Texas Air Quality Research Program Research Priorities, 2026-2027

A State of the Science assessment, available on the Texas Air Quality Research Program (AQRP) website (https://aqrp.ceesa.utexas.edu/research/publications-and-reports/state-of-science) summarizes the scientific understanding of air quality issues that emerged from projects funded by the AQRP during the 2016 through 2021 project cycles. (More detailed findings can be found in the reports funded 2010 through 2025 at https://aqrp.ceesa.utexas.edu/research/projects.) Findings have been summarized in the areas of emissions inventory development and assessment, tropospheric chemistry, and atmospheric physical processes and long-range transport of pollutants. While these AQRP project findings have advanced scientific understanding in these areas, additional research needs have emerged from this work. Addressing these additional research needs, which are summarized below, involve collection and analysis of field measurements, improvements to photochemical models and improvements to emission inventories. These research needs, the associated data collection, and model improvements, might be addressed through multiple funding mechanisms.

Field Studies and Data Analysis:

- **Development of ozone, PM_{10}, and $PM_{2.5}$ field studies in other areas of Texas:**
  - Areas with elevated ozone, PM_{10}, and/or $PM_{2.5}$ concentrations at regulatory monitors in recent years.
  - Areas of Texas affected by international emission.
  - Areas of Texas impacted by fires.
  - Additional measurements in areas where data gaps are found in previous studies.
- **Further Analysis of Past Field Studies:** Last biennium the following studies were performed which could benefit from further analysis of collected data:
  - **Project 24-003: Improving Emission Rates Estimates of Commercial Marine Vessels gathered data over the Gulf and Galveston Bay**.
  - **Project 24-024: Novel Observations and Quantified Source Apportionment of Ozone, Particulate Matter and Contributing Precursors in the El Paso Area**
  - **Project 24-007: Texarkana Intensive Campaign**
- **Photochemical air quality models:** Photochemical air quality models quantitatively assess the air quality of an area and potential effectiveness of air quality management strategies. AQRP projects directed at improving model **performance** have focused on improving the description of emissions and atmospheric chemistry, improvements in cloud characterizations, cloud processes, and models of wind fields. A variety of projects could be performed to improve model performance including but not limited to planetary boundary layer height, or other areas where uncertainty still exists. Areas of study already conducted can also be refined.
- **Improve emission inventories in nonattainment Areas:** New geolocation and remote

sensing data sources, and analyses of imagery, are becoming increasingly available, and may be useful for improving emission inventories for on-road, non-road, commercial marine, and rail. For example, analysis of traffic camera images, or other data on vehicle mixes, could be used to identify, categorize, and count vehicles by use type, and create new inputs for on-road sources using EPA's Motor Vehicle Emission Simulator. New sources of activity data may be identified and applied to existing inventories using new techniques or analytics. Projects on emission sources where recent analyses have suggested emission inventory improvements may be needed, such as vehicle brake wear and volatile consumer product emissions, are also of interest. Projects that lead to results that are rapidly actionable and could help improve state and regional emission inventories are of interest. Emission inventory categories of interest include, but are not limited to:

- On-road emission sources
- Non-road construction equipment sources
- Commercial-marine sources (additional analysis of data collected during previous studies may be warranted.)
- Satellite-based estimates and verification
- Population/activity counts
- Temporal profiles of point source categories. This topic could look at potential temporal profiles for specific industrial activities such as tank degassing and when they normally occur. This would let us better model the emissions from these activities at the right time.
- Projections of emissions/activity data for future years. This topic will allow review of the projections data to be used for future years.
- Intermittent sources. - This topic could look at the rise of data center construction in Texas, emissions, and impact on air quality in Texas.
- International emissions.

- **Use of satellite and other remote sensing data:** Satellite and other remote sensing data sources are becoming increasingly available and may be useful for improving understanding of a variety of issues in air quality. Projects that lead to results that are rapidly actionable and could be incorporated into state and regional emission inventories and photochemical modeling are of interest. These types of projects may include better methods for converting existing air quality information into forms that can be reconciled with satellite measurements, such as better characterization of the contribution of stratospheric concentrations to total column concentrations detected by satellites, and better understanding of the dynamics of conversion of emitted NO_X into nitrogen dioxide (NO_2), which is detectable by satellites. Specific topics of interest include, but are not limited to the following:
  - What are NO_2 and sulfur dioxide concentrations above the planetary boundary layer (PBL) and how do the concentrations vary over the continental US? How much do these concentrations above the PBL influence total column measurements?
  - How does the lifetime of NO_2 vary with exhaust characteristics and meteorology? Would additional information on the lifetime of NO_2 significantly influence reconciliations between model predictions and satellite observations?
  - Use of satellite data products for model performance evaluation and ground

truthing of model inputs.
    - Analysis of Texas Tropospheric Emissions: Monitoring of Pollution (TEMPO) satellite data and potential improvements in data.

- **Domestic fire emissions:** Multiple AQRP projects have focused on international transport of particulate matter, ozone, and their precursors into Texas from agricultural burning and wildfire sources in Mexico, and this remains an area of continuing interest; however, there is limited information on the impact of domestic wildfires and fires at the wildland-urban interface on particulate matter, particulate matter precursor, ozone and ozone precursor concentrations in Texas. Large-scale air pollutant transport associated with these fires may lead to new insights. Questions of interest include, but are not limited to:
    - What are concentrations of PM and ozone, and their precursors, transported into Texas, from domestic wildfires and wildland-urban fires?
    - Is the atmospheric chemistry of fire plume interaction with urban air accurately captured in photochemical models?
    - What role do domestic and international smoke emissions have in exceptional events?
    - A unique measurement of house fire emissions during **Project 24-024: Novel Observations and Quantified Source Apportionment of Ozone, Particulate Matter and Contributing Precursors in the El Paso Area** could be further investigated to determine the kinds of pollutants emitted during such an event.
    - Field studies on fires could be of interest as to fire chemistry in chemical mechanism used for modeling is being updated. Measured data could help with validation of updated scheme.

- **Trends in wind-blown dust (PM_{10} and $PM_{2.5}$) in Texas:** Predictions and observations of the component of particulate matter concentrations attributable to wind-blown dust are often significantly different. Recent AQRP projects have made improvements to wind-blown dust emission models, however significant uncertainties remain. Issues of interest include, but are not limited to, better characterization of the multiple sources of windblown dust and their contribution to coarse and fine particulate matter, PM_{10} and $PM_{2.5}$.