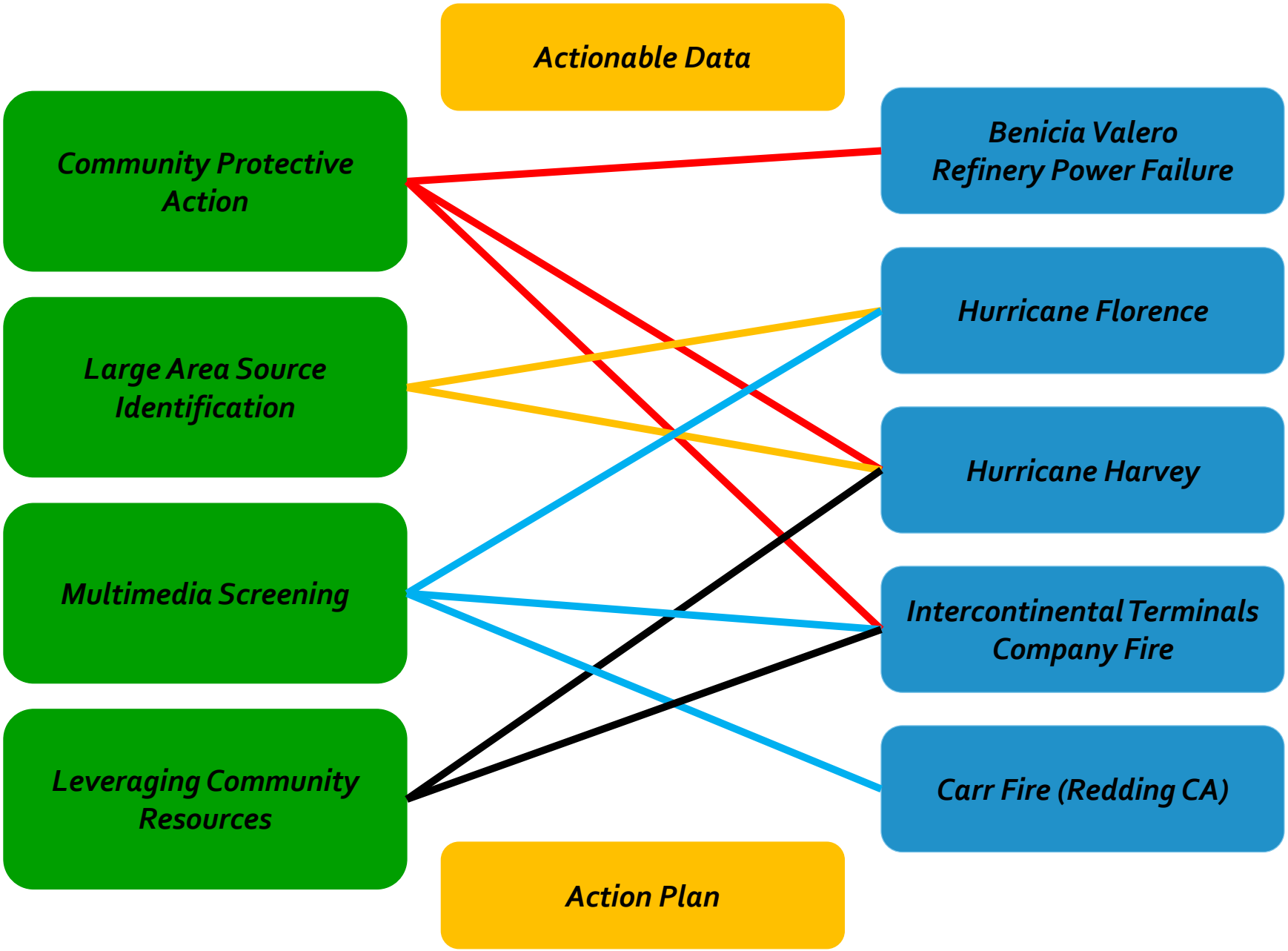
Emergency response panel discussion

Elena Craft, Ph.D.; Tony Miller, Ph.D.

entanglement TECHNOLOGIES, INC.

