Ambient Air Quality Monitoring

Marta Fuoco

Environmental Scientist

U.S. EPA - Region 5

Fuoco.Marta@epa.gov

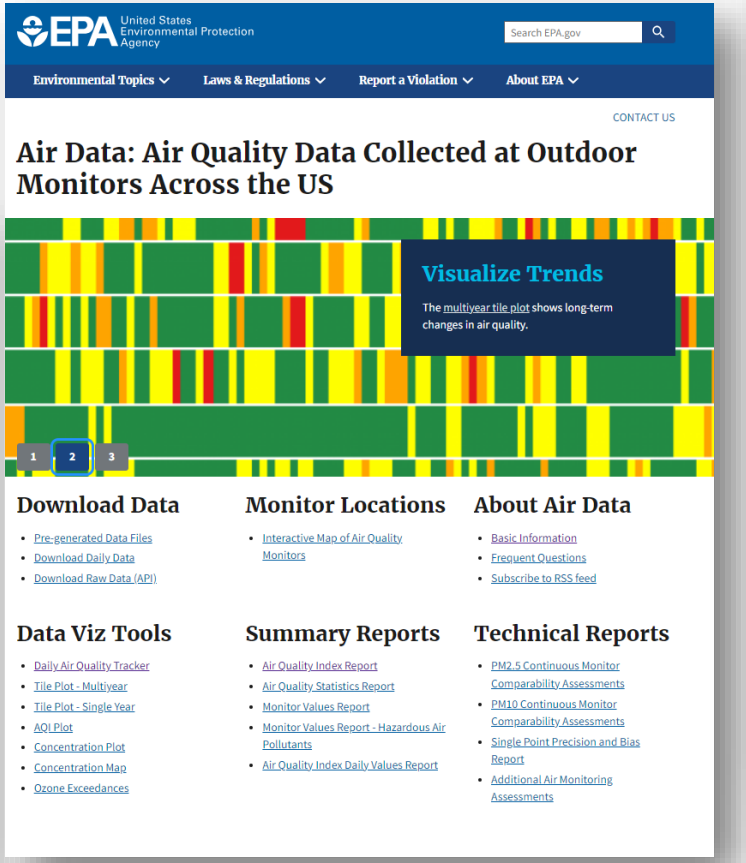
[Source: Minnesota 2019 Annual Network Plan]

Ambient Air Quality Monitoring

- Objectives of the National Ambient Air Quality Monitoring Network:
  - Protection of **human health** and welfare
  - Supports **compliance** with NAAQS
  - Provides timely and **real-time air quality data** to the public
  - **Validates** emissions models and **verifying** control strategies
  - Supports air pollution **research** studies
- Network Operators: Federal, state, local, and tribal (SLT) agencies

References: Air Pollution Training Institute (APTI), Ambient Monitoring Technology Information (AMTIC)

AirNow - AirData - AQS



Air Quality Monitoring and the NAAQS

- CAA Section 319
  - Requires an ambient air quality monitoring system throughout the U.S. to meet multiple objectives and provide recordkeeping with respect to such monitoring data
  - Supports periodic analysis and reporting to the general public by the Administrator with respect to air quality trends

40 CFR Parts 53 and 58

- The “Home” of requirements for:
  - Method approvals
  - Sampling frequency
  - Network design
  - Annual plans and network assessments
  - Monitoring location
  - Quality Assurance
  - Data reporting

Definitions

- **Monitor**: A device used to measure air quality, typically automated continuous gases like ozone, CO, SO2, NO2, and others
- **Sampler**: A device that supports manually operated, filter-based methods, typically for particles (PM and metals) and/or air toxics measurements
- **Station**: a physical monitoring location (with a building or platform) that houses monitors and samplers
- **Network**: A collection of monitoring stations of a given type or types

Networks

- SLAMS – State and Local Air Monitoring Station
- NATTS – National Air Toxics Trends Station
- NCore – National Core
- PAMS – Photochemical Assessment Monitoring Stations
- IMPROVE – Interagency Monitoring of Protected Visual Environments
- CSN/STN – Chemical Speciation Network/Speciation Trends Network
- SPM – Special Purpose Monitor
- CASTNet – Clean Air Status and Trends Network
- NADP – National Atmospheric Deposition Program
- Radnet – Radiation monitoring network

SLAMS Network

State and Local Air Monitoring Stations (SLAMS)

