



Air Quality Forecasting

Public Health Preparedness Planning and Response

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Air Quality Forecaster

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October 24, 2023

Virginia Department of Environmental Quality

Mission: Protect and improve the environment (air, water, land) for the health, well-being, and quality of life for all Virginians

- Monitor pollutants
- Issue emission permits
- Inspect sources
- Enforce laws and regulations

www.DEQ.Virginia.gov



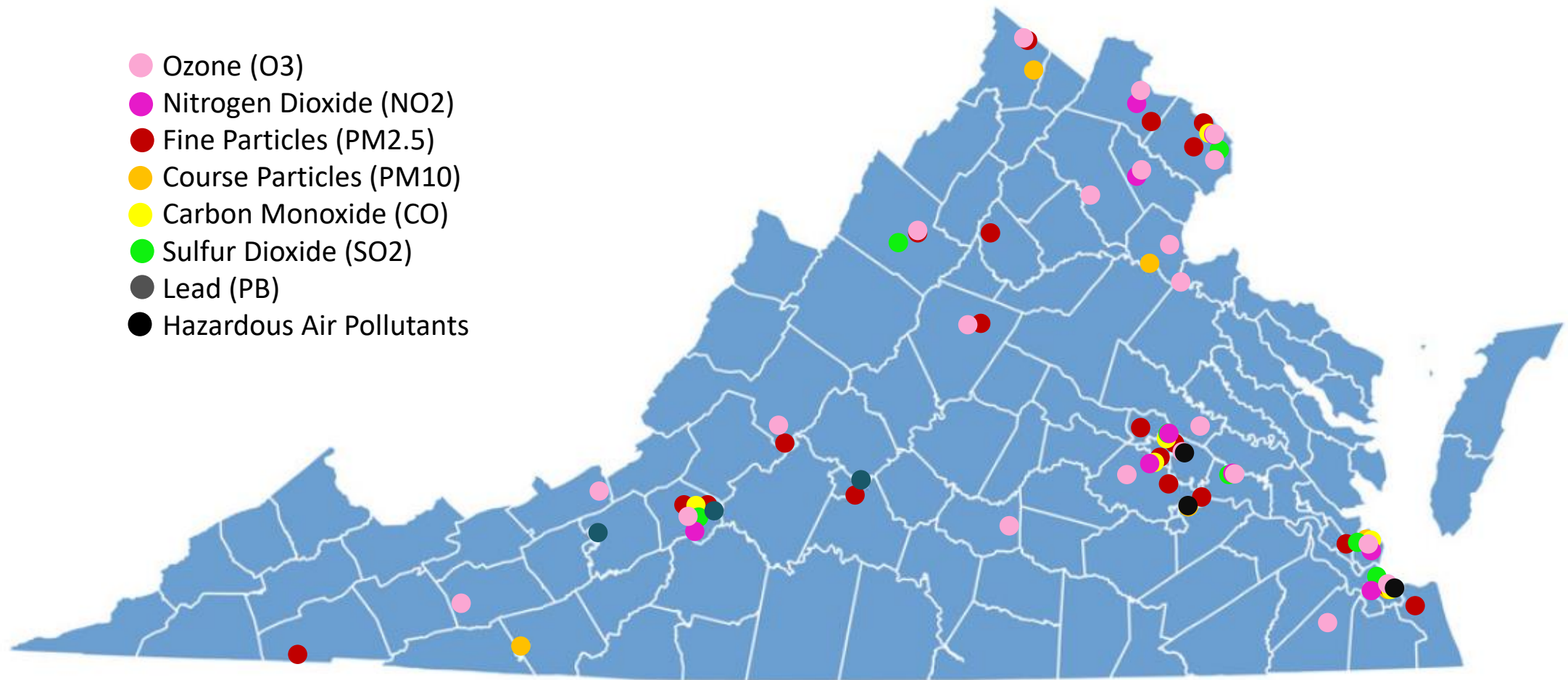
DEQ Air Quality Program

- *Monitoring*: Ambient air quality at designated locations
- *Permitting*: Allowable emissions from the construction or operation of a facility
- *Compliance*: Confirms facilities are following permits
- *Emissions*: Gather, calculate, and submit final annual emissions from all sources to Environmental Protection Agency (EPA)
- *Planning*: Provides formal documentation to EPA
- ***Assessments*: Air quality modeling and daily forecasting**

Why is Air Quality Important?

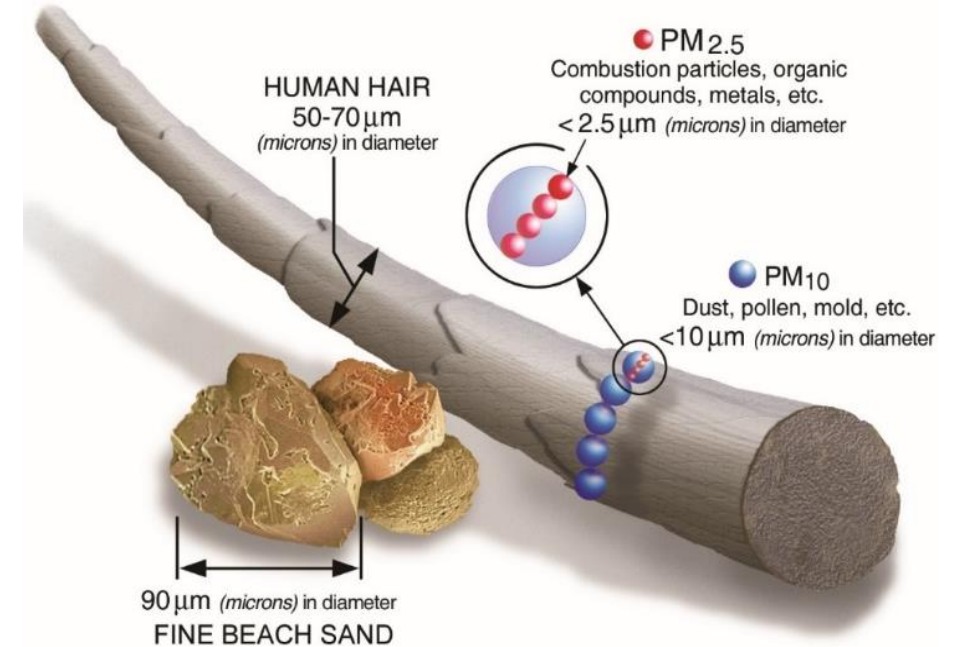
- Long exposure to high concentrations of air pollution can impact heart and lungs
- Sensitive groups (children, the elderly, and those with existing heart and lung conditions) are more susceptible to health impacts
- Air quality can also impact plants, wildlife, and visibility
- EPA established the National Ambient Air Quality Standards (NAAQS) for six pollutants based on health and environmental impacts
 - Ozone (O₃), Particulate Matter (PM), Carbon Monoxide (CO), Lead (Pb), Sulfur Dioxide (SO₂), Nitrogen Dioxide (NO₂)
 - NAAQS are reviewed (and revised if necessary) by EPA every 5 years
- Pollutant concentrations are converted to Air Quality Index (AQI) and color coded for simplicity

