AQRP Monthly Technical Report

PROJECT TITLE	Novel Observations and Quantified Source Apportionment of Ozone, Particulate Matter and Contributing Precursors in the El Paso Area	**PROJECT #**	24-024
PROJECT PARTICIPANTS	Pawel Misztal, Lea Hildebrandt-Ruiz, David Sullivan, Elena McDonald-Buller, Yosuke Kimura	**DATE SUBMITTED**	2/10/2025
REPORTING PERIOD	**From:** 1/1/2025 **To:** 2/9/2025	**REPORT #**	4

A Financial Status Report (FSR) and Invoice will be submitted separately from each of the Project Participants reflecting charges for this Reporting Period. I understand that the FSR and Invoice are due to the AQRP by the 15th of the month following the reporting period shown above.

Detailed Accomplishments by Task for reporting period

Task 1:

- Analyzed wind patterns (see previous MTRs) and available data to guide mobile track design and optimization
- Discussed and optimized driving routes on modeling results (see previous MTRs and Task 2b below)
- Assembled waypoints and areas of interests (e.g. TCEQ sites, City of El Paso sites, certain sources of interests such as rail depots and warehouses onto one map including planned driving routes (Figure 1). The full map can be accessed here https://www.google.com/maps/d/u/0/edit?mid=13ewCnkAXJYB_n6KrBb7oeXLXQkUnYqQ&ll=31.7953248119333%2C-106.54676681688365&z=11
- Prepared the mobile van for measurements, secured and strapped instruments, batteries charged, and secured (3 independent circuits), inspected the van and pumped the wheels to recommended pressures.
- Booked AirBnB near UTEP for the measurement team and van's stationary measurements.
- Coordinated sighting of the UTEP site.
- Explored RV parks for potential charging of the van while taking stationary measurements overnight.
- Purchased consumables for the field.
- Perfomed practice drives on battery circuits before setting off to El Paso.
- All core and standby team members applied and received travel authorizations.
- The team schedule and logistics finalized. https://docs.google.com/spreadsheets/d/1mEcRr9zG51ok5nnde08AkZiTP3Jueps8Fm_FuG_bsb0/edit?gid=0#gid=0

