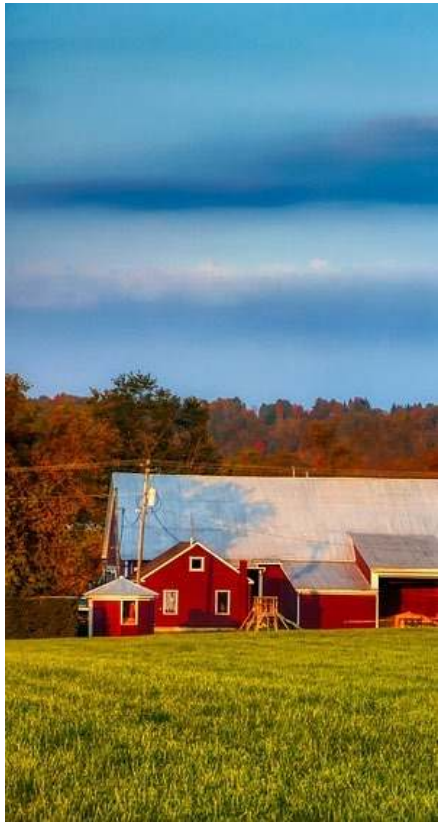
NEW HAMPSHIRE DEPARTMENT OF Environmental Services

New Hampshire Air Quality and Monitoring

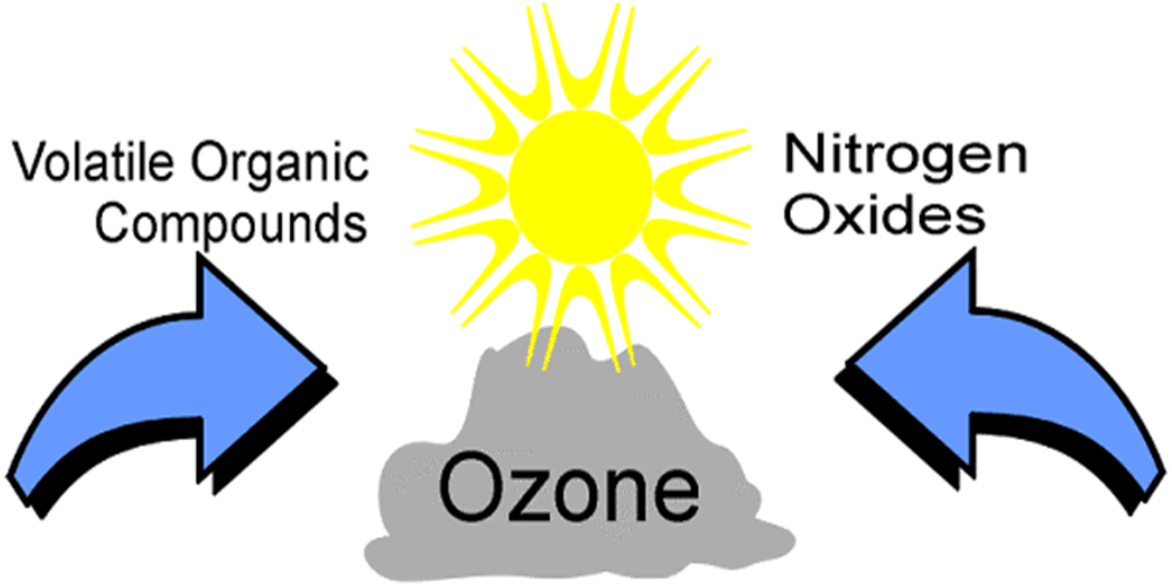
Kathleen Errington and Marcus Chase
2023 BIA Conference
September 12, 2023

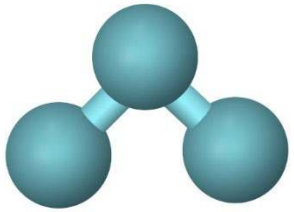


Pollutants of Concern

Ozone

- Molecule comprised of three oxygen atoms
- Not directly emitted. Formed through complex chemical reactions
- Present during the summer





Pollutants of Concern

Particulate Matter

- Either directly emitted or formed through complex chemical reactions
- Mixture of solid particles and liquid droplets
- Can be very small and therefore, inhaled → PM10 and PM2.5

PM10

- 10 microns or less in diameter
- Inhalable Particles
- Dust, Pollen, Mold, etc.

PM2.5

- 2.5 microns or less in diameter
- Fine Inhalable Particles
- Combustion Particles, Organic Compounds, Metals, etc.

Woodsmoke

Wildfires

Ozone and PM2.5 Health Effects: *General Population*

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Ozone

- Not as water soluble as other pollutants and can travel deeper into the lower respiratory tract.
- Once there it is highly reactive and can kick off a series of events leading to lung inflammation
- Health effects include:
  - Coughing
  - Throat Irritation
  - Reduced Lung Function
  - Chest Tightness
  - Shortness of Breath

PM2.5

- Incredibly small and can be inhaled deep into the respiratory tract leading to numerous health effects
- Can get into the bloodstream
- Health effects include:
  - Decreased lung function
  - Irregular heartbeat
  - Nonfatal heart attacks
  - Aggravated asthma

Ozone and PM2.5 Health Effects: *Sensitive Groups*

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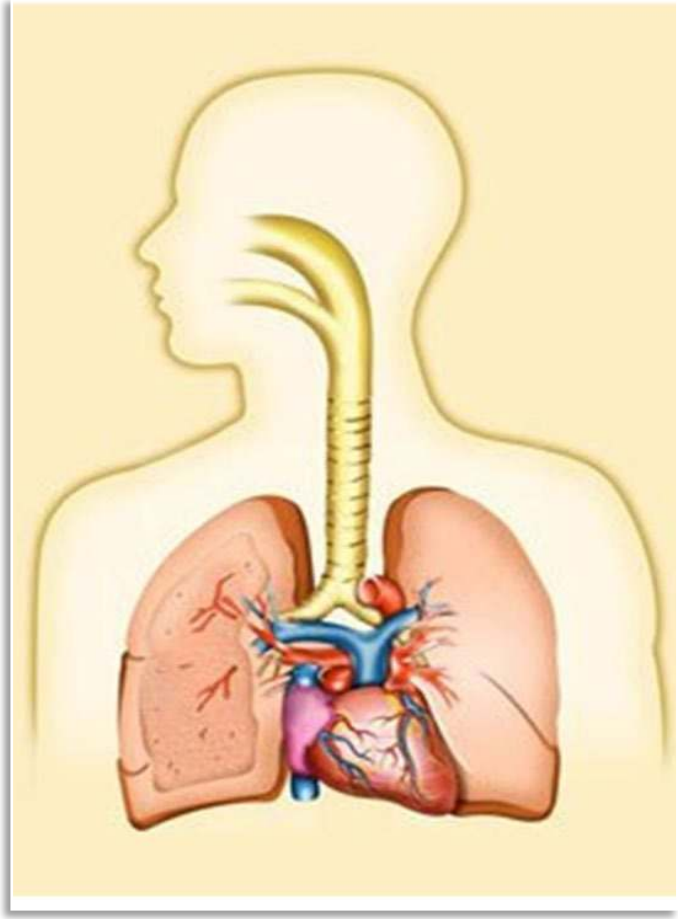
Sensitive Groups Include:

- People with lung or heart diseases
- Older Adults
- Children

Additional Health effects include:

- Narrowing of Airways
- Decreased Airflow
- Excessive Mucus Production
- Increase in Medication Usage
- Increase in Asthma Attacks
- Increase in Hospitalizations and ER visits



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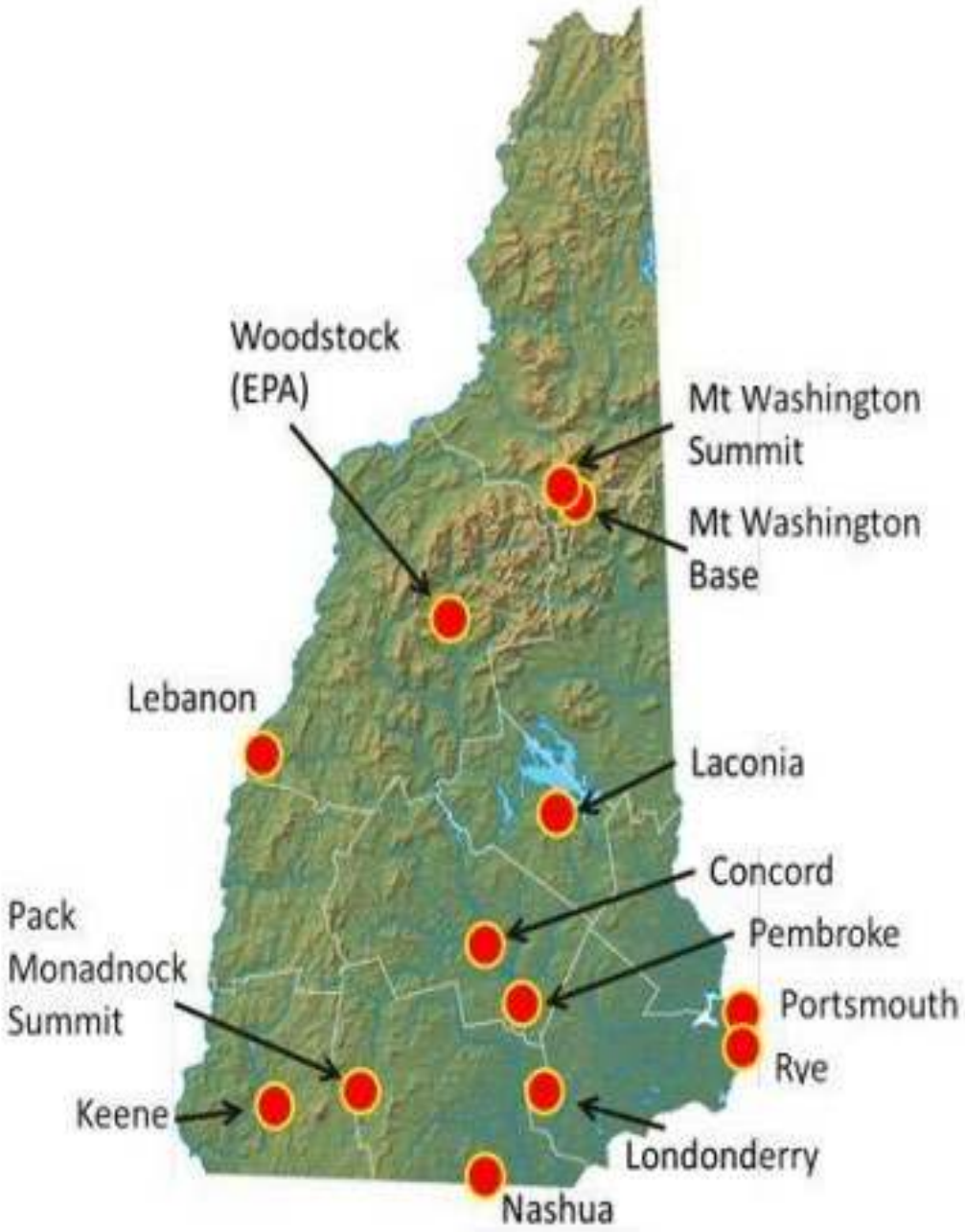
Air Quality

NH Ambient Air Monitoring Network

- 11 Ozone Monitors
- 6 Particulate Matter Monitors
- 4 Sulfur Dioxide Monitors
- 2 Nitrogen Dioxide Monitors
- 2 Carbon Monoxide Monitors



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National **A**mbient **A**ir **Q**uality **S**tandards (NAAQS)

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Ozone

8 hour averaging time

- NAAQS: 70 parts per billion (ppb)

PM2.5

24 hour averaging time (midnight to midnight)

- NAAQS: 35 $\mu g/m^3$

Annual Average

- NAAQS: 12 $\mu g/m^3$

Air Quality Index (AQI)

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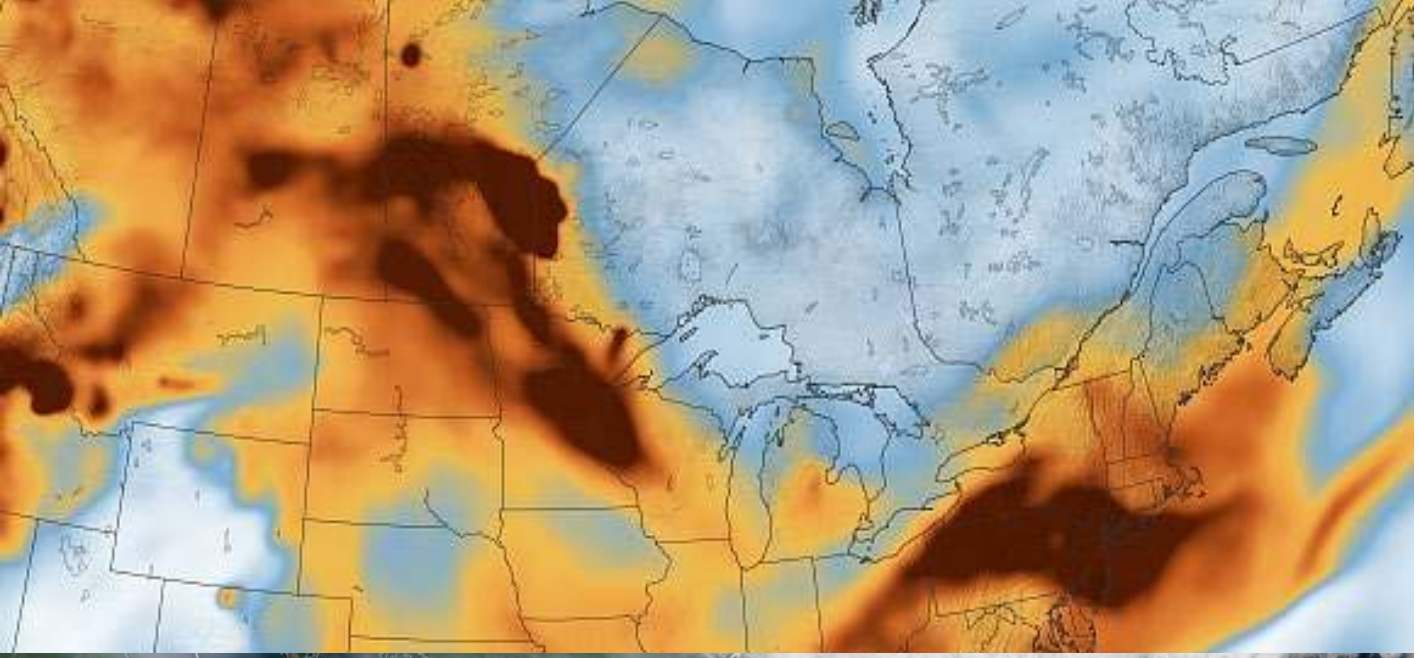
AQI Basics for Ozone and Particle Pollution

Daily AQI Color	Levels of Concern	Values of Index	Description of Air Quality
Green	Good	0 to 50	Air quality is satisfactory, and air pollution poses little or no risk.
Yellow	Moderate	51 to 100	Air quality is acceptable. However, there may be a risk for some people, particularly those who are unusually sensitive to air pollution.
Orange	Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is less likely to be affected.
Red	Unhealthy	151 to 200	Some members of the general public may experience health effects; members of sensitive groups may experience more serious health effects.
Purple	Very Unhealthy	201 to 300	Health alert: The risk of health effects is increased for everyone.
Maroon	Hazardous	301 and higher	Health warning of emergency conditions: everyone is more likely to be affected.



