# OTC Modeling Committee Update

## OTC Annual Meeting

## June 2, 2022





OZONE TRANSPORT COMMISSION

# Accomplishments & Ongoing Work

- Tracking OTR ozone levels and the preliminary attainment status
- Modeling:
  - Completed V1 2016 and 2023 Modeling with CMAQ and CAMx
  - Starting updating to the new V2 emission inventories and performing new base case modeling for 2016, 2023 and 2026
  - Performed sensitivity modeling on the OTC 4km modeling subdomain
  - Nearing Completion - 2018/19 Episodic screening modeling for High Energy Demand Days (HEDD)
- Nearing completion of the draft Modeling Technical Support Document (TSD)
- Following the evolving science of regional research efforts

# 2008 and 2015 Ozone NAAQS Timelines

| Ozone Timeline | 2008 NAAQS | 2015 NAAQS |
|---|---|---|
| Marginal Nonattainment Area Attainment Date | | August 2021 (2018-20 data) |
| Moderate Nonattainment Area Attainment Date | | August 2024 (2021-23 data) |
| Serious Nonattainment Area Attainment Date | July 2021 (2018-20 data) | August 2027 (2024-26 data) |
| Severe Nonattainment Area Attainment Date | July 2027 (2024-26 data) | August 2033 |
| Extreme Nonattainment Area Attainment Data | July 2032 | August 2038 |