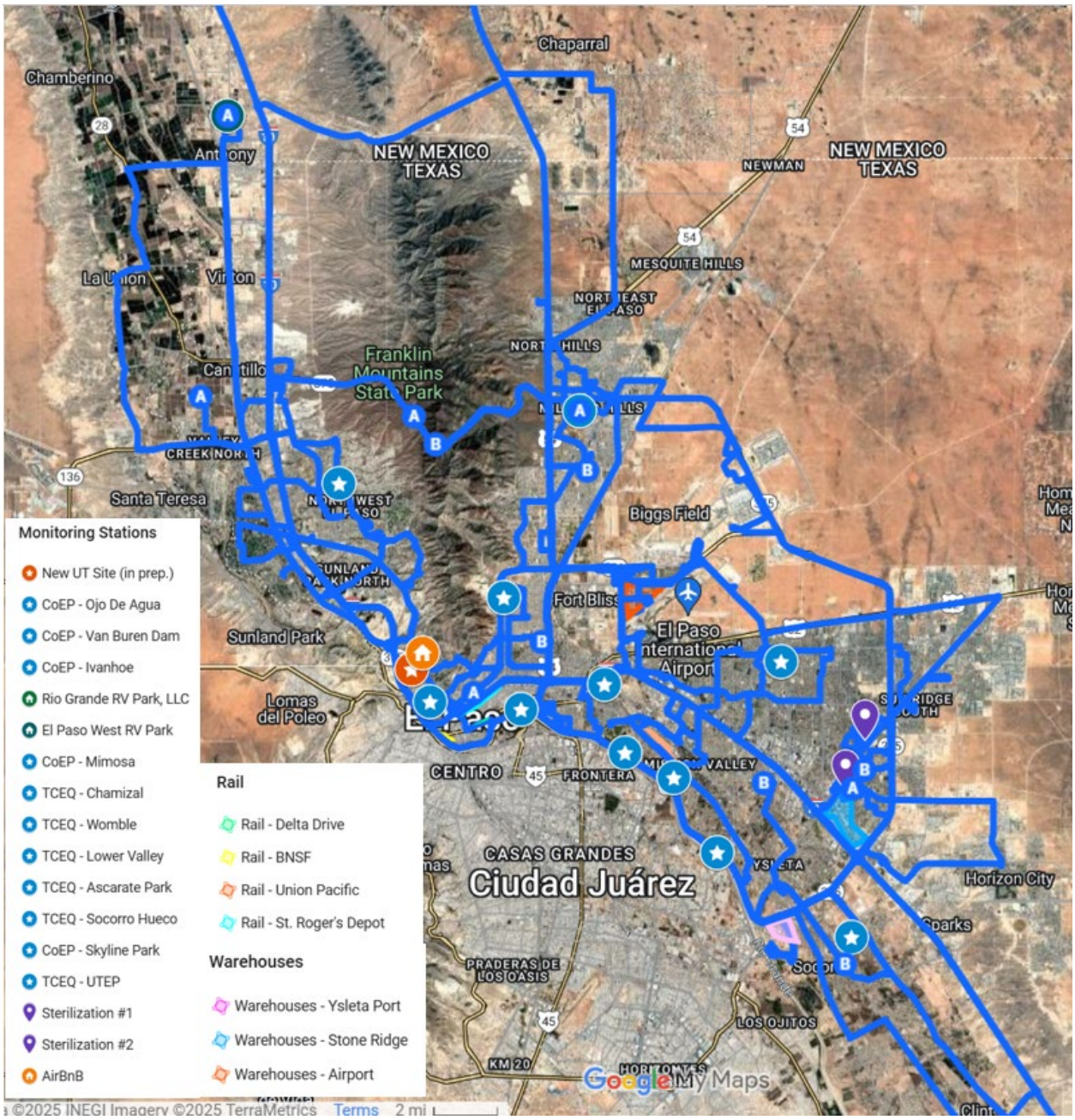


Figure 1. Planned driving routes overlayed on the TCEQ & City of El Paso air monitoring stations, points of interests, anchor points. Red star shows the new UTEP/UTA site and orange house represents AirBnB close to the campus.

Task 2a:

- Wind direction and toluene patterns examined at different monitoring stations.
- While stations far from the border did not exhibit clear directionality of toluene concentrations, the analysis on the near-border Chamizal Station showed distinct

increases in toluene during southerly winds, indicating a potential foreign origin (Figure 2)

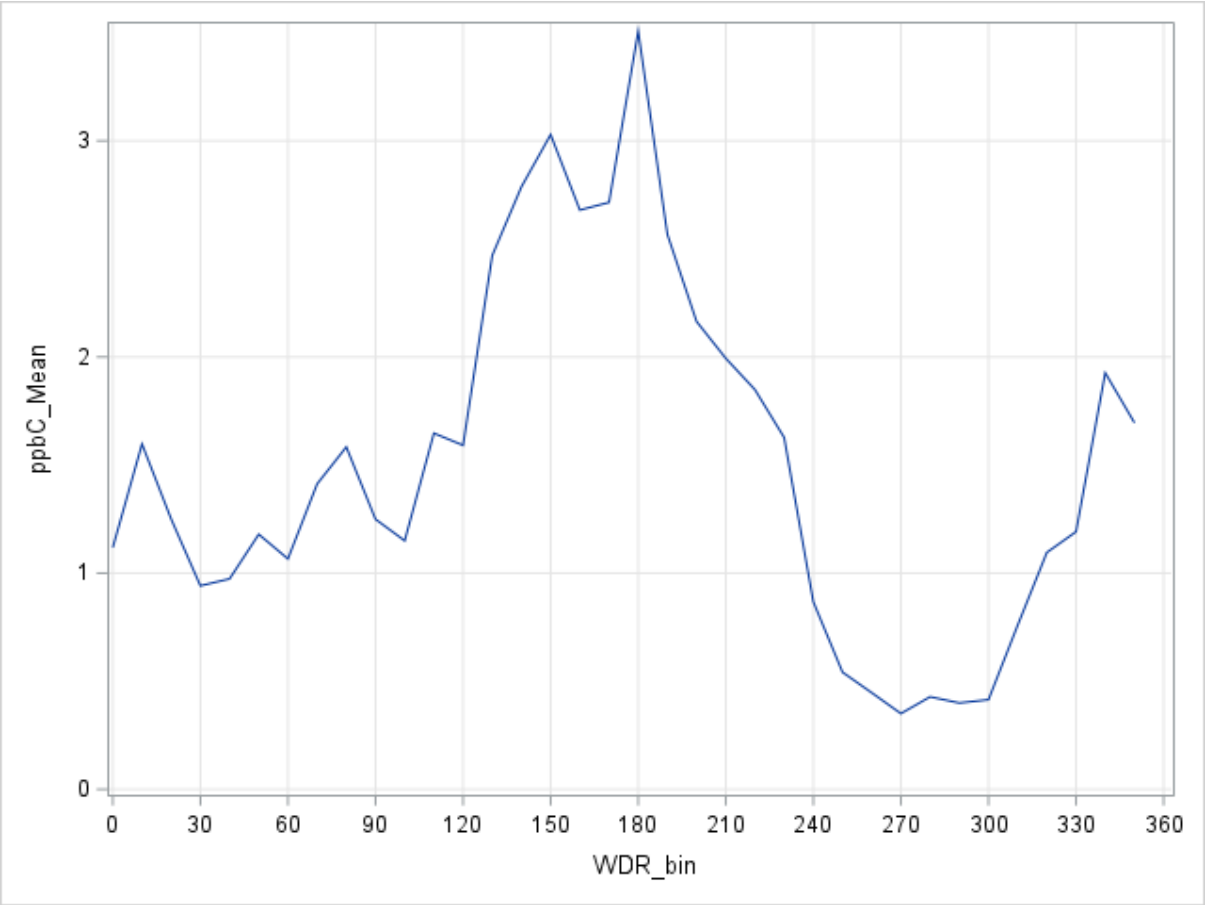


Figure 2. Wind directionality of the average toluene concentration at Chamazal monitoring station for Jan. 2022 to June 2024 at Chamizal Station.

