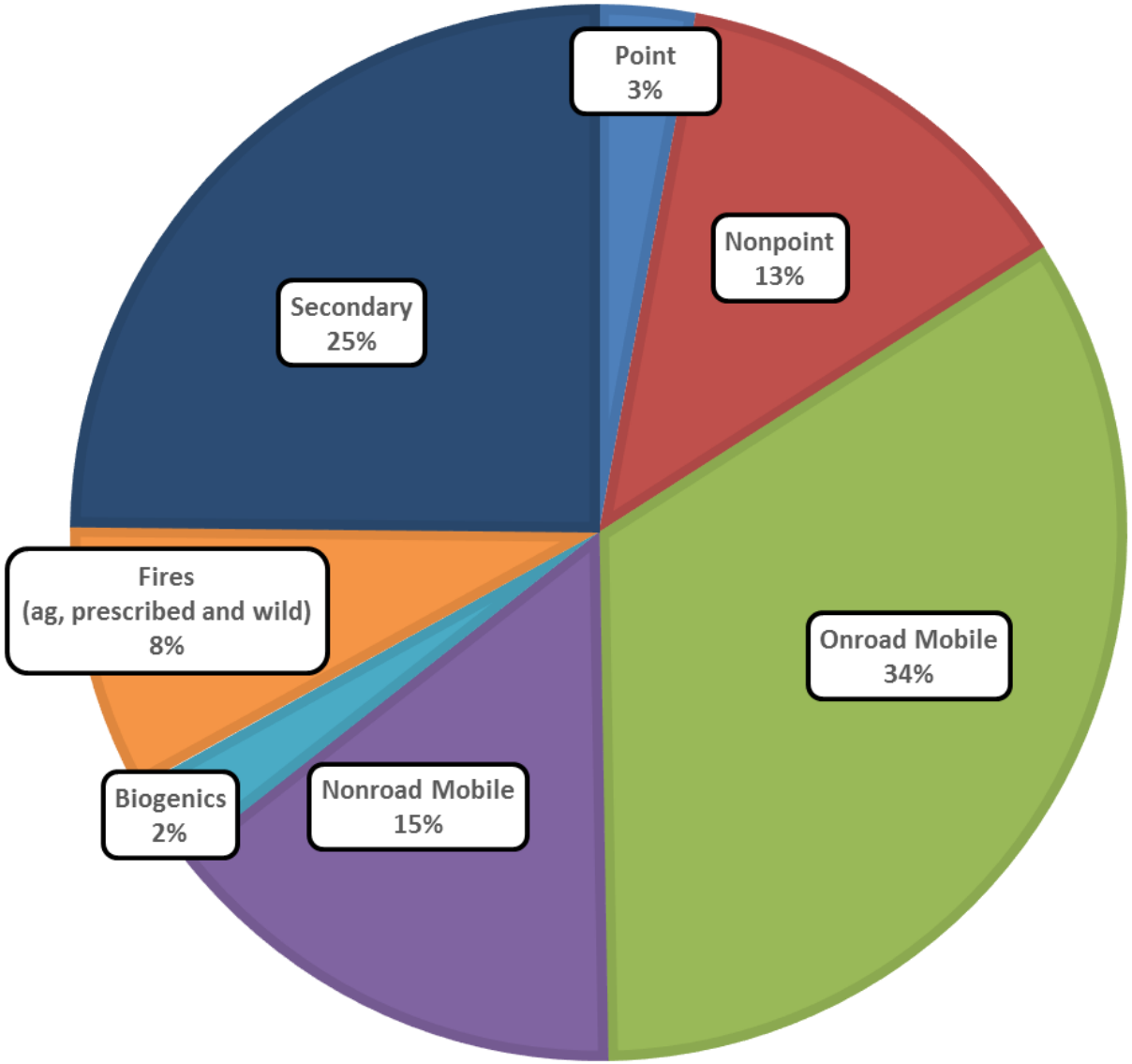
| | |
|---|---|
| National Driver: | FORMALDEHYDE |
| Regional Cancer Drivers: | BENZENE |
| | COKE OVEN EMISSIONS |
| | CHLOROPRENE |
| National Cancer Contributor: | CARBON TETRACHLORIDE |
| | ACETALDEHYDE |
| | 1,3-BUTADIENE |
| | NAPHTHALENE |
| | ETHYLBENZENE |
| | CHROMIUM VI (HEXAVALENT) |
| Regional Cancer Contributor: | 1,3-DICHLOROPROPENE |
| | 1,4-DICHLOROBENZENE |
| | ARSENIC COMPOUNDS |
| | ETHYLENE OXIDE |
| | NICKEL COMPOUNDS |
| | PAHPOM |

**National Driver**: Risks > 10 in a million for 25 million people;
**Regional Cancer Driver**: Risks > 1 in a M for 1 million people or > 100 in a M for 10,000 people;
**National Cancer Contributor**: Risks > 1 in a million for 25 million people;
**Regional Cancer Contributor**: Risks > 1 in a million for 1 million people.