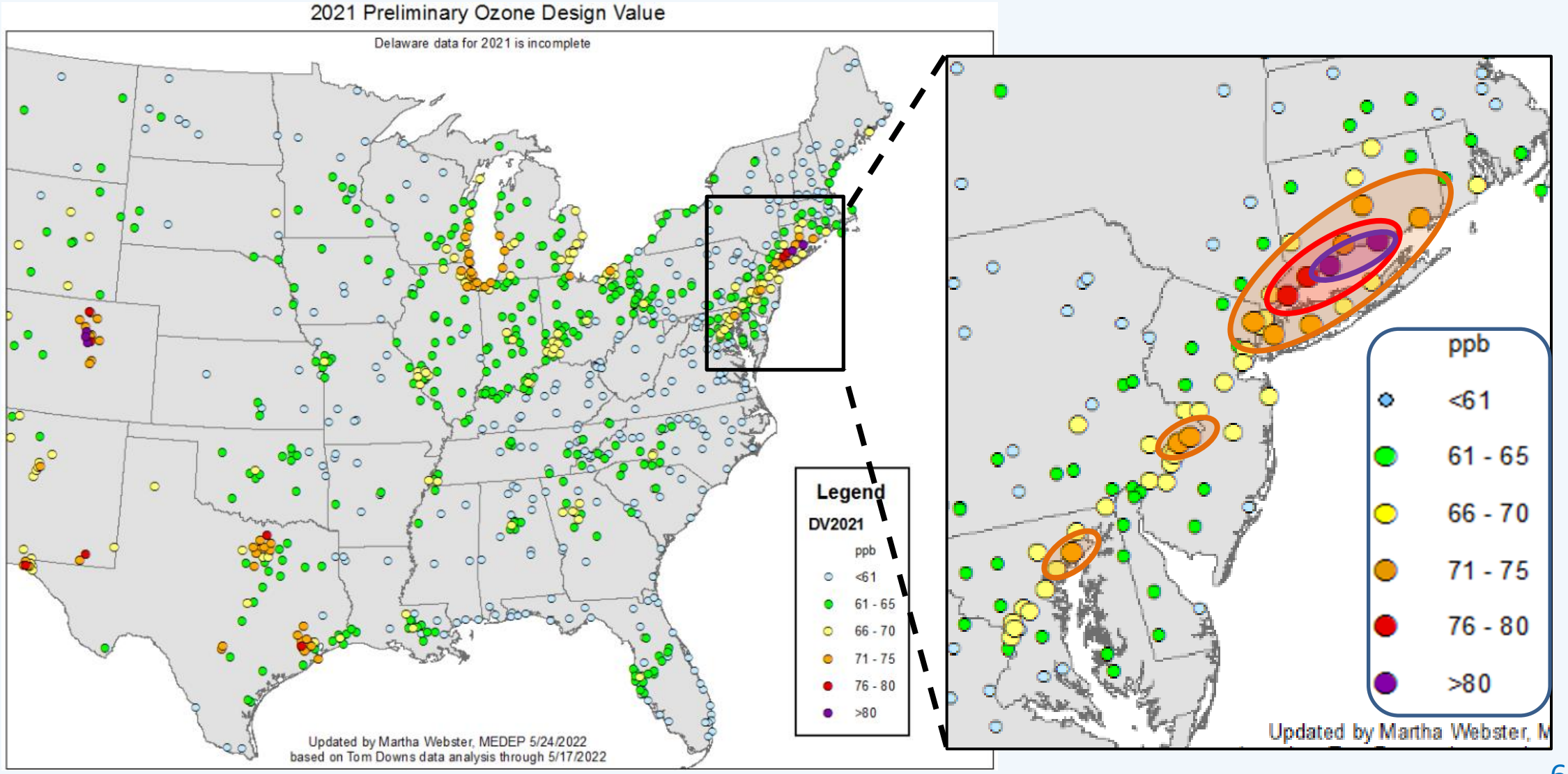
**Proposed Bump-ups**

**Greater CT, Philly, Baltimore, & DC Nonattainment Areas**

**NY Nonattainment Area**

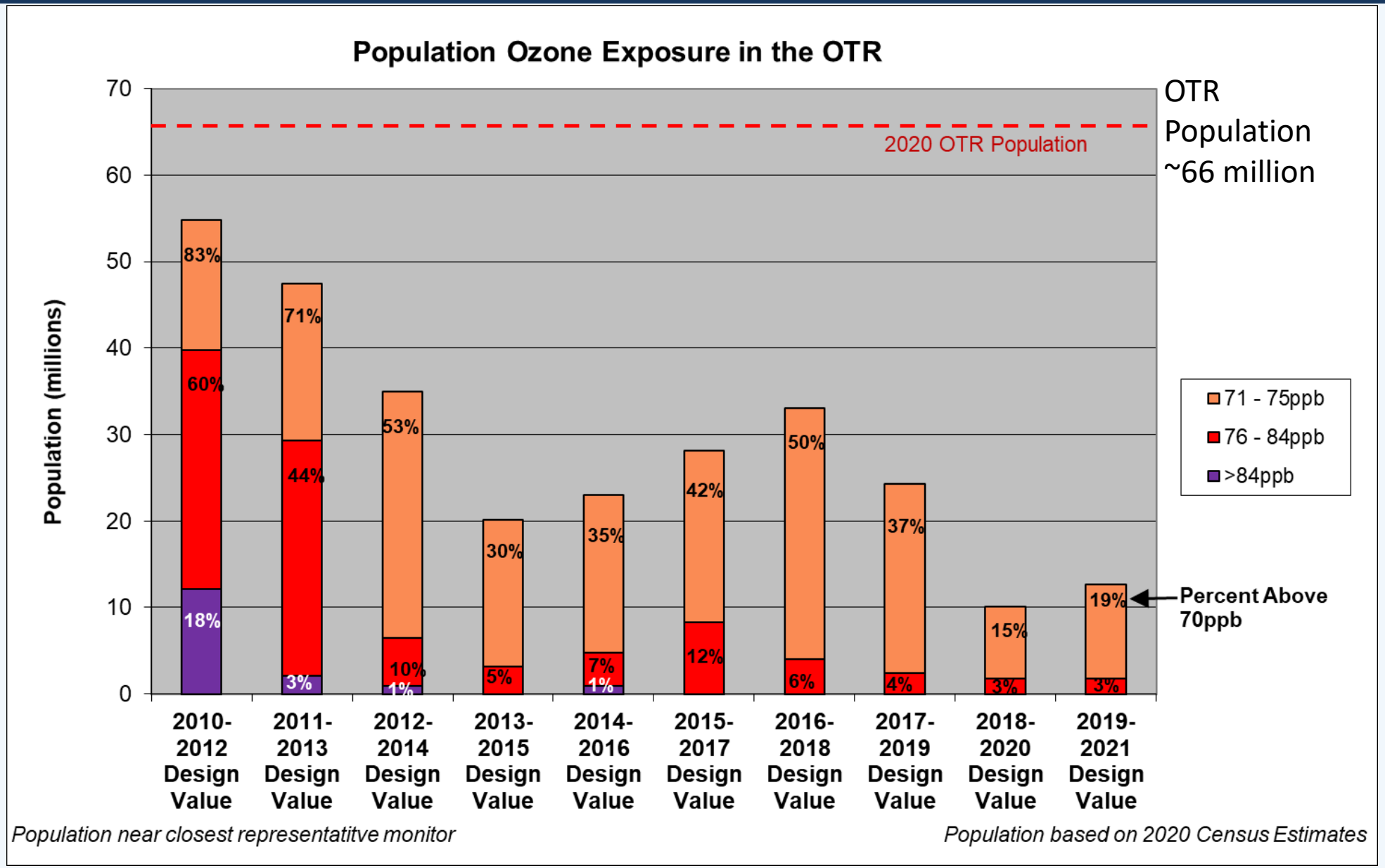
# OZONE MONITORING AND NONATTAINMENT

# 2019-2021 Design Values




*Ozone design values are the 3-year average of the year's 4th maximum 8-hour concentration at each monitor. It directly compares to the health standard (NAAQS).*

