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AirToxScreen: EPA's Screening-Level Assessment Tool for Outdoor Air Toxics

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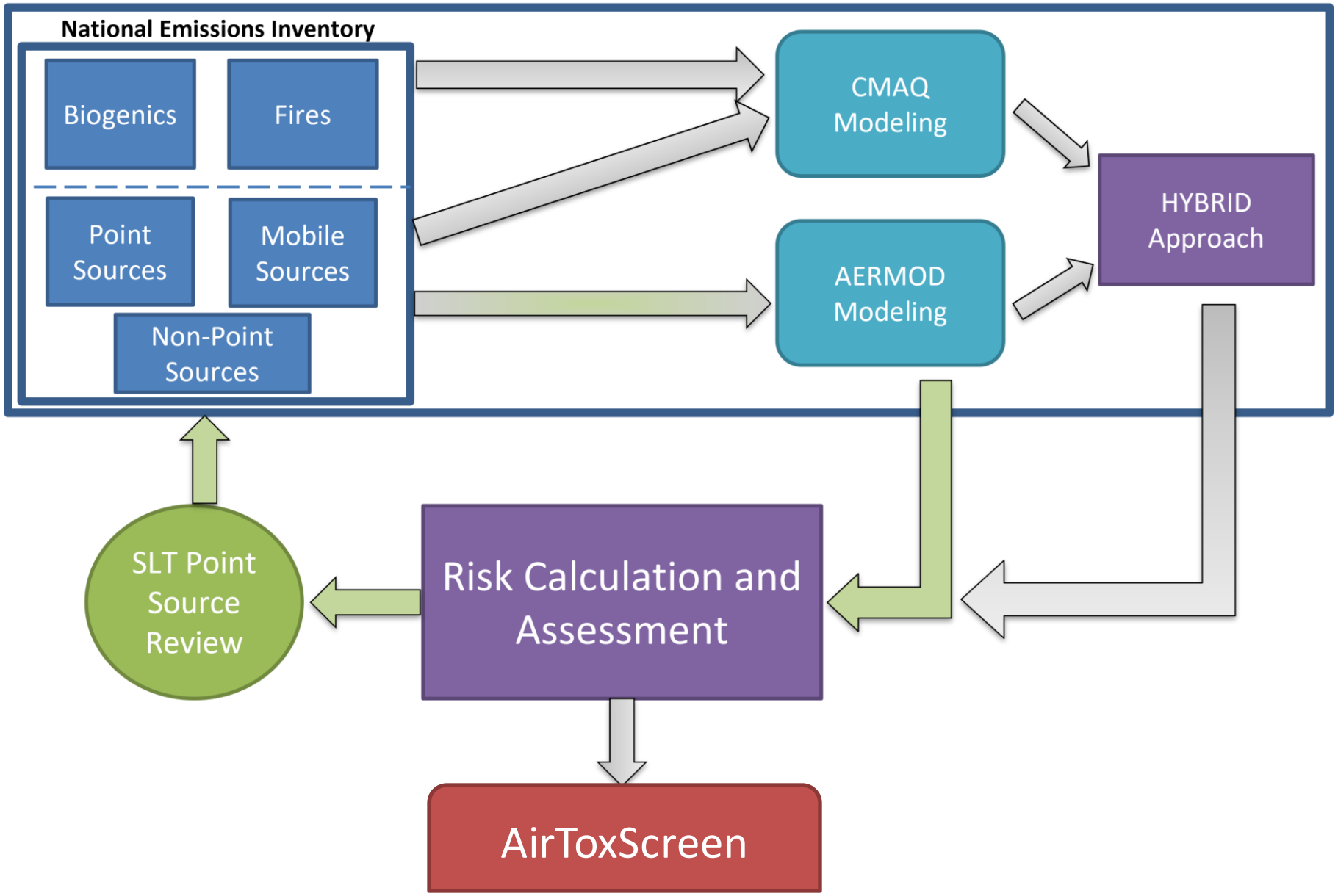
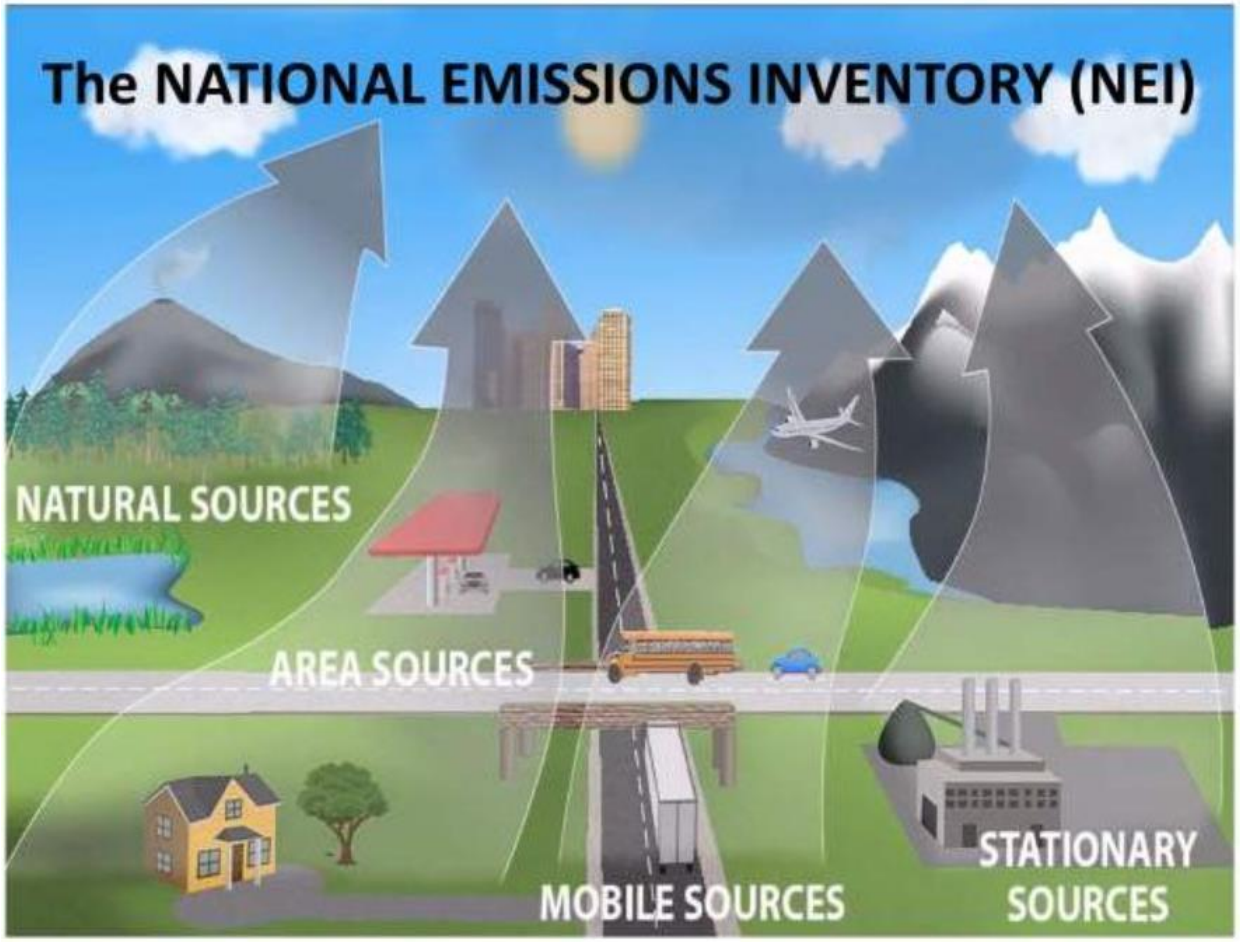
The AirToxScreen System



