A Comparison of Hazardous Air Pollutant Concentrations and Emissions in El Paso, Texas and Camden, New Jersey

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Urban Air Toxics Monitoring Program (UATMP)

- Since 1984, EPA has been measuring air toxic concentrations in urban areas around the country
- Of the seventy UATMP compounds, 42 are listed as hazardous air pollutants (HAPs)
- Samples are typically collected every 12 days, but some programs opt to collect samples every 1-, 3-, or even 6-days.

Ambient Monitoring Data End Purposes

- Assess air quality trends in a specific location
- Validate emissions modeling exercises
- Identify emissions sources

National Emissions Inventory (NEI)

- EPA also initiates the compilation of a triennial HAP emissions inventory for the entire country

- There are two types of anthropogenic emission source types in the NEI:
  1) Stationary sources (Point and nonpoint)
  2) Mobile sources (onroad and nonroad)

- The NEI for HAPs has currently three baseyears: 1993, 1996, and 1999.

Emissions Data End Purposes

- Assess air emission trends in a specific location
- Validate emissions modeling exercises
- Identify areas for ambient monitoring
- Identify potential shortfalls in sampling methods

Emissions Inventory and Air Quality Data

- Much work has been done by EPA to determine the atmospheric fate of air toxic compounds emitted from stationary and mobile sources (http://www.epa.gov/ttn/atw/)
- Ambient air toxic monitors are strategically located around these emission sources to quantify this relationship
- However…

Emissions Inventory and Air Quality Data

- **…the exact mathematical relationship between emissions and concentrations is not well defined, as various chemical and physical mechanisms, such as chemical transformation and wind and temperature parameters, may affect the downwind measured concentration**

National Air Toxics Assessment (NATA)

- The NATA was designed to help EPA, state/local/ tribal agencies, and the public to better understand the air toxics problem in the United States
- NATA used the 1996 NEI for HAPs to model 33 selected HAPs. Modeled concentrations were compared to ambient monitoring data

National Air Toxics Assessment (NATA)

- **A subset of seven HAPs were further analyzed. Modeled concentrations for six of these HAPs ranged from one-half to as much as one-sixteenth underestimation of the ambient data**

- **One possible reason proposed by EPA for this underestimation is that emission sources may be missing in the emissions inventory (http://www.epa.gov/ttn/atw/nata/draft6.html#secV.A)**

NEI and UATMP

- **Monitoring sites in El Paso, Texas (EPTX) and Camden, New Jersey (CANJ) participated in the 1996 and 1999 UATMPs.**
- **For both urban areas, HAP emissions inventory source data (stationary and mobile) are also available for the same years.**

Purpose of this paper

- To provide a comparison of emissions strength and measured concentrations for each of the sites
- To perform a HAP data validation analysis between the emission inventories and the ambient monitoring data

Monitoring Site Information

Comparison Parameter	CANJ	EPTX
AIRS Site Code	34-007-0003	48-141-0055
Location Setting	Residential	Commercial
Land Use Classification	Suburban	Urban
Estimated Traffic Count	62,000	3,790
Population w/10 miles	2,113,778	423,488
Closest NWS Station (WBAN ID)	Philadelphia (94732)	El Paso Intl (23044)

Camden, New Jersey (CANJ)

El Paso, Texas (EPTX)

Concentration and Emissions Analysis

Concentration Analysis

- At CANJ, only acrolein, chloroform, styrene, and 1,1,1-trichloroethane significantly decreased from 1996 to 1999.
- At EPTX, only bromomethane (i.e., methyl bromide), propionaldehyde, and 1,1,1-trichloroethane significantly decreased from 1996 to 1999

Emissions Analysis

- At CANJ, stationary sources increased from 1996 to 1999, while mobile emissions decreased.
- As with the ambient data, styrene, acrolein, and 1,1,1-trichloroethane emissions also experienced total county-level emission decreases

Emissions Analysis

- At EPTX, stationary and mobile onroad emission sources decreased from 1996 to 1999, while mobile nonroad emissions increased
- As with the ambient data, propionaldehyde and 1,1,1-trichloroethane emissions also experienced total county-level emission decreases