Task 2b: As part of the monthly technical report for work completed during the month of December, preliminary tile maps of daily average emissions of carbon monoxide, nitrogen oxides (NO_x), total volatile organic compounds (VOC), sulfur dioxide (SO_2), fine particular matter ($PM_{2.5}$), toluene, and ethylene oxide (EtO) from all source categories during January-March of 2022 collectively by pollutant in the EPA 2022v1emissions modeling platform were provided with 1-km grid cell resolution for the El Paso-Juarez modeling domain. Tile maps of emissions of these pollutants by individual source categories were also provided.

During this month, these tile maps were updated with higher visual resolution of the base map and additional clarifications. We have added maps of point source emissions by industry type (i.e., based on North American Industry Classification System (NAICS) codes) for the US and Mexico, shown in Appendix Figure 1 to provide data on the diversity of industries in the region. A description of the emission processing approach is ongoing. All files can be accessed at: https://utexas.box.com/s/ml6fi8uveacs2u7ptnvph2c84500q8ol.

In order to generate boundary and initial conditions for the El Paso-Juarez outer 4-km domain, a CAMx simulation is running that uses the U.S. Environmental Protection Agency's (EPA's) input files given at https://registry.opendata.aws/epa-2022-modeling-platform/, but specifying 3-D output for all species. This was necessary because quality assurance of the EPA model output is still ongoing, and the output is unavailable at this time. Our simulation is being conducted at the Texas Advanced Computing Center (TACC) but is requiring greater computational time both because of the need for 3-D output as well as the lack of interim 'spin-up' files that would allow us to run individual months in parallel rather than sequentially. We have appreciated assistance of EPA in resolving questions that we have identified as we have implemented this modeling.

Task 3:

- The campaign started on Jan 3 when the team set off from Austin to El Paso. As the van is electric with ~110 miles range, it took the team 1.5 days to reach El Paso on Jan 4 evening.
- Initial days of the campaign have gone smoothly and minor challenges were solved on the fly. The major challenge was unexpectedly cold weather in El Paso often with subzero temperatures (< 0 °C) and strong winds.
- To keep the instruments comfortable the electric van provided heat from A/C system requiring much energy and fast charging. The energy requirements for charging the van were fulfilled at the RV stations (Santa Teresa, NM) and Roadrunner RV in East El Paso where the team initially kept the van overnight. We have been continuously measuring during mobile and stationary measurements as of now with 0% downtime.
- We sighted the UTEP site which looks perfect for stationary measurements. The power was not yet available during sighting but it has been coordinated to house the van during the second week of campaign assuming there is power. The trailer to house auto-GC was delivered and installed on January 9th.
- The team initially stayed in West El Paso and since January 7th at AirBnB in the vicinity of the UTEP campus. The Airbnb allowed for charging the van and powering instruments and has been a good anchor point for mobile measurements.
- The initial findings are fascinating. We completed a large portion of the planned tracks and fingerprinted numerous sources downwind as well as collocated with several monitoring stations. Example pictures are shown in Figure 3. As we were driving down on trans-mountain track, we saw burning plume of a house on fire. As we drove to the plume the Vocus observed very high concentrations of various burning markers (furan, furfural, acetonitrile, benzene) as well as high PM concentrations on HR-TOF-AMS. Other sources included waste water treatment plants (high alkyl mercaptans, low aerosol), oil and gas refineries (benzenes, naphthalenes, etc.). The notable increases in ethylene oxide were observed downwind of a sterilization facility in East El Paso.