National Emissions Inventory

- AirToxScreen begins with the National Emissions Inventory (NEI)
- The NEI provides a comprehensive and detailed estimate of criteria air pollutants (CAPs) and their precursors, and hazardous air pollutants (HAPs) from air emissions sources in the United States.
- The full NEI is released every three years and is based primarily upon data provided to the EPA by state, local and tribal air agencies (SLTs) across the country.
  - A point source inventory of Major sources is released annually.
- 188 HAP pollutants are included in the NEI.



Air Emissions Reporting Rule (AERR)

- The Air Emissions Reporting Rule (AERR), originally promulgated in 2008 and revised in 2015, requires state and local agencies to collect and submit emissions data to the EPA.
  - Criteria air pollutant and precursor (CAP) emissions required by all sources every 3 years
    - CAP emissions (CO, VOC, NOx, SO2, PM10, PM2.5, NH3, and Lead (Pb)
    - CAP emissions required for larger point sources every year
  - Hazardous Air Pollutant (HAP) emissions voluntarily reported

- EPA has proposed updates to the AERR
  - Considerations include:
    - Improvement of the quality and completeness of hazardous air pollutant (HAP) emissions from stationary sources.
    - Improvement of the quality and completeness of all pollutant emissions from prescribed fires.
    - How to address known data gaps and improve data quality for nonpoint and mobile sources.

For questions about AERR, contact Houyoux.Marc@epa.gov

Data Sources for the NEI

- **Main data source: All 50 states, several local agencies, and tribes are key partners in the NEI process**
  - Submit emissions or model inputs of point, nonpoint, onroad mobile, nonroad mobile, and certain fire emission sources
  - Participate in developing the methods used in constructing the NEI
- Additional data sources:
  - Stationary sources:
    - Toxics Release Inventory (TRI)
    - The Greenhouse Gas Reporting Program (GHGRP)
    - Emissions data collected as part of Risk and Technology Review of the National Emissions Standards for HAPs (when available).
  - Mobile Sources:
    - Onroad and nonroad: the EPA uses the Motor Vehicle Emission Simulator (MOVES) model, developed by the EPA's Office of Transportation and Air Quality (OTAQ)
    - Airports: data from the Federal Aviation Administration
  - Natural Sources:
    - Biogenic emissions: estimates generated using the Biogenic Emission Inventory System (BEIS) model along with land use data and meteorological data.
  - Fires:
    - Together with satellite, national fire information databases, and SLT fire occurrence/activity data, the SmartFire2 and Bluesky Pipeline models estimate emissions.

Additional HAP Data Sources

- In addition to voluntary SLT-submitted HAPs, EPA uses additional sources to create the most complete inventory
  - Toxic Release Inventory
  - HAP Augmentation
  - Chromium Speciation

SLT Point Source Review

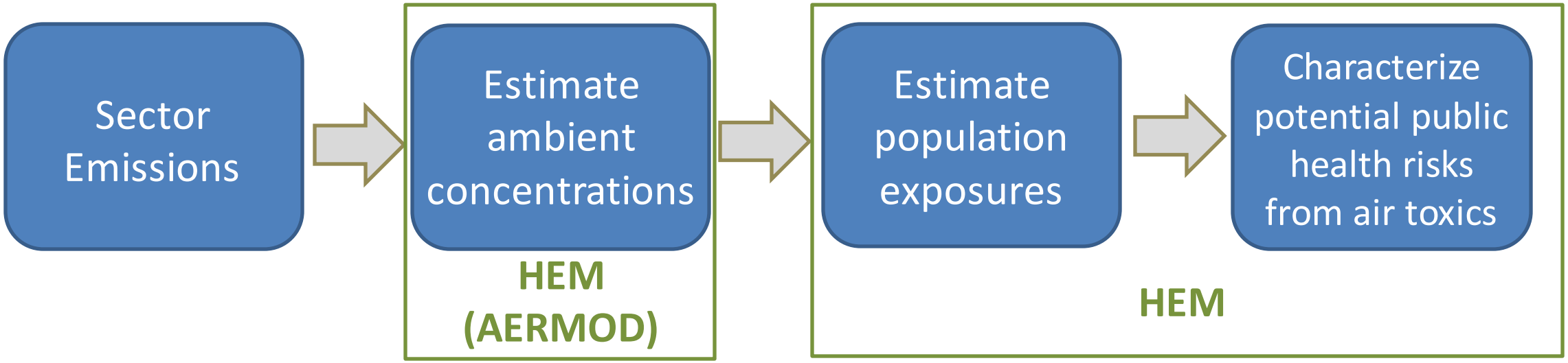
- EPA works closely with our State, Local, and Tribal agency partners to review the NEI. As part of this process, every summer, we model point source HAP emissions in AERMOD to assign a draft risk to each point facility.
  - Results are shared with SLTs in three levels of data (facility-level, facility-pollutant, facility-process-pollutant).
- This review helps ensure that the emission inventory is as accurate as possible prior to final modeling for AirToxScreen.
  - The review includes point sources only at this time.
- Submitted comments are reviewed and, if accepted, are included into the Emission Inventory System (EIS) to become part of the final NEI.
  - Note: Because of the timing, comments on the 2017 and 2018 point sources were not included in the final NEI.
- **Each year, we attempt to improve the SLT Review process and strike a better balance between accuracy and burden. If you have suggestions to improve the process, please let us know!**