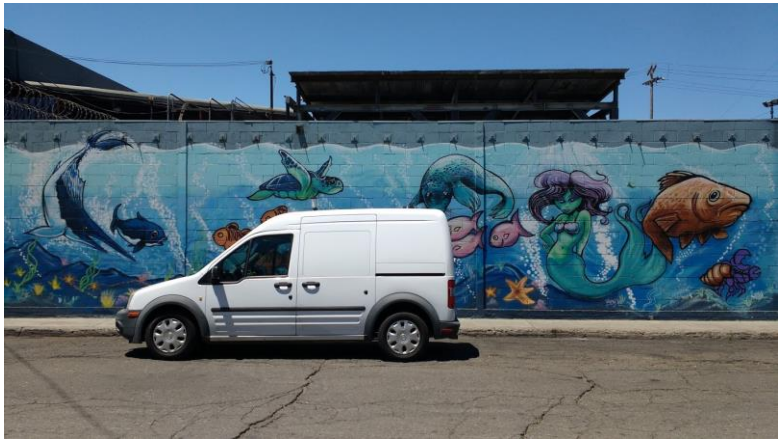
EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

Topics


Actionable Data
Community Protective Action
Large Area Source Identification
Multimedia Screening
Leveraging Community Resources
Action Plan
Benicia Valero Refinery Power Failure
Hurricane Florence
Hurricane Harvey
Intercontinental Terminals Company Fire
Carr Fire (Redding CA)