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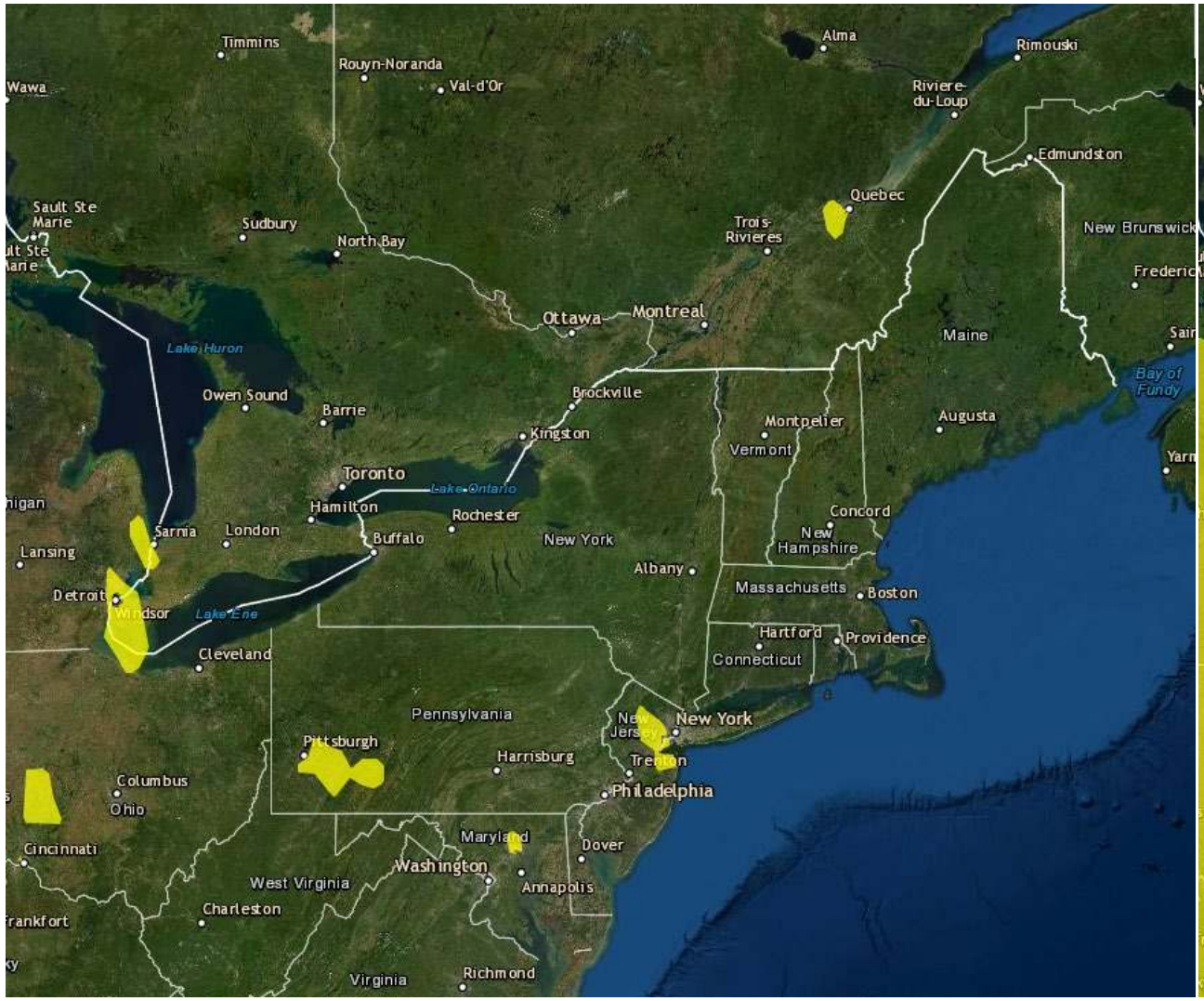
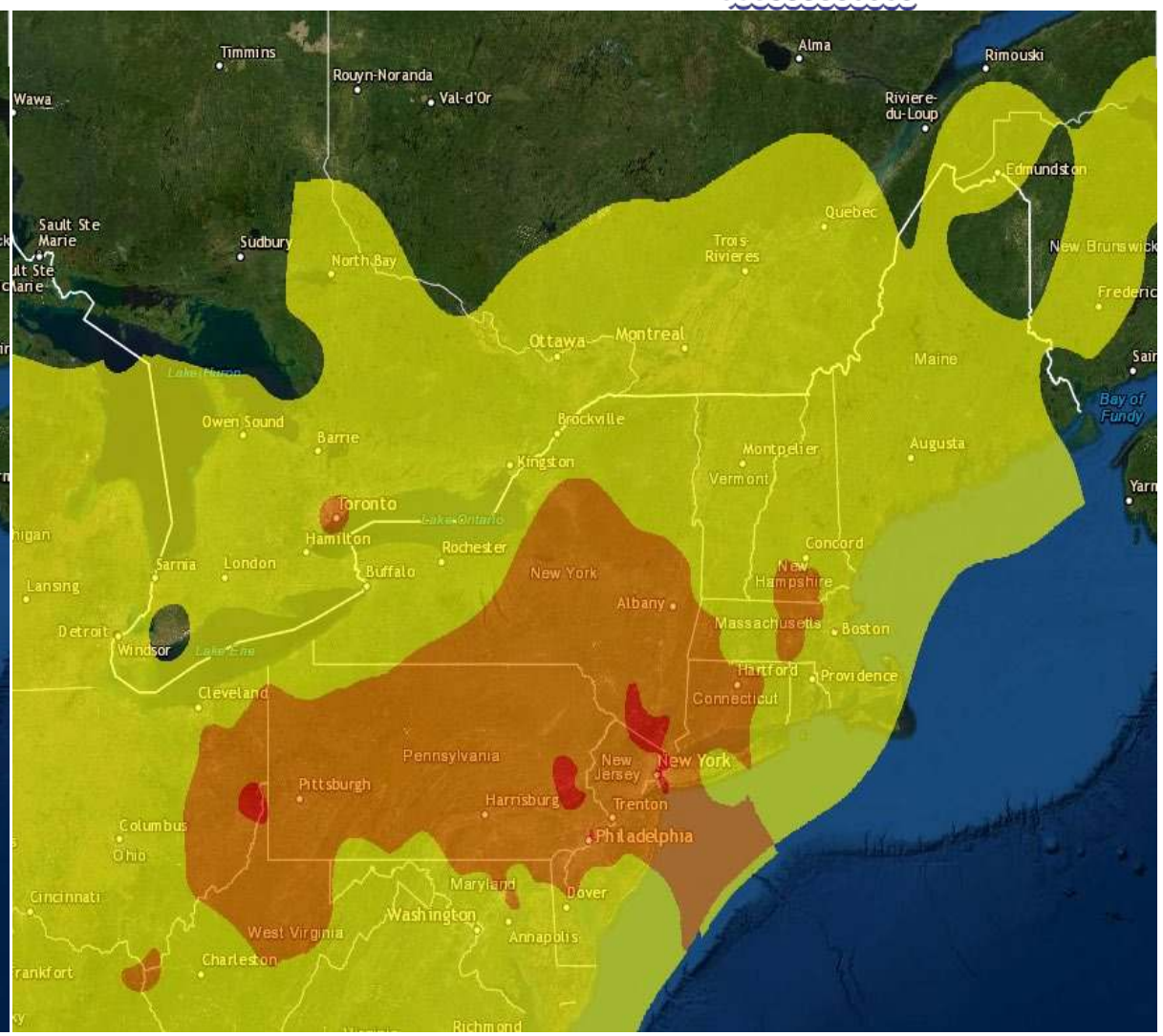
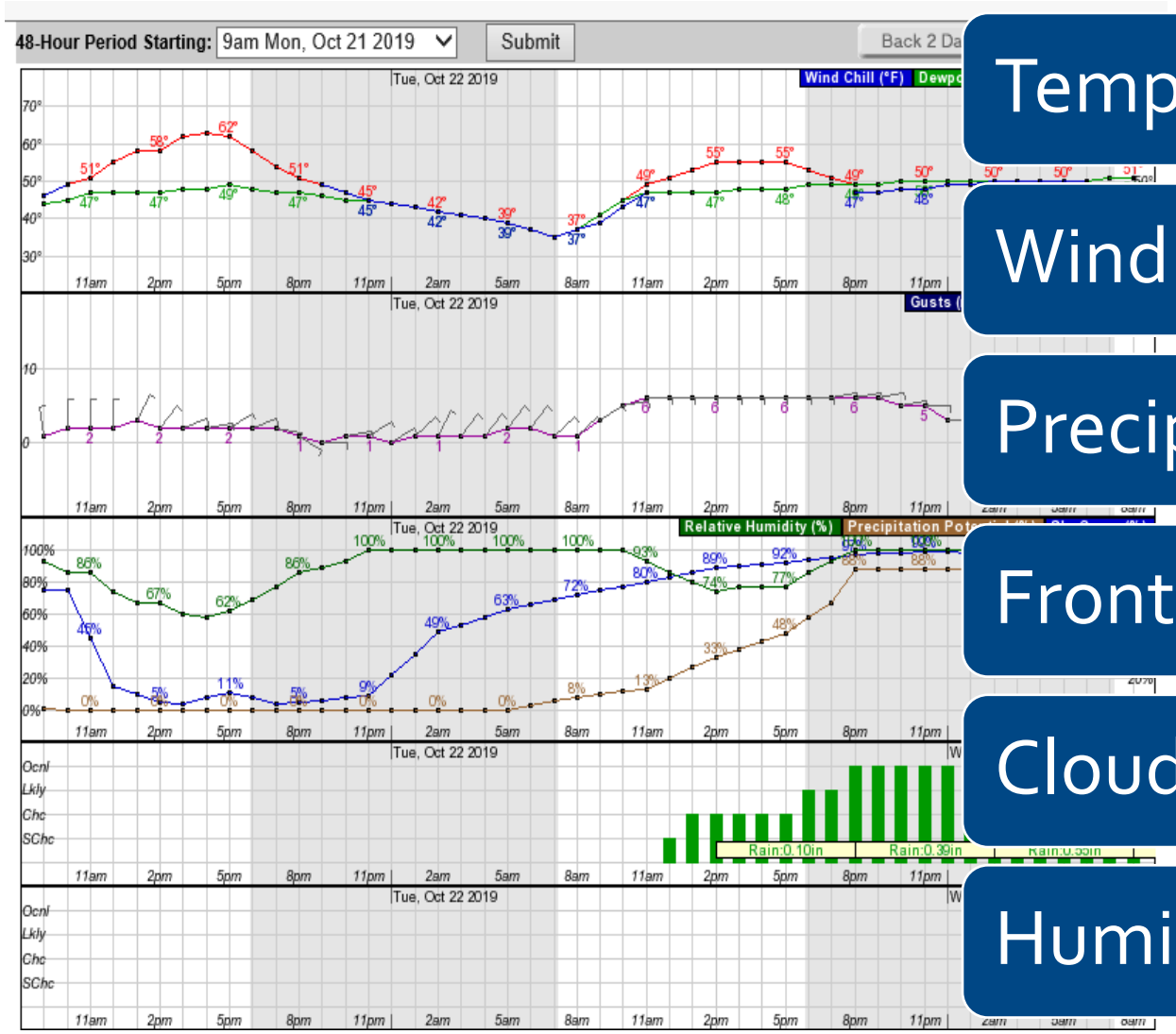
Air Quality Forecasting

Current Air Quality





Meteorology



Temperature

Wind Speed/Direction

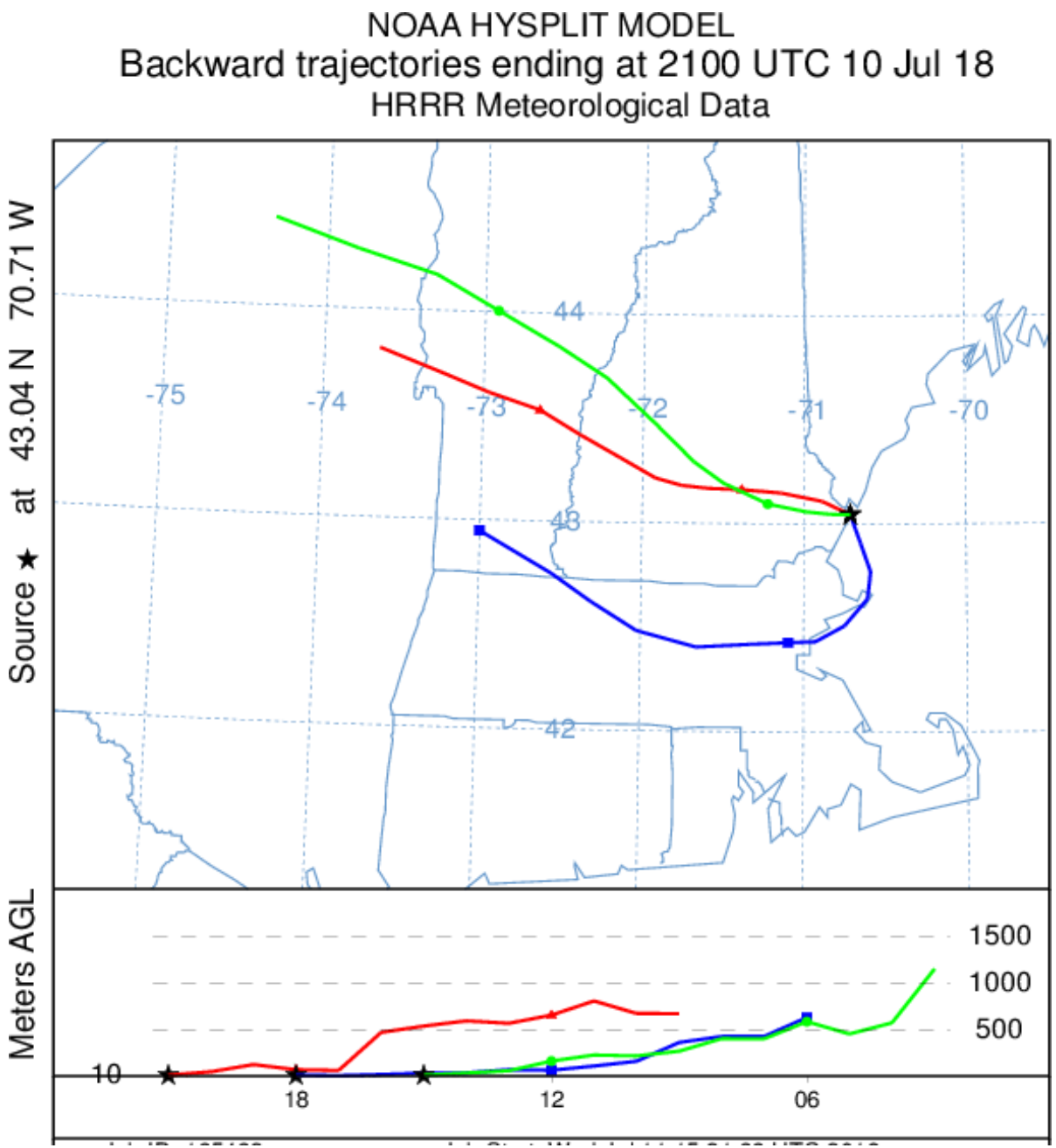
Precipitation

Frontal Systems

Cloud Cover

Humidity

Trajectories



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Air Quality Models

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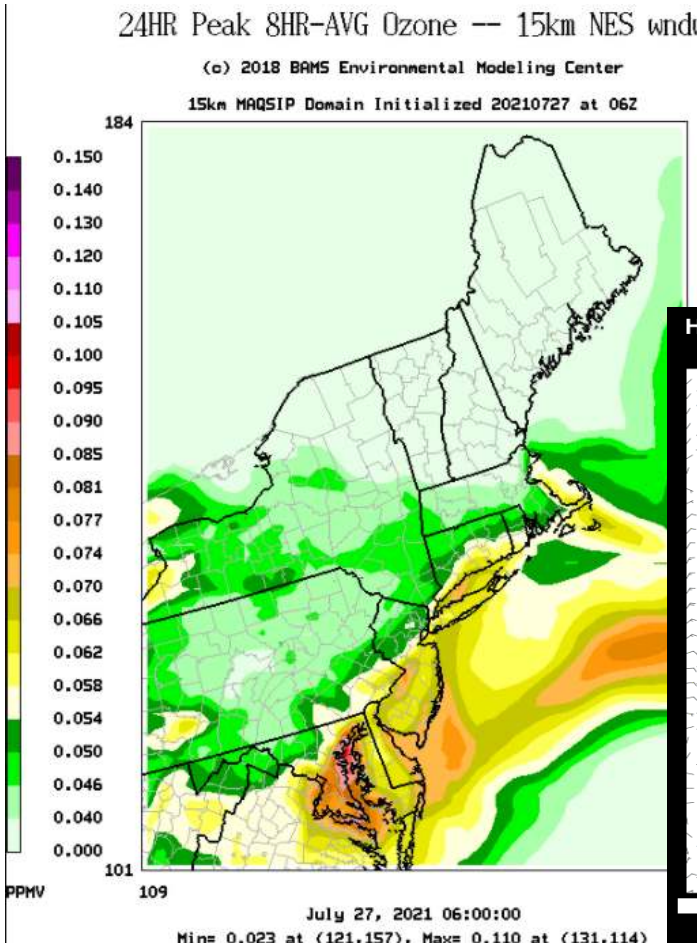

