How do we answer air quality questions?

**LONG-TERM, TRENDS MONITORING**
- Estimate population exposure and compliance to regulations over long duration
- Highly-accurate measurements
- Understand pollutant composition in an area
- Capture variations in weather & emissions
- Inform other monitoring approaches

**SCREENING**
- Short duration to cover large areas
- Identify “hot spots” for further investigation

**SPECIAL STUDIES**
- Investigate emissions from specific sources
- Portable monitoring systems

**Air Monitoring Approaches**

**Factors that Affect Monitoring**
- Location & obstructions
- Distance from sources
- Meteorology & topography
- Interferences (such as other gases, water vapor)
- Logistics such as power, security, and access
- Instrument quality and sample duration

**Example**

Question: Is particulate matter (PM) higher in certain communities?

Approach: Mobile monitoring can be used to make comparisons of concentrations

Monitoring: Drive with PM sensors repeatedly along city streets

Analysis: Assess where PM is consistently higher

Answer: Areas of highest PM

Note: Data may already exist that answers the question, and additional monitoring may not be necessary.
## Ways to Conduct Measurements: Air Quality Monitoring Modes

### Mobile: Measurements while in motion
- **Features:**
  - Screen pollution over a broad area
  - Identify pollution “hot spots”
  - Help direct resources & additional monitoring efforts
- **Considerations:**
  - Only provides a snapshot of pollutants
  - Many passes needed for confidence in results
  - Limited instrumentation

### Saturation: Sensor network
- **Features:**
  - Stationary, frequent measurements
  - Dense spatial coverage
  - Can be easy to use and deploy
- **Considerations:**
  - Limited pollutants measured
  - Significant resources for upkeep
  - Lower-quality data

### Portable: Stationary for days to weeks
- **Features:**
  - Movable, minimal site preparation
  - May identify sources
  - Medium to high data quality
- **Considerations:**
  - Temporary monitoring
  - May need access to power
  - Instruments need to be easy to transport & deploy

### Short-term: Stationary for weeks to months
- **Features:**
  - Short-term trends of pollutants
  - Wide range of instrumentation
  - High quality data
- **Considerations:**
  - Siting, power, and security needs
  - Low spatial coverage
  - Build-out may be costly

### Long-term: Stationary for a year or more
- **Features:**
  - Long-term trends of pollutants
  - Wide range of instrumentation
  - High-quality data
- **Considerations:**
  - Moving difficult
  - Siting, power, security, space needs
  - Low spatial coverage
  - Costly build-out
Mobile Lab Summary

- **General information:**
  - Instruments measure either gases or particles
  - Instruments on the passenger side of the van are for gases
  - Instruments on the driver side of the van are for particles

- **Gas instruments:**
  - Ozone, CO, CO$_2$, methane, NO/NO$_x$, volatile organic compounds (VOCs)

- **Particle instruments:**
  - Particle mass, particle size, black carbon mass

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**Gas instruments**

- Thermo-Scientific 42C model
  - Ozone
- Thermo-Scientific 49C model
  - NO/NO$_x$
- Picarro G2401
  - CO/CO$_2$/CH$_4$
- Ionicon Proton Transfer Mass Spectrometer
  - VOC identification and measurement

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**Particle instruments**

- TSI Optical Particle Sizer
  - Particle sizes and mass from 0.3 to 10 µm diameter
- TSI Fast Mobility Particle Sizer Spectrometer
  - Particle sizes and mass from 5.6 to 560 nanometers
- Magee Scientific AE33 Aethalometer
  - Black carbon mass measurement

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**Meteorology**

- Wind Speed
- Wind Direction
- Solar Irradiance
- Relative Humidity
- Temperature
- Dew point
- Pressure
- GPS
  - Latitude
  - Longitude
  - Vehicle heading
  - Vehicle velocity