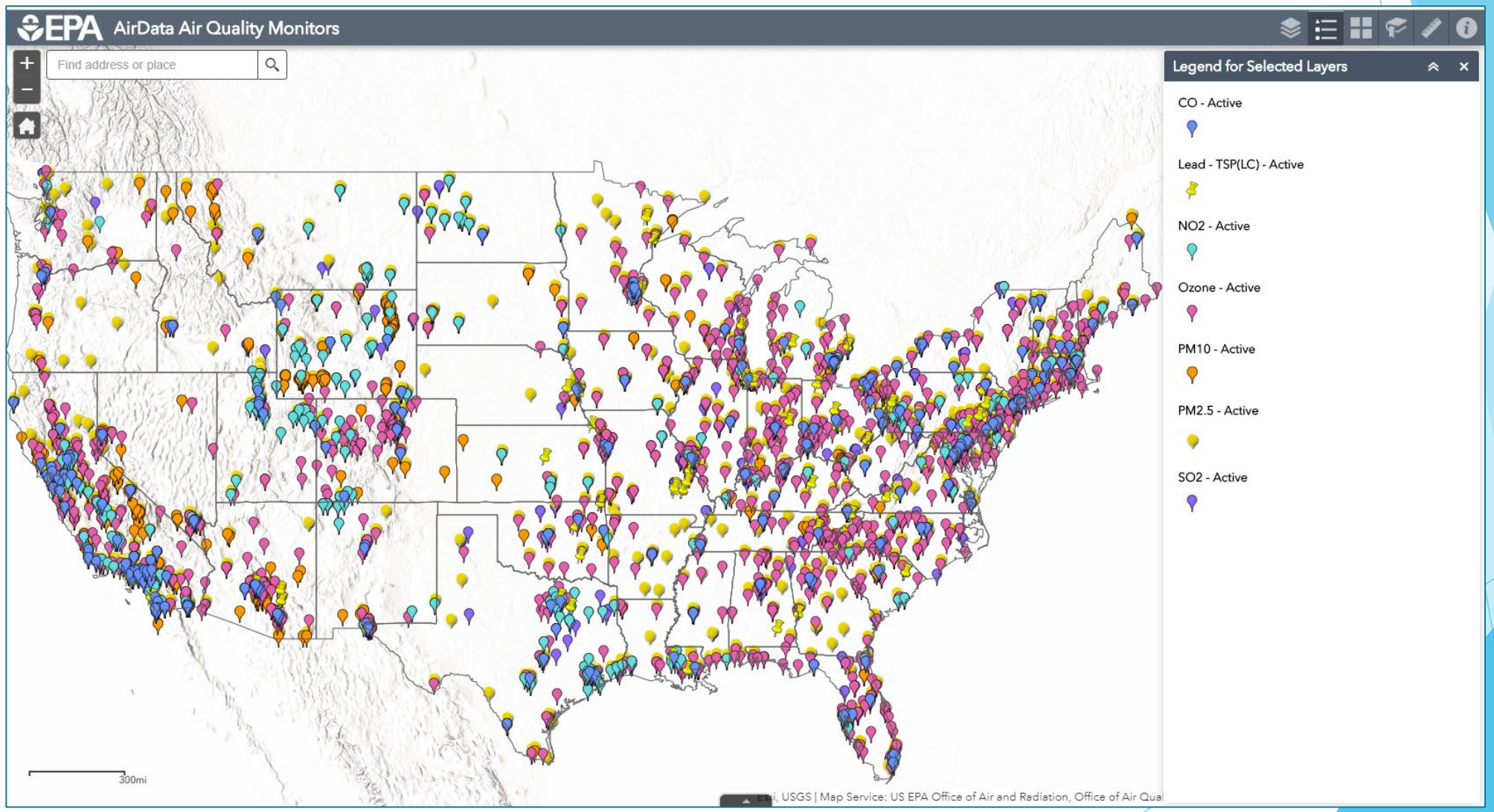
Objectives:

- Fulfills Code of Federal Regulations requirements outlined in 40 CFR Part 58 to **demonstrate compliance with the NAAQS** for different criteria such as:
  - Metropolitan or core based statistical areas (O_3, $PM_{2.5}$, SO_2, CO)
  - Facility emission based (Pb, SO_2)
  - Susceptible and vulnerable populations

Parameters Measured:

- Ozone, CO, SO_2, NOx
- PM_{10} and $PM_{2.5}$
- Lead (Pb) Monitoring
- Near-road CO, NO_2, and $PM_{2.5}$ Monitoring
- Susceptible and Vulnerable Populations - NO_2 Monitoring
- Meteorological Measurements

SLAMS Criteria Pollutant Monitoring Sites



NATTS Network

National Air Toxics Trends Station (NATTS)