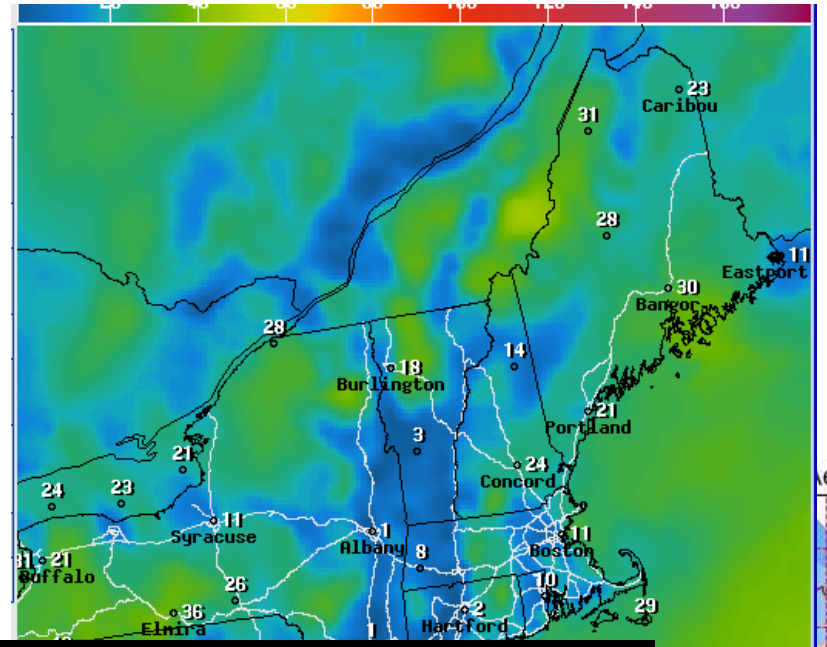

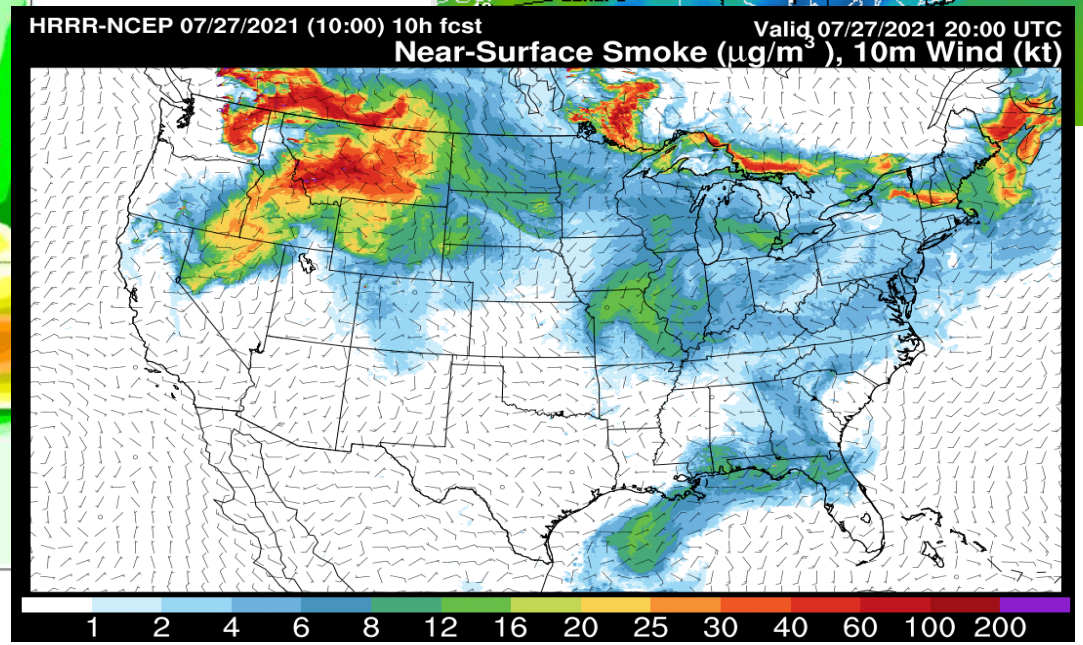

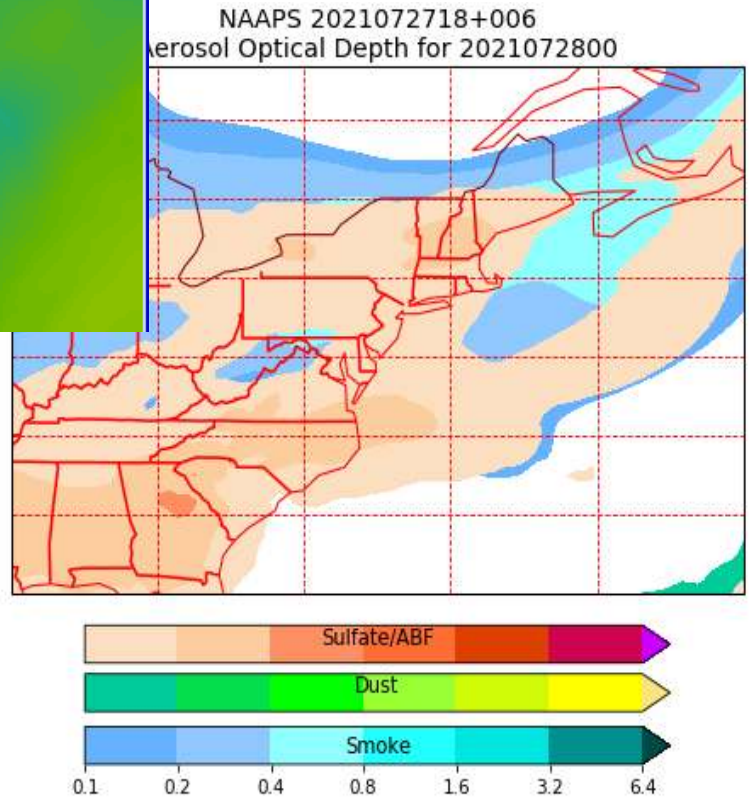

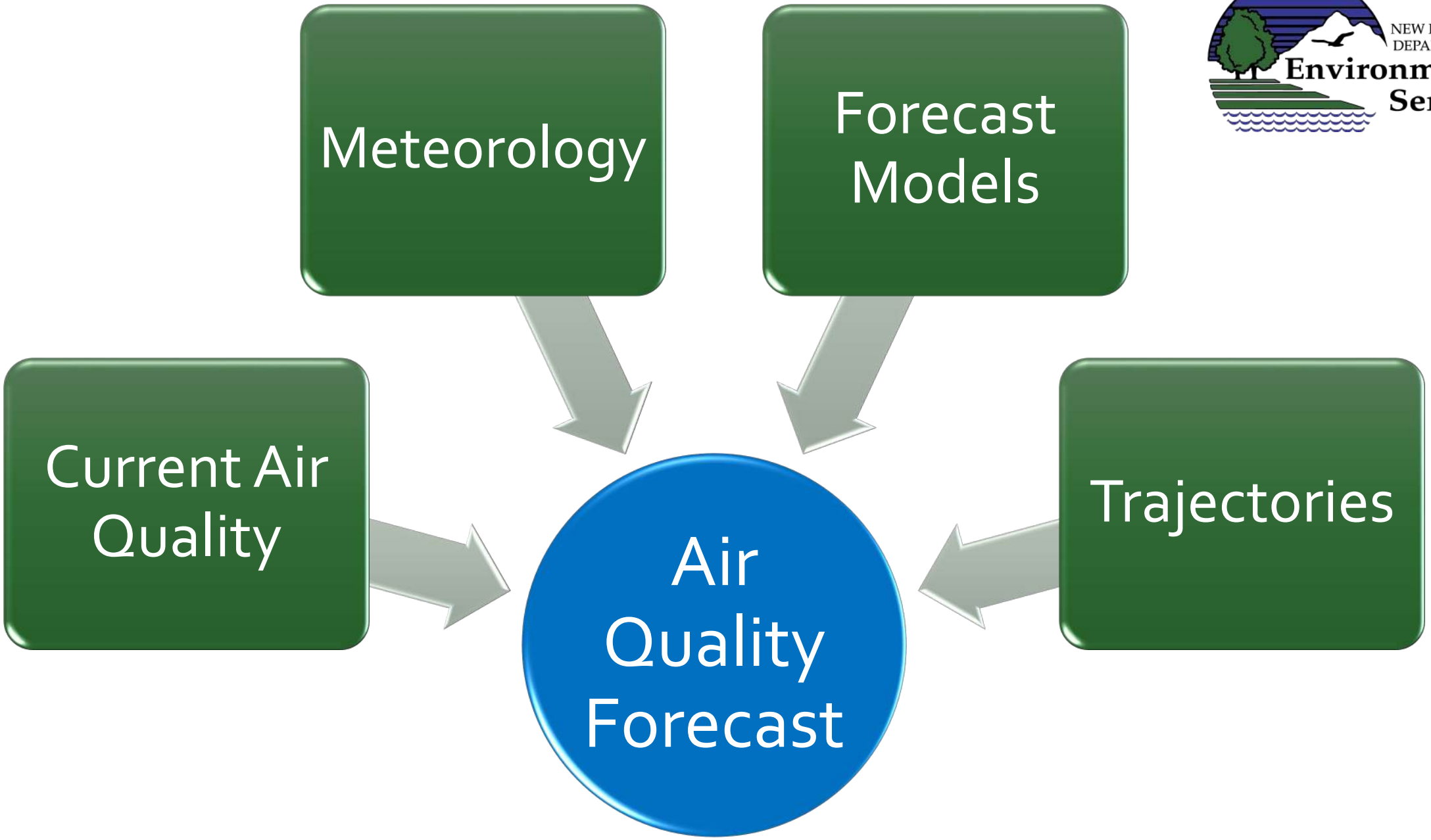

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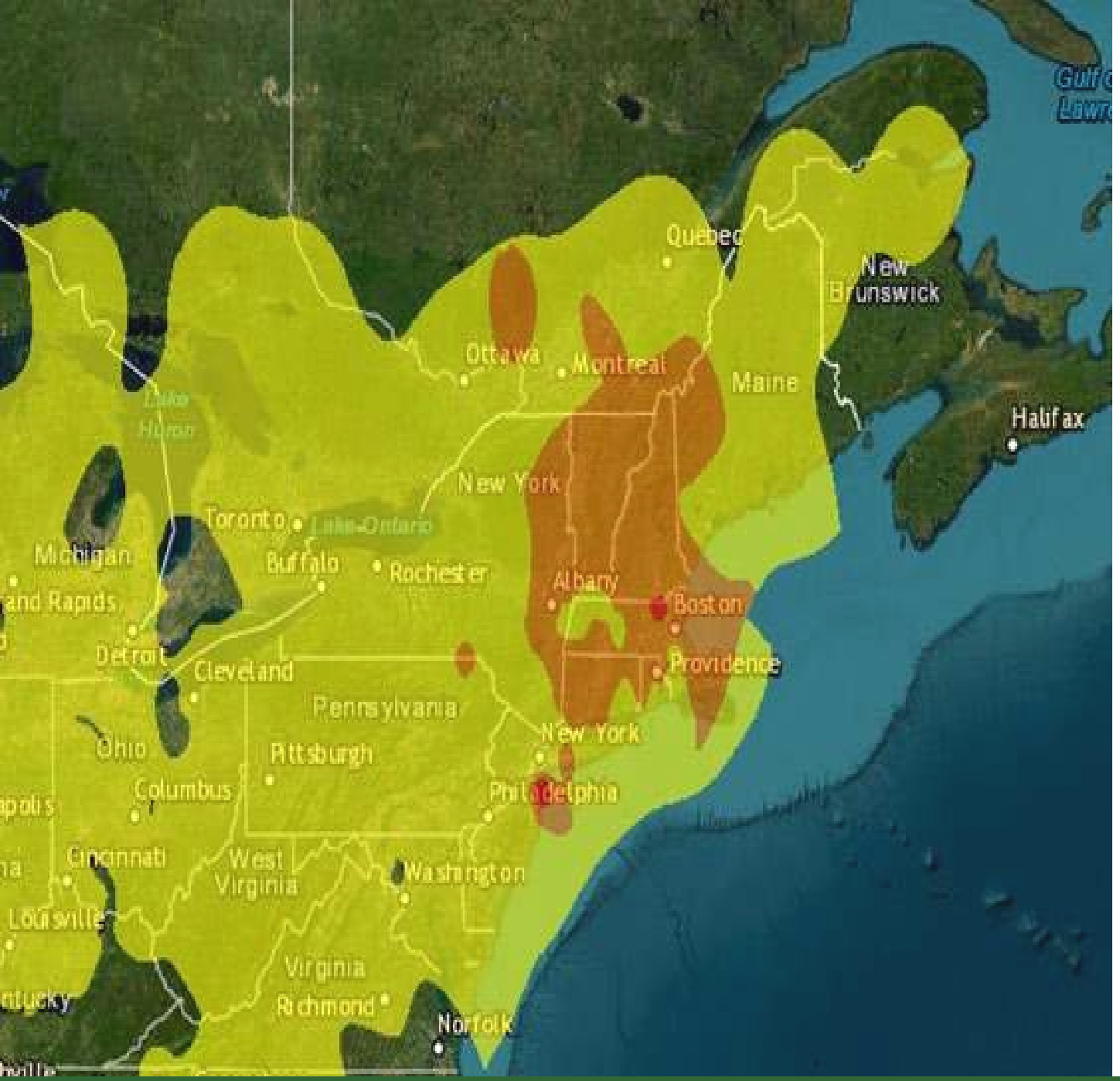

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Air Quality Action Days (AQAD)

Air Quality Action Days

Issued when levels of either ozone or $PM_{2.5}$ are forecasted to be above the standard

- NHDES Issues Press Release
- Posted to Social Media
- Distributed to local television stations
- Alerts Displayed on National Weather Service website

News from the New Hampshire Department of Environmental Services

FOR IMMEDIATE RELEASE
DATE: August 3, 2022
CONTACT: David Healy (603) 419-0330
Jana Ford (603) 848-0765

NHDES Declares Air Quality Action Day

Air Pollution Levels Unhealthy for Sensitive Groups Predicted for Thursday

Concord, NH – The New Hampshire Department of Environmental Services (NHDES) is expecting air pollution concentrations to reach unhealthy levels for sensitive individuals in **Hillsborough and Rockingham Counties** on **Thursday August 4.** NHDES officials are calling for an Air Quality Action Day and advise sensitive individuals in these areas to take precautions to protect their health by limiting prolonged outdoor exertion. Sensitive individuals include children and older adults; anyone with lung disease such as asthma, emphysema, or bronchitis; and people who are active outdoors. Even non-sensitive individuals could experience mild health effects and may want to consider limiting strenuous or prolonged outdoor activities.