Air Quality Modeling

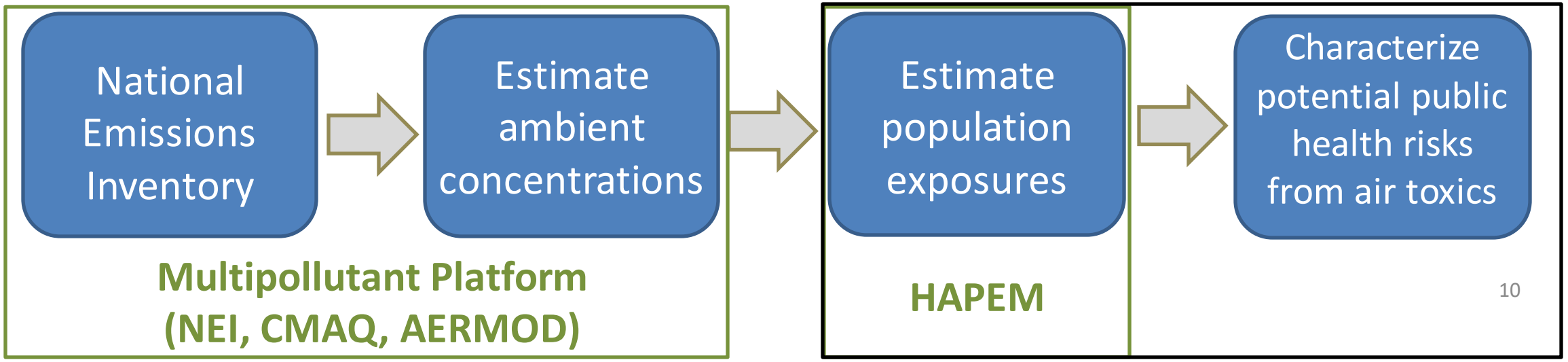
- CMAQ Multi-pollutant (v5.4)
  - 50+ HAPs based on NEI
  - All 50 states and PR/VI (4 domains)
    - CONUS: 12 km resolution
    - AK: 9 km resolution
    - HI & PR/VI: 3 km resolution
- AERMOD Model
  - 185 HAPs + diesel PM based on NEI
  - All 50 states and PR/VI
  - Source attribution (around 30 source groups)
  - WRF data for meteorology
- Hybrid method
  - Combines output from CMAQ and AERMOD

EPA Air Toxics Risk Assessments

Sector-based Rules



National Screening for Air Toxics



Estimate Population Exposures

- Hazardous Air Pollutant Exposure Model (HAPEM)
  - Accounts for people moving through locations and microenvironments where pollutant concentrations can differ
    - Six age-based cohorts (0–1, 2–4, 5–15, 16–17, 18–64 and ≥65)
    - Activity-pattern data from EPA's Consolidated Human Activity Database (CHAD)
  - AirToxScreen pollutants modeled in HAPEM include: coke oven emissions, diesel PM, **benzene, PAHs, hexavalent chromium, and nickel**
    - **BOLD** pollutants used as surrogates
  - Available at https://www.epa.gov/fera