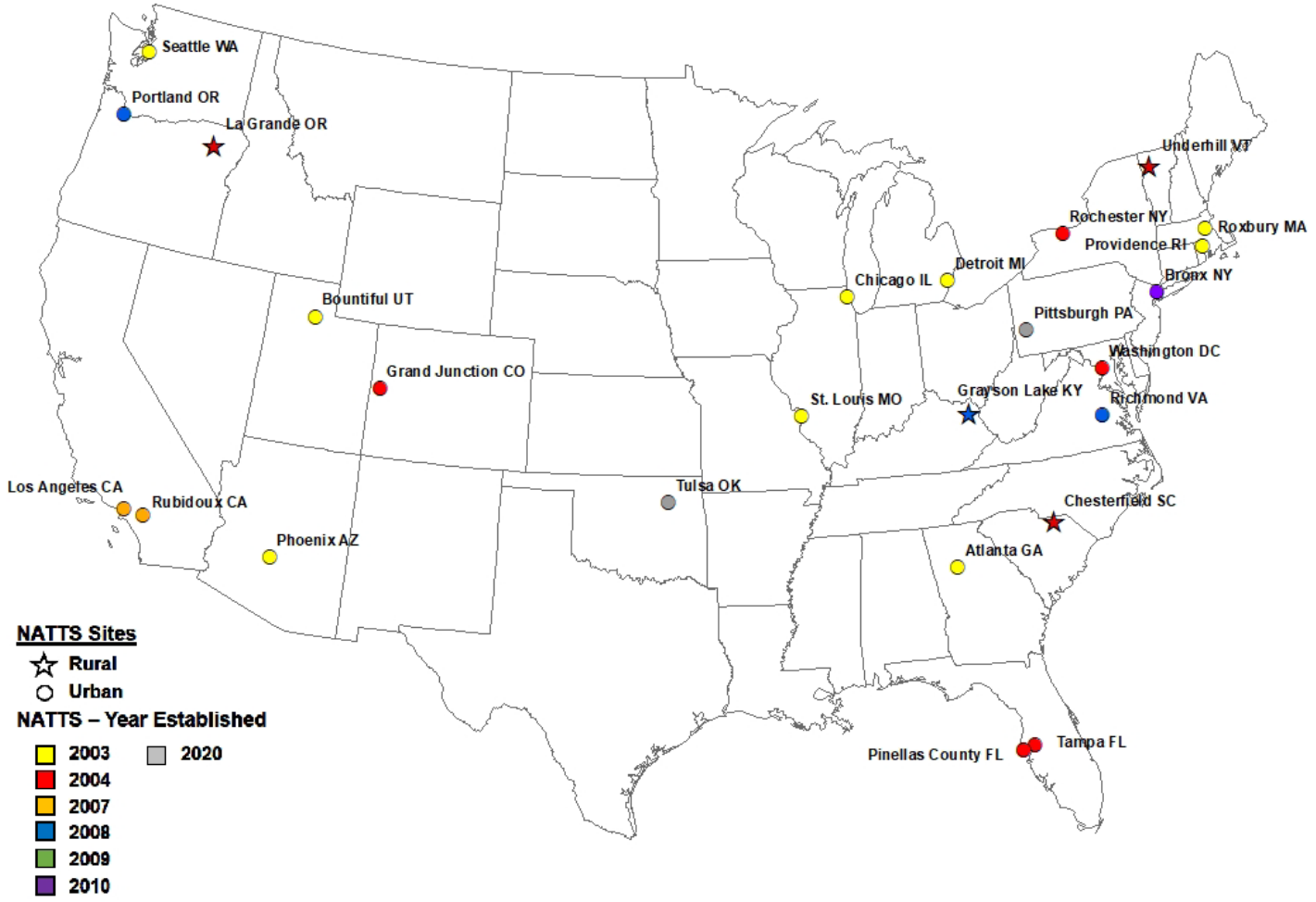
Objectives:

- Fulfills need for **long-term** hazardous air pollutant monitoring
- Assesses **trends** and **emissions reduction** program effectiveness
- Assesses and **verifies** air quality models

Parameters Measured:

- Typically over 100 pollutants measured, 19 required:
  - VOCs
  - Carbonyls
  - PM_{10} metals
  - Hexavalent Chromium
  - Polyaromatic hydrocarbons

NATTS Monitoring Sites



[NAATS Information]

NCore Network

National Core (NCore)

Objectives:

- Supports **reporting** of ambient air quality data reporting to public
- Supports **development of emission strategies** through air quality model evaluation
- Support for **long-term health assessments** that contribute to ongoing NAAQS reviews