NHDES forecasts that concentrations of **ground-level ozone** (the main component of smog) will rise to levels that are unhealthy for sensitive individuals during afternoon and evening hours in the above-mentioned regions. The predicted air pollution comes from winds transporting pollutant emissions into New Hampshire from surrounding areas, which combine with local emissions. High temperatures and sunny skies then enhance the creation of ozone from these precursor pollutants. Air quality is expected to improve on Friday as cloud cover and precipitation chances increase.

Symptoms of ozone exposure may include coughing, wheezing, chest tightness, shortness of breath, or pain when inhaling deeply. People with asthma and other existing lung diseases may

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Air Quality Trends

93.8%

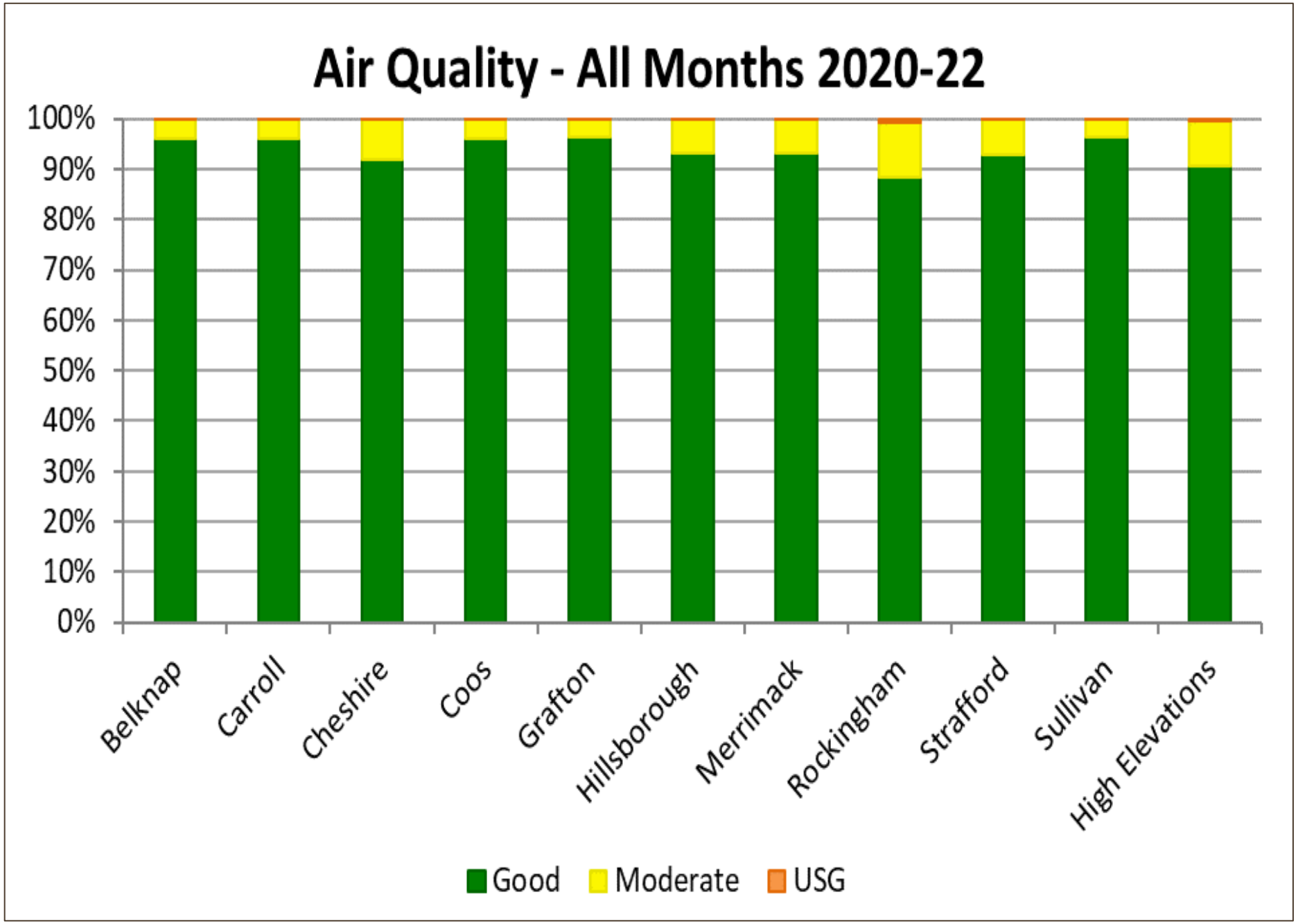
Good Days

6.0%

Moderate Days

0.2%

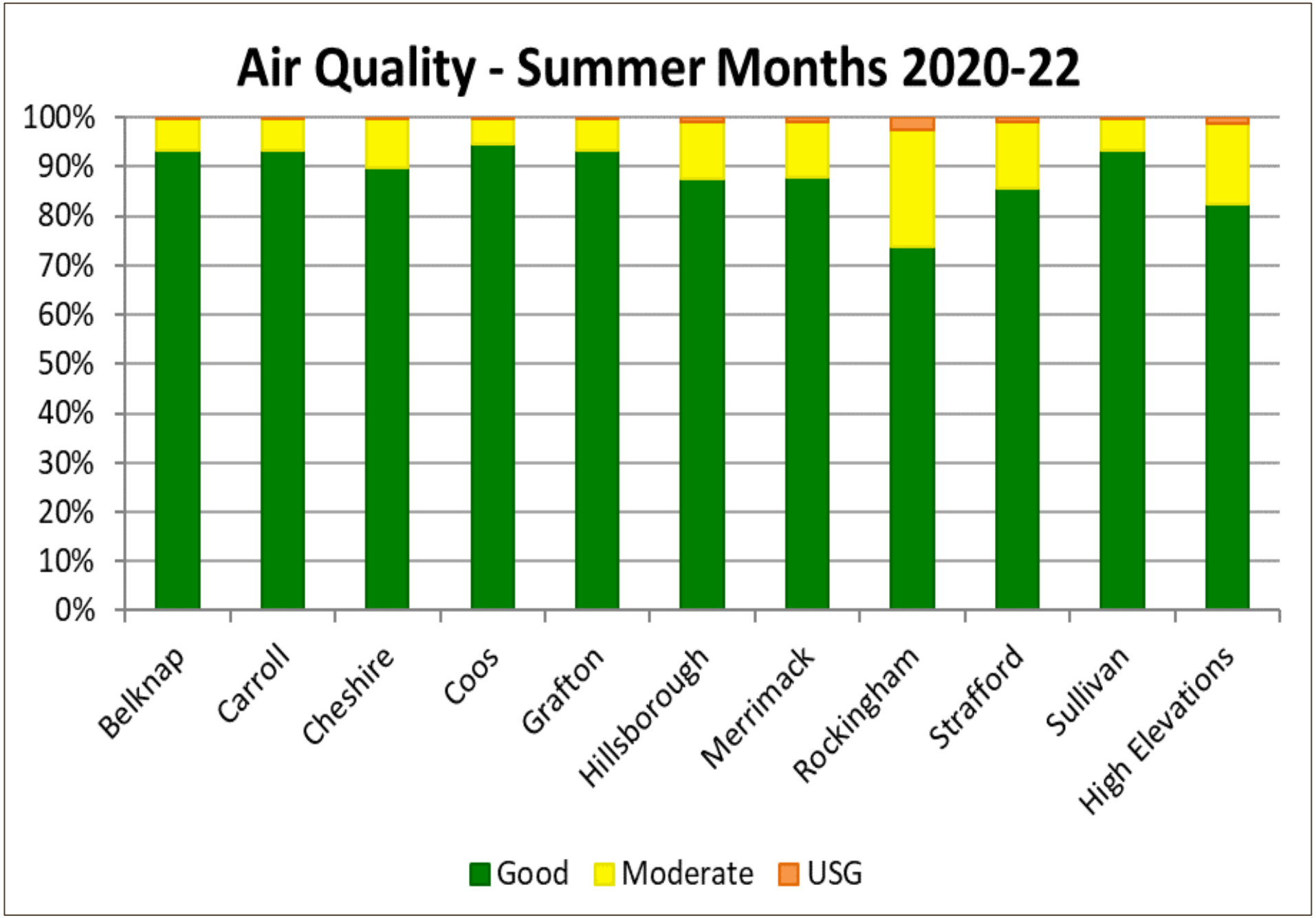
USG Days



88.7%
Good Days

10.6%
Moderate Days

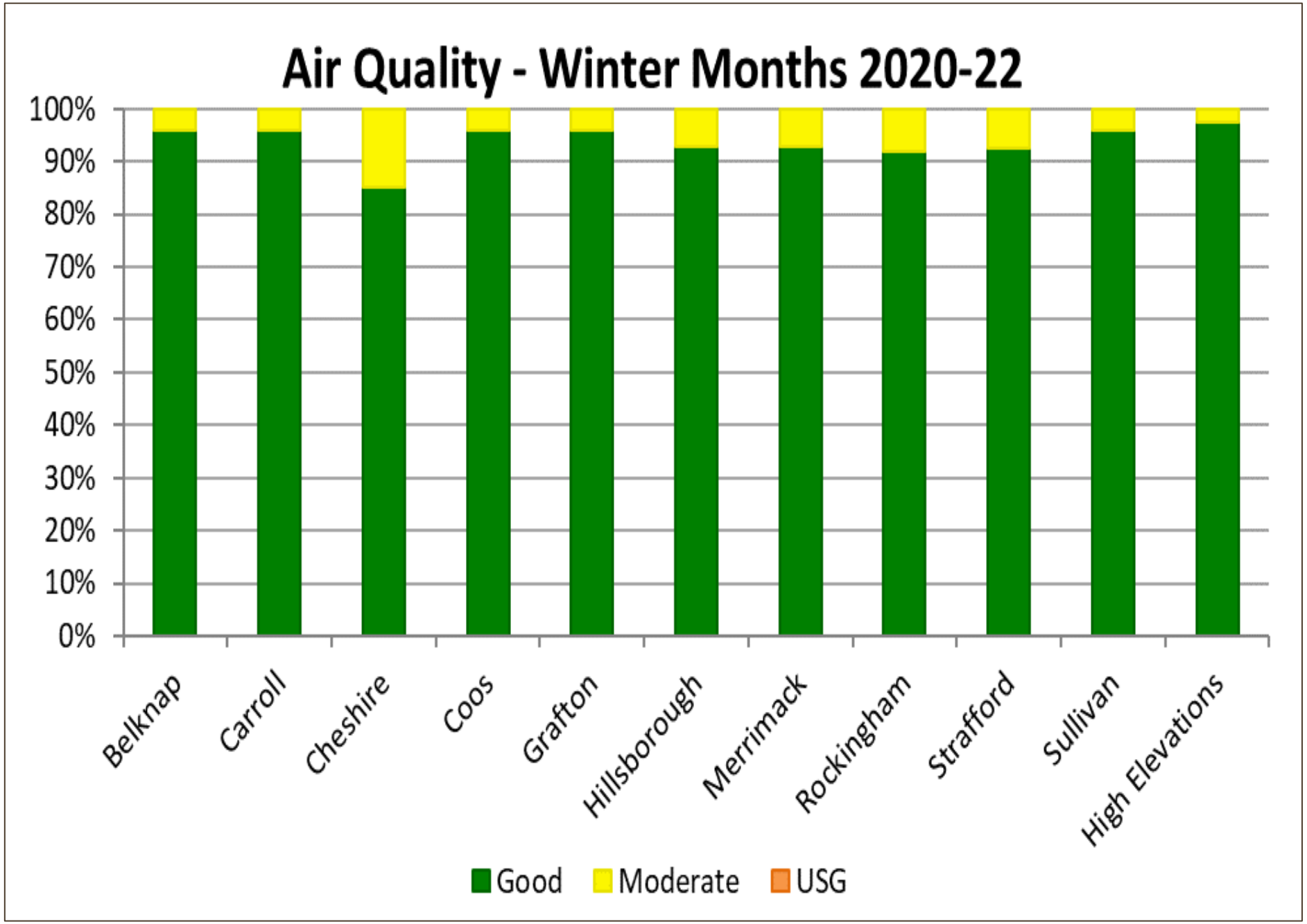