Where Does VA DEQ Monitor Air Quality?



Fine Particulate Matter (PM_{2.5})

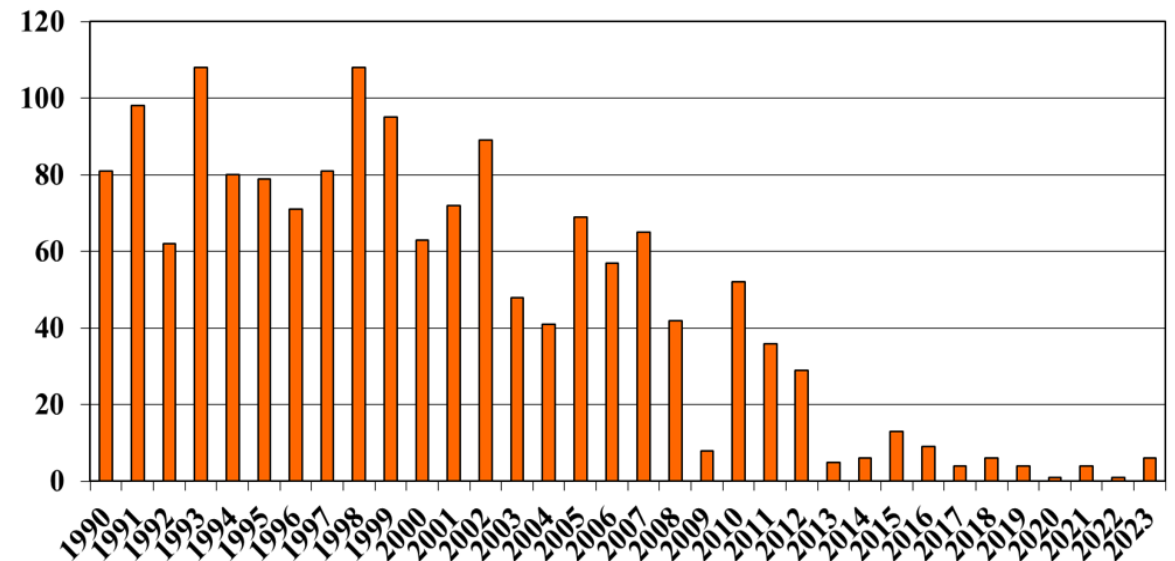
- Variable chemical composition
 - Primary pollutant
 - Secondary pollutant
- Health impacts
 - Difficulty breathing
 - Irritate airways
 - Irregular heartbeat
 - Nonfatal heart attacks
 - Premature death in people with heart or lung disease
- Forecast
 - January - December
 - Daily 24-hour average concentration



Ozone (O₃)

- NO_x + VOC + Sunlight
 - Secondary pollutant
- Health impacts
 - Difficulty breathing
 - Inflammation/damage airways
 - Aggravate existing lung diseases
- Forecast
 - April - September
 - Daily maximum 8-hour average concentration
- “Good up high, bad nearby.”

Number of 8-hour Ozone Exceedance Days in Virginia, 1990-2023



AQI: Air Quality Index

What I use:		Air Quality Index	Level of Health Concern	Meaning/What Should I Do?
O ₃ (ppb) 8-hour	PM _{2.5} (µg/m ³) 24-hour			
0-54	0-12	0-50	Good	Air pollution poses little or no health risk.
55-70	12.1-35.4	51-100	Moderate	Air quality is acceptable. Sensitive groups: Consider reducing prolonged or heavy exertion outdoors
71-85	35.5-55.4	101-150	Unhealthy for Sensitive Groups	Sensitive groups: Reduce prolonged or heavy exertion outdoors
86-105	55.5-150.4	151-200	Unhealthy	Sensitive groups: Avoid prolonged or heavy exertion outdoors Everyone: Reduce prolonged or heavy exertion outdoors
106-200	150.5-250.4	201-300	Very Unhealthy	Sensitive groups: Avoid all outdoor activity Everyone: Avoid prolonged or heavy exertion
*	250.5-500.4	301-500	Hazardous	Health Warning of Emergency Conditions Everyone: Avoid all outdoor activity

Air Quality Forecasting

- Daily forecast
 - 5 regions: Richmond, Norfolk, Roanoke, Winchester, Northern VA
 - Next day forecast Mon-Thur
 - 3-day forecast on Fri
 - Leading/primary pollutant
 - Available after 3pm via email, DEQ website, AirNow.gov
- Air Quality Action Day
 - Air quality is *forecasted* to be Code Orange/Unhealthy for Sensitive Groups or worse
 - Susceptible citizens should monitor conditions throughout the day
 - Take voluntary measures to reduce pollutant production
- Air Quality Health Alert
 - Air quality *currently* exceeds Code Orange/Unhealthy for Sensitive Groups
 - Uses estimated air quality index based on current hourly conditions and trends