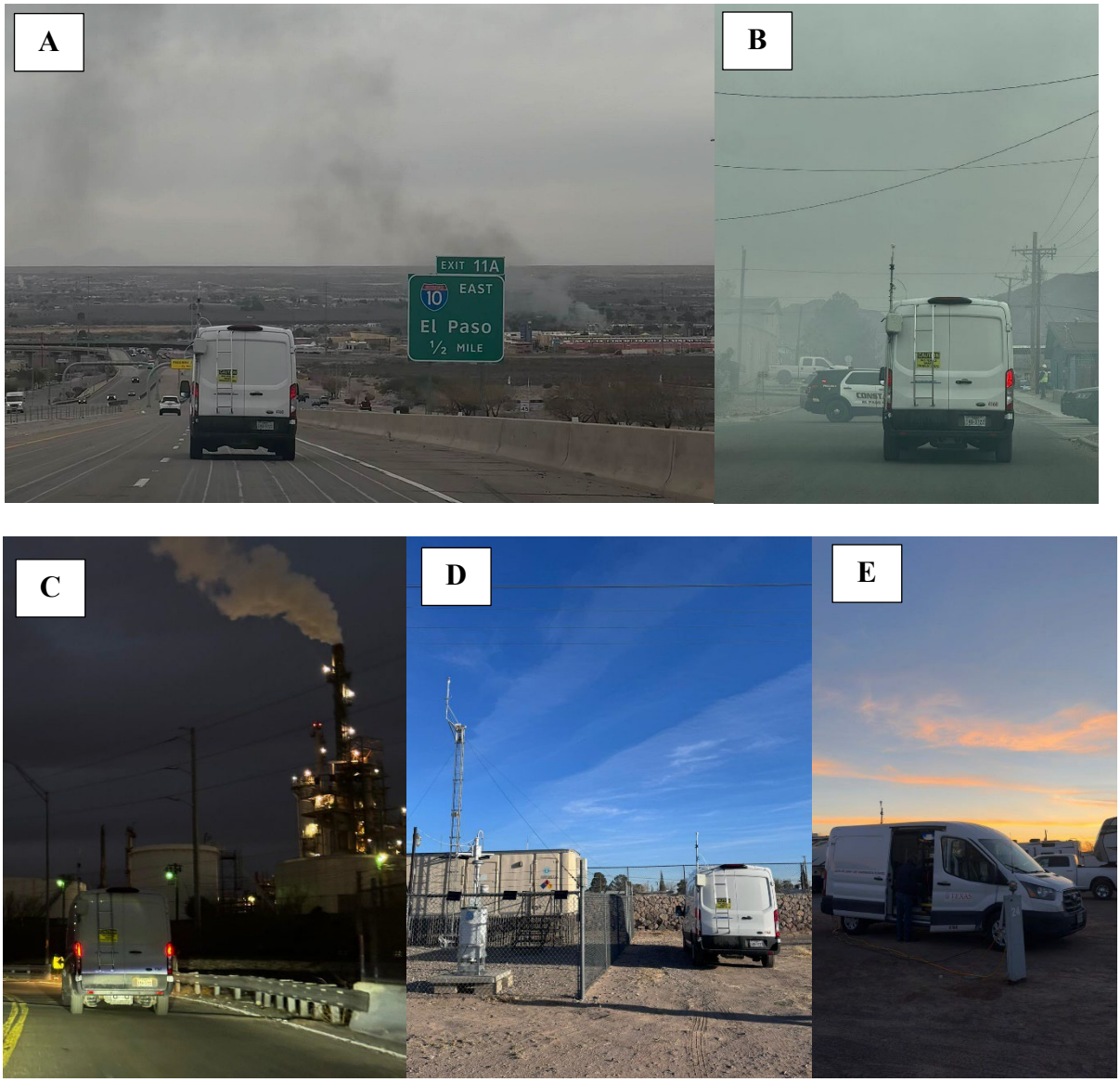


Figure 3. Photographs showing the UT mobile lab in (A) driving down the trans mountain drive; (B) near the house fire; (C) near refineries; (D) colocation with Chamizal TCEQ station; (E) charging and measurement at Roadrunner RV.

Preliminary Analysis

Figure 4 shows the conducted measurement tracks which correspond to 978 km of data and ~0.3 TB with near 100% of instrument uptime. The current dataset is being processed and analyzed, and below are the preliminary data previews with an example of the plumes encountered near the house on fire.

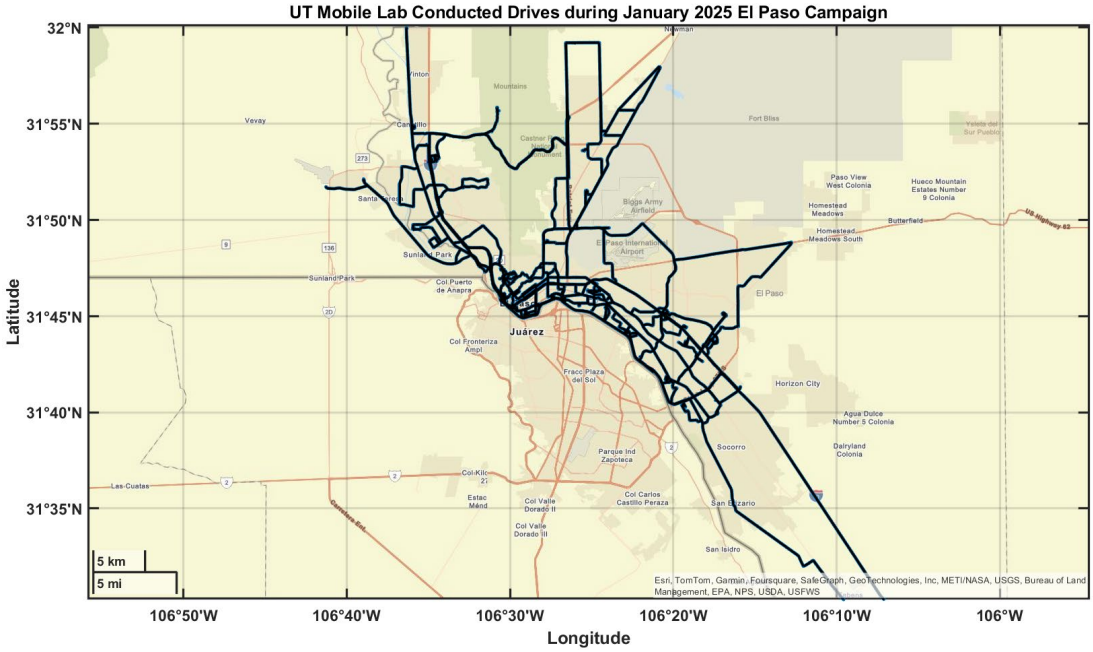


Figure 4. The tracks driven during the January 2025 El Paso Mobile Measurement Campaign (978 km driven).