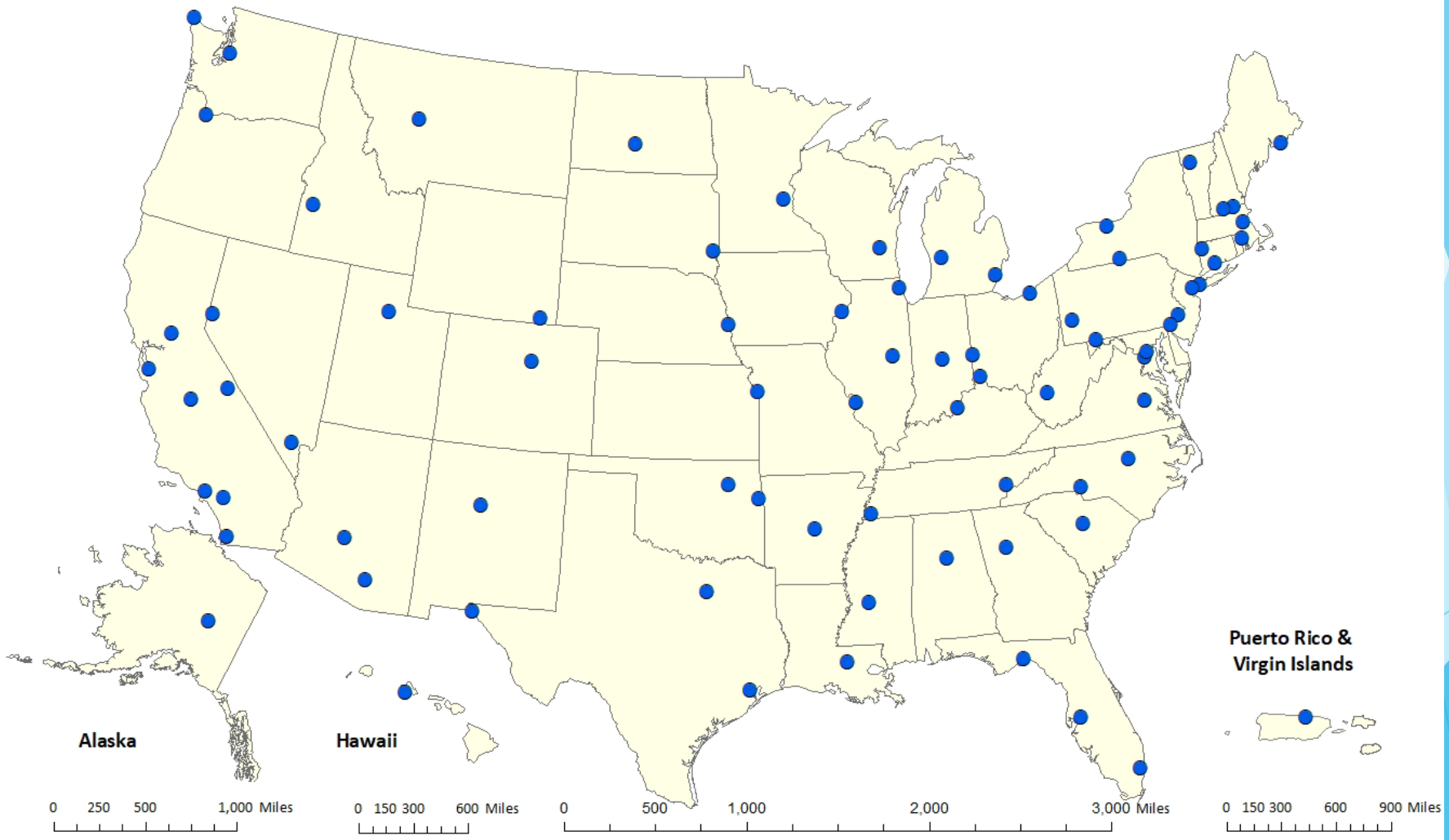
Information:

- Currently 58 sites
- Began in 2011

Parameters Measured:

- Multipollutant site:
  - $PM_{2.5}$ speciation, FRM mass, continuous
  - $PM_{(10-2.5)}$ mass
  - O_3, CO, SO_2, NO, total reactive nitrogen (NO_y)
  - Meteorological parameters

