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Air Pollutant Patterns and Human Health Risk following the East Palestine, Ohio, Train Derailment

Albert Presto

Oladayo Oladeji, Mariana Saitas, Toriq Mustapha, Natalie M.
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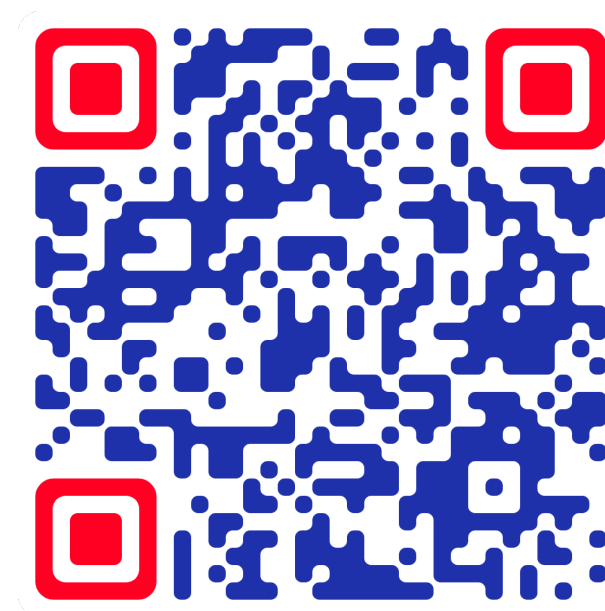


Supporting Info (1) »

SUBJECTS: [Aromatic compounds](#), [Atmospheric chemistry](#), [Computer simulations](#), ✓



Carnegie Mellon University



Take home points

- Disasters can release a wide variety of pollutants into the environment. This can challenge traditional measurement techniques.
- New and emerging techniques offer high chemical specificity and fast response times that enable detailed sampling.
- Application of novel measurement techniques can create analytical challenges when results need to be communicated with speed and precision.

Our sampling was informed by Hazard Quotients calculated from EPA data

Chemicals (CAS#)	EPA Reported Concentrations		Calculated Hazard Quotient (HQ) for East Palestine (OH)		HQ due to "Normal" Ambient Levels in Counties Across USA, Counties in Ohio, and in Columbiana County (OH)				
	Median (mg/m³) in East Palestine (OH) Feb 2023	Highest (mg/m³) in East Palestine (OH) Feb 2023	HQ for median in East Palestine (OH) Feb 2023	HQ for highest in East Palestine (OH) Feb 2023	HQ for median county in USA (EPA 2019 AirToxScreen)	HQ for highest county in USA (EPA 2019 AirToxScreen)	HQ for median county in Ohio (EPA 2019 AirToxScreen)	HQ for highest county in Ohio (EPA 2019 AirToxScreen)	HQ for Columbiana County, Ohio (EPA 2019 AirToxScreen)
1,1,2-Trichloroethane (79-00-5)	<0.00014	0.00029	<0.7	1.5	0.00	0.04	0.00	0.00	0.00
1,3-Butadiene (106-99-0)	0.000082	0.00053	0.04	0.27	0.00	0.04	0.00	0.01	0.01
Acrolein (107-02-8)	<0.00028	0.0008	<14	40	0.44	6.32	0.42	0.81	0.44
Benzene (71-43-2)	0.00089	0.012	0.03	0.40	0.01	0.06	0.01	0.02	0.01
m,p-Xylenes (179601-23-1)	0.00078	0.097	0.01	0.97	0.00	0.03	0.00	0.01	0.00
Naphthalene (91-20-3)	<0.00014	0.0024	<0.05	8.0	0.00	0.03	0.00	0.01	0.00
o-Xylene (95-47-6)	0.00026	0.021	0.00	0.21	0.00	0.03	0.00	0.01	0.00
Trichloroethylene (79-01-6)	<0.000035	0.00053	<0.02	0.27	0.00	0.02	0.01	0.01	0.01
Vinyl Chloride (75-01-4)	0.00036	0.016	0.00	0.20	0.00	0.00	0.00	0.00	0.00

Background Information:

- Hazard Quotient (HQ) = Concentration ÷ RfC
- HQ < 1: little concern for single chemical
- HQ < 0.1: little concern for multiple chemicals
- RfC = level likely to be without appreciable risk over a lifetime
- Values below reporting limit denoted by "<"

Interpretation:

- ***Concentrations for nine of the ~50 chemicals EPA reported are higher than "normal" average levels***
- ***If they continue at these levels, they may be of health concern (especially acrolein)***