Primary Analysis Tool

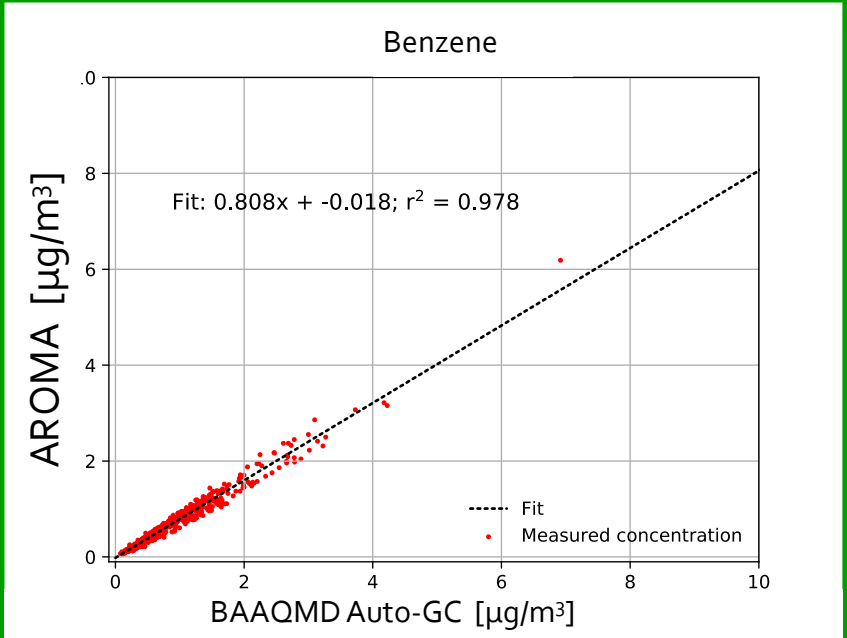
AROMA-VOC analyzer

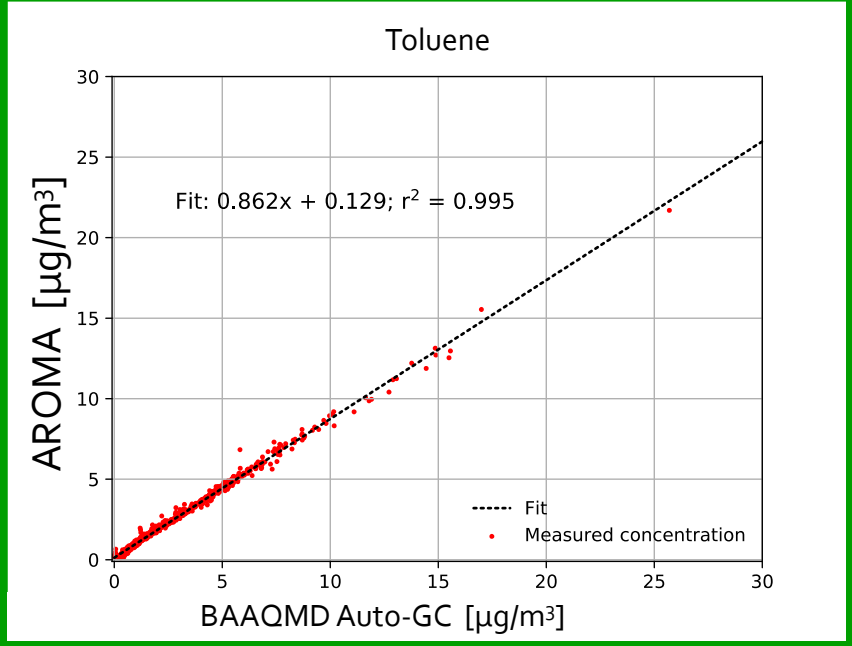


Speciated Analysis Mode		
Analytical Performance		
Species†	**MDL (1500 mL sample)***	**MDL (100 mL sample)***
Benzene	< 10 pptv (0.03 µg/m3)	< 150 pptv (0.45 µg/m3)
Toluene	< 50 pptv (0.15 µg/m3)	< 750 pptv (2.25 µg/m3)
Ethylbenzene	<100 pptv (0.45 µg/m3)	<1500 pptv (6.75 µg/m3)
Xylenes	<100 pptv (0.45 µg/m3)	<1500 pptv (6.75 µg/m3)
Trichloroethylene	< 50 pptv (0.10 µg/m3)	< 750 pptv (1.50 µg/m3)
1,2-cisDichloroethylene	< 100 pptv (0.40 µg/m3)	< 1500 pptv (6 µg/m3)
Isoprene	< 100 pptv (0.30 µg/m3)	<1500 pptv (5 µg/m3)
1,3-butadiene	<200 pptv (0.55 µg/m3)	<4 ppbv (9 µg/m3)
Acrolein	<200 pptv (0.55 µg/m3)	<4 ppbv (9 µg/m3)
Styrene	<500 pptv (2.1 µg/m3)	<10 ppbv (42 µg/m3)
Zero level drift (per analyte)	< MDL	
Analytical Precision (per analyte)††	greater of 25% of measured value or MDL	
Analytical Accuracy (per analyte)††	greater of 30% or MDL	

Extensive real-world verification

AROMA has exhibited outstanding agreement with laboratory analytical methods in multiple side-by-side studies. Shown below is comparison with an auto-GC operated by BAAQMD during a 30 day, unattended trial on ambient air.





BAY AREA AIR QUALITY MANAGEMENT DISTRICT

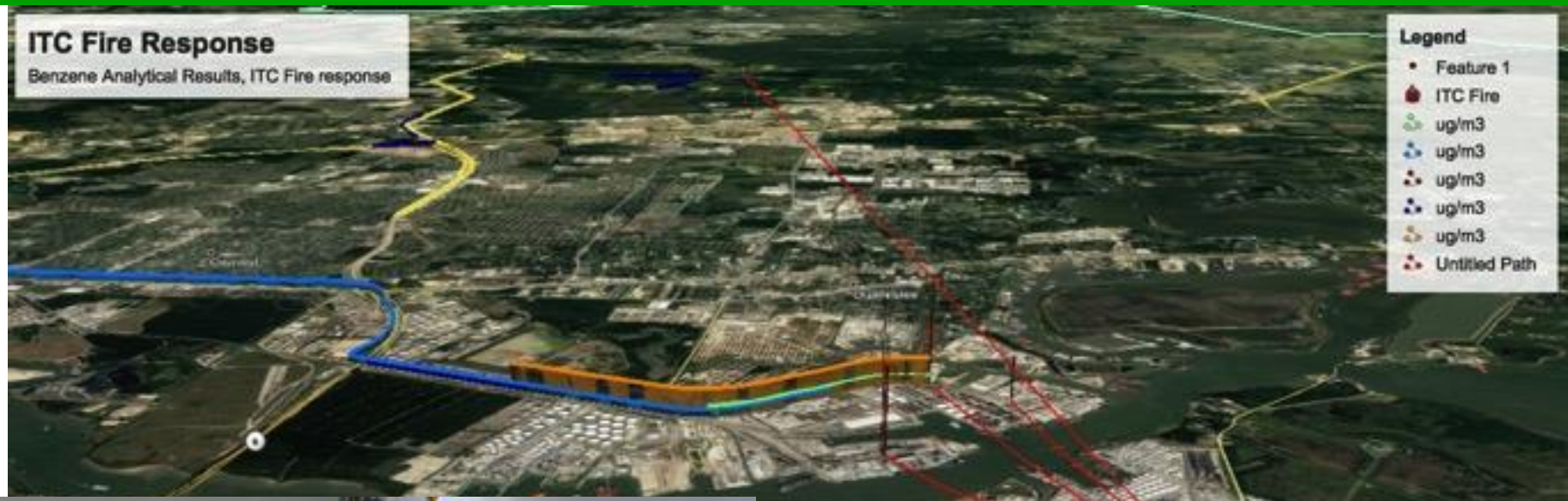
Species	Mean Conc [µg/m3]	MDL [µg/m3]	MDL [pptv]
Benzene	0.05	0.0045	1.4
Toluene	0.08	0.01	2.6
Ethylbenzene	0.07	0.10	4.4
Xylenes	0.20	0.044	10