Figure 5 shows the preview data example from the Vocus (Panel A) and the TOFAMS (Panel B) for the source profiling – house burning plume shown previously in Figures 3A and 3B.

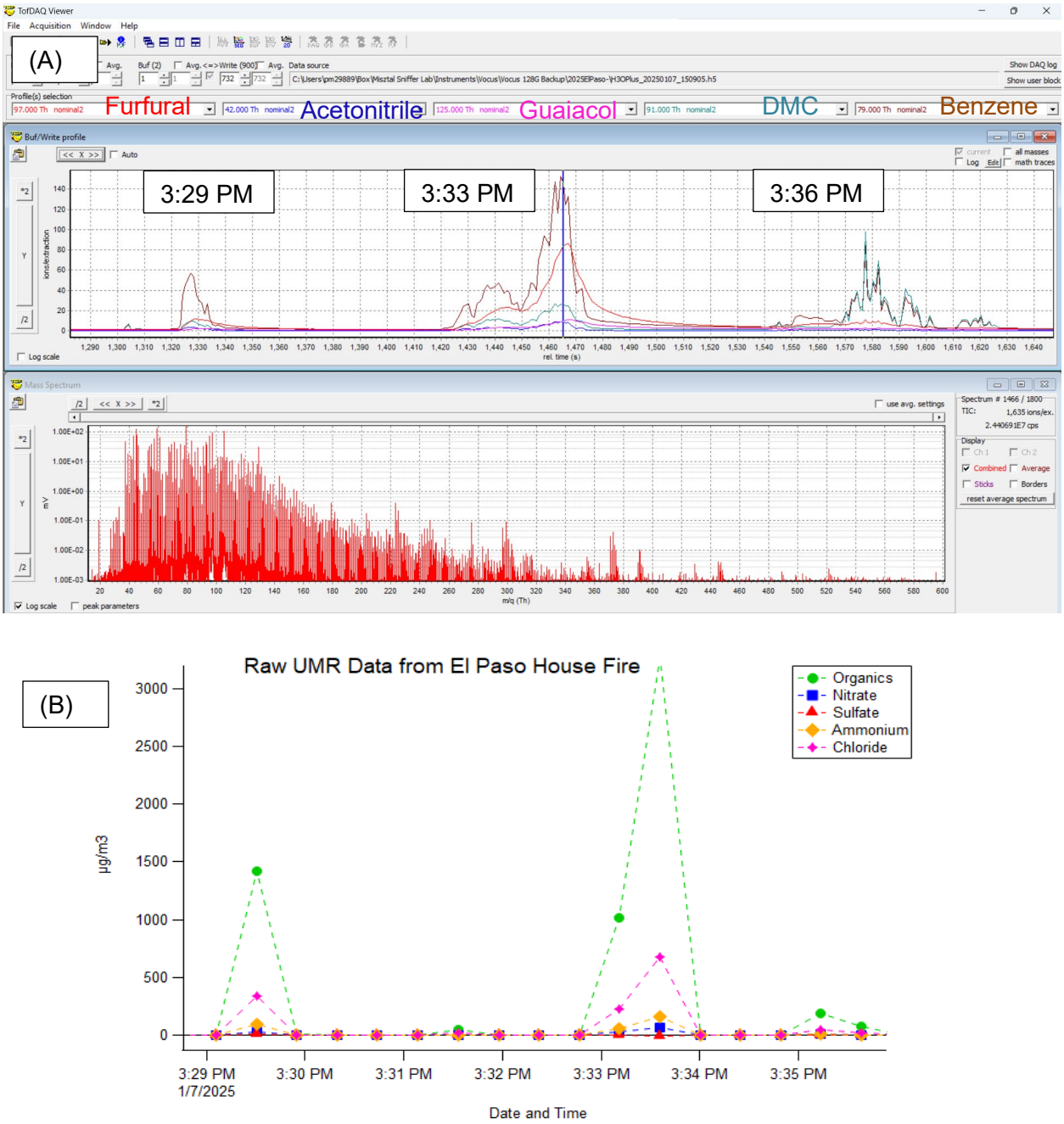


Figure 5. Preliminary raw preview of the observed gas-phase compositions by the Vocus (A); and observed nonrefractive submicron aerosol by the TOFAMS (B).

Although the exact chemical composition will be confirmed after processing the data, the preliminary previews indicate the smoke contained high concentrations of burning markers such as furfural (M97), acetonitrile (M42), guaiacol (M125), and benzene (M79). The M91 is likely dimethyl carbonate marker expected from burning lithium-ion batteries. The mass spectrum during the plume at 3:33 PM shows hundreds of peaks representing the rich source profile. The same plumes were also observed by the TOFAMS which captured large enhancements of particle phase in organics, chlorides, ammonium and nitrate. In addition QuantAQ monitor also show consistent PM plumes with maximum at 31.912714, -106.598128.