Back Trajectory Analysis

Back Trajectory Analysis

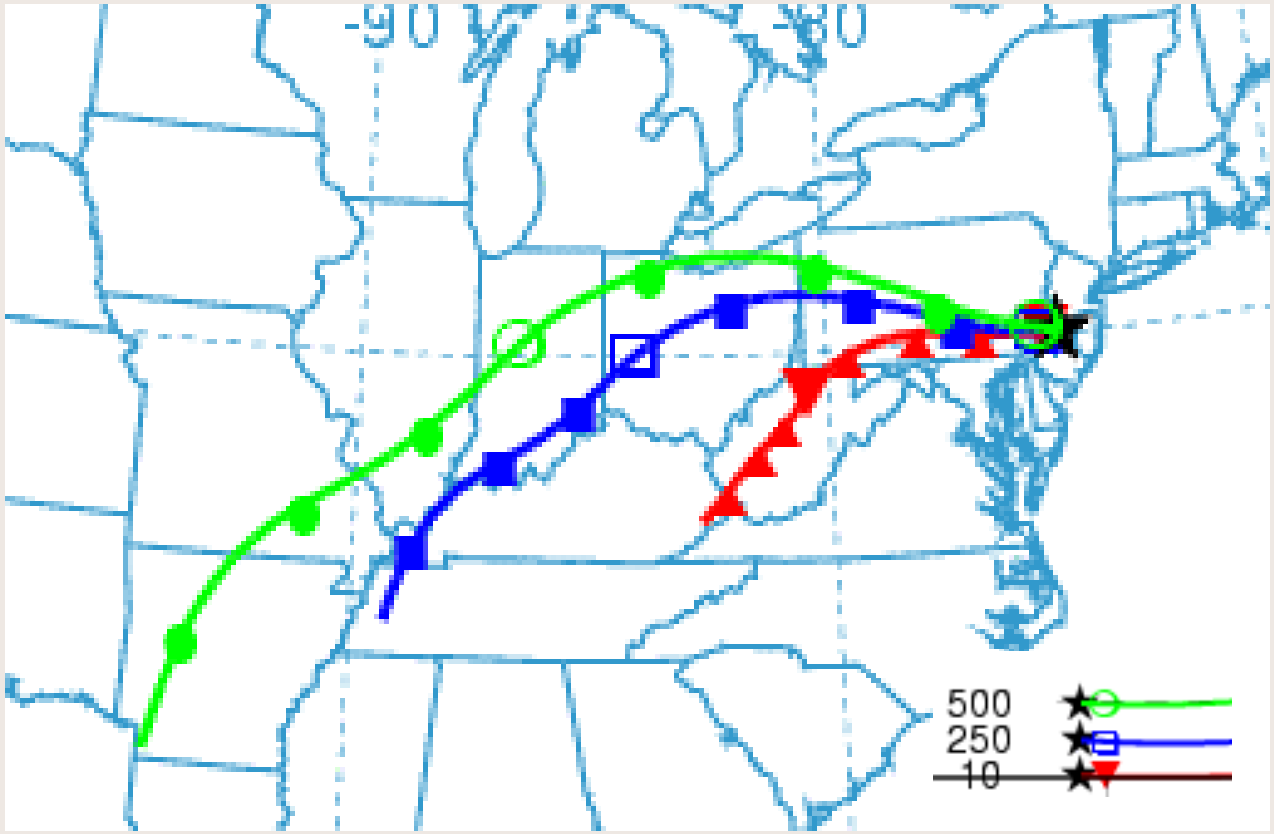
- 24-hour back trajectories were constructed for all sampling days (1996 and 1999) using HYSPLIT.
- The origins of the air parcels in relation to the monitoring site were classified by regimes using the standard 8-point compass directions: north, northeast, east, southeast, south, southwest, west, and northwest