Community Protection

- Key Policy Objectives:
  - Ensure no communities are exposed to unacceptable harms or risks of harms
  - Ensure that communities are informed in a timely and appropriate manner
- Requirements:
  - Identification of high risk/susceptibility priority locations
  - Identification of likely plume trajectories/impacts
  - Action plan to respond to elevated concentrations and communications plan
- Data Generation
  - Evaluate exposure risk at granular level
  - Deploy real-time data to update risk modeling
  - Rapidly and effectively communicate data to impacted communities

Large Scale Fire Event

Large Scale Fire Event



Power Interruption Event

Benzene Measurements performed in conjunction with BAAQMD in response to Valero Benicia uncontrolled flaring and venting.

3.3 µg/m^3

School with shelter in place order. < 0.7 µg/m^3
Data used to lift shelter in place.

Source Detection and Triage

- Policy Objectives:
  - Protect communities
    - Identify areas of potential community harm
  - Regulate emissions
    - Identify large emission events
  - Mitigate Harm
    - Focus emergency response assets on areas with greatest risk
- Triage large areas to determine if sources are present and develop phenomenological evaluation source hazard level.
- Release reports in immediate aftermath are largely uncorrelated with concentrations in nearby communities
- Widespread screening is needed to evaluate risks to communities.
- Alternative sources of information (odor reports in particular) are a valuable input to route planning and (low sample size) more correlated with concentrations than release reports (STEERS)

air ALLIANCE HOUSTON

EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

EPA won't release benzene levels collected post-Harvey; private tests show elevated levels

> Environmental groups hired a private firm after the flooding and found higher than normal levels of dangerous chemicals in the air around a refinery.

BY KIAH COLLIER, THE TEXAS TRIBUNE AND LISA SONG AND AL SHAW, PROPUBLICA
SEPT. 14, 2017 3 PM

U.S. Environmental Protection Agency (USEPA) Environmental Response Team Trace Atmosphere Gas Analyzer (TAGA) Post-Harvey Monitoring Houston, Corpus Christi, and Beaumont Areas, TX

Harvey makes landfall near Port Aransas and moves north toward Houston. The region receives over 5 feet of rain within 5 days.

City of Houston receives odor complaints. EDF coordinates with City officials to deploy mobile monitoring unit from CA.

Conference call with EPA, EDF, and City of Houston to discuss situation. Concentrations remain elevated but not as high.

EPA tells Houston Chronicle that Valero significantly underreported emissions (shortly before ProPublica article is published).

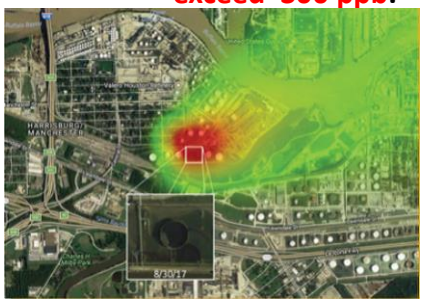
October 9, 2017

TCEQ releases a summary of EPA's monitoring results, 39 days after resident concerns.

Aug 25	Aug 27	Aug 31	Sept 4	Sept 5	Sept 6	Sept 14	Sept 15	Sept 27	Oct 9

Valero files initial report to TCEQ indicating excess benzene emissions of 6.7 pounds. Valero in daily communication with TCEQ. TCEQ never takes a single measurement.

EDF and City of Houston take independent measurements. Benzene concentrations in Manchester exceed 300 ppb.



EDF releases air quality health alert.