Data Collected

We collected 0.3 TB of nearly 1000 km of spatiotemporal data and stationary overnight data in the first winter campaign.

Identify Any Problems or Issues Encountered and Proposed Solutions or Adjustments

None

Goals and Anticipated Issues for the Succeeding Reporting Period

The observation team returned from El Paso on January 20th and since then have been processing the large datasets (0.3 TB). The Vocus data are being processed using multistep routine and we expect to have the preliminary processed data available for inclusion in the next MTR. Similarly, the large data from the TOFAMS is being processed and analyzed and the preliminary findings will be included in the MTR in March.

The modeling team expects to complete the preparation of boundary and initial conditions, emissions, and meteorological fields from the Weather Research and Forecasting Model (v4.4.2) for the El Paso-Juarez CAMx configuration. Once the necessary input has been finalized, we will conduct the CAMx simulation for the El Paso-Juarez domain.

Detailed Analysis of the Progress of the Task Order to Date

None

Do you have any publications related to this project currently under development? If so, please provide a working title, and the journals you plan to submit to.

☐**Yes** ☒ **No**

Do you have any publications related to this project currently under review by a journal? If so, what is the working title and the journal name? Have you sent a copy of the article to your AQRP Project Manager and your TCEQ Liaison?

☐ **Yes** ☒ **No**

Do you have any bibliographic publications (i.e.: publications that cite the project) related to this project that have been published? If so, please list the reference information. List all items for the lifetime of the project.

☐ **Yes** ☒ **No**

Do you have any presentations related to this project currently under development? If so, please provide working title, and the conference you plan to present it (this does not include presentations for the AQRP Workshop).

☐ **Yes** ☒ **No**

Do you have any presentations related to this project that have been published? If so, please list reference information. List all items for the lifetime of the project.

☐ **Yes** ☒ **No**

Have any personnel changes occurred that were not listed in the original proposal? If so, please include a detailed description of the personnel change(s) below.

☐ **Yes** ☒ **No**

Are any delays expected in the progress of the research? If so, please include a detailed description of the potential delay below.

☐ **Yes** ☒ **No**

Describe any possible concerns/issues (technical or non-technical) that AQRP should be made aware of.

Are you anticipating using all the available funds allocated to this project by the end date? If not, why and approximately what is the amount to be returned?

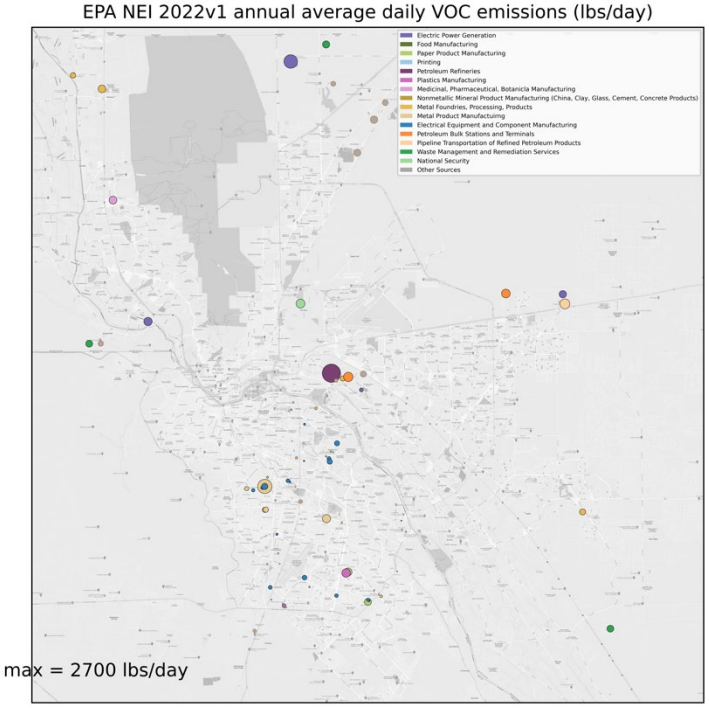
☒ **Yes** ☐ **No**

Submitted to AQRP by
Pawel Misztal

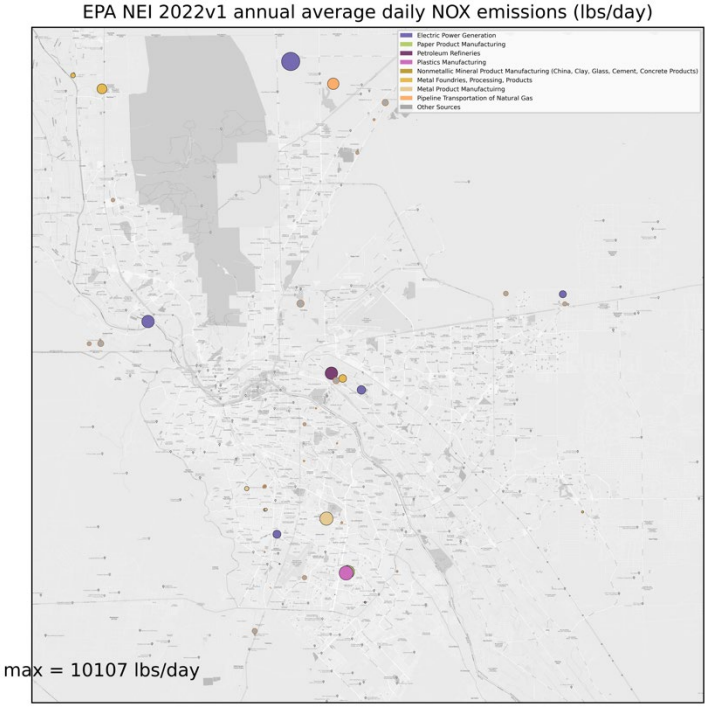
Appendix

Figure 1. Point Source Emissions by Industry Type for the El Paso-Juarez 4-km CAMx Domain