0.7%
USG Days

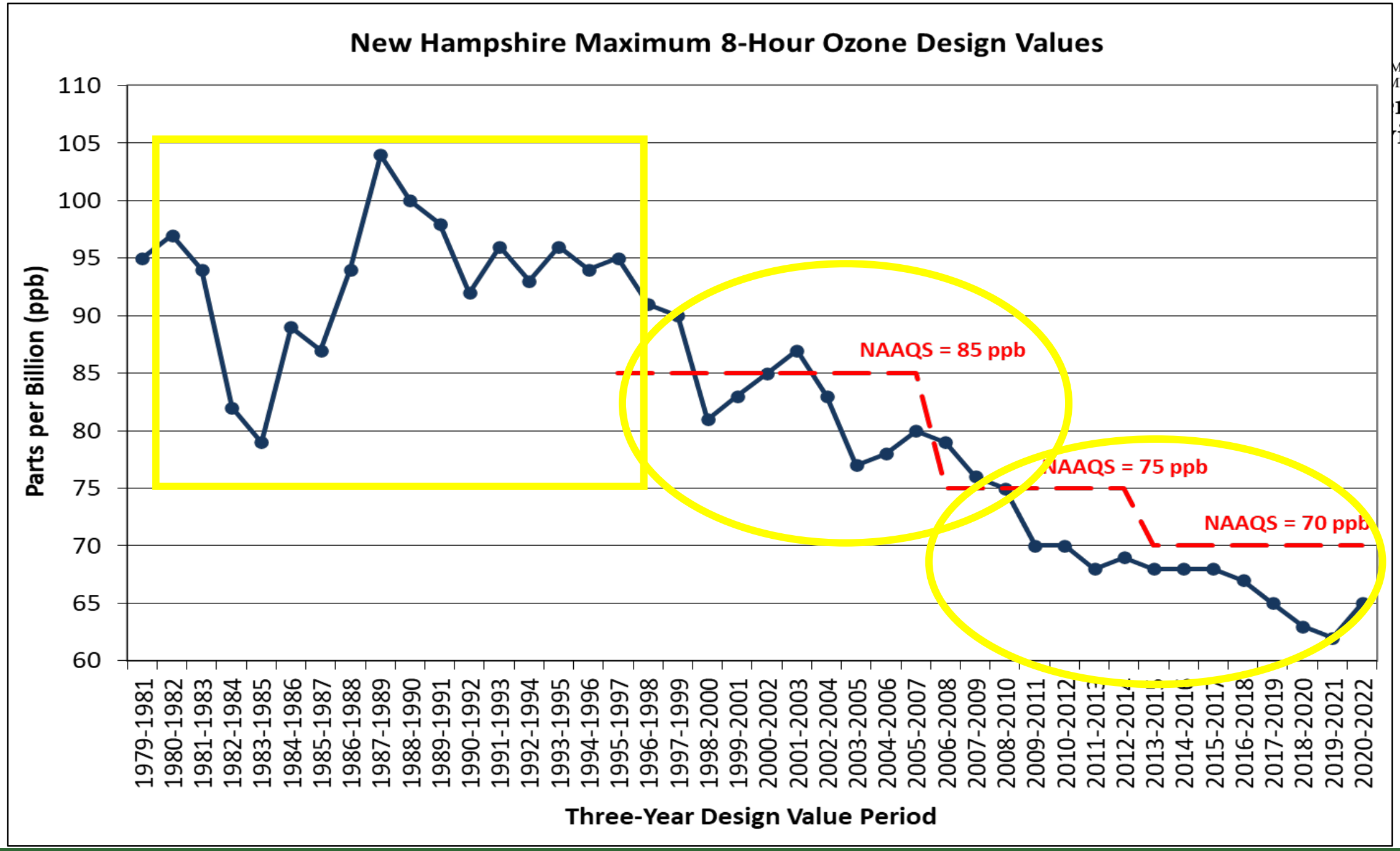


93.9%
Good Days

6.1%
Moderate Days

0%
USG Days





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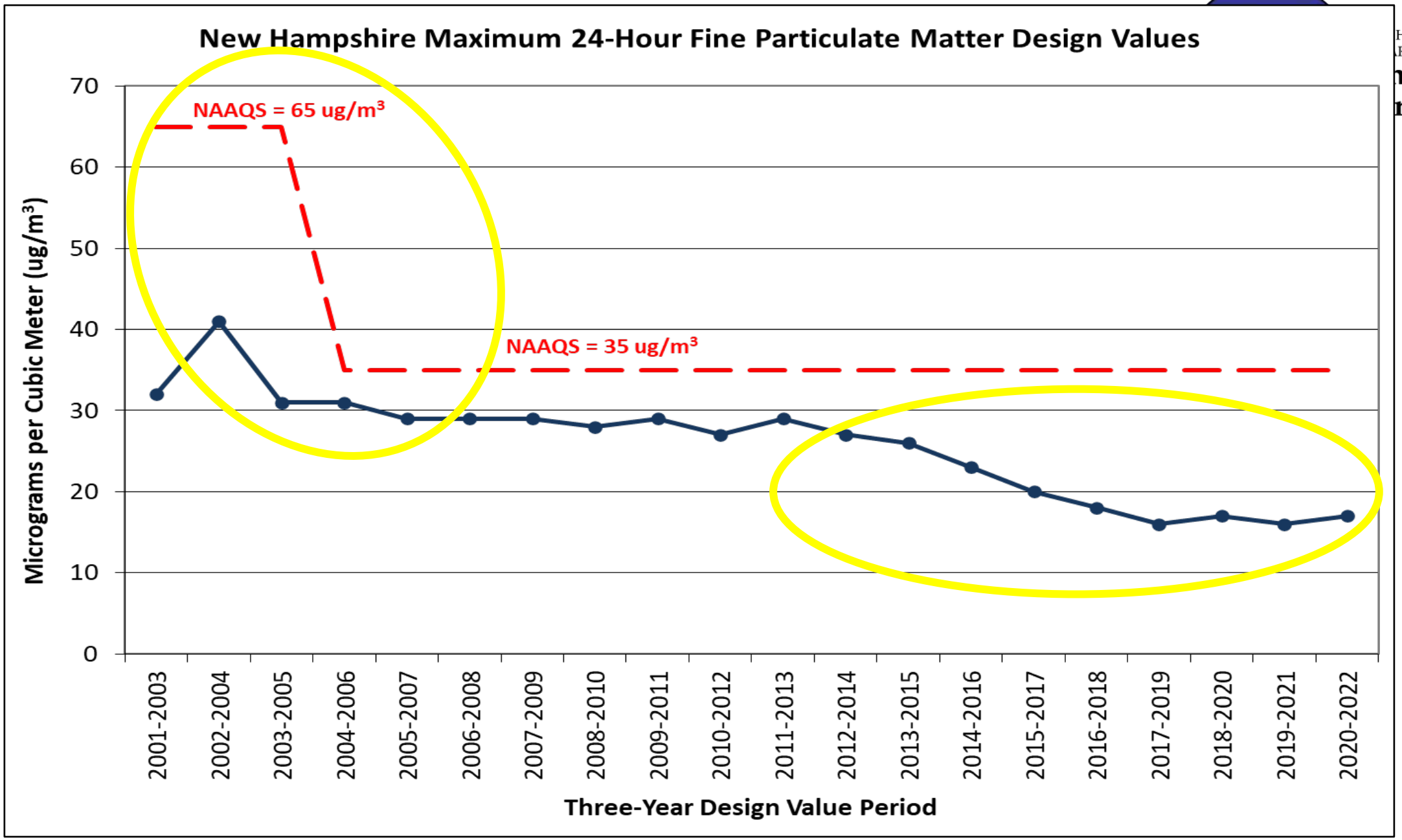

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New Hampshire 2023 Air Quality Exceedances

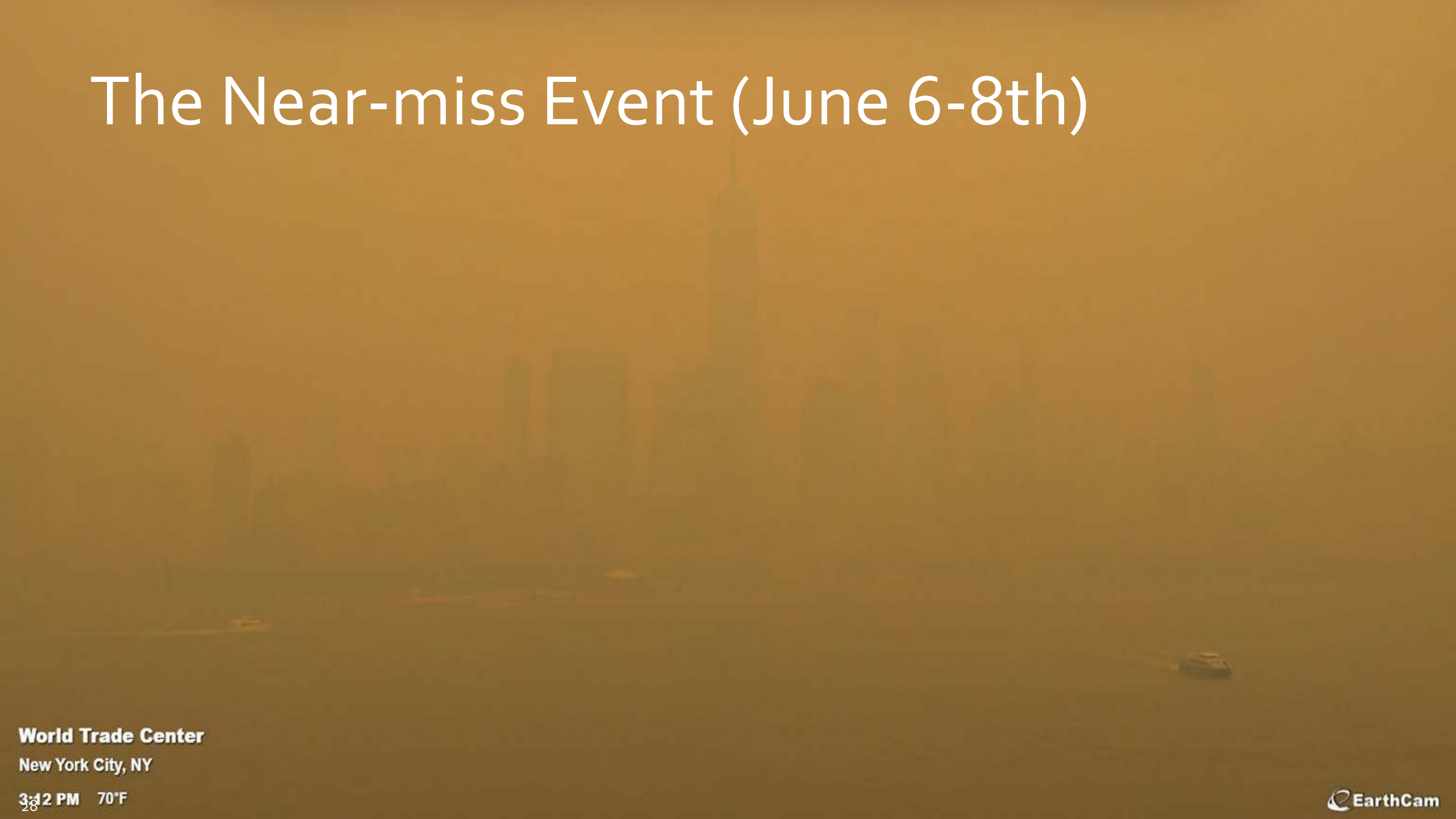
Ozone		
Date	**Site**	**Max 8-hr Avg (ppb)**
4/14/2023	Summit	71
4/14/2023	Miller	74
4/14/2023	Nashua	74
4/15/2023	Summit	81
6/11/2023	Miller	72
7/1/2023	Keene	76
7/1/2023	Summit	71

PM2.5		
Date	**Site**	**24-hr Mid Avg (ug/m3)**
7/1/2023	Keene	45.4
7/1/2023	Miller	38.8
7/17/2023	Keene	39.9
7/18/2023	Laconia	37.3

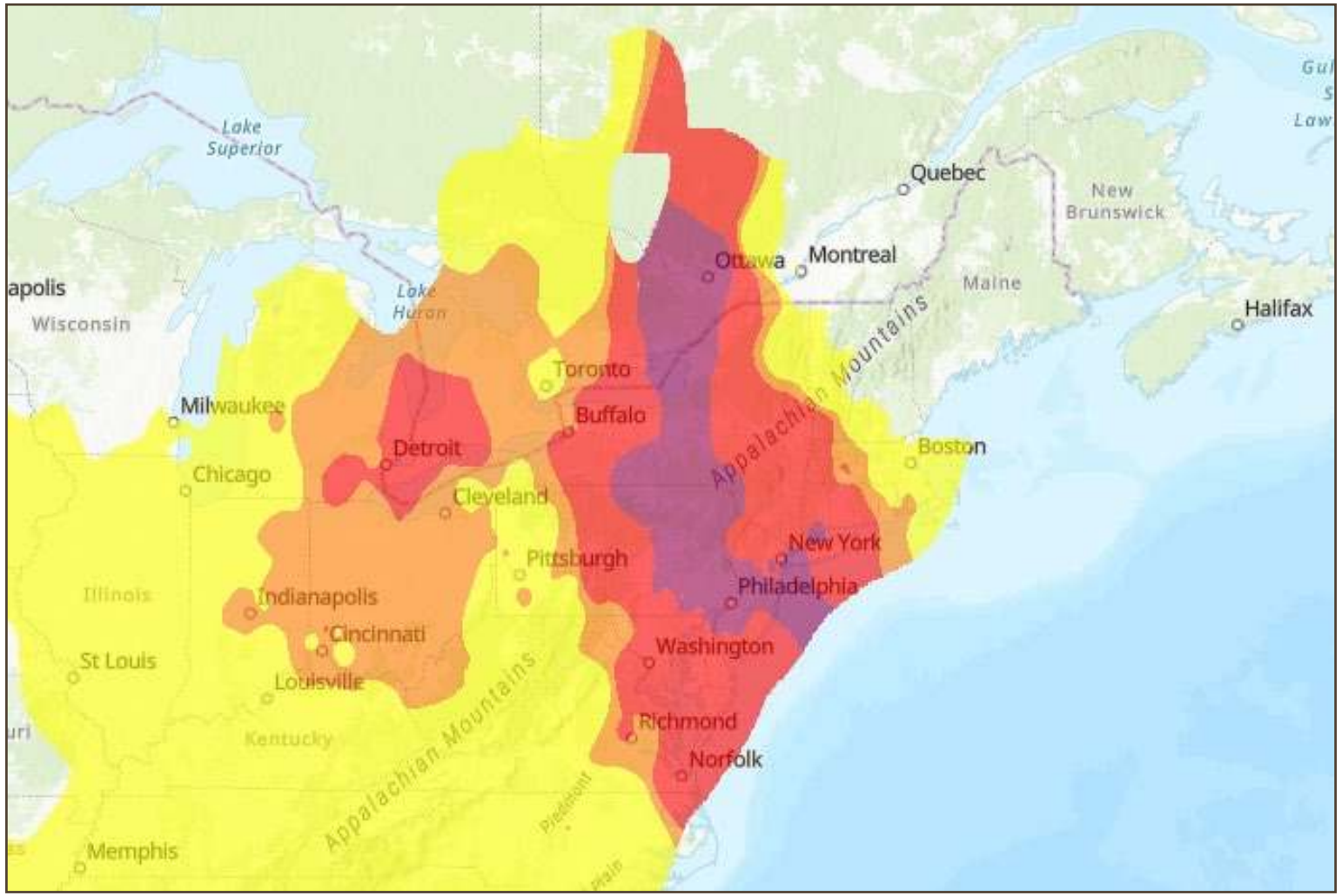
Exceedance ≠ Violation

2023
Air Quality Events

The Near-miss Event (June 6-8th)



The Near-miss Event (June 6-8th)

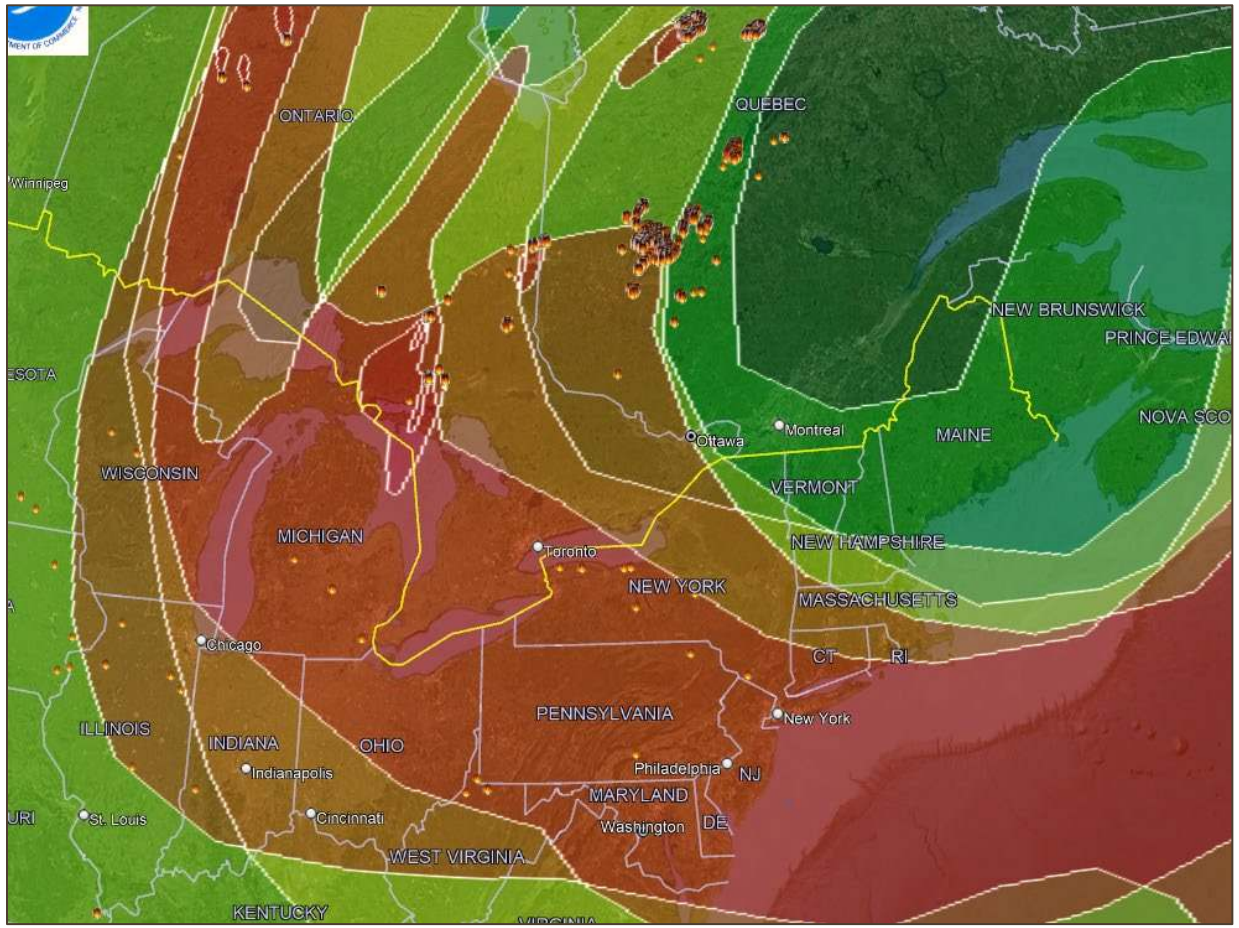


U.S. Air Quality Index

- Good (0-50)
- Moderate (51-100)
- Unhealthy for Sensitive Groups (101-150)
- Unhealthy (151-200)
- Very Unhealthy (201-300)
- Hazardous (301-500)