EDF
ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

FOR IMMEDIATE RELEASE

Contact:

Matthew Tresaugue, (713) 392-7888, mtresaugue@edf.org

Air quality remains a concern after Harvey despite claims from EPA officials

Statement from EDF's Dr. Elena Craft, senior health scientist

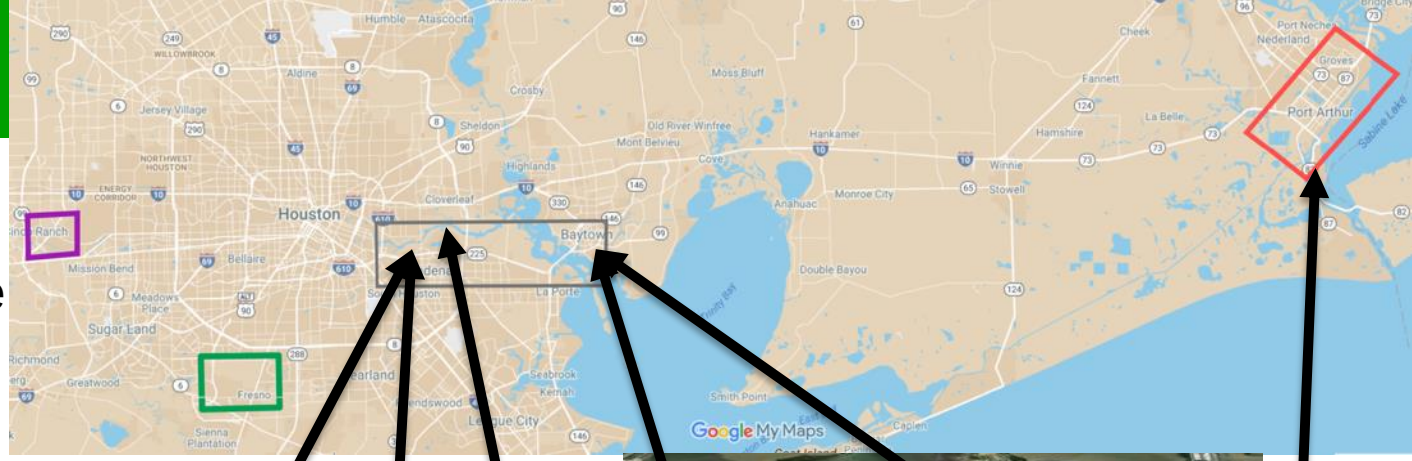
(HOUSTON – Sept. 4, 2017) The Environmental Protection Agency released a statement Sunday that "local residents should not be concerned about air quality issues related to the effects of the storm." Yet the Houston area was under alert for ground-level ozone, a lung-damaging air pollutant, for the fourth day in a row, according to the EPA's Air Now website.

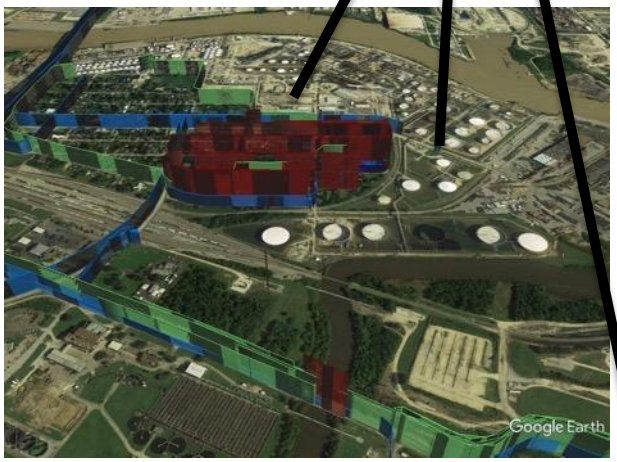
EPA takes measurements in Manchester but does not release data to public.

EPA demands that Valero release reports related to the release.

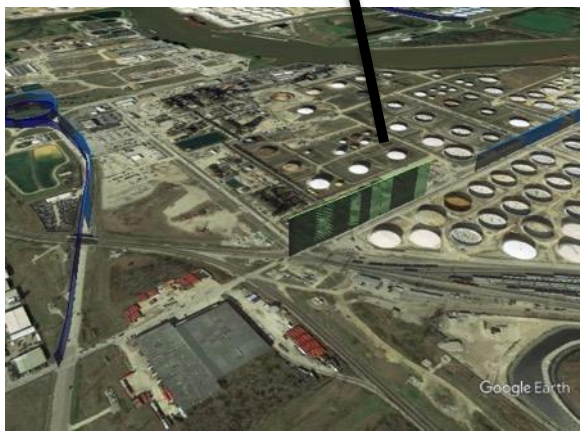
Valero files final emissions report with the state revising their emission estimate to 1881 pounds. Valero never released a public statement.