NCore Monitoring Sites



NCore Information

PAMS Network

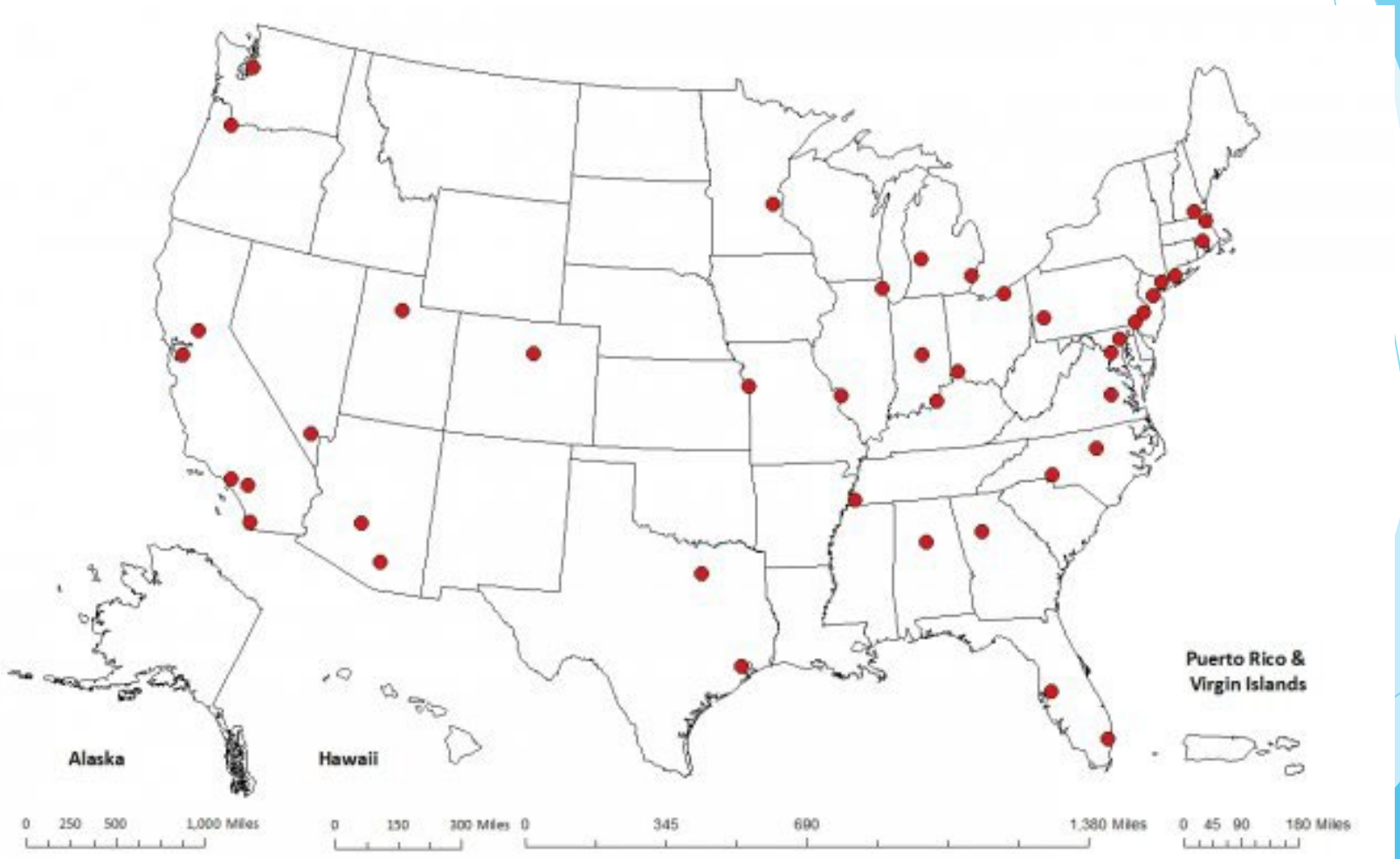
Photochemical Assessment Monitoring Stations (PAMS)

- Provide database to evaluate tools for control strategies, cost-effectiveness, and pollutant transport
- Provide local, current meteorological and ambient air quality data for model evaluation
- Provide data to analyze emissions inventory issues and progress towards attainment

Information:

- Stationed in areas that are not attaining the O_3 standard
- Began in 1994 with 22 sites
- Re-engineered PAMS:
  - Implementation by June 1, 2021 and collocated with NCore in areas with population of 1 million or more (irrespective of ozone NAAQS attainment status)
  - 43 sites nationally (7 in Region 5)
  - Enhanced Ozone Monitoring Plans in areas designated moderate or above ozone nonattainment and the OTR
- Parameters Measured:
  - Multipollutant sites:
    - O_3, true NO_2
    - VOCs (hourly, speciated)
    - Carbonyls (3 8-hour samples every 3rd day, speciated)
    - Meteorological parameters (including barometric pressure, precipitation, mixing heights, UV and solar radiation)

PAMS Monitoring Sites



PAMS Information

Other Ambient Air Monitoring Networks

- **IMPROVE**: Collects visibility related data associated with Class I areas (i.e., national parks)
- **CSN/STN**: Component of the $PM_{2.5}$ national network to assess trends and chemical makeup of $PM_{2.5}$
- **SPM**: Special study monitors used by federal and SLT agencies
- **NADP**: Collaborative network to assess amounts, trends, and geographic distributions of acids, nutrients, and base cations in precipitation
- **CASTNet**: National network to assess trends in pollutant concentrations, atmospheric deposition, and ecological effects
- **Radnet**: Monitors nation's air, precipitation, and drinking water to track radiation in the environment

Documenting Network Changes

- 40 CFR 58.10 lists the requirements for documenting network changes in the Annual Monitoring Network Plan
- Must include all proposed changes due to NAAQS revisions or other reasons
- Must be made available for public inspection for at least 30 days prior to submissions to EPA, typically released for comment in May

https://www.epa.gov/amtic/state-monitoring-agency-annual-air-monitoring-plans-and-network-assessments