Virginia DEQ – Forecast Email

- Email distributed by 3 pm weekdays
- Links to sign up are on Virginia DEQ Air Quality Forecast website
- Northern VA forecast managed through EnviroFlash

Hampton Roads

Color Code: **Green** - Good air quality

Primary Pollutant: Particle pollution

Richmond

Color Code: **Green** - Good air quality

Primary Pollutant: Particle pollution

Roanoke

Color Code: **Green** - Good air quality

Primary Pollutant: Particle pollution

Winchester

Color Code: **Green** - Good air quality

Primary Pollutant: Particle pollution

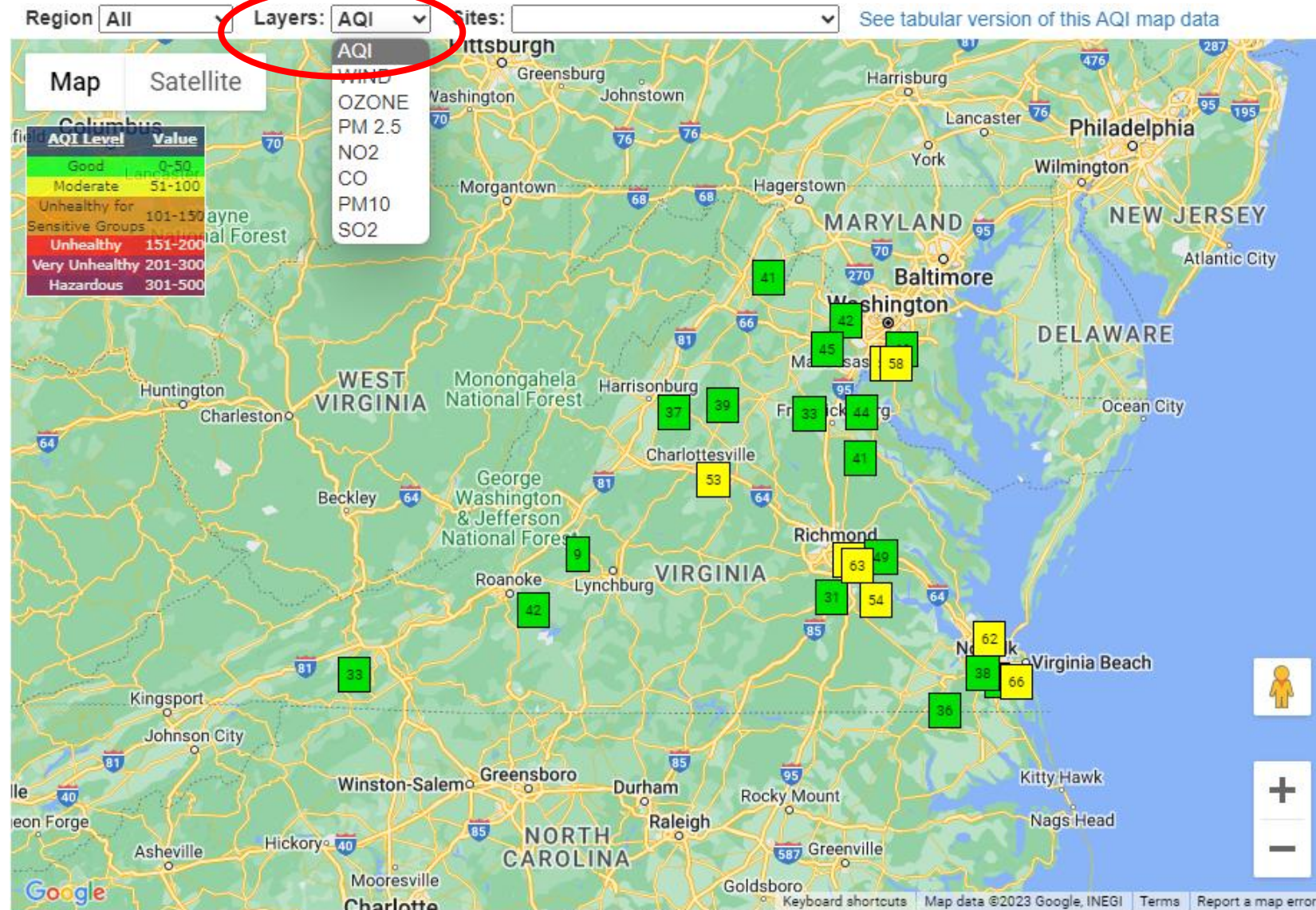
Health Information

- Code Green: Poses little or no health risk.
- Code Yellow: Unusually sensitive people should consider reducing strenuous outdoor activities.
- Code Orange: Active children and adults, and people with heart or lung disease (including asthma) should limit or reschedule strenuous outdoor activities.
- Code Red: Active children and adults should limit or reschedule strenuous outdoor activities. People unusually sensitive to air pollution, especially those with heart or lung disease (including asthma), should avoid strenuous outdoor activities.
- Code Purple: Active children and adults should avoid prolonged strenuous outdoor activities. People unusually sensitive to air pollution, especially those with heart or lung disease (including asthma), and older adults should avoid all outdoor strenuous activities.