The Near-miss Event (June 6-8th)

GOES-EAST Imagery 6/6/23



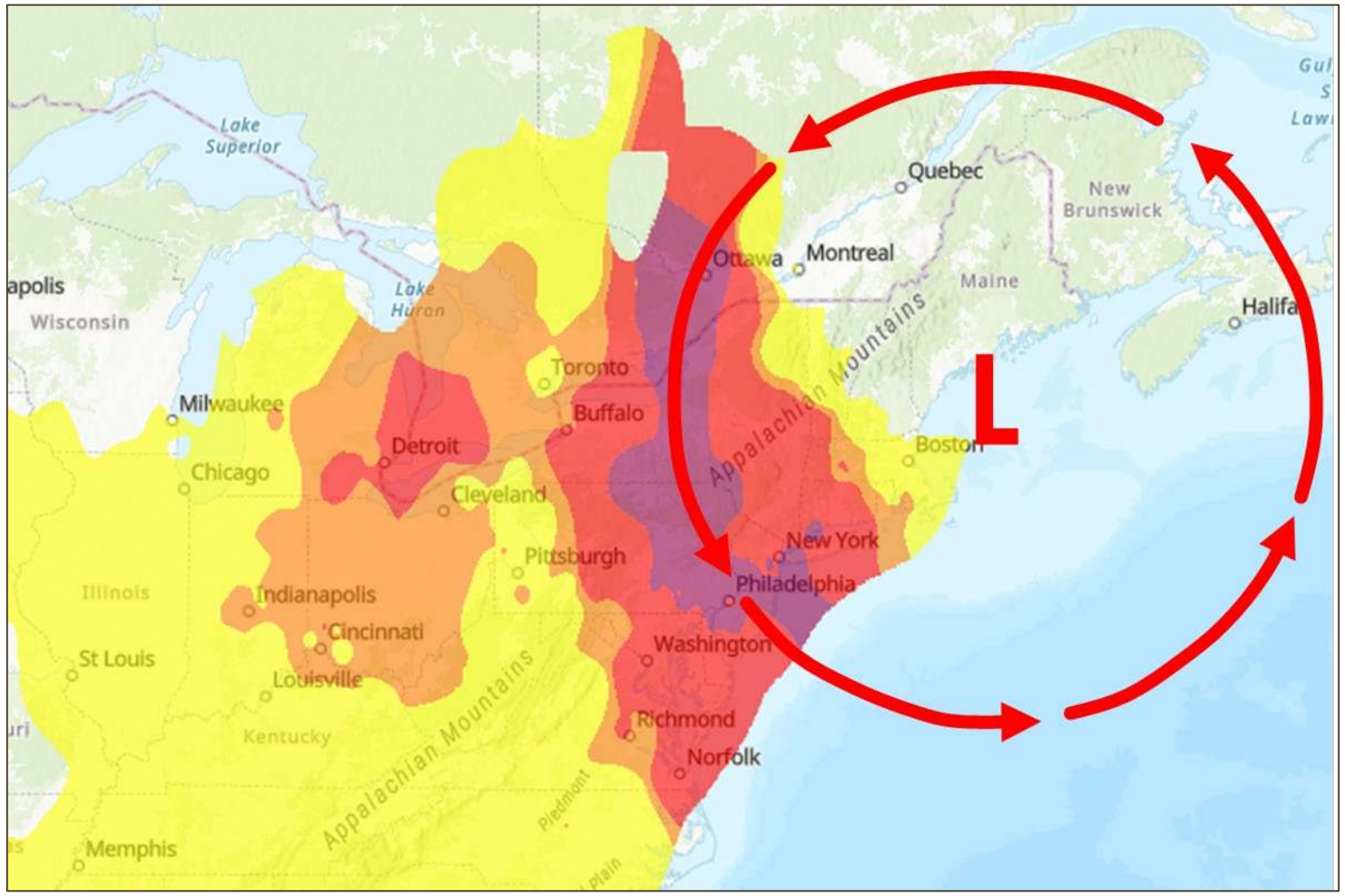
NOAA Hazard Mapping System Fire and Smoke Product 6/7/23

The Near-miss Event (June 6-8th)

Location	Daily PM2.5 AQI	Daily PM2.5 Conc. ($\mu g/m^3$)
Freemansburg, PA	309	258.9
Scranton, PA	268	217.7
Philadelphia, PA	261	211.1
Queens, NY	254	203.5
Syracuse, NY	233	182.6
Trenton, NJ	222	172.0
Wilmington, DE	229	178.8

- Some of the recorded PM2.5 values in the Northeast on June 7, 2023

The Near-miss Event (June 6-8th)



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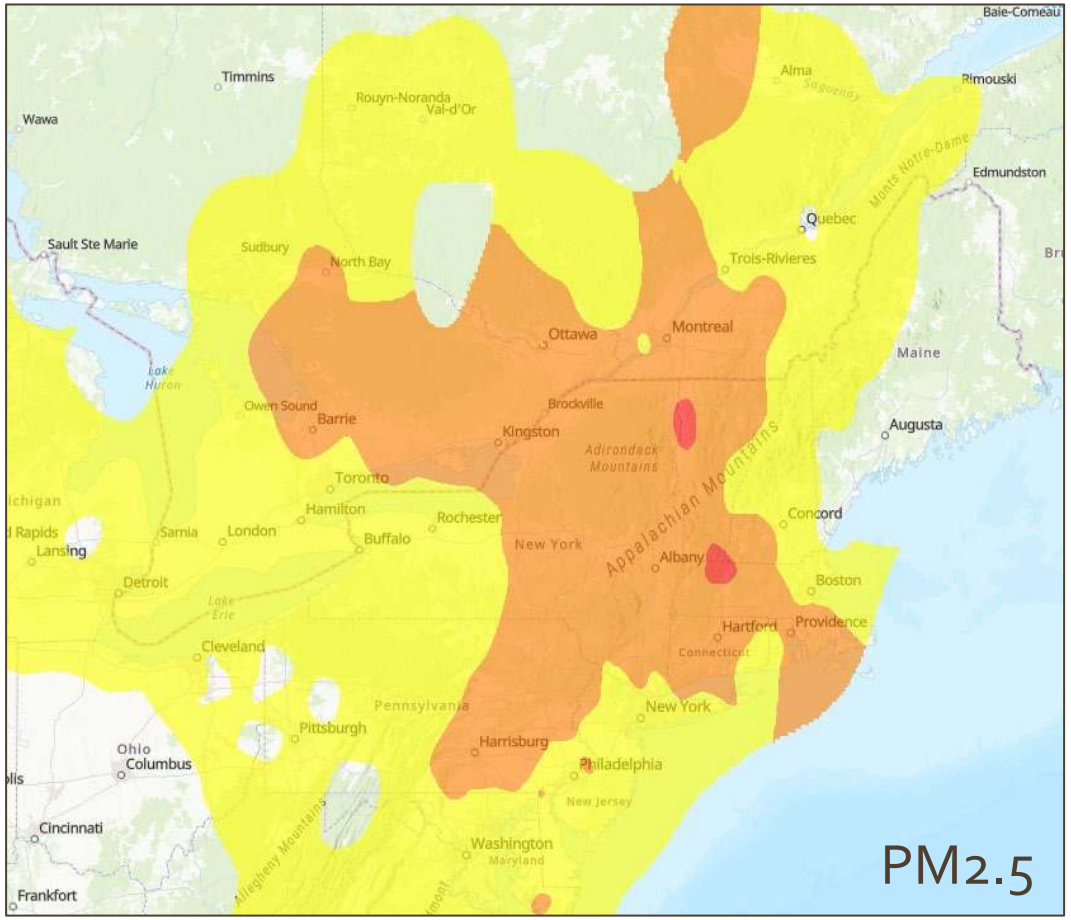
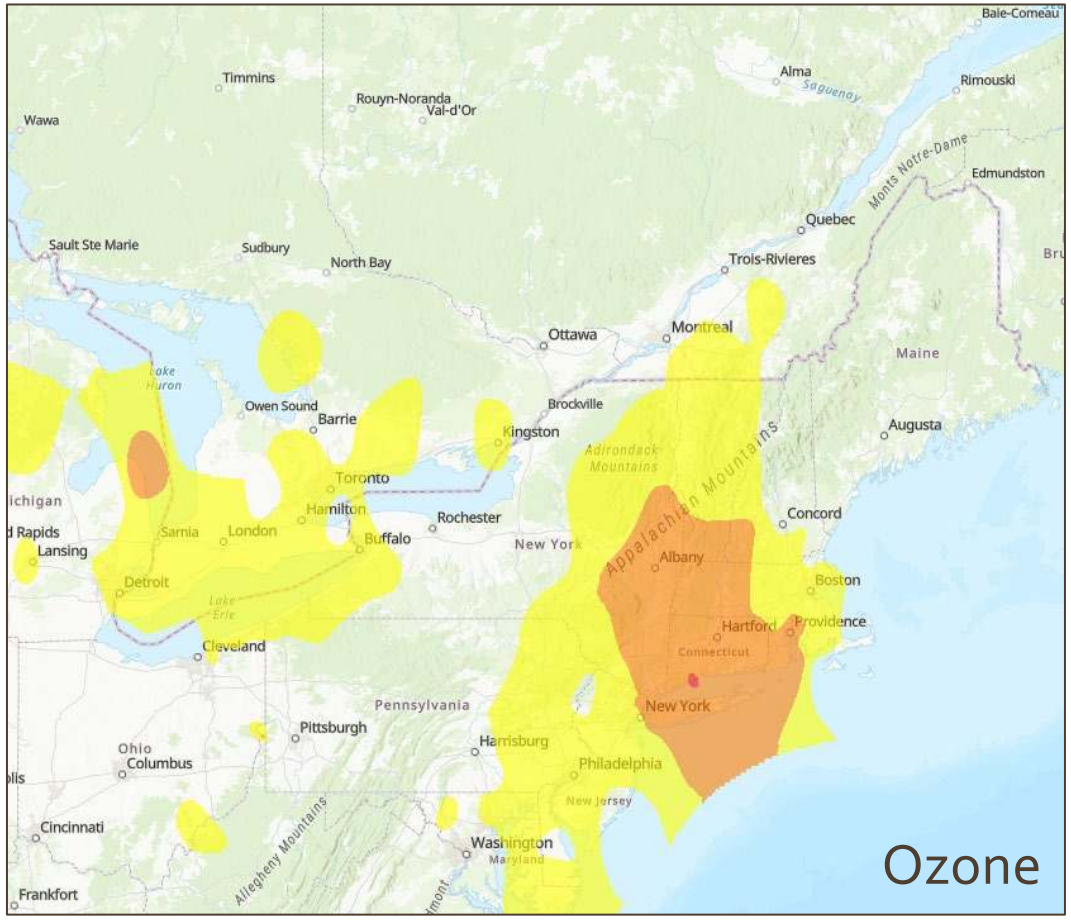
July 1st PM2.5 and Ozone Event





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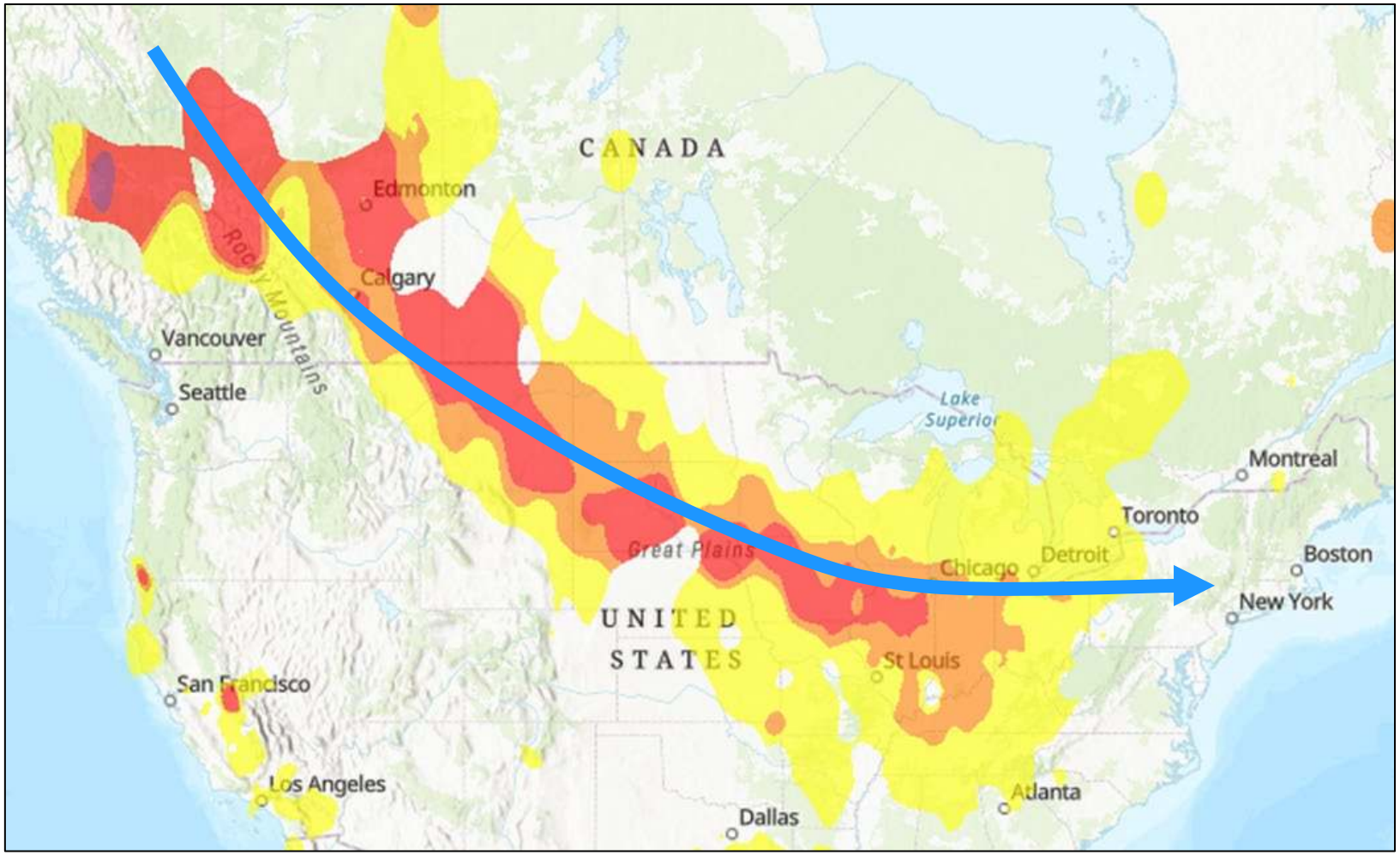
AirNow AQI contour maps