Documenting Network Changes

- EPA Regional Administrator has 120 days to review and approve
- Always due to EPA by July 1 of each year
- Plan elements required to support NAAQS revisions will typically have specific due dates

Assessing Network Adequacy

- 40 CFR 58.10 also requires a network assessment every 5 years
- The assessment differs from an annual plan revision by including a more in-depth review of certain elements including:
  - Use of more advanced tools to review spatial and temporal trends in ambient data
  - Evaluation of new technologies
  - Exposure of sensitive individuals
  - Reliance of health studies on sites being proposed for discontinuing or relocation

Assessing Network Adequacy

- Network assessments are a particularly powerful tool to support monitoring network changes that are needed to respond to the recently rapid pace of NAAQS revisions
- In Region 5, the Lake Michigan Air Directors' Consortium (LADCO) organized the 2010, 2015, and 2020 5-year network assessment in conjunction with state agencies and US EPA. LADCO is currently working on 2025.

LADCO 5-Year Network Assessments

Monitor Siting Considerations

- Monitoring sites must be capable of informing managers about many things including:
  - Peak air pollution levels
  - Typical levels in populated areas
  - Air pollution transported into and outside of a city or region
  - Air pollution levels near specific sources

Monitor Siting Considerations

Six general classes of monitoring sites:

1. Sites located to determine the **highest concentrations** expected to occur in the area covered by the network
2. Sites located to measure **typical concentrations** in areas of **high population density**
3. Sites located to determine the **impact of significant sources** or source categories on air quality
4. Sites located to determine **general background concentration** levels
5. Sites located to determine the extent of **regional pollutant transport** among populated areas; and in support of secondary standards
6. Sites located to measure air pollution **impacts on visibility**, **vegetation damage**, or other **welfare-based impacts**

Reporting the Data

- 40 CFR 58.16 requires data reporting to the national database – the Air Quality System (AQS)
  - All ambient data and quality assurance data must be reported on a quarterly schedule within 90 days after the end of the quarterly reporting period. This applies to all SLAMS monitors and some special purpose monitors.
- 40 CFR 58.15 also requires a data certification letter from the senior air pollution official by May 1 of each year, attesting that the previous calendar year of data are accurate and complete, taking into account QA considerations
  - The certification process is intended to demonstrate to stakeholders that data have undergone final edits
- OAQPS typically waits for data to be certified before issuance of final Design Values (DVs) used for calculating violations of the NAAQS