Back Trajectory Analysis

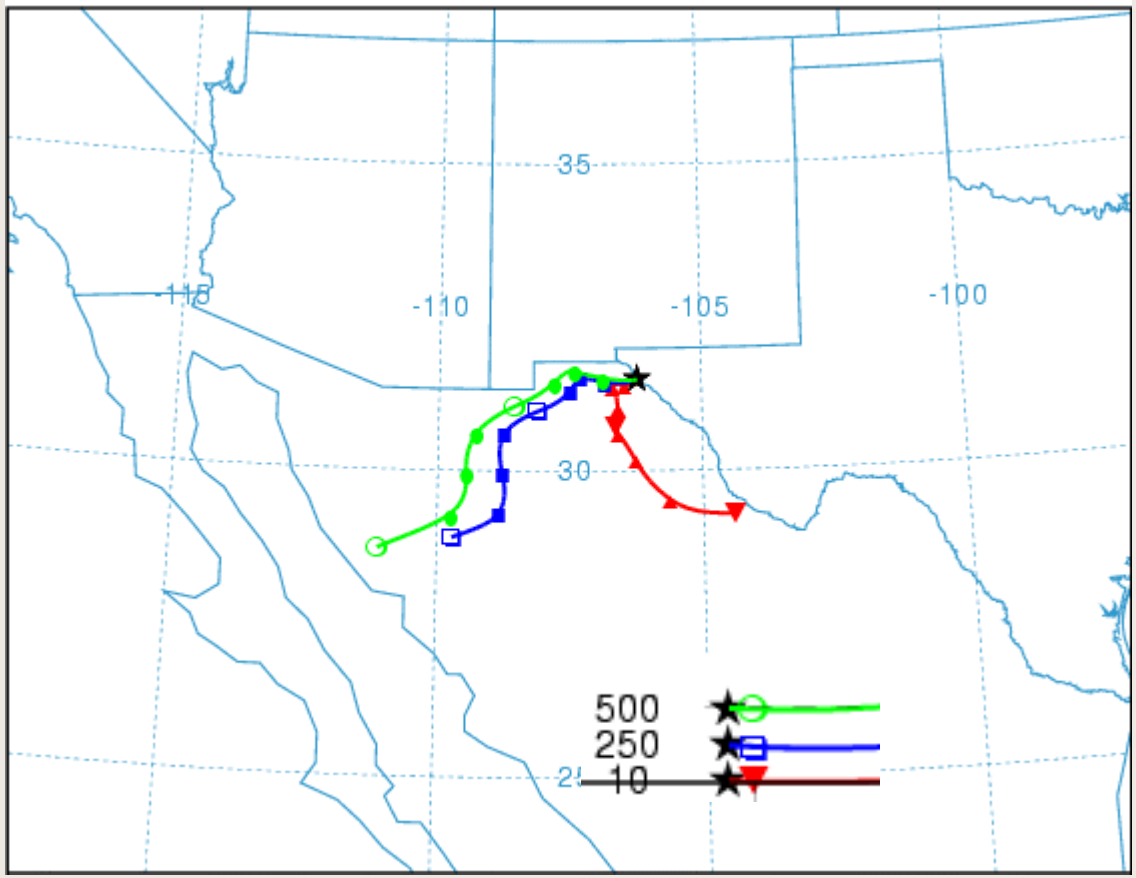
10 HAPs of interest were selected for this analysis:

- **Acetaldehyde, benzene, formaldehyde, and tetrachloroethylene were HAPs of interest from the NATA study**
- **Toluene, ethybenzene, and xylenes (along with benzene) form the BTEX compounds**
- **Acetonitrile, acrolein, and trichloroethylene each measured high concentrations at each site**

Back Trajectory Analysis – July 5, 1999



Back Trajectory Analysis – June 23, 1999



Back Trajectory Analysis - Results

Average total UATMP concentration (ppbv) by regime

Site	N	NE	E	SE	S	SW	W	NW
CANJ	18.6	17.9	15.5	17.4	14.6	12.8	21.7*	13.8
EPTX	31.1	15.1	58.4	32.4	24.9	20.5	42.3	64.7*

* = highest average concentration

HAP Validation Analysis

HAP Validation Analysis

- What does it mean if the ambient monitoring data identifies a particular HAP, but the emissions inventory data does not contain this HAP?
- What does it mean if the emissions inventory contains emissions for a particular HAP, but it is not detected in the ambient monitoring data?