# How Many People are Exposed to High Ozone?



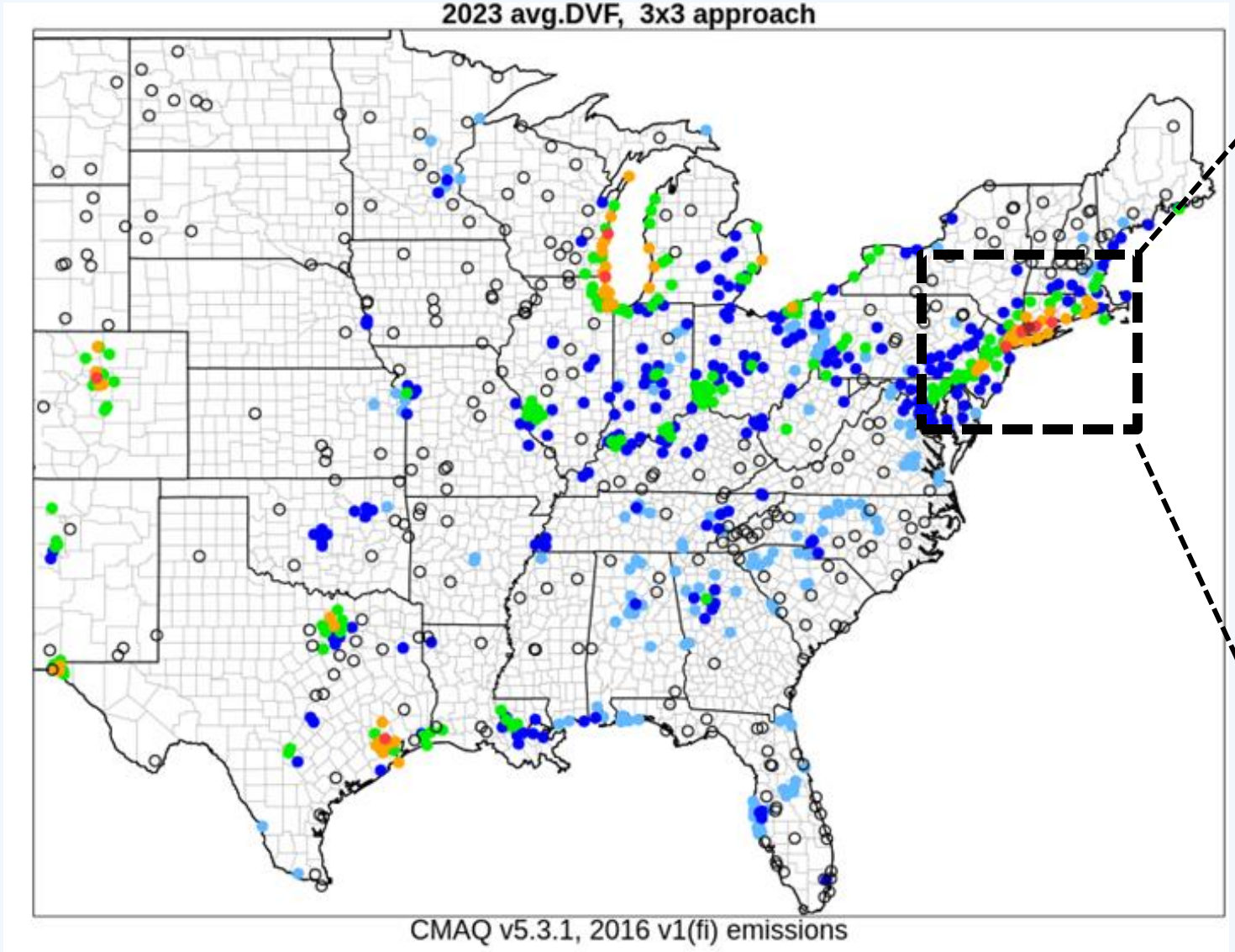
# Current Air Quality Summary

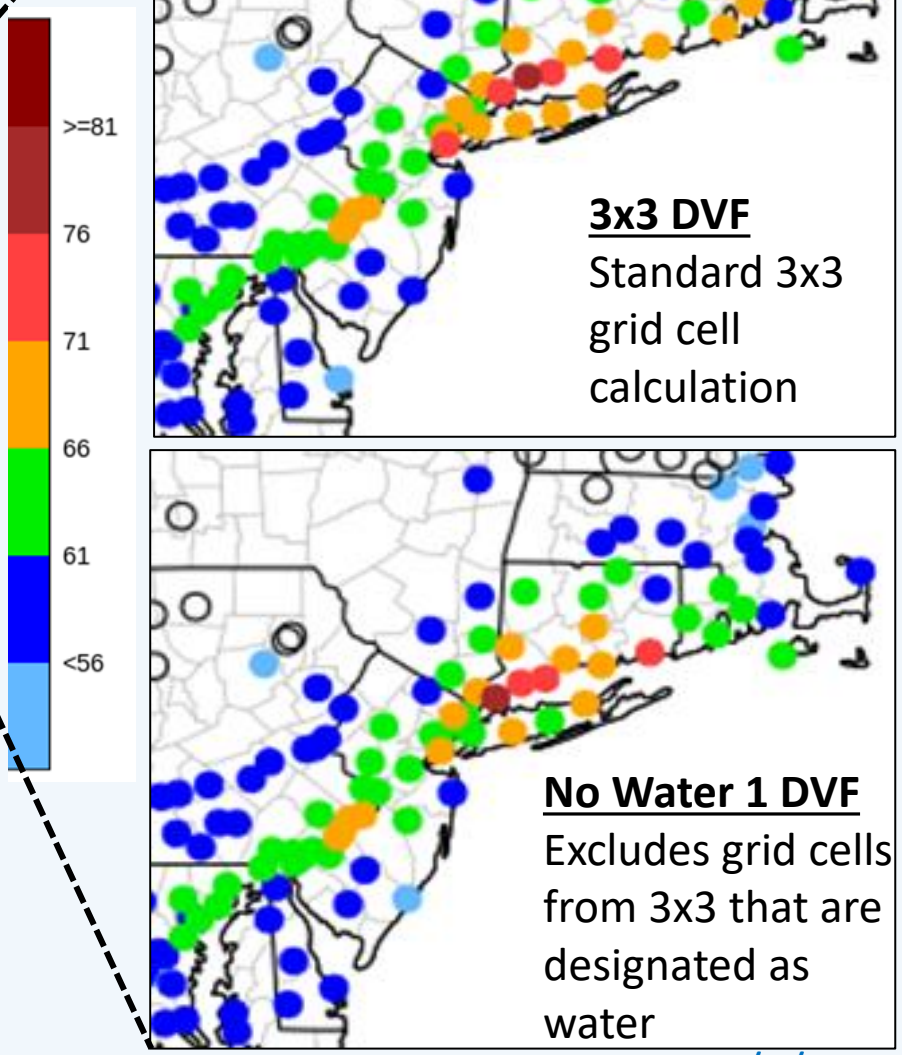
1. Some improvement in recent years but progress has flattened out over since 2013
2. There are 13 ozone monitors in the OTR that are failing to meet the 2015 ozone NAAQS and 4 that are failing to meet the 2008 NAAQS
3. All OTR ozone nonattainment areas are being bumped up in classification
4. About 12 million people living in the OTR are still breathing air that fails to meet ozone health standards