# 2011 NATA CANCER RISKS ENTIRE US (40-IN-1 MILLION) SOURCE CATEGORY CONTRIBUTIONS

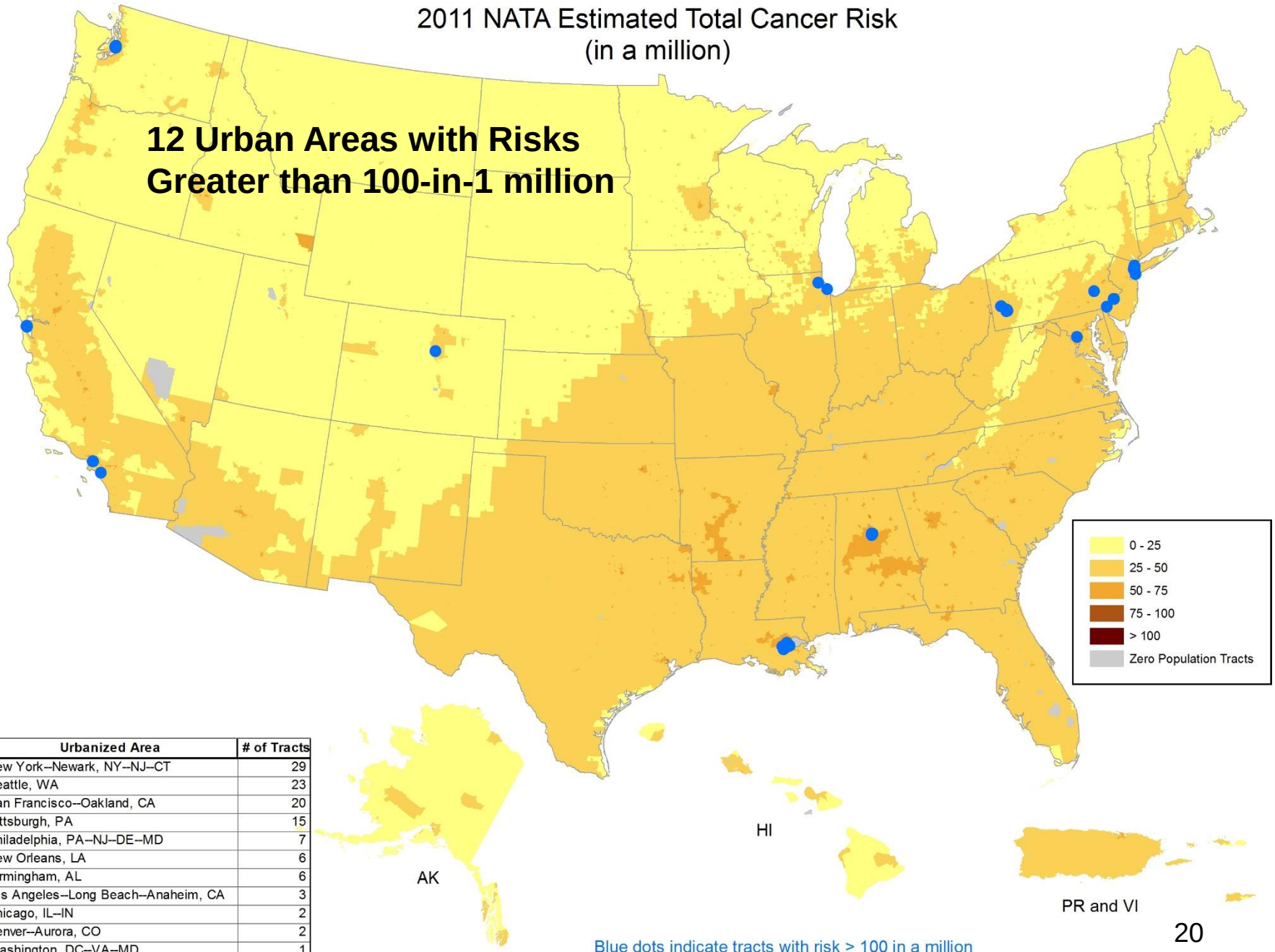


# 2011 NATA RESPIRATORY RISKS ENTIRE US (HI= 2)
# SOURCE SECTOR CONTRIBUTIONS



# 2011 NATA Estimated Total Cancer Risk (in a million)

## 12 Urban Areas with Risks Greater than 100-in-1 million




| Urbanized Area | # of Tracts |
|---|---|
| New York--Newark, NY--NJ--CT | 29 |
| Seattle, WA | 23 |
| San Francisco--Oakland, CA | 20 |
| Pittsburgh, PA | 15 |
| Philadelphia, PA--NJ--DE--MD | 7 |
| New Orleans, LA | 6 |
| Birmingham, AL | 6 |
| Los Angeles--Long Beach--Anaheim, CA | 3 |
| Chicago, IL--IN | 2 |
| Denver--Aurora, CO | 2 |
| Washington, DC--VA--MD | 1 |
| Reading, PA | 1 |

Blue dots indicate tracts with risk > 100 in a million
121 tracts nationwide (12 Urbanized Areas)

# Detailed NATA data – download from website

- Emissions Data – County, Facility, Facility & Release Point
- Modeled Ambient and Exposure Concentration Data
  - Pollutant (180) and source category (broad) summaries at census tract level
- Cancer and Noncancer Risks
  - About 140 pollutants at census tract level
  - Pollutants and source group (41) summaries
  - Cancer risks expressed as in-1 million
  - Noncancer risks expressed as Hazard Indices

# http://www.epa.gov/national-air-toxics-assessment