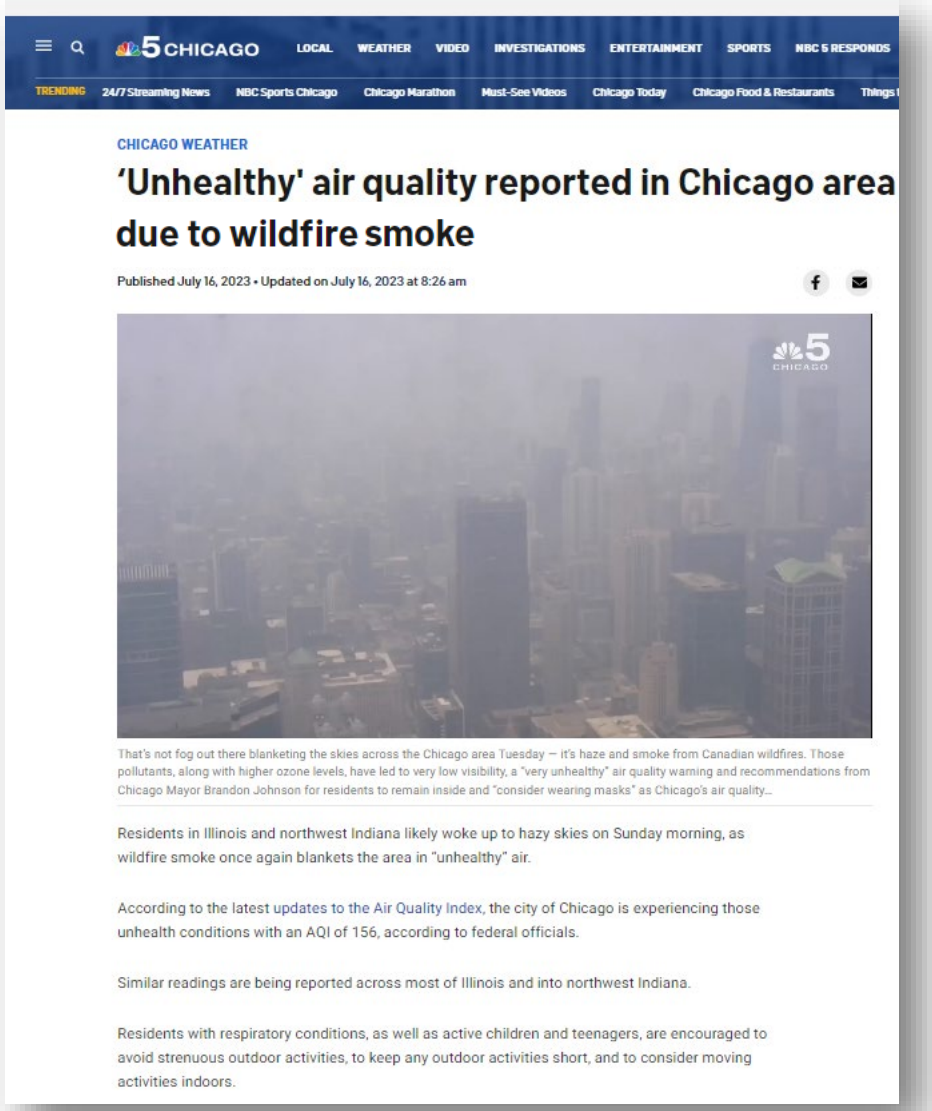
Monitoring Quality Assurance Issues

- Appendix A of 40 CFR Part 58 contains QA requirements, including:
  - Quality system requirements
  - Data quality objectives
  - Performance of measurement quality checks, collocated sampling, and independent audits
  - Procedures for calculating measurement uncertainty (precision and bias)
  - Reporting requirements
- QA Handbook Volume 2: Ambient Air Quality Monitoring Program guidance document
  - Provides additional **guidance** and information beyond CFR requirements
  - Assist technical personnel at the SLT level in developing and implementing a quality system

Monitor Design Values

- The NAAQS are defined by four parts:
  1. Indicator
     - e.g., ozone, $PM_{2.5}$
  2. Averaging period
     - e.g., 1 hour, 8-hours, 24-hours, annual
  3. Statistical form
     - e.g., three-year average of 4^{th} highest daily maximum 8-hour concentration
  4. Level (the concentration)
     - e.g., 70 ppb, 12 $\mu g/m^3$

Smoke and Wildfires - EE



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'Unhealthy' air quality reported in Chicago area due to wildfire smoke

Published July 16, 2023 • Updated on July 16, 2023 at 8:26 am

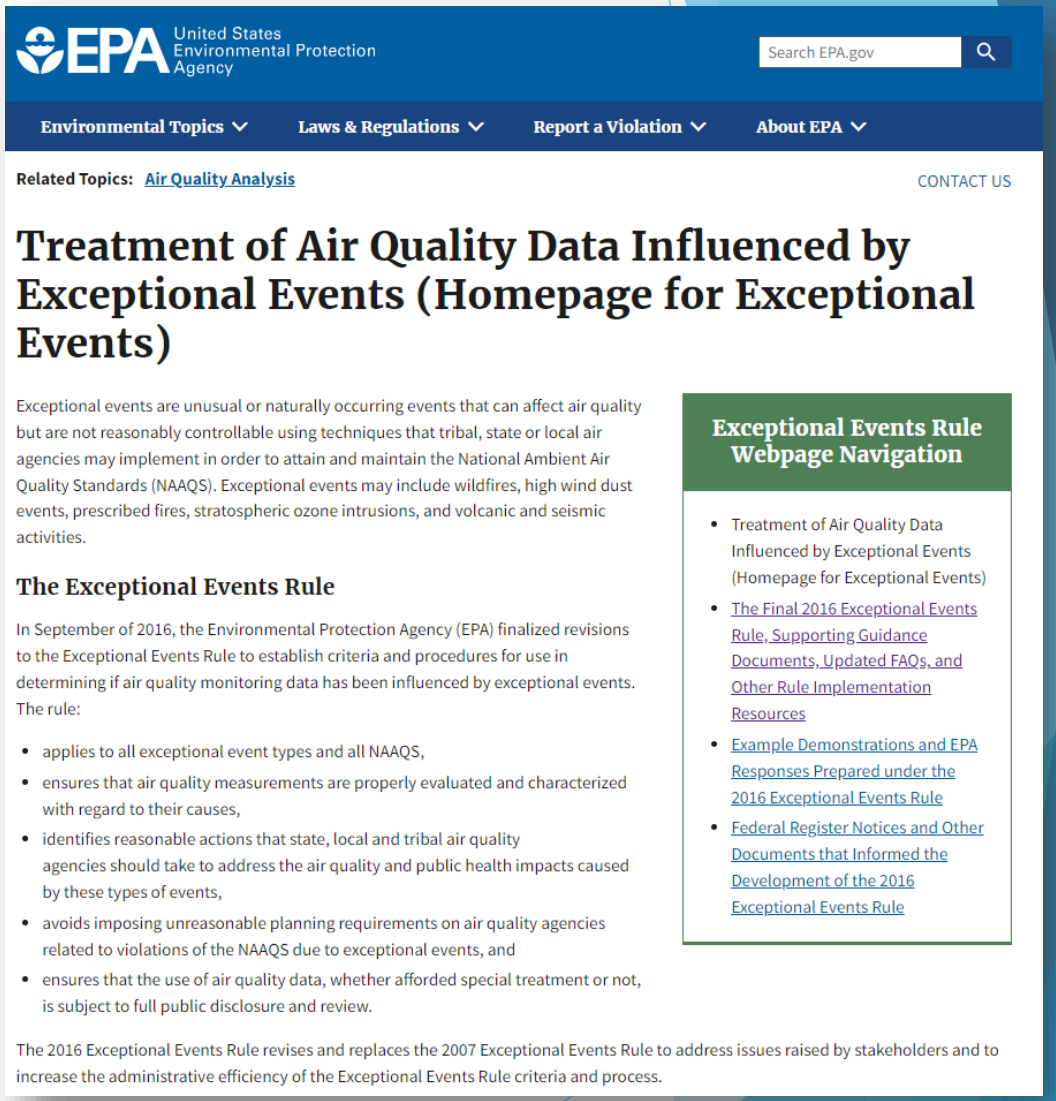
That's not fog out there blanketing the skies across the Chicago area Tuesday — it's haze and smoke from Canadian wildfires. Those pollutants, along with higher ozone levels, have led to very low visibility, a "very unhealthy" air quality warning and recommendations from Chicago Mayor Brandon Johnson for residents to remain inside and "consider wearing masks" as Chicago's air quality...