# OTC MODELING FOR 2023

1. V1 2023 BASE CASE
2. HEDD EPISODIC SENSITIVITY MODELING
3. TAGGED EMISSION CONTRIBUTION MODELING

# OTC 2023 Projected Design Values (V1) - CMAQ

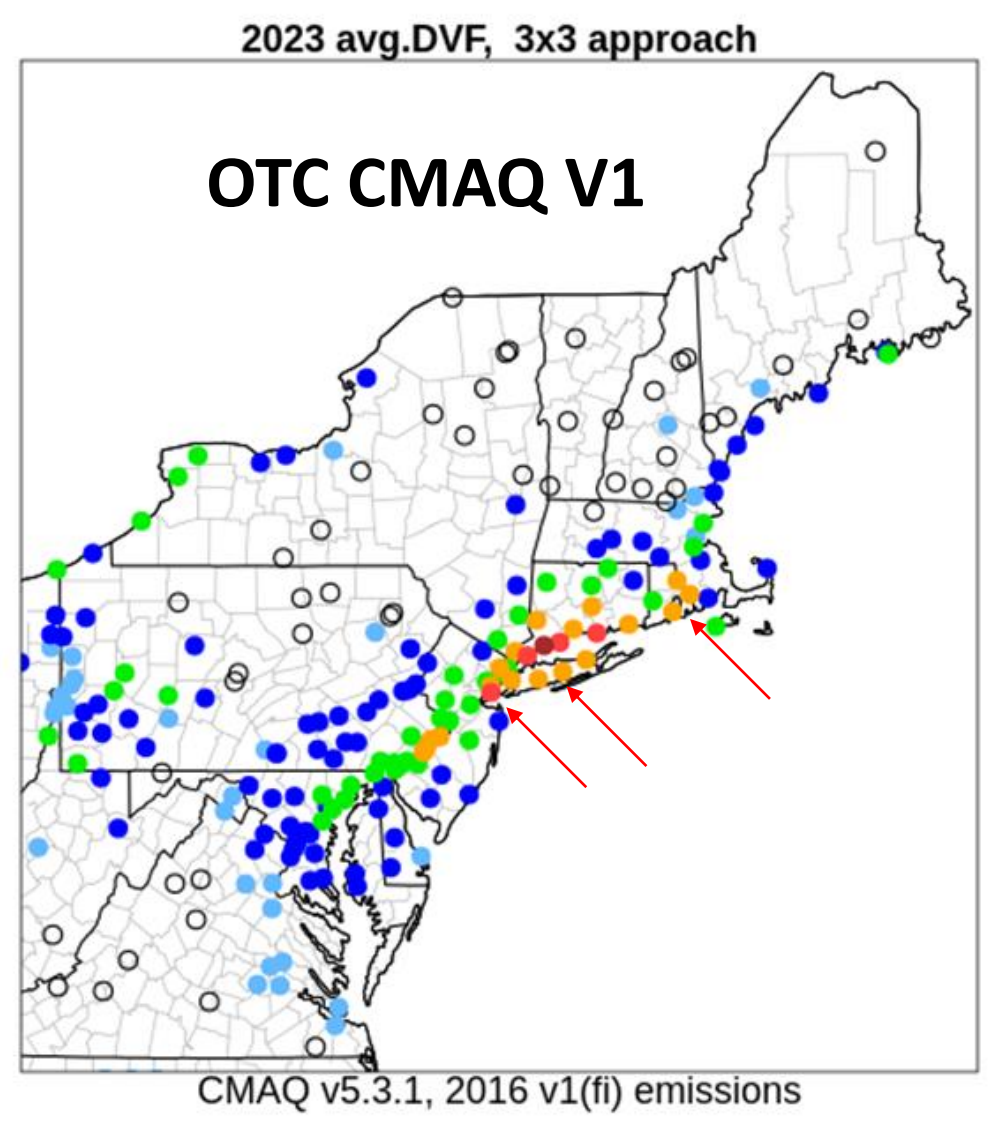