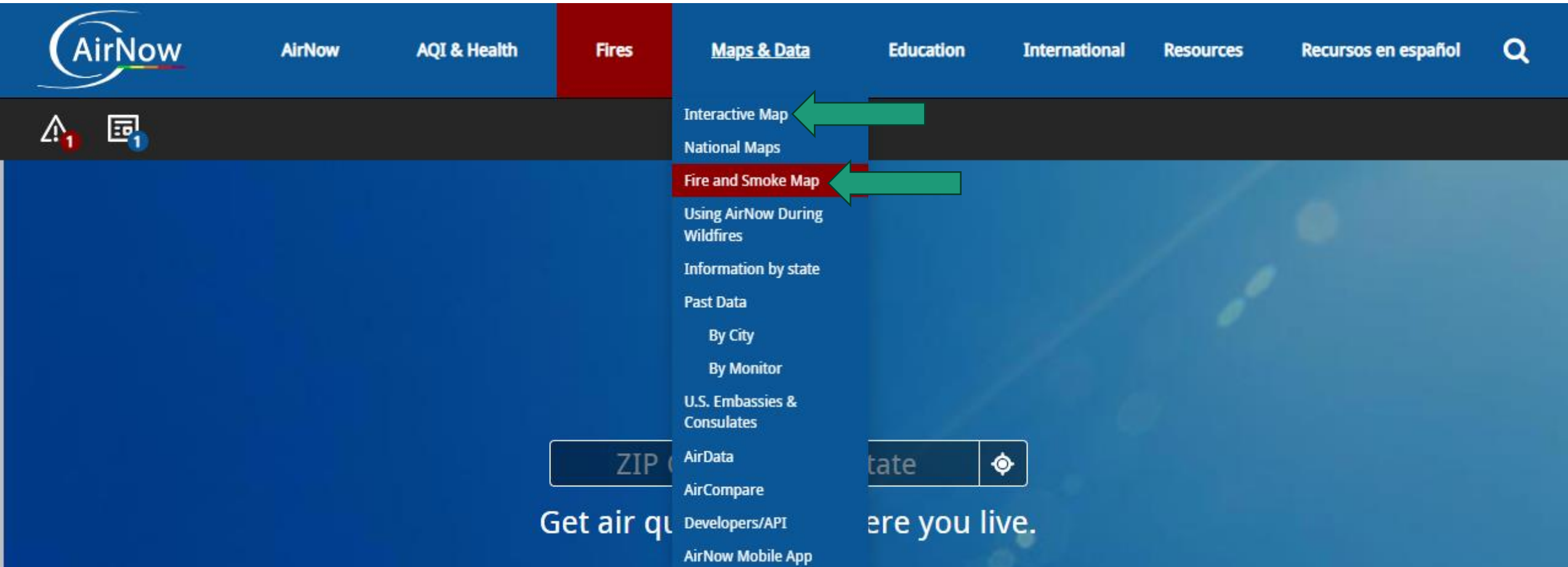
Virginia DEQ – Forecast Website

Forecast										
Today's Forecast						Tomorrow's Forecast				
Region	AQI	Class	Pollutant	Activity Caution	Risk Groups	AQI	Class	Pollutant	Activity Caution	Risk Groups
HAMPTON ROADS	74	Moderate	OZONE_PPb	Unusually sensitive people should consider reducing prolonged or heavy outdoor exertion.	Children and people with asthma are the groups most at risk.		No Forecast			
NORTHERN VIRGINIA	93	Moderate	OZONE_PPb	Unusually sensitive people should consider reducing prolonged or heavy outdoor exertion.	Children and people with asthma are the groups most at risk.		No Forecast			
RICHMOND	90	Moderate	OZONE_PPb	Unusually sensitive people should consider reducing prolonged or heavy outdoor exertion.	Children and people with asthma are the groups most at risk.		No Forecast			
ROANOKE	53	Moderate	PM25LC	Unusually sensitive people should consider reducing prolonged or heavy exertion.	People with respiratory or heart disease, the elderly and children are the groups most at risk.		No Forecast			
WINCHESTER	47	Good	OZONE_PPb	None	Children and people with asthma are the groups most at risk.		No Forecast			