July 17th & 18th PM2.5 Event



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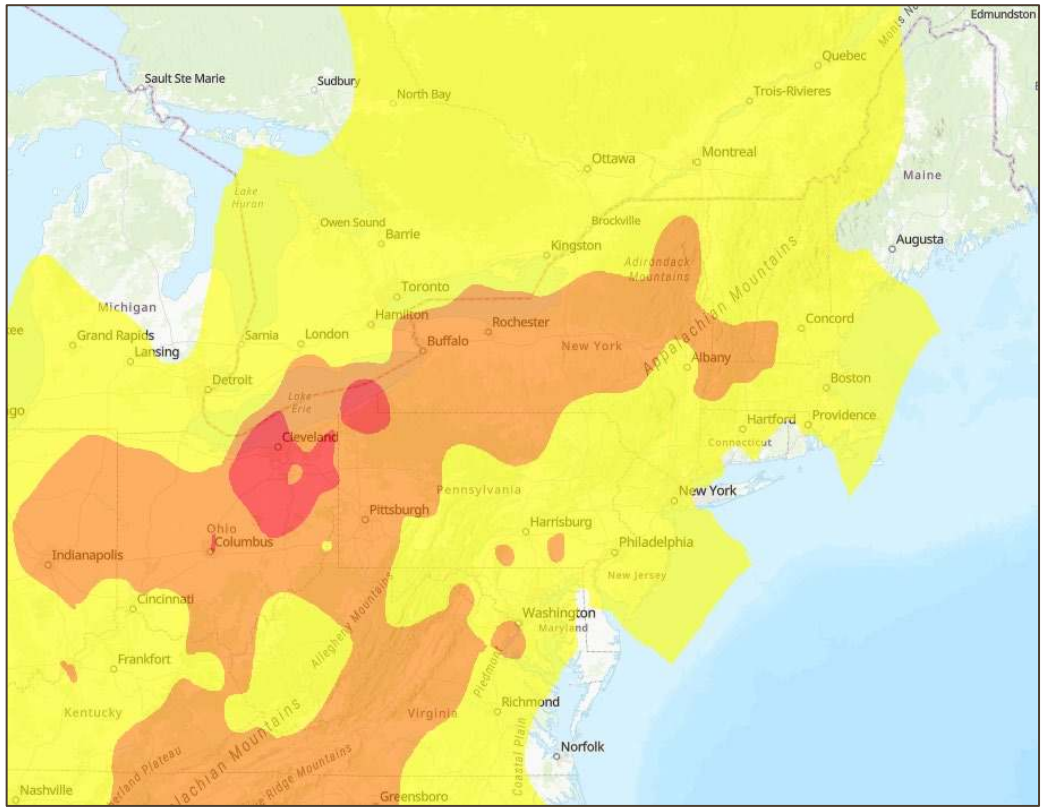
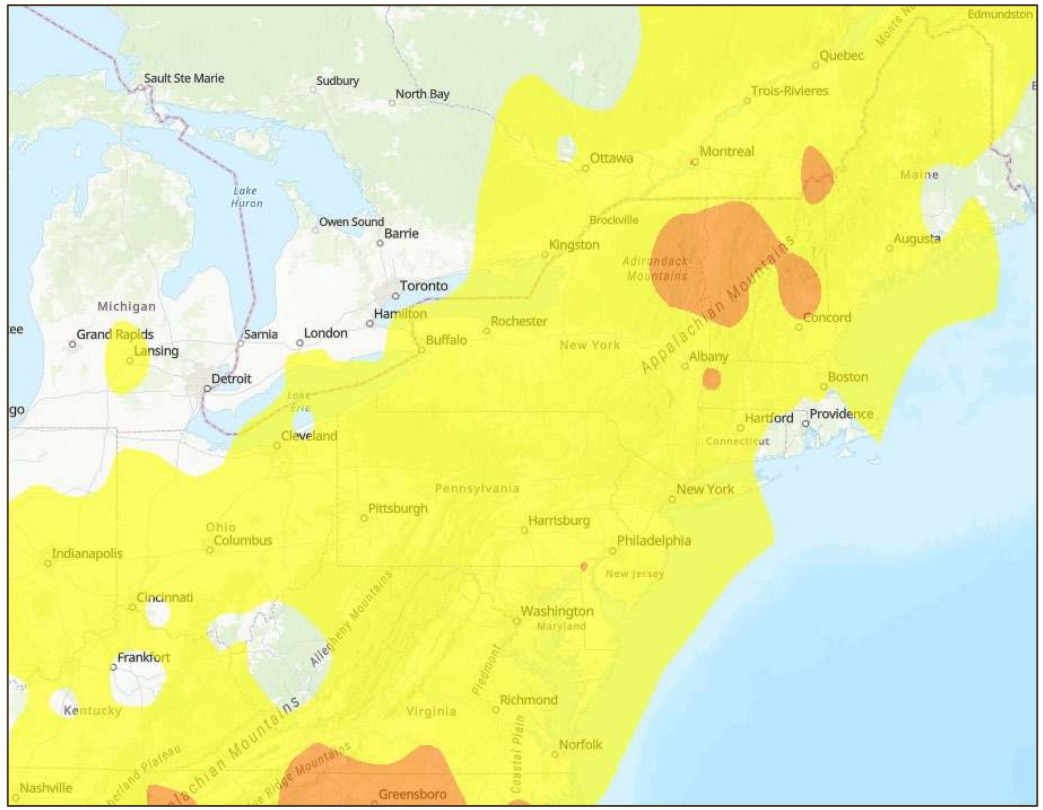
AirNow AQI contour map July 16, 2023

July 17th & 18th PM2.5 Event



July 17th, 2023



July 18th, 2023

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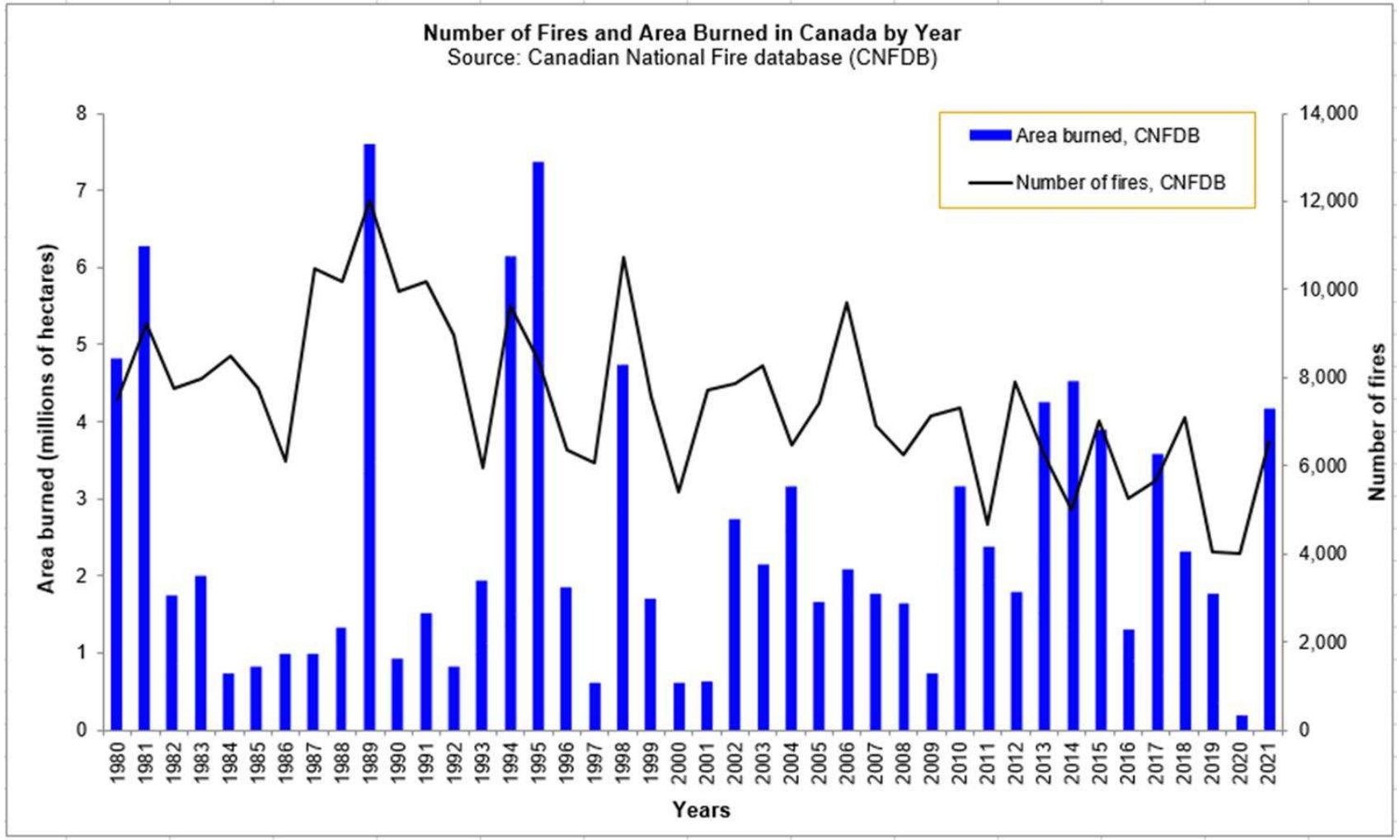
AirNow AQI contour PM2.5 map

Canadian Wildfire Statistics



2023 statistics as of 8/30/23:

- 15.2 hectares burned
- 10 year average = 2.6 ha
- 6,000+ fires
- 255 uncontrolled fires still burning
- 90 fires being held

State Monitoring for PM2.5

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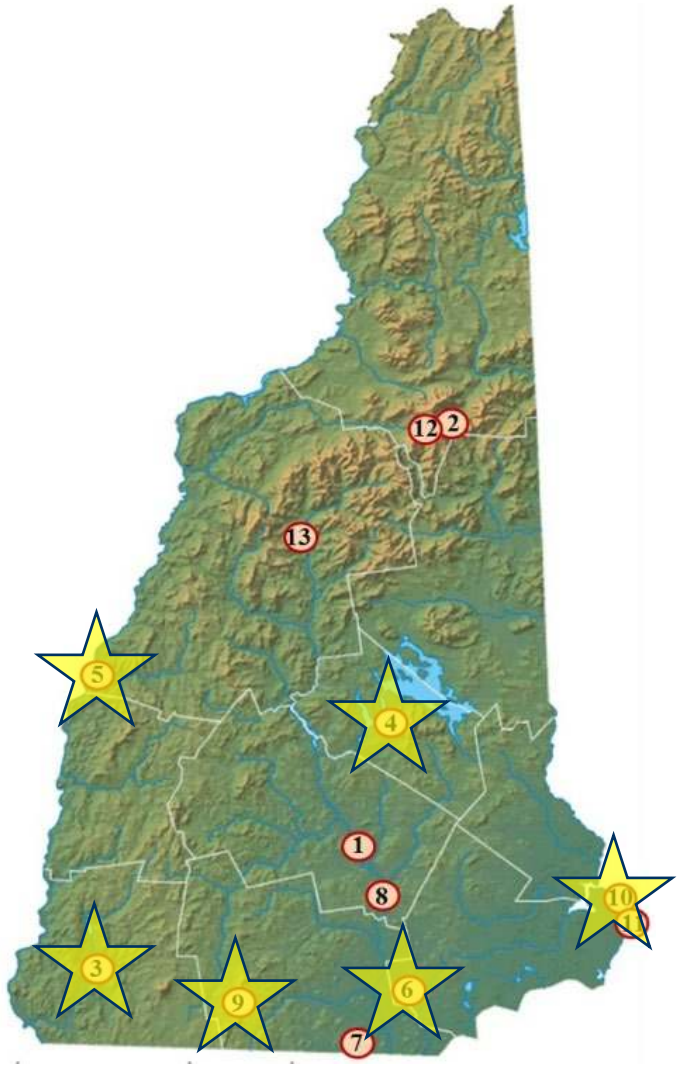

Summer 2023	Ncore	IMPROVE	CASTNET	NADP	PAMS	Laboratory	Carbon Monoxide (CO)	Nitrogen Dioxide (NO2)	Nitrogen Oxides (Noy)	Ozone (O3)	PM2.5	PM2.5 Co-Location	PM10	PMCoarse	Sulfur Dioxide (SO2)	Wind Direction (WD)	Wind Speed (WS)	External Temperature (ETP)	Barometric Pressure (BP)	Relative Humidity (RH)	Precipitation (RF)	Solar Radiation (SolRad)	UV Radiation (UVRad)
1. Concord						●				●						●	●	●					
2. Greens Grand -Camp Dodge		●								●								●					
3. Keene										●	●	●		●		●	●	●					
4. Laconia										●	●			●		●	●	●			●		
5. Lebanon										●	●			●		●	●	●					
6. Londonderry	●	●			●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
7. Nashua										●						●	●	●					
8. Pembroke															●	●	●	●					
9. Peterborough - Pack Monadnock	●	●					●		●	●	●	●		●	●	●	●	●	●	●	●		
10. Portsmouth										●	●		●	●		●	●	●					
11. Rye										●						●	●	●					
12. Sargents Purchase -Mt. Washington Summit										●													
13. Woodstock -Hubbard Brook				●																			

Supplemental Monitoring

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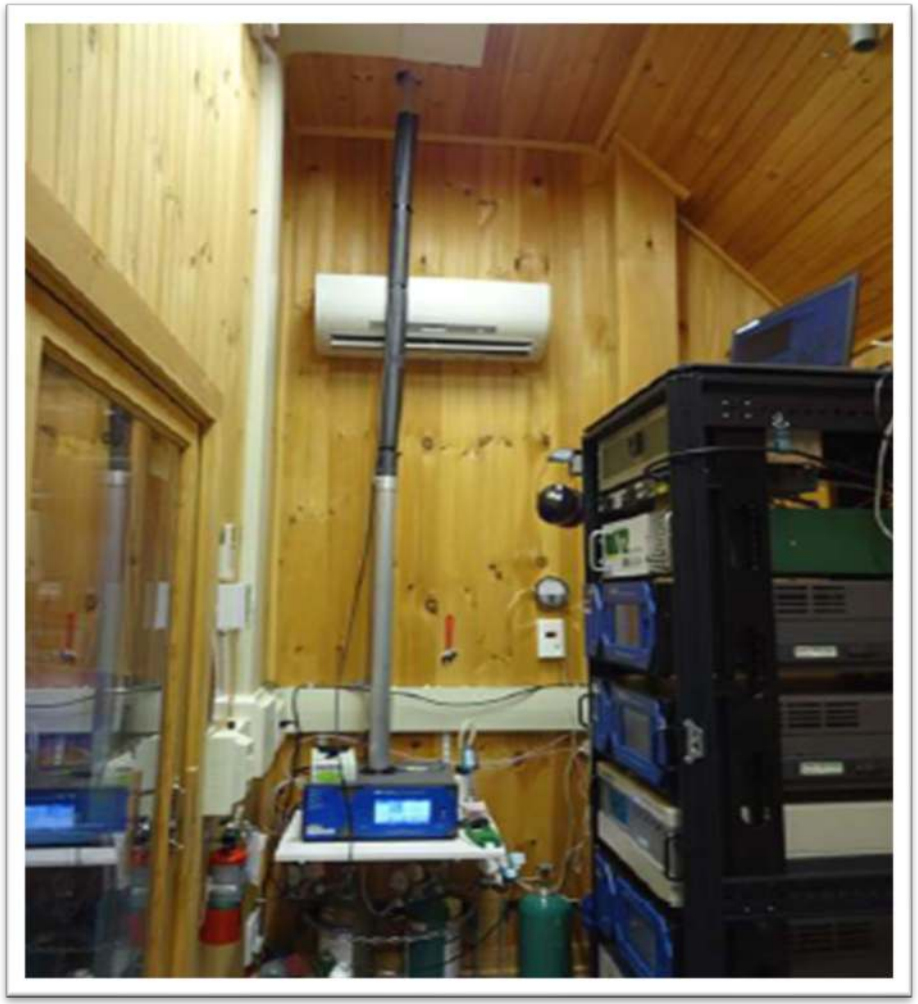