Seven significant benzene plumes were identified in exceedance of refinery fence-line standards.

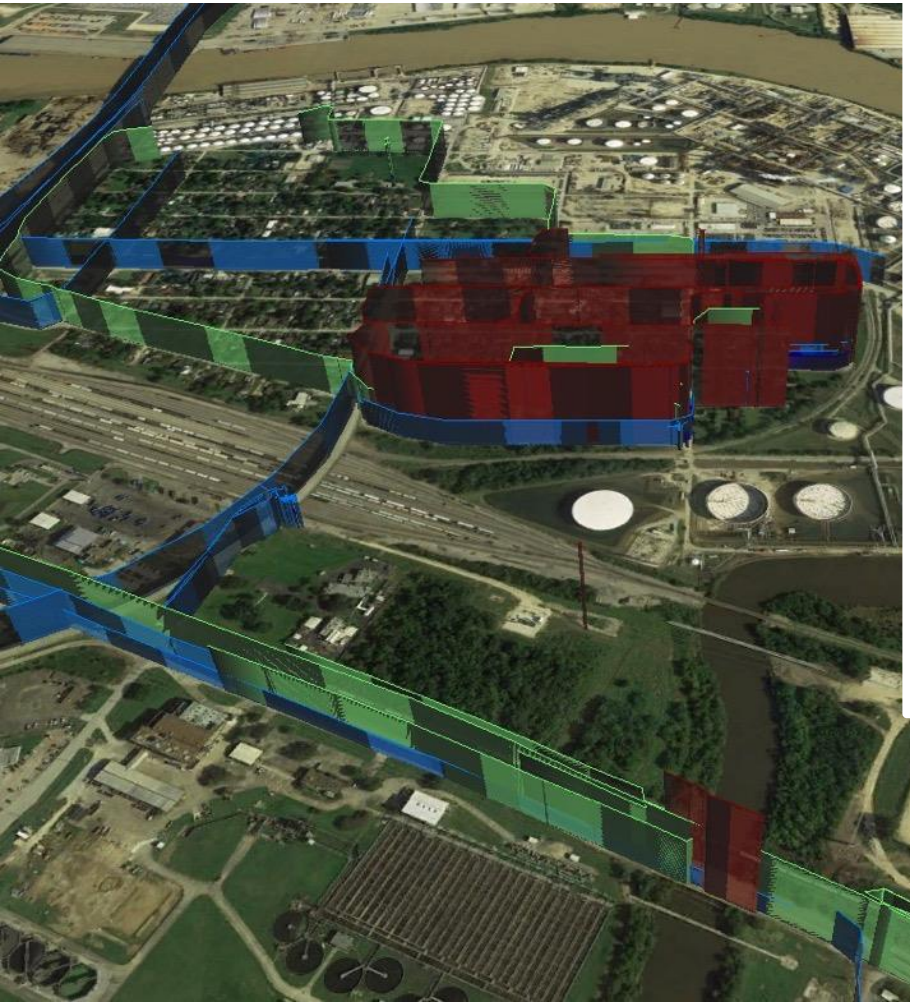


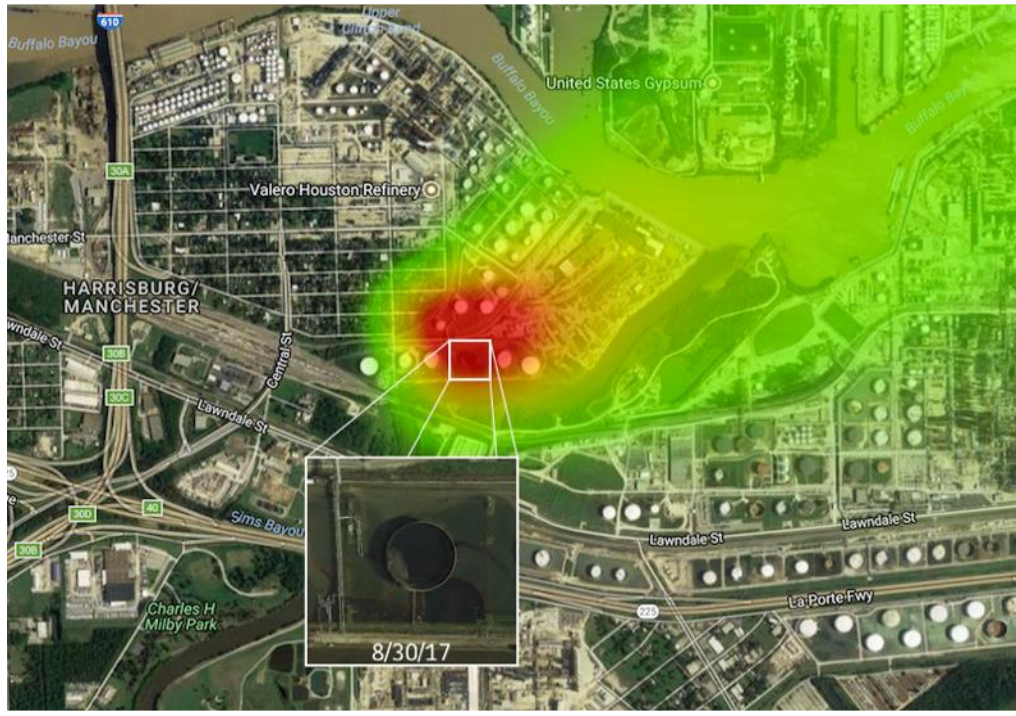


Real-time measurement allowed triage assessment of potential health impacts to direct follow on resources.



Ambient Surveys and Leak Identification