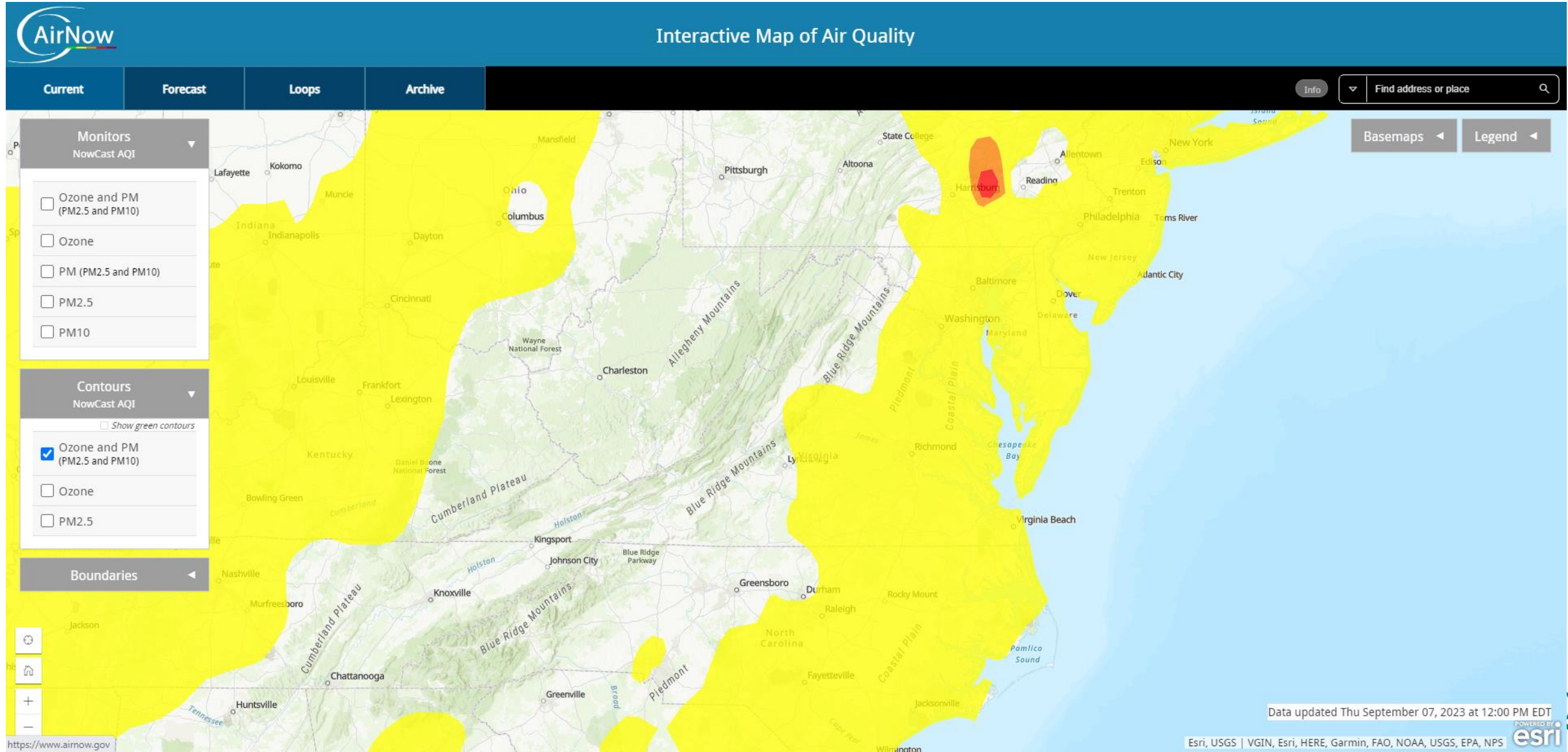
Virginia DEQ – All pollutants



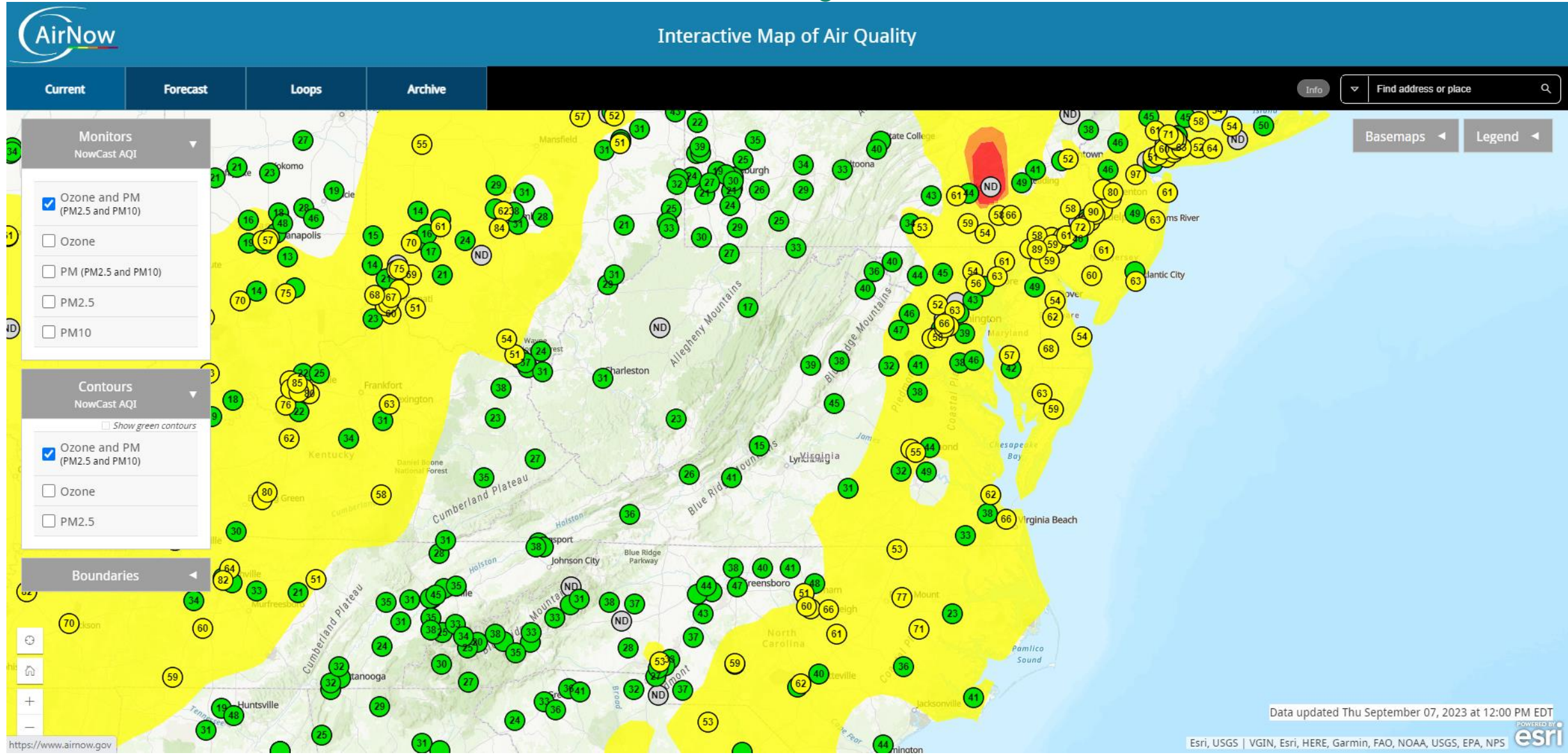
National Maps From AirNow.gov



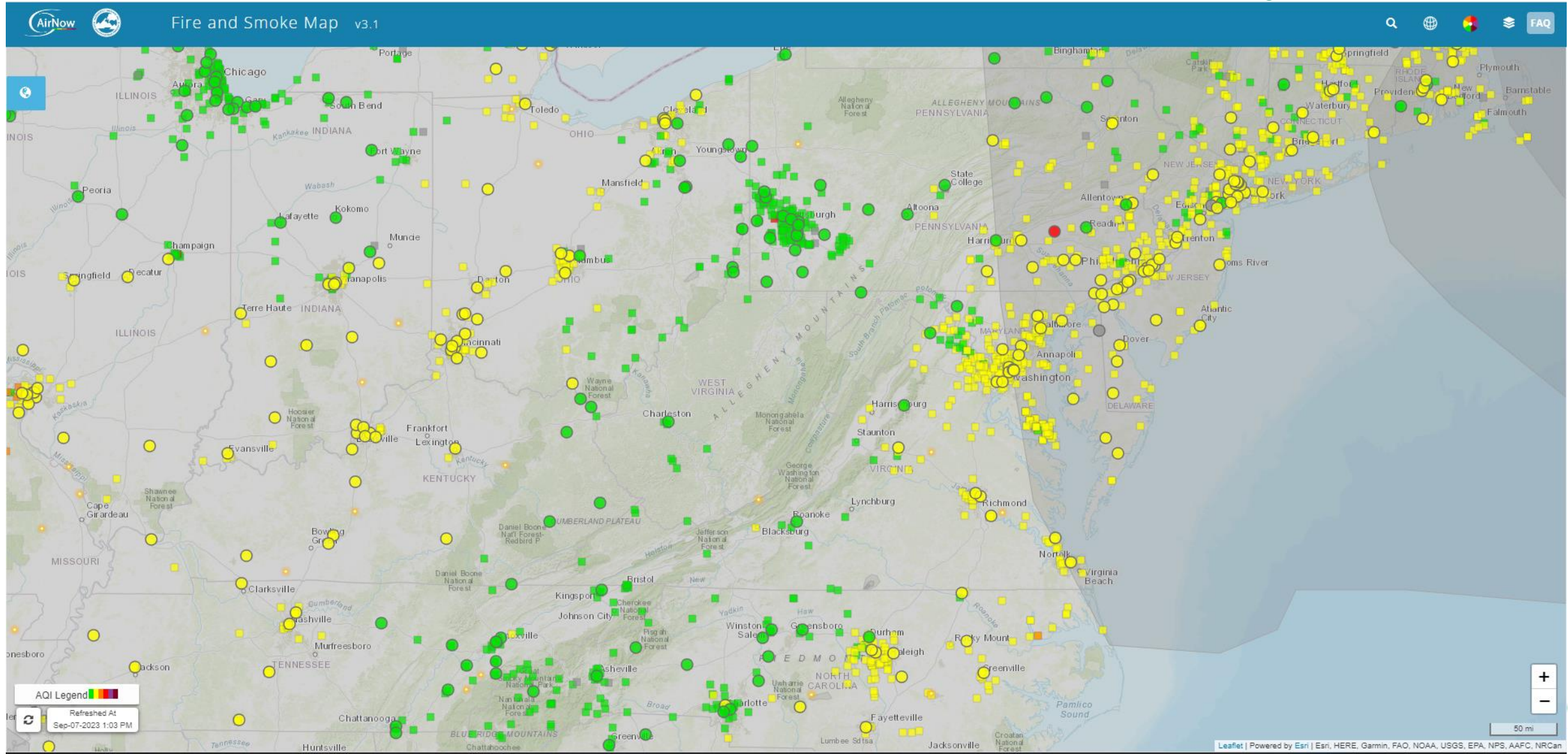
AirNow – O₃ and PM



AirNow – O₃ and PM

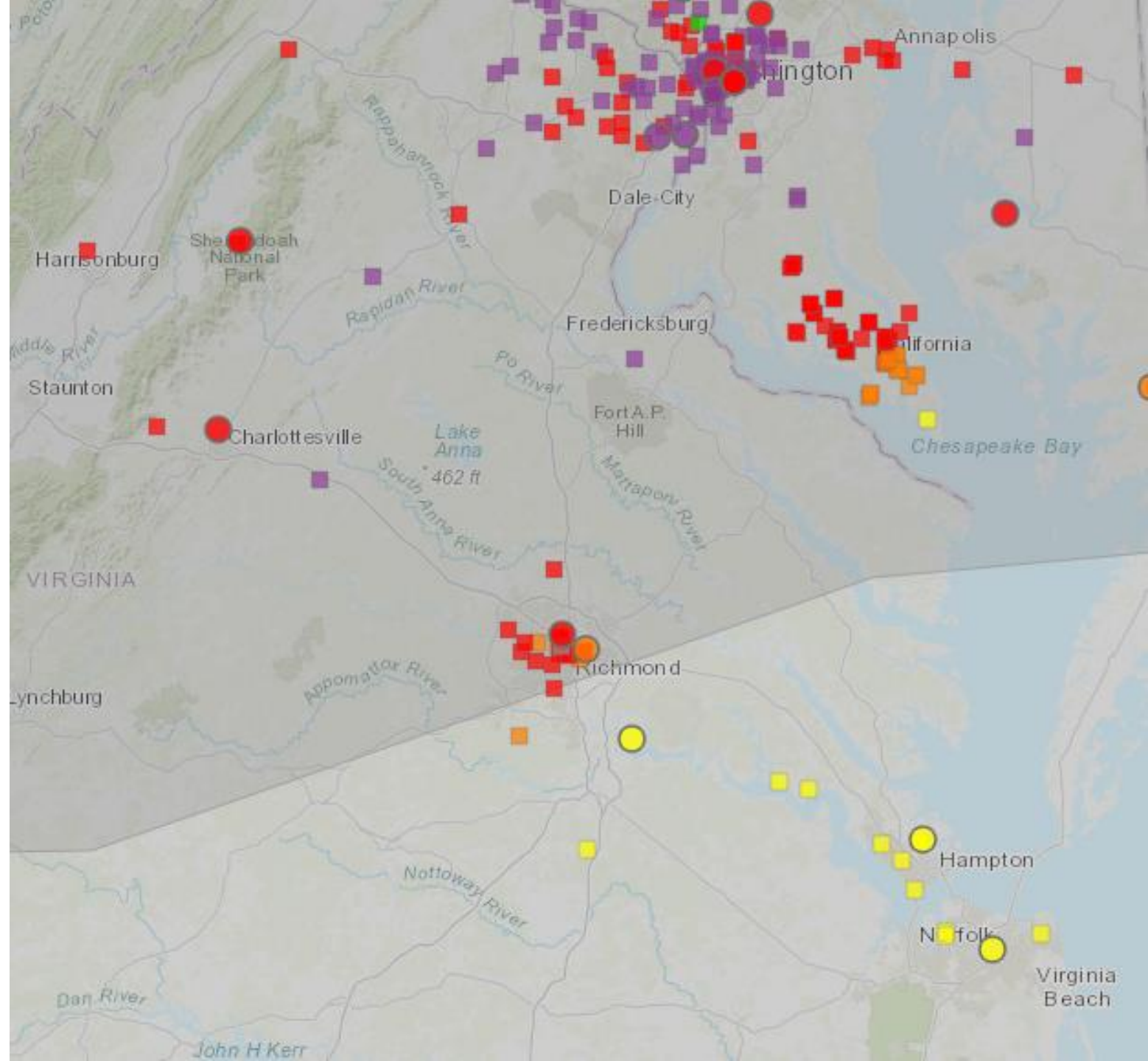