HAPEM microenvironments

Indoors	Outdoors	In Vehicle
Residence	*Near-road*	Car/Truck
Residential	Motorcycle/Bicycle	Public Transit
Other Building	Outdoors, Near Roadway	
Air Travel	Outdoors, Parking Garage	
Bar/Restaurant	Outdoors, Service Station	
Hospital	Residential Garage	
Office	Waiting Outdoors for Public Transit	
Public Access	*Away-from-road*	
School	Ferryboat Outdoors	
Waiting Inside for Public Transit	Other	

Estimates of Health Risks

- All risk results currently at the census tract level
- Assume a 70-year lifetime exposure based on annual exposure concentrations

- Cancer
  - Combined cancer risk based on exposure to all modeled air toxics
  - Presented as risk “in-1 million”

- Noncancer Hazards
  - Target organ specific (14 total) hazard index
    - respiratory, neurological, liver, developmental, reproductive, kidney, ocular, endocrine, hematological, immunological, skeletal, spleen, thyroid, and whole body

Toxicity Values

Cancer

Source	Value
U.S. EPA Integrated Risk Information System (IRIS)	Inhalation Unit Risk (IUR)
California Environmental Protection Agency (CalEPA)	IUR

Chronic Noncancer

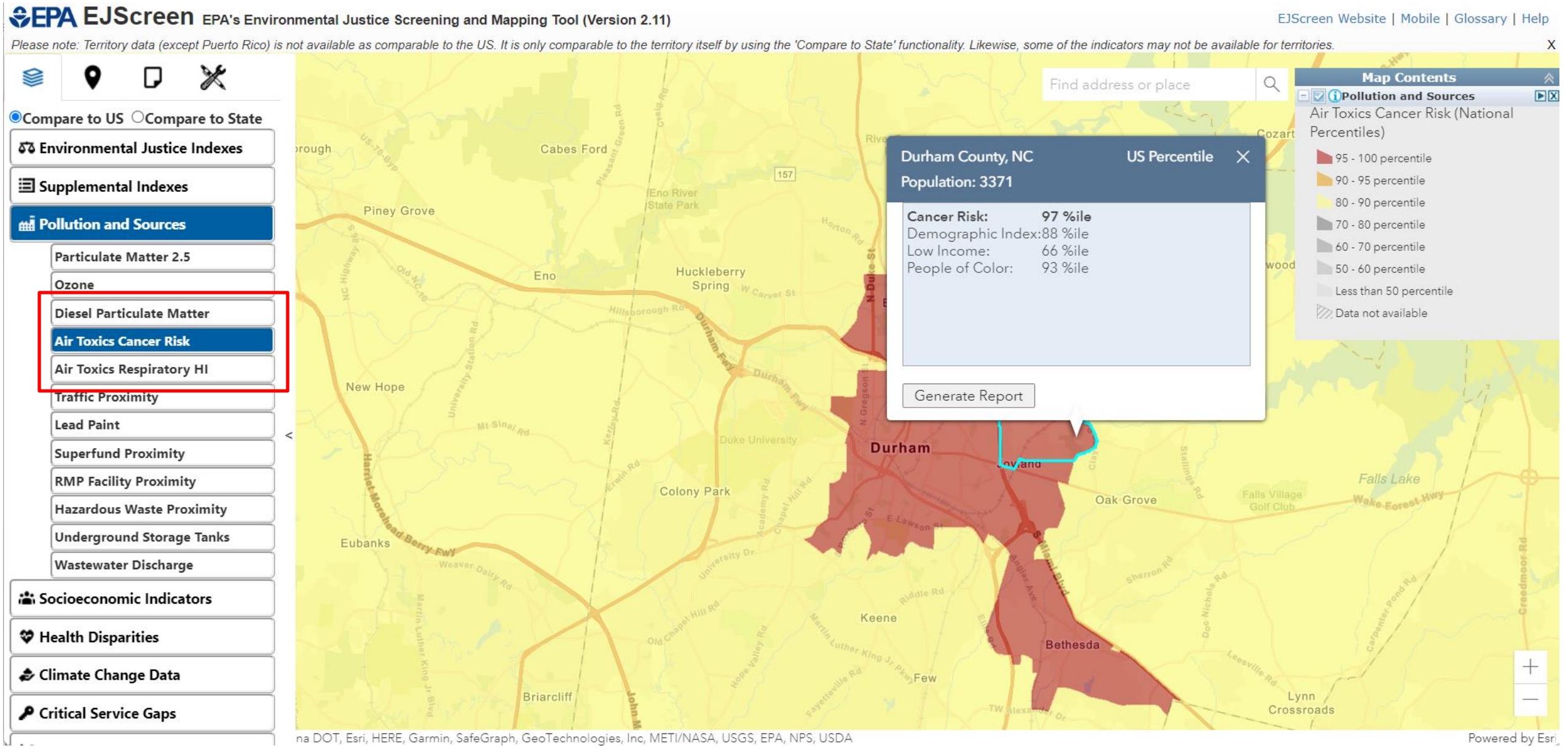
Source	Value
IRIS	Reference Concentration (RfC)
U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry (ATSDR)	Minimal Risk Level (MRL)
CalEPA	Reference Exposure Level (REL)