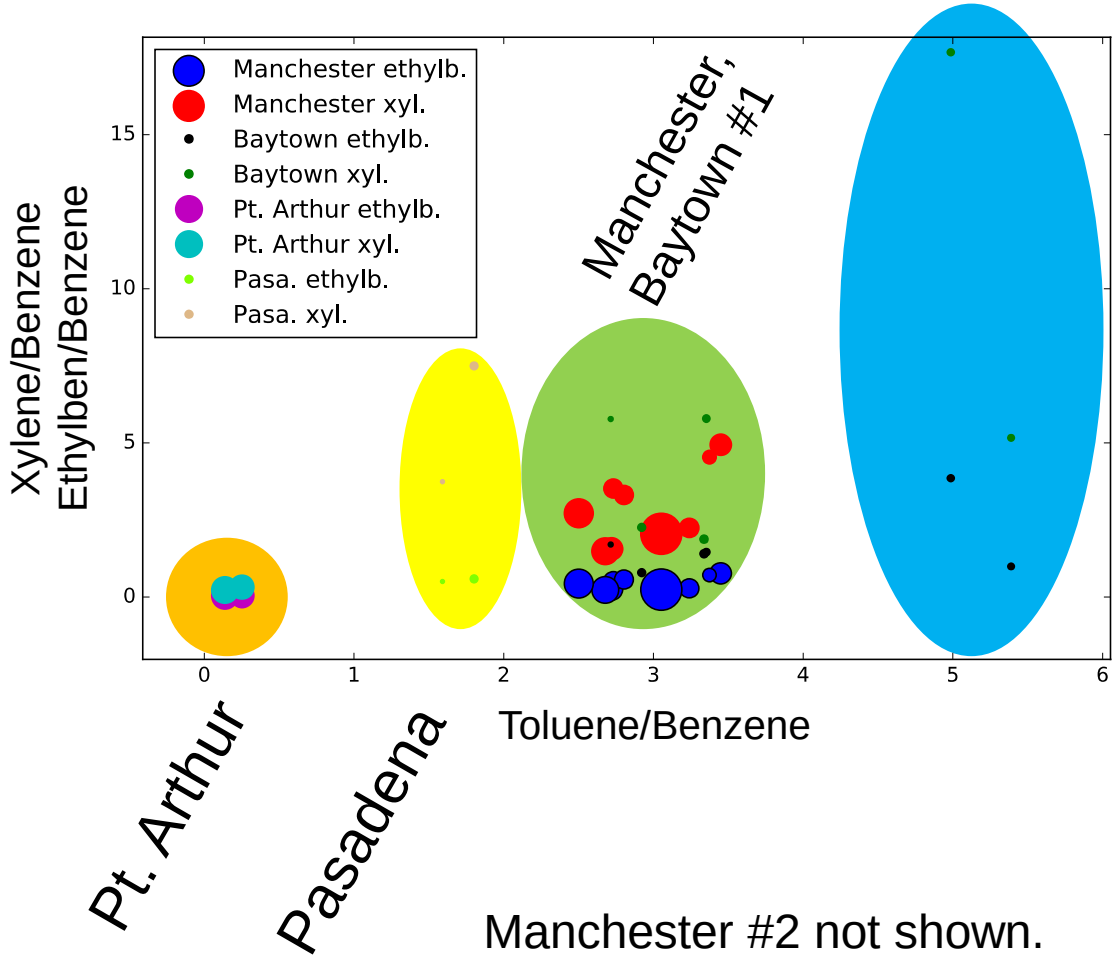




Likelihood of source origin using concentration, locations, and met data. Good agreement with subsequent satellite data

Plume Fingerprinting

- 5 of 6 plumes show distinct BTEX ratios.
- Allowed for differentiation of two overlapping plumes @ Exxon baytown



Manchester #2 not shown. Only Xylenes above ambient.