- EPA Compliant
- Testing & Criteria
- Costly

- Easy to Use
- Effective
- Affordable

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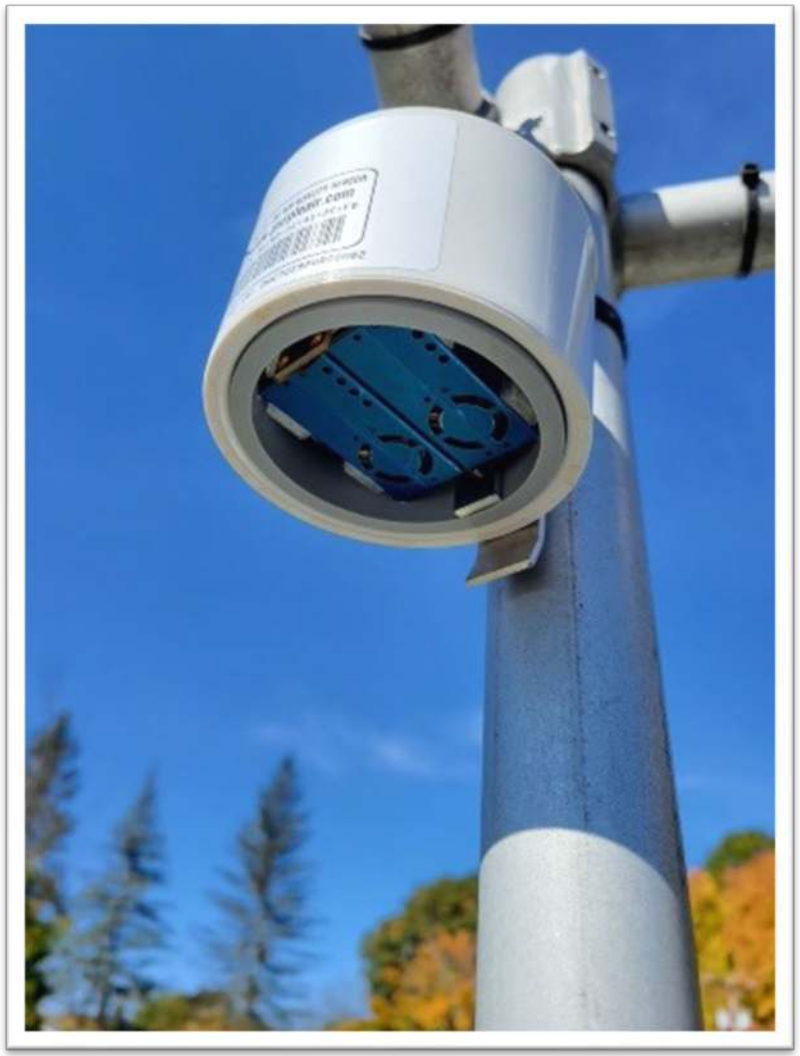
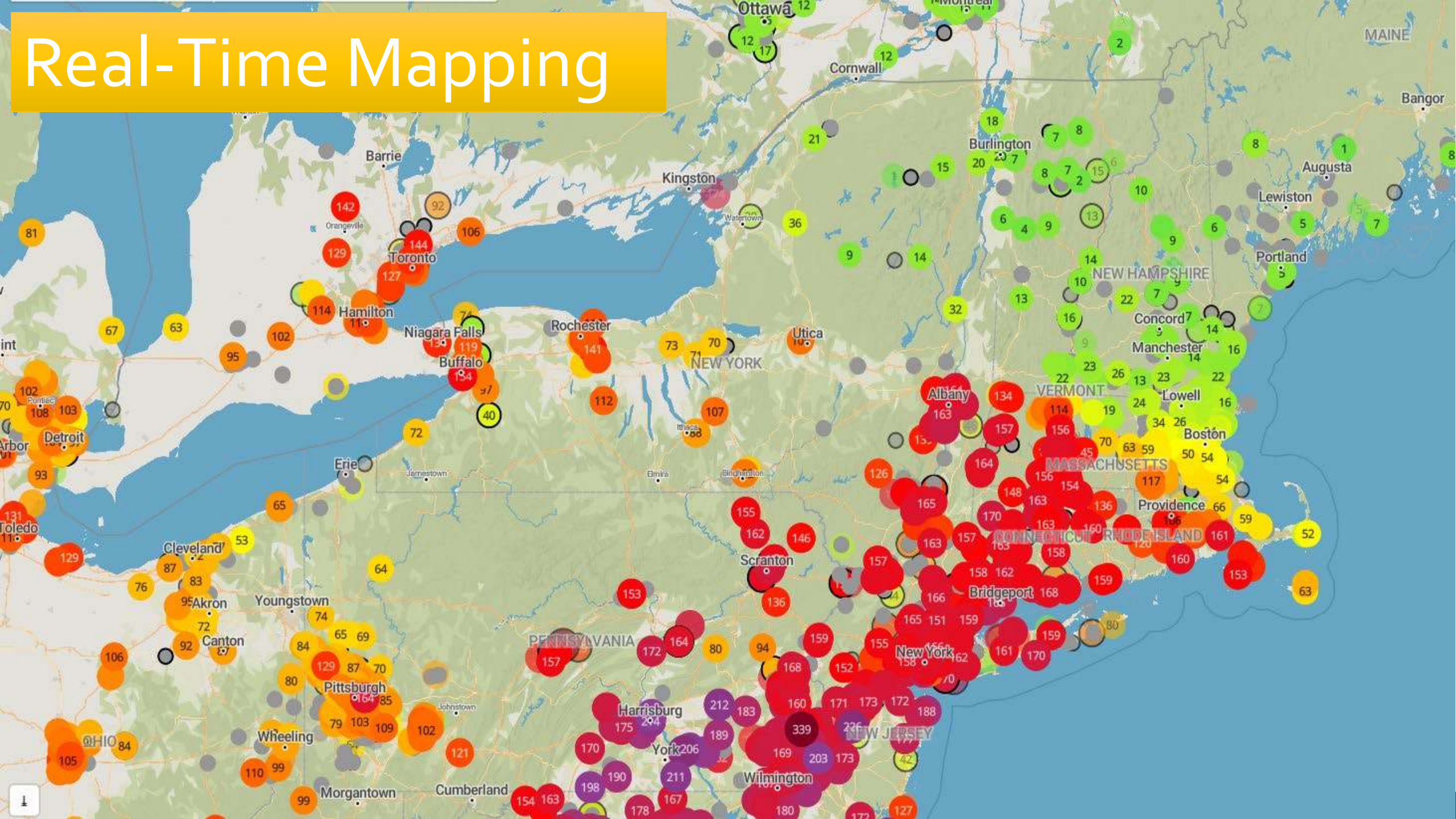
Citizen Scientist $PM_{2.5}$ Monitoring

PurpleAir Particle Sensors



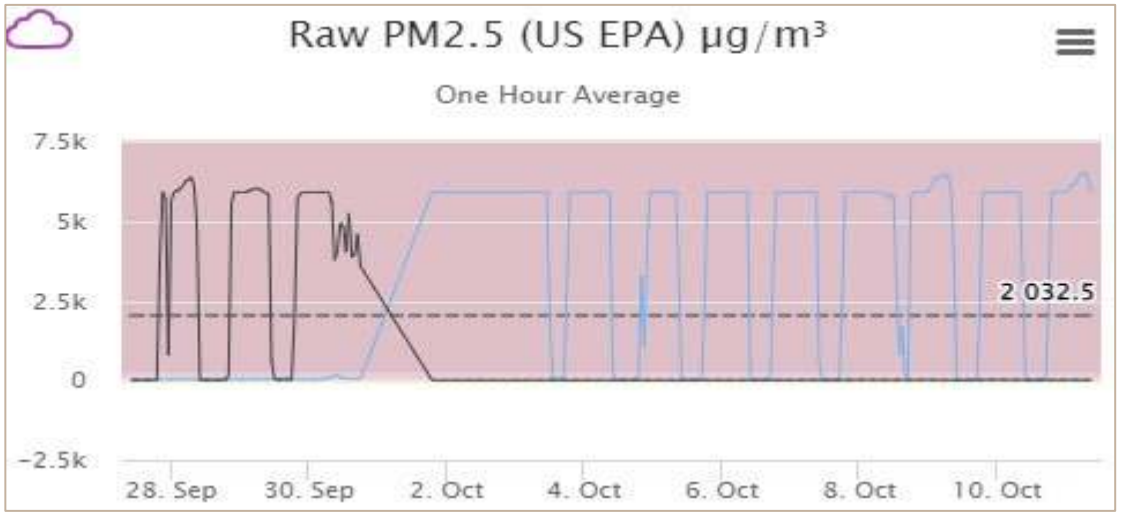
- Laser particle counters
- Dual PM sensors
- Temp & humidity sensor
- 2-minute averaging
- Wi-Fi connectivity

Real-Time Mapping



Data Trustworthiness

- Minimal quality assurance
- Many unknowns
  - Setup
  - Location, location, location



NHDES Citizen Air Monitoring Program

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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Citizen Air Monitoring Program

Monitoring for fine particulate matter throughout New Hampshire using PurpleAir sensors.

Fine particulate matter (PM2.5) is one of the most pervasive and widespread air pollutants in New Hampshire. These small particles come from many sources, but woodsmoke is the primary driver for elevated concentrations in the Granite State due to the common practice of burning wood for residential heating. Though considerable progress has been made in reducing PM2.5 from woodsmoke, largely in part to newer EPA certified wood stoves entering the market, there still exists room for continued improvement. In order to make additional progress in lowering PM2.5 levels, it is important to understand what current levels are, which can be done through monitoring. Currently, there are six PM2.5 monitoring stations throughout New Hampshire that are owned and operated by NHDES, but there are many areas of the state that are not covered by this monitoring.

Thanks to modern technology and initiatives to improve air quality, effective low-cost air quality sensors have come into the market, including PurpleAir monitors. PurpleAir is a private company that makes air quality sensors available for the public, measuring PM2.5 and providing local air quality data at an affordable cost. The unit is easy to install, and information is uploaded every 10 minutes to an online, publicly available map. Data provided can help households, businesses and municipalities better understand their local air quality.

Related Content

- PurpleAir
- Air Resources Programs
- Air Quality Information
- Current Air Quality
- NH Air Quality Forecast

PurpleAir Sensor Registration

VERSION 1.2

INSTRUCTIONS

NHDES-A-04-001
10/5/22
Voluntary

Your personal information will not be published, sold, or used in any way. You may opt out of contact and/or the program at any time after you register.

Should we come across any issues with your registration or any data quality concerns, communication will be vital to ensure your sensor remains part of our citizen science network. Nonetheless, you may opt out of communication in this form.

Click the "Begin Form Entry" link to register your device and become a citizen scientist.

Begin Form Entry

https://www.des.nh.gov/home-and-recreation/air-quality/citizen-air-monitoring-program

Benefits of Joining CAMP

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Installation Guidance

Quality Assured Data

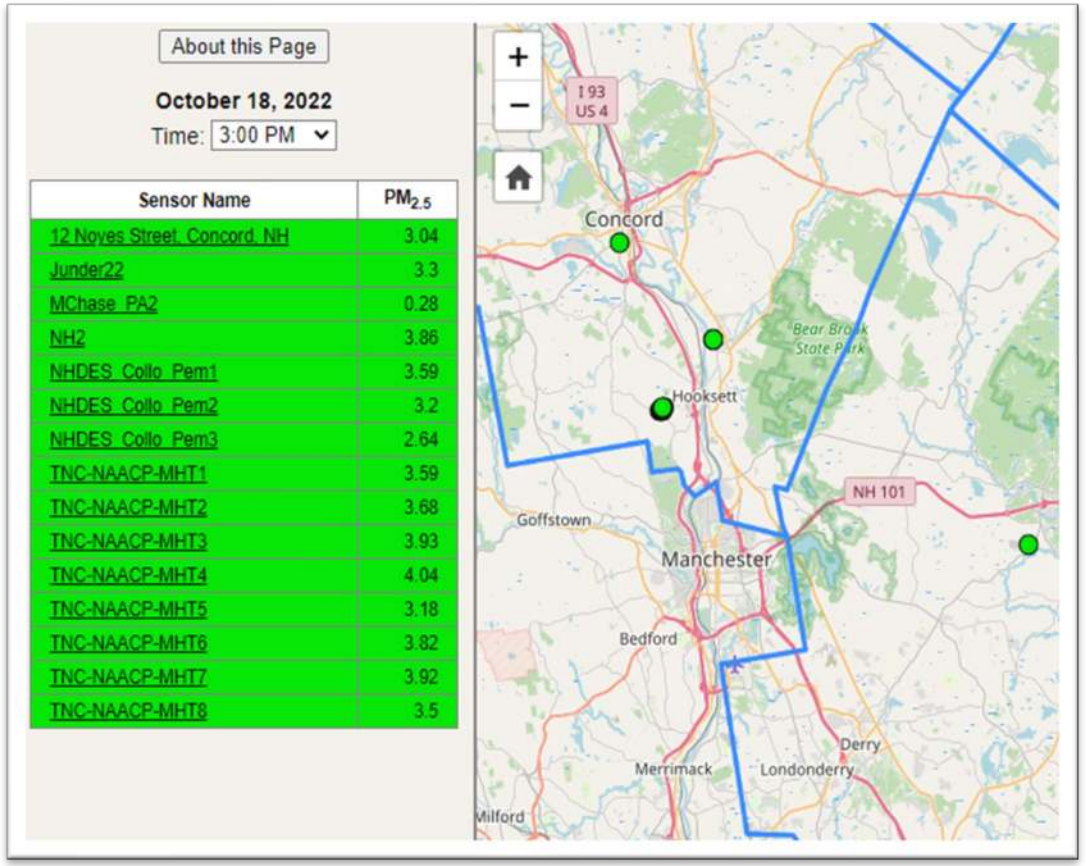
Data-Correction

NHDES Live Map

Access to Archived Data

Troubleshooting Assistance

Voluntary and Free!



Collaboration is a Win-Win!

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Community trusted data collection

NHDES guidance and QA'd data

=

Accurate scientific knowledge

Further protect the health of you and your fellow NH neighbors!

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Thank you

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