AirNow Fire and Smoke Map – Only PM_{2.5}



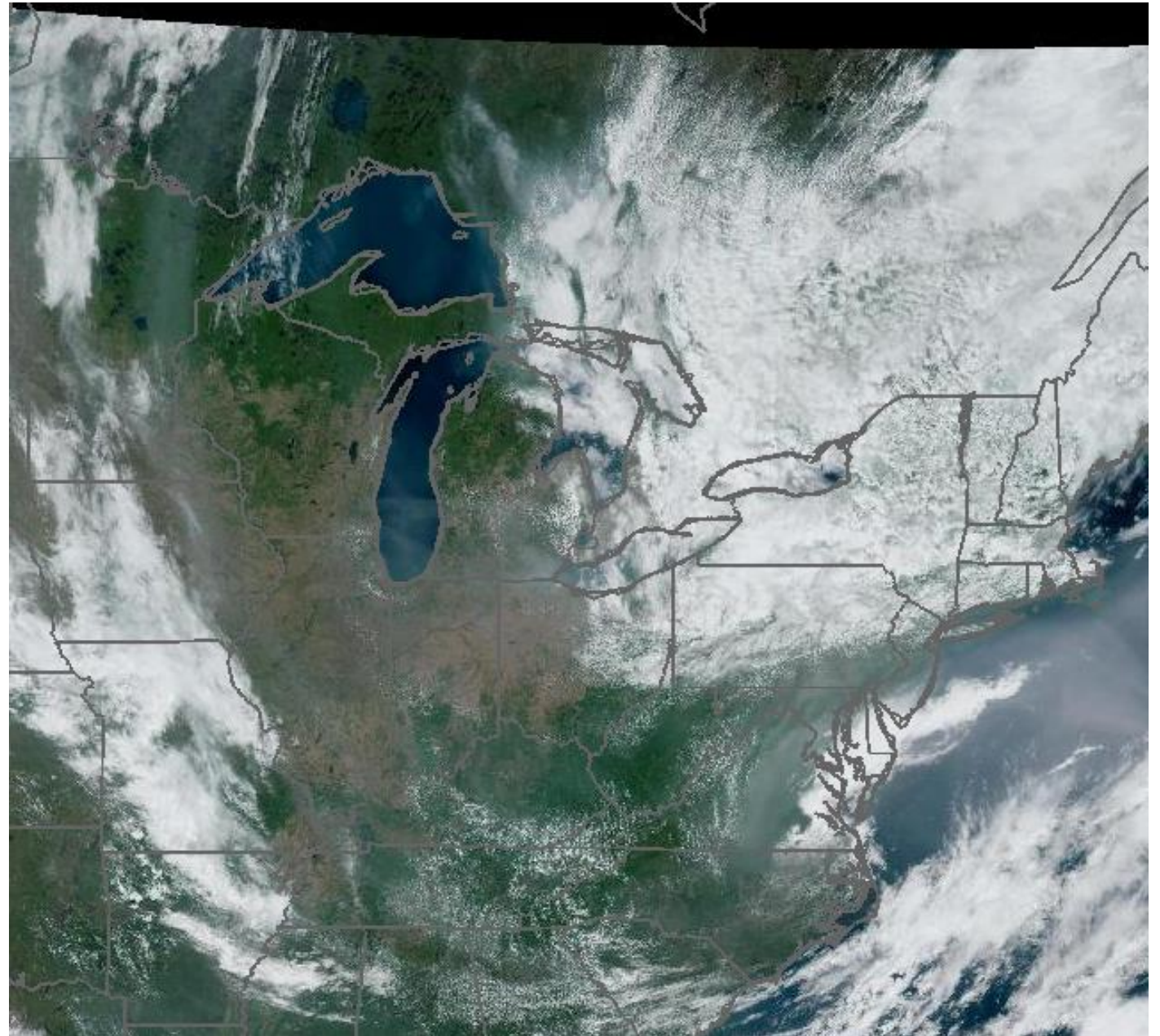
AirNow Fire and Smoke Map – June 8, 2023

- Circles: official monitors
- Squares: air sensors purchased and owned by citizens (Purple Air)
- Layers of grey show satellite observed smoke plumes
- Helpful for interpolating where official monitors are not available
- DEQ issues air quality alert for the metro area based on the worst conditions observed by official monitors
 - Richmond would be considered Code Red
 - Northern VA considered Code Purple
- UI currently be revamped