Response Planning

Houston develops tool to better monitor levels of cancer-causing benzene

Perla Trevizo | Aug. 28, 2019 | Updated: Aug. 28, 2019 5:59 a.m.

A teenage girl walks around the track of a park across the street from the Valero refinery Monday, Aug. 4, 2014, in the Manchester neighborhood of Houston.
Photo: Pat Sullivan, STF / Associated Press

C40 CITIES

Clean Air Cities: Our Commitment to Healthy Air for Every Citizen

Nine out of 10 people around the world are breathing dirty air.[1] Not only does this lead to early death and increased disease, it impacts our economies and reduces opportunities for our citizens to thrive. It is the poorest and most vulnerable communities in our cities that are most at risk.

Breathing clean air is a human right. As mayors of world-leading cities, we will not wait for others to act to protect our citizens from the devastating consequences of air pollution.

We know that air pollution and the climate crisis go hand-in-hand. Both need swift, unprecedented and collective action to remove the pollution that is harming our health and warming our planet.

The most significant causes of air pollution vary between our cities. We must take action to better understand the problem, find ways to control pollution at the source, protect people from exposure to dirty air, evaluate the health impacts and determine how all these factors are shaped by our local economy, geography, demographics and city powers.

Air pollution does not recognize municipal, regional and national borders. Clean air can only be achieved by forming strong partnerships, including between cities, with regional and national authorities, as well as with the private sector and academic institutions. We must exchange best practices and coordinate action to address the sources of pollution both within and beyond our borders or control.

Together, we will work towards a shared vision of meeting World Health Organization Air Quality Guidelines by 2030.[2] We will use all the powers at our disposal as mayors to tackle air pollution, and call on others responsible for the sources of air pollution that poison the air in our cities to match this commitment.

- August (2019) Houston announced a new toxic alert system for detecting high concentrations of benzene
- September (2019) Harris County commissioners voted to spend $11.6 million on new personnel and equipment, including air quality monitors, to increase its ability to respond to environmental emergencies. It is the most significant investment in environmental protection for the region in at least 30 years.
- September (2019) Houston announced a commitment to clean air goals at the C40 summit in Copenhagen. Goals included setting reduction targets for air pollutants, implementing strategies to address sources of air pollution within the city by 2025, and reporting annually on the city's progress.
- October (2019) TCEQ, the Texas State Environmental Agency, committed 1.5M toward the purchase of three vans with real-time, mobile air monitoring technology and three fixed air-monitoring stations. This investment comes less than two years after the then-TCEQ Chairman Bryan Shaw told lawmakers after Harvey that the agency didn't need any additional monitoring funds.

entanglement TECHNOLOGIES, INC.

Good Data for Good Decisions

Item	Frequency	Acceptance	Corrective Action
Initial Calibration	Instrument bring-up, after CCV fails, Major instrument work	5 Levels (Min) % RSD 30 with 2 compounds allowed out to 40% RSD	1. May repeat 1 point. 2. Examine Instrument 3. Repeat full calibration
Initial Calibration Verification (ICV)	After initial calibration	Recoveries within 70%-130%	1. Prepare new standard 2. Repeat initial calibration
Continuing Calibration Verification (CCV)	At the start and end of each operational day	70–130%	1. Compounds outside of 70-30 are flagged and narrated. 2. If more than 2 compounds are outside of 60-140% analysis is discarded unless it meets project needs 3. Repeat of initial calibration may be required
Laboratory Blank	After calibration standards, after very high concentrations, or when contamination present	All detections at or below MQL	1. Repeat blank until MQLs are reached. 2. Perform extended cleaning cycles
Laboratory Duplicates (Field duplicates may apply for direct sampling)	Once every batch of 20 or fewer samples	RPD within +/-25% for detections	1. Narrate exceedances 2. Investigate instrument