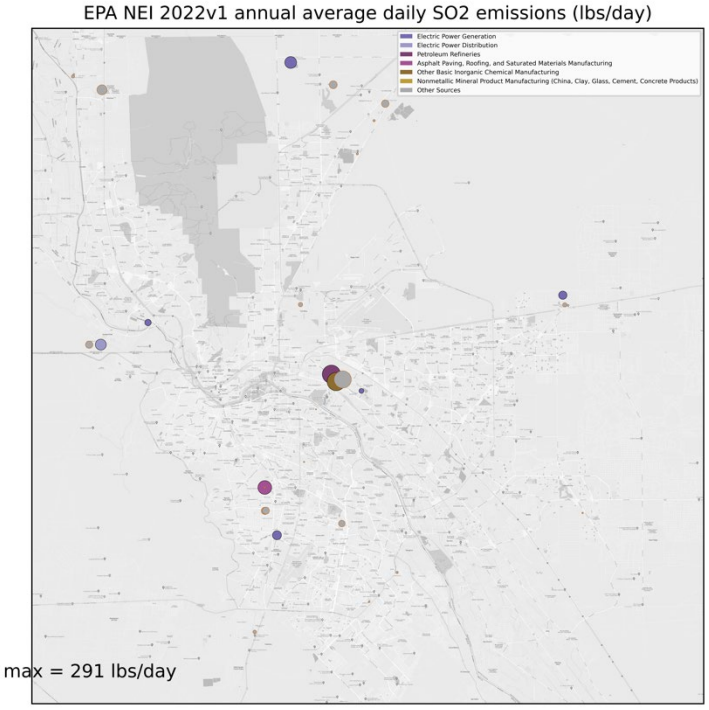
(a) VOC



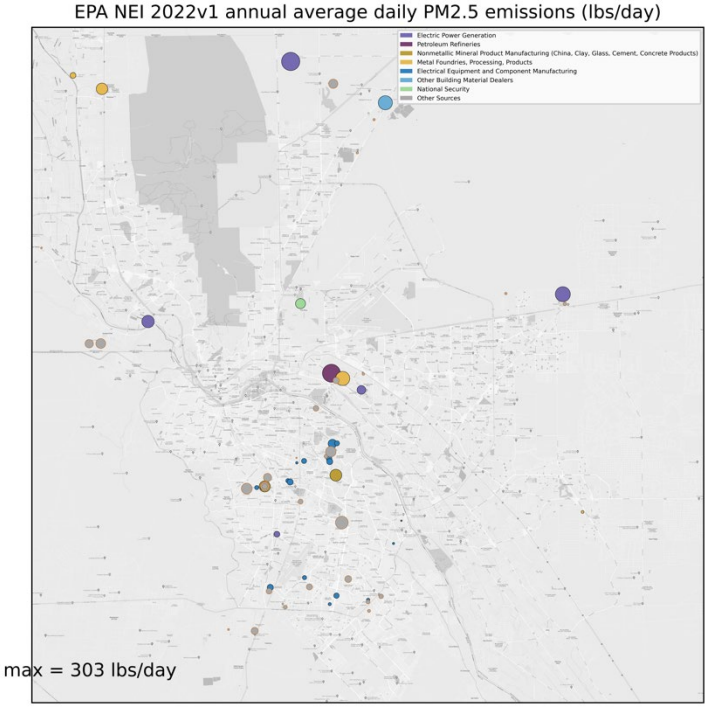
(b) NOx



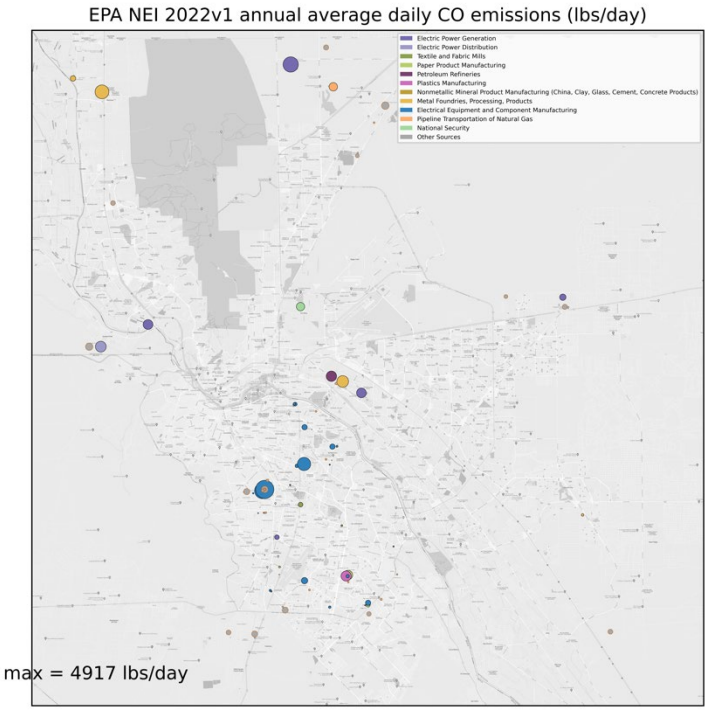
(c) SO_2


EPA NEI 2022v1 annual average daily SO2 emissions (lbs/day)
Electric Power Generation
Electric Power Distribution
Petroleum Refineries
Asphalt Paving, Roofing, and Saturated Materials Manufacturing
Other Basic Inorganic Chemical Manufacturing
Nonmetallic Mineral Product Manufacturing (China, Clay, Glass, Cement, Concrete Products)
Other Sources
max = 291 lbs/day

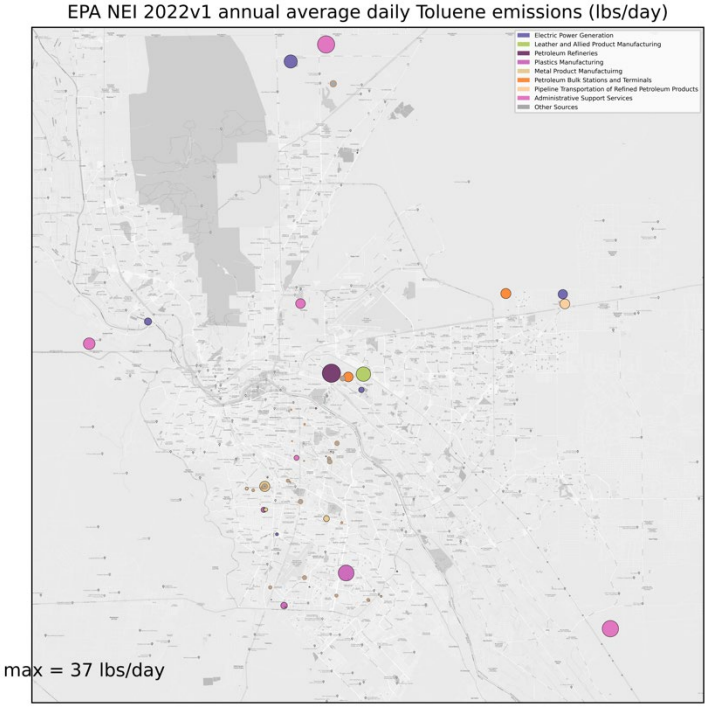