Cancer Risk and Noncancer Hazard Calculations

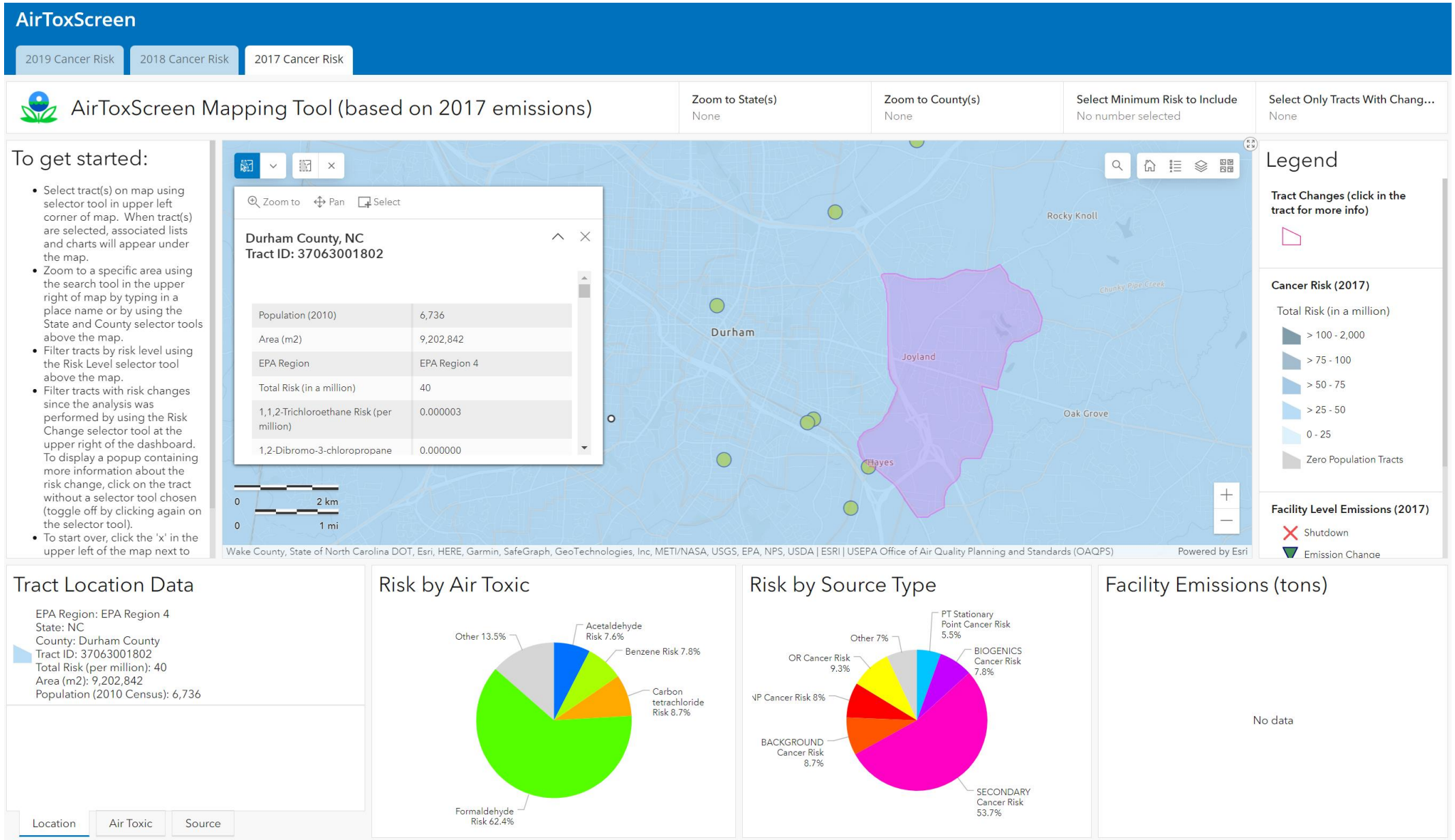
- Cancer
  - Cancer Risk = Exposure Concentration x URE
    - Multiplied by 1E6 to convert to “in-1 million”
  - Summed across all pollutants to estimate a total cancer risk