Wildfire Smoke Impacts

- Wildfire smoke can impact PM and O₃
- Canadian wildfires had ***highly unusual*** impact on Virginia this year, especially on PM_{2.5}

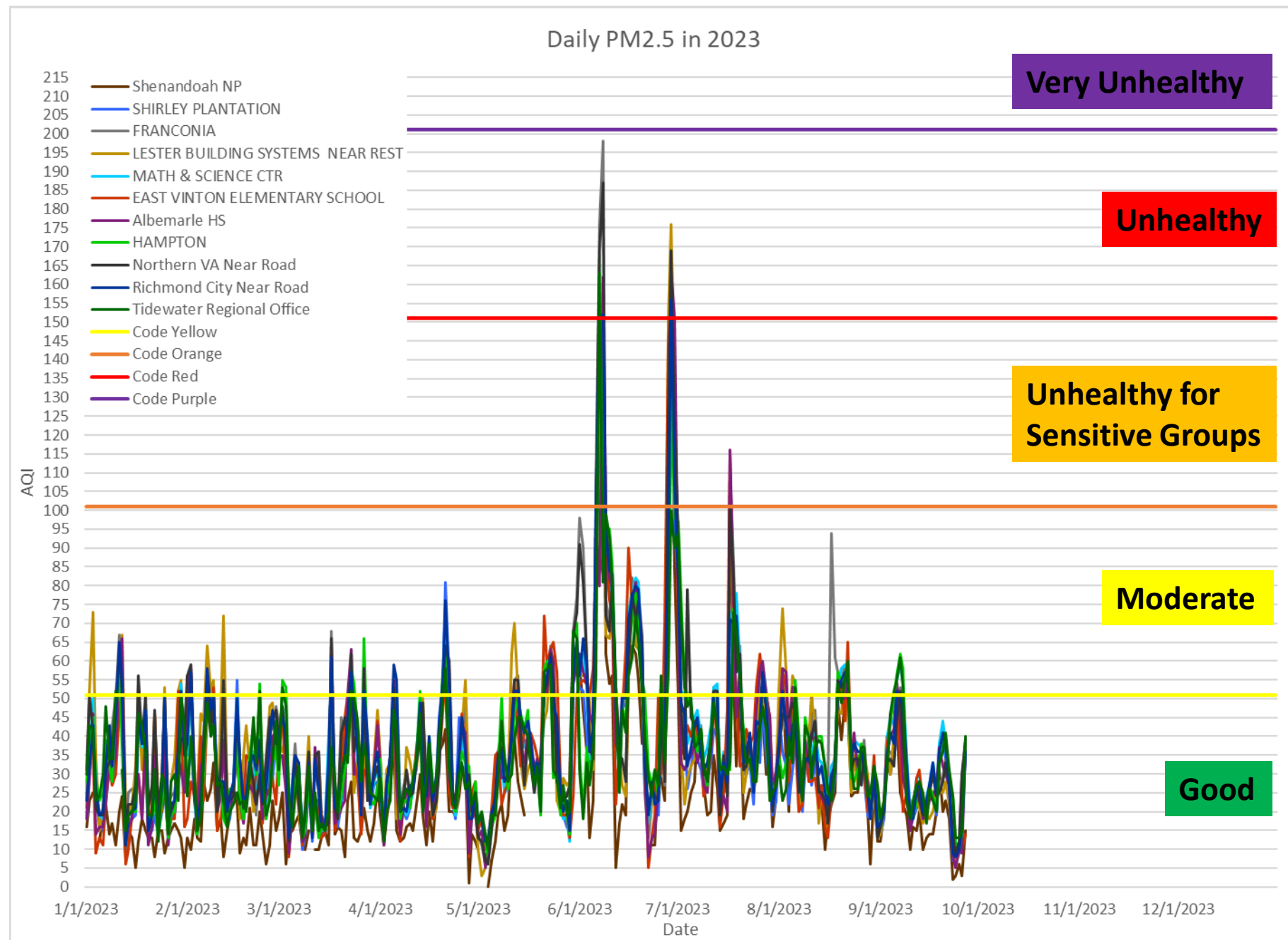


Satellite image from June 8, 2023

How Unusual is 2023 PM_{2.5}?

Poor PM_{2.5} days by year

Year	Days
2019	0
2020	0
2021	2
2022	0
2023	7



AQI: Air Quality Index

Air Quality Index	Level of Health Concern	Meaning/What Should I Do?
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201-300	Very Unhealthy	Sensitive groups: Avoid all outdoor activity Everyone: Avoid prolonged or heavy exertion
301-500	Hazardous	Health Warning of Emergency Conditions Everyone: Avoid all outdoor activity

Summary

- Long term exposure to high levels of air pollution (O_3 or $PM_{2.5}$) can impact heart and lung health
- VA DEQ forecasts for $PM_{2.5}$ all year and O_3 from spring-fall
- The forecast is for a daily average, not a maximum hourly, because of the exposure time
- Forecast and current conditions are available from DEQ website and AirNow.gov
- Forecast is also available via email (sign up on DEQ website)
- Wildfire impact this summer was highly unusual for Virginia

Links

State Level

- [Department of Environmental Quality \(DEQ\)](#)
- [Current Air Quality Conditions and Forecast](#)
- [Sign up for Daily Forecast Email](#)
- [Sign up Health Alert Email](#)
- Northern VA: [EnviroFlash](#)

Federal/National Level

- [Environmental Protection Agency \(EPA\)](#)
- [AirNow](#)
- [Interactive Map \(O₃ and PM\)](#)
- [Fire and Smoke Map \(PM_{2.5}\)](#)
- [Air Quality Resource Publications](#)

Contacts

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