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Potential challenge: Health-relevant concentrations can be below minimum detection limits of traditional measurements

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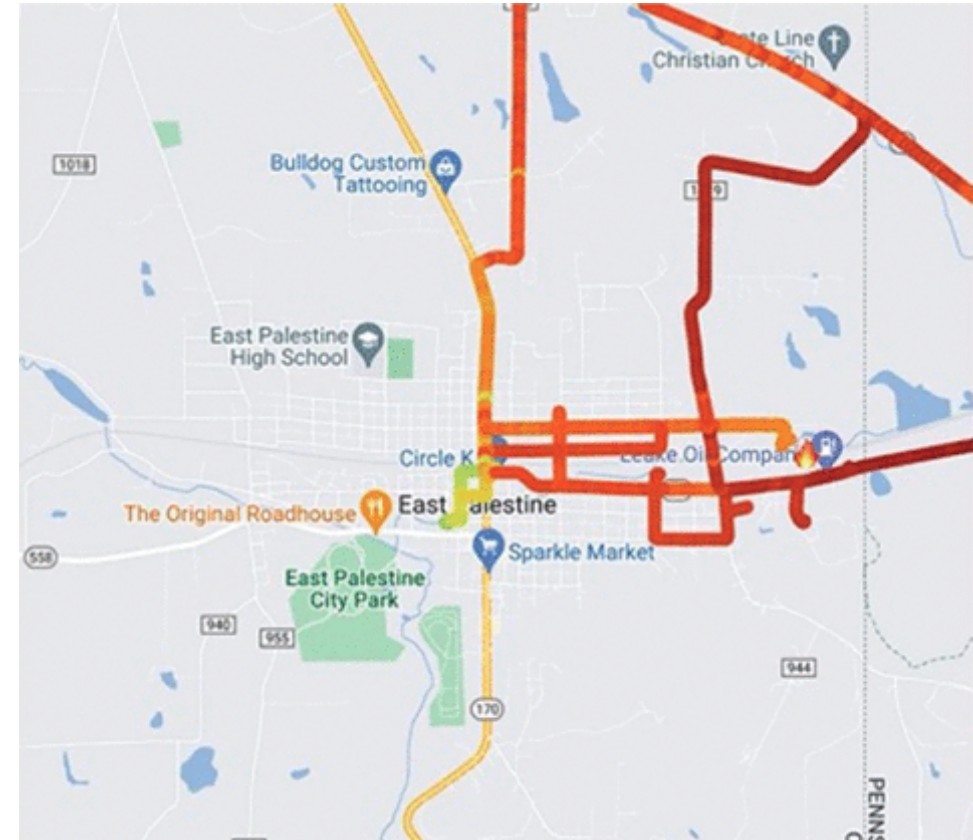
We performed mobile sampling in Feb 2023



PTR-ToF-MS

- Measures 100s – 1000s of species
- 1 second resolution
- Highly sensitive

We performed mobile sampling in Feb 2023



- Mobile sampling data for BTEX and vinyl chloride agrees with EPA measurements collected from Feb 8 – 22.
- All species are below the ATSDR minimal risk levels for intermediate (15 days -1 yr) exposures
- Mobile sampling did not detect any “hot spots”