Residents in Illinois and northwest Indiana likely woke up to hazy skies on Sunday morning, as wildfire smoke once again blankets the area in "unhealthy" air.

According to the latest updates to the Air Quality Index, the city of Chicago is experiencing those unhealth conditions with an AQI of 156, according to federal officials.

Similar readings are being reported across most of Illinois and into northwest Indiana.

Residents with respiratory conditions, as well as active children and teenagers, are encouraged to avoid strenuous outdoor activities, to keep any outdoor activities short, and to consider moving activities indoors.



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Treatment of Air Quality Data Influenced by Exceptional Events (Homepage for Exceptional Events)

Exceptional events are unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that tribal, state or local air agencies may implement in order to attain and maintain the National Ambient Air Quality Standards (NAAQS). Exceptional events may include wildfires, high wind dust events, prescribed fires, stratospheric ozone intrusions, and volcanic and seismic activities.

The Exceptional Events Rule

In September of 2016, the Environmental Protection Agency (EPA) finalized revisions to the Exceptional Events Rule to establish criteria and procedures for use in determining if air quality monitoring data has been influenced by exceptional events. The rule:

- applies to all exceptional event types and all NAAQS,
- ensures that air quality measurements are properly evaluated and characterized with regard to their causes,
- identifies reasonable actions that state, local and tribal air quality agencies should take to address the air quality and public health impacts caused by these types of events,
- avoids imposing unreasonable planning requirements on air quality agencies related to violations of the NAAQS due to exceptional events, and
- ensures that the use of air quality data, whether afforded special treatment or not, is subject to full public disclosure and review.

Exceptional Events Rule Webpage Navigation

- Treatment of Air Quality Data Influenced by Exceptional Events (Homepage for Exceptional Events)
- The Final 2016 Exceptional Events Rule, Supporting Guidance Documents, Updated FAQs, and Other Rule Implementation Resources
- Example Demonstrations and EPA Responses Prepared under the 2016 Exceptional Events Rule
- Federal Register Notices and Other Documents that Informed the Development of the 2016 Exceptional Events Rule

The 2016 Exceptional Events Rule revises and replaces the 2007 Exceptional Events Rule to address issues raised by stakeholders and to increase the administrative efficiency of the Exceptional Events Rule criteria and process.

Monitor Design Values

- Design values are calculated by EPA each year for informational purpose, whether EPA is actually making an official determination or not.
  - See: EPA Design Values

Monitor Design Values

- The Design Value (DV) is a statistic that describes the air quality status of a given location relative to the level of the NAAQS
- The DV for an area is equal to the highest monitor-specific DV for all monitors in an nonattainment area (which could be a partial area, multi-county, or multi-state area) or in a MSA or CBSA for O_3 and $PM_{2.5}$

Monitor Design Values

- Design values
  - defined to be consistent with the individual NAAQS as described in 40 CFR Part 50
  - used to designate and classify nonattainment areas
  - used to assess progress towards meeting the NAAQS
  - computed and published annually by EPA's Office of Air Quality Planning and Standards and reviewed in conjunction with the EPA Regional Offices