HAP Validation Analysis – Missing HAP Emissions

- **Of all the UATMP HAPs sampled for, only bromoform was not inventoried in either county. All other UATMP HAPs measured had either a stationary and/or mobile source within the county.**

- **In 1996, bromoform was detected in 73% of CANJ samples and 59% of EPTX samples. Bromoform was not detected in 1999 at either site.**

HAP Validation Analysis – Missing HAP Emissions

- For CANJ, the closest bromoform emissions source, according to the NEI, is located to the northeast at a landfill 66 miles away. Approximately 100 miles away, two more landfills are located to the southwest in Maryland.

- For EPTX, the closest bromoform emissions source, is located to the east at a portland cement manufacturing facility over 500 miles away.

HAP Validation Analysis – Unmeasured Ambient HAPs

- For CANJ, 5 of 32 UATMP HAPs were not detected during the 1996 sampling season; in 1999, 15 of 42 were not detected.
- For EPTX, 8 of 32 UATMP HAPs were not detected during the 1996 sampling season; in 1999, 14 of 42 were not detected.

HAP Validation Analysis – Unmeasured Ambient HAPs

- For CANJ, all of the non-detect compounds at CANJ, except bromoform and chloroprene, had an emitting point source within 50 miles.
- For EPTX, all but five compounds (bromoform, chloroprene, 1,3-dichloropropene, methyl methacrylate, and 1,1,2-trichloroethane) had an emitting point source within 50 miles.

HAP Validation Analysis – Unmeasured Ambient HAPs

- For the non-detect compounds which didn't have an emitting point source within 50 miles, this would suggest good agreement with the ambient monitoring data.

HAP Validation Analysis – # of Facilities within 50 miles

Compound	CANJ	EPTX
Chlorobenzene	55	5
Chloroethane	NA	4
Chloroform	NA	5
Dibromoethane, 1,2-	38	4
Dichloroethane, 1,1-	38	4
Dichloroethane, 1,2-	59	5
Dichloropropane, 1,2-	40	4
Dichloropropene, 1,2-	2	NA
Ethyl Acrylate	7	NA
Methyl Methacrylate	15	0
Tetrachloroethane, 1,1,2,2-	39	4
Trichloroethane, 1,1,2-	2	NA
Vinyl chloride	51	5

HAP Validation Analysis – Unmeasured Ambient HAPs

For the remaining non-detect compounds (vinyl chloride, etc.), this might raise three possible HAP validation flags:

- **The sample monitor may not be truly downwind of the emissions source;**
- **The sample monitor may be too far away from emission sources for these non-detected compounds;**
- **Possible incorrect inclusion of a HAP in the emissions inventory**

Summary and Conclusions

Summary and Conclusions

- **Ambient concentration and emissions information data for similar HAPs were analyzed for two monitors that participated in EPA's UATMP for the 1996 and 1999 sampling season: CANJ and EPTX**

- **A concentration trends analysis at CANJ showed that acrolein, chloroform, styrene, and 1,1,1-trichloroethane significantly decreased from 1996 to 1999**

Summary and Conclusions

- NEI data also showed a decrease in Camden County emissions for acrolein, styrene, and 1,1,1-trichlorethane
- At EPTX, bromomethane, propionaldehyde, and 1,1,1-trichloroethane concentrations significantly decreased from 1996 to 1999

Summary and Conclusions

- NEI data also showed a decrease in El Paso County emissions for propionaldehyde and 1,1,1-trichloroethane
- Total HAP concentrations were highest when air originated to the west of CANJ and to the northwest of EPTX.

Summary and Conclusions

- **Bromoform emission sources may be underestimated surrounding the CANJ and EPTX monitors.**
- **However, the emissions inventory surrounding the EPTX monitor (close to the Mexican border) is incomplete, as HAP emissions data from Mexico is unavailable.**

Summary and Conclusions

- **For the non-detects that have an emission point source within 50 miles of the monitor, this might raise questions as to the sampling analysis and/or the incorrect inclusion of a HAP in the emissions inventory**

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Questions or Comments?