(d) $PM_{2.5}$


EPA NEI 2022v1 annual average daily PM2.5 emissions (lbs/day)
Electric Power Generation
Petroleum Refineries
Nonmetallic Mineral Product Manufacturing (China, Clay, Glass, Cement, Concrete Products)
Metal Foundries, Processing, Products
Electrical Equipment and Component Manufacturing
Other Building Material Dealers
National Security
Other Sources
max = 303 lbs/day

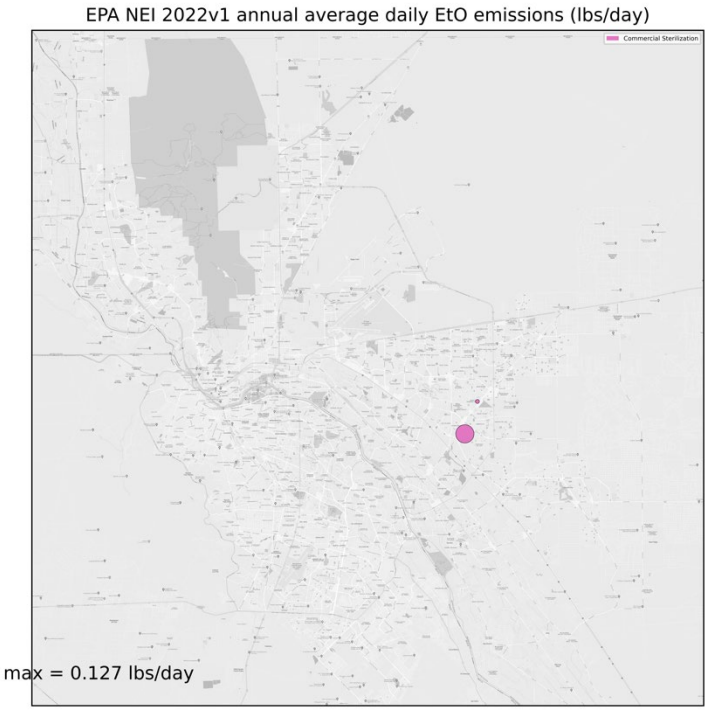
(e) CO



(f) Toluene



(g) Ethylene Oxide



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