- Noncancer
  - First calculate pollutant specific Hazard Quotient (HQ)
    - HQ = Exposure Concentration / RfC
  - Then calculate target organ-specific hazard index (TOSHI) by summing HQs that affect the same target organ or organ system

AirToxScreen Data in EJScreen



AirToxScreen Mapping Tool



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Questions?

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epa.gov/airtoxscreen

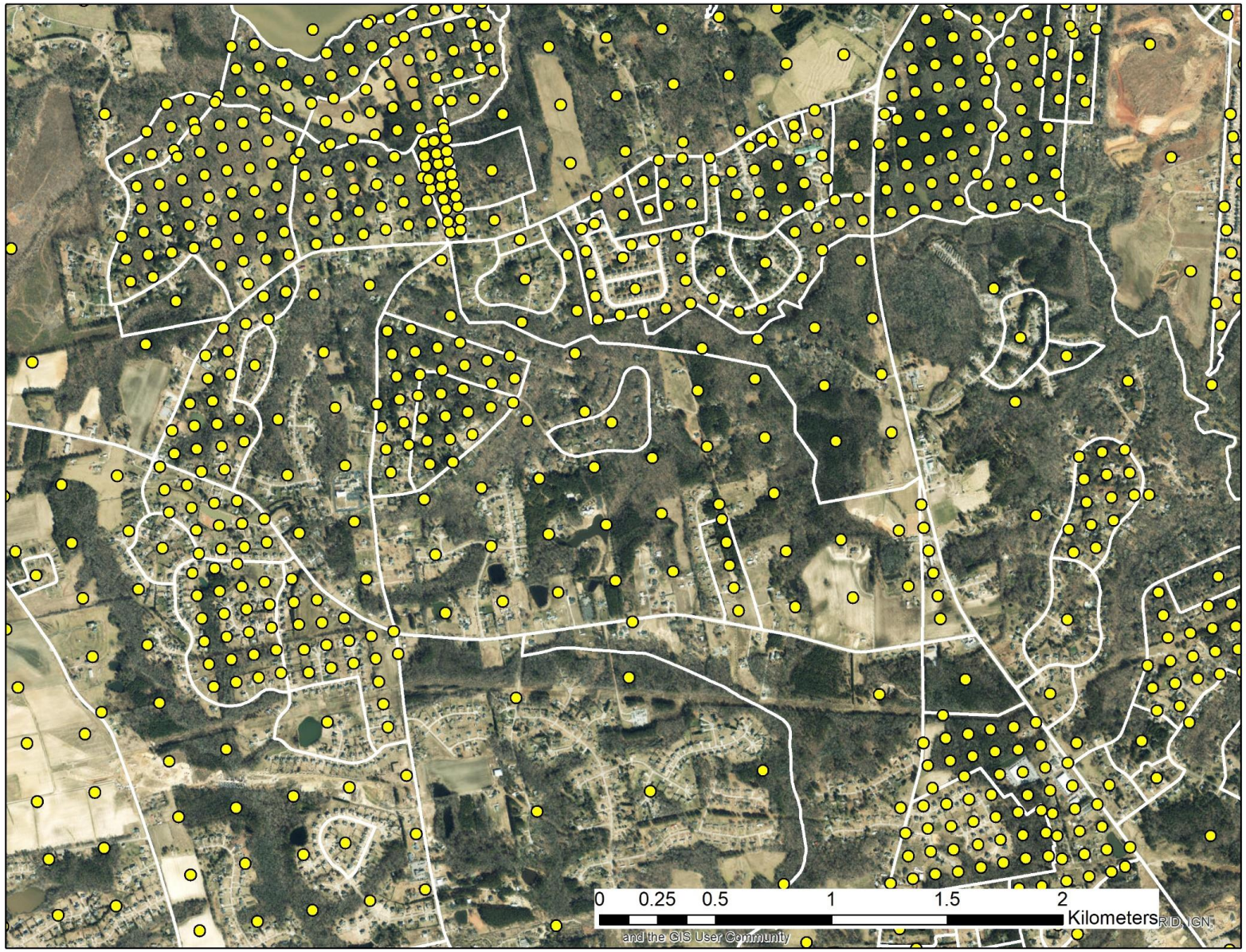
APPENDIX SLIDES

New Block Receptor Strategy for 2020 ATS

- For each census block, create a grid of receptors within the block
  - Resolution 25 m to 10 km depending on block size
  - Exception: blocks less than 500 x 500 m or less than 5 receptors at 25 m resolution will use the centroid to represent the block
  - Better characterizes air quality concentrations in larger census blocks
- Account for ambient air
  - If a receptor < 30 m from a source at a point facility, port, or airport then that receptor will not be deemed representative of ambient air
    - 30 m distance subject to change for final 2020 modeling
    - Receptor concentration will be ignored for the facility being modeled
    - Exception: If census block is represented by a single receptor, that receptor will be included for the facility
  - Bringing in fence-line/property boundary information
    - Within boundary, receptor ignored for facility with exception of census block centroid

Census blocks with centroids

Census blocks with grids



Toxic Release Inventory

- The Toxics Release Inventory (TRI) tracks the management of 770 individually listed chemicals and 33 chemical categories that may pose a threat to human health and the environment.
- U.S. facilities that report to TRI include facilities involved in manufacturing, metal production, mining, electric power generation, chemical manufacturing, and hazardous waste treatment.
- Facilities that meet criteria for required reporting to TRI annually provide information on qualifying chemicals released to the environment and/or managed through recycling, energy recovery and treatment at their facility.
- The NEI uses TRI facility stack and fugitive air emissions data for any available HAP that isn't reported to EIS by an SLT for that facility for a reporting year.

HAP Augmentation

- EPA's HAP augmentation approach is based on reported CAP data
  - VOC to organic HAP
  - PM for metal HAP
- Emissions of each HAP are calculated as a percentage of the reported pollutant, given an assigned profile.
- Profiles are assigned as specifically as possible based on source type

- Example: VOC is reported for a pulp and paper wood-fired dryer.

Profile 30700626 Input Pollutant = VOC

Output Pollutant Description	Multiplication Factor
Formaldehyde	0.060000
Acetaldehyde	0.036875
Methanol	0.036875
Acrolein	0.009375
Phenol	0.004938
Toluene	0.003688
Xylenes (Mixed Isomers)	0.003625
Benzene	0.002938
Propionaldehyde	0.002625
Methylene Chloride	8.75E-04
Styrene	3.56E-04

Chromium Speciation

- Chromium emissions can either be reported as:
  - Total chromium (including TRI chromium air release information), or
  - Under separate pollutant codes for Hexavalent Chromium and Trivalent Chromium

- Hexavalent Chromium is a potent carcinogen and evaluated in AirToxScreen, while Trivalent Chromium has no chronic health benchmark for cancer or noncancer effects and is not included in AirToxScreen.

- If Total Chromium is reported, we speciate into Hexavalent Chromium and Trivalent Chromium using profiles in EIS (similar to HAP augmentation process) where Total Chromium is the input pollutant and ratios for Hexavalent Chromium and Trivalent Chromium.
  - Profiles are dependent on SCC or NAICS or facility-specific information and are based on measurements.
  - If there isn't an applicable profile for total chromium emissions, a default average profile 34% hexavalent chromium is applied.