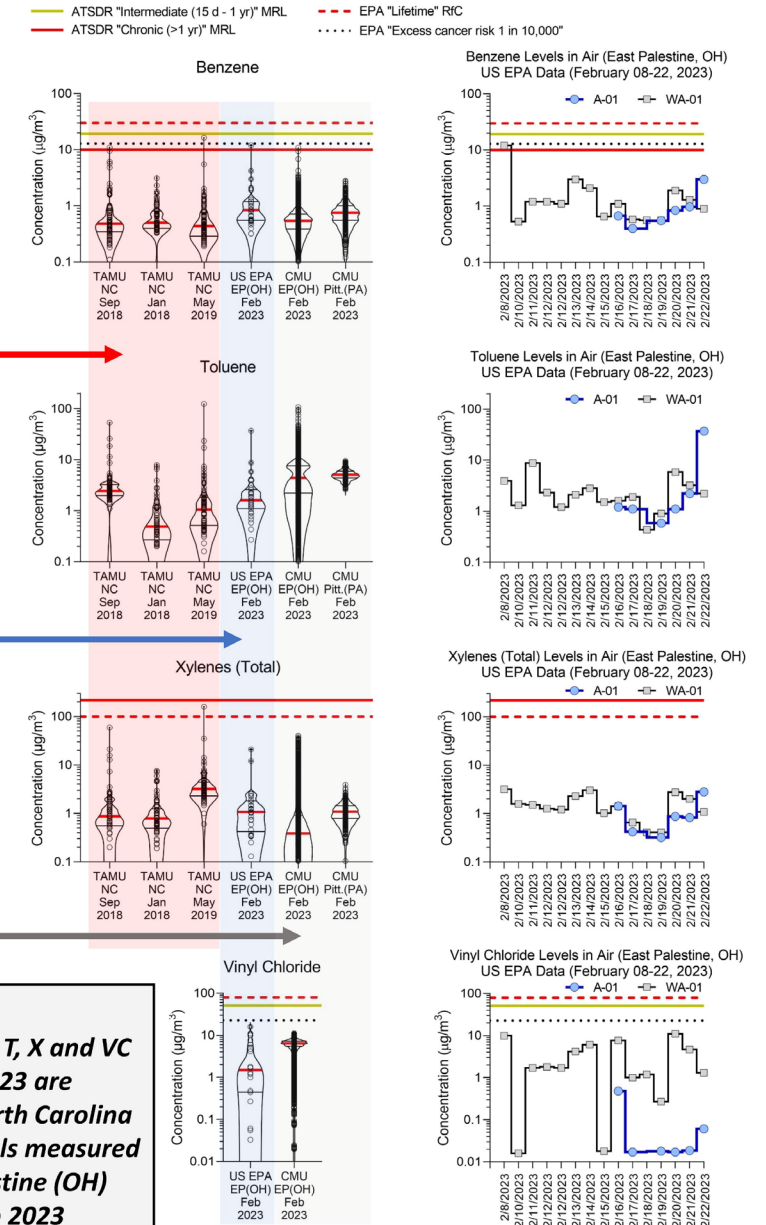
Air Toxics Data from East Palestine (OH): Comparing Across sampling Methods

**Texas A&M and
Entanglement
Technologies
Mobile Sampling
in North Carolina
(2018-2019)**

**EPA Reported
Concentrations in
East Palestine (OH)
(Feb 08-22, 2023)**

**Carnegie Mellon
Mobile Sampling in
East Palestine (OH)
& Pittsburgh (PA)
(February 2023)**

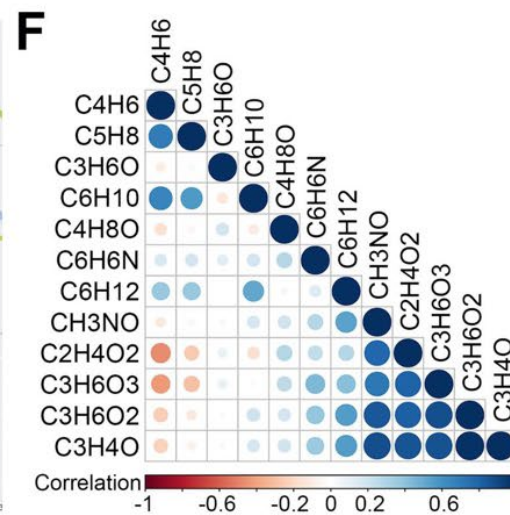
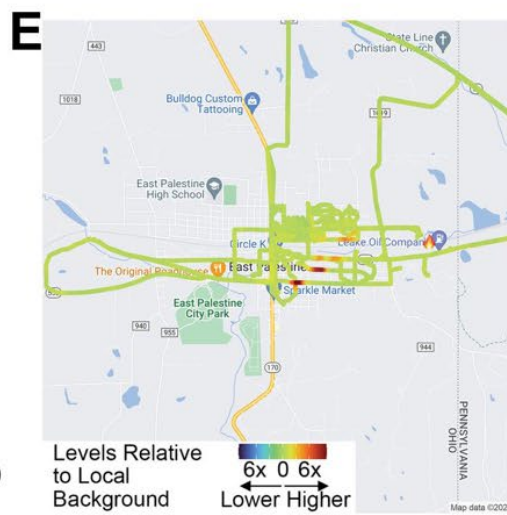
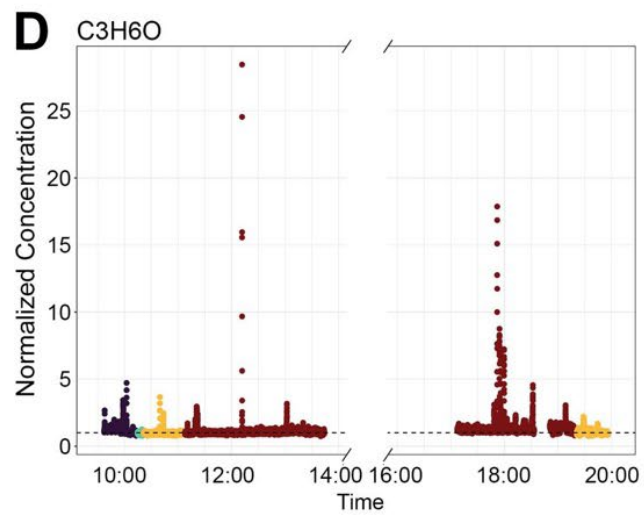
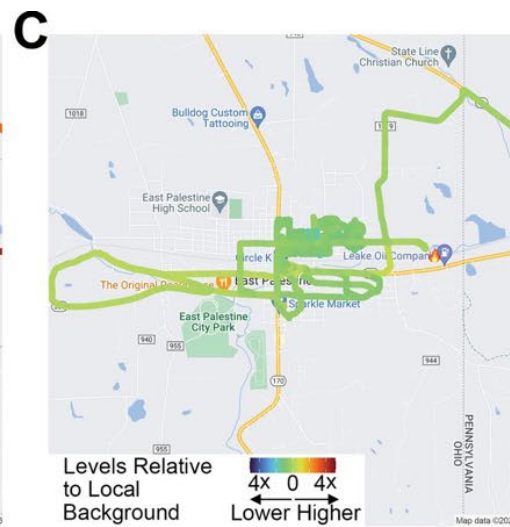
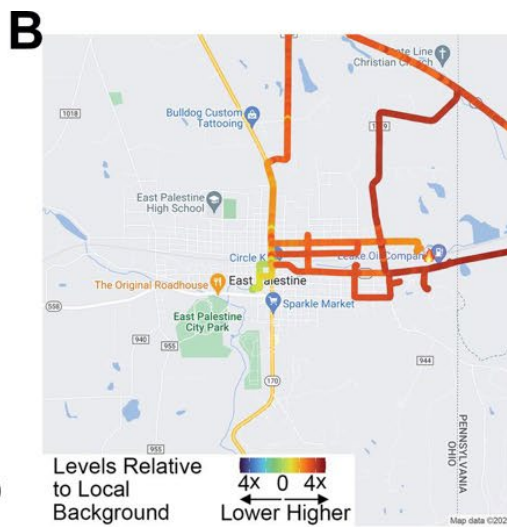
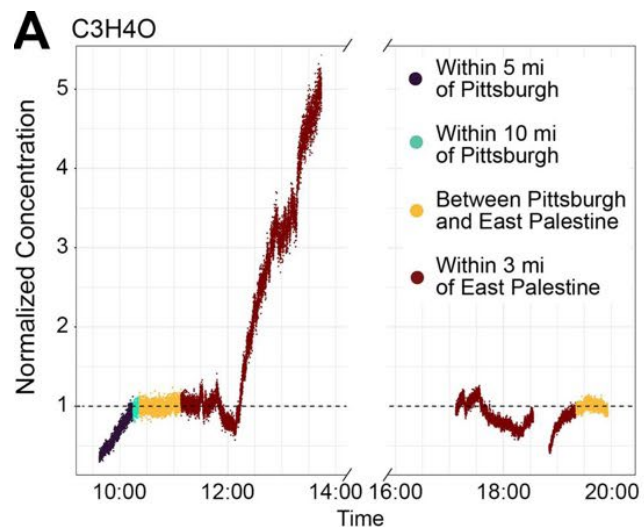
Interpretation:
EPA's measurements of B, T, X and VC in East Palestine in Feb 2023 are similar to the levels in North Carolina (2018-19) AND to the levels measured by CMU in both East Palestine (OH) and Pittsburgh (PA) in Feb 2023



- Acrolein concentrations were compared to concentrations in downtown Pittsburgh.
- Pittsburgh concentrations are typical of US cities.
- Acrolein in East Palestine varied from 5x lower to 3x higher than in Pittsburgh.
- There is geographic variation to the acrolein concentration.
- This data represents one day of sampling.



Mobile sampling generates an abundance of data



- Quantifying long-term concentrations requires repeat sampling visits
- The size of the dataset and the sampling requirements can be a challenge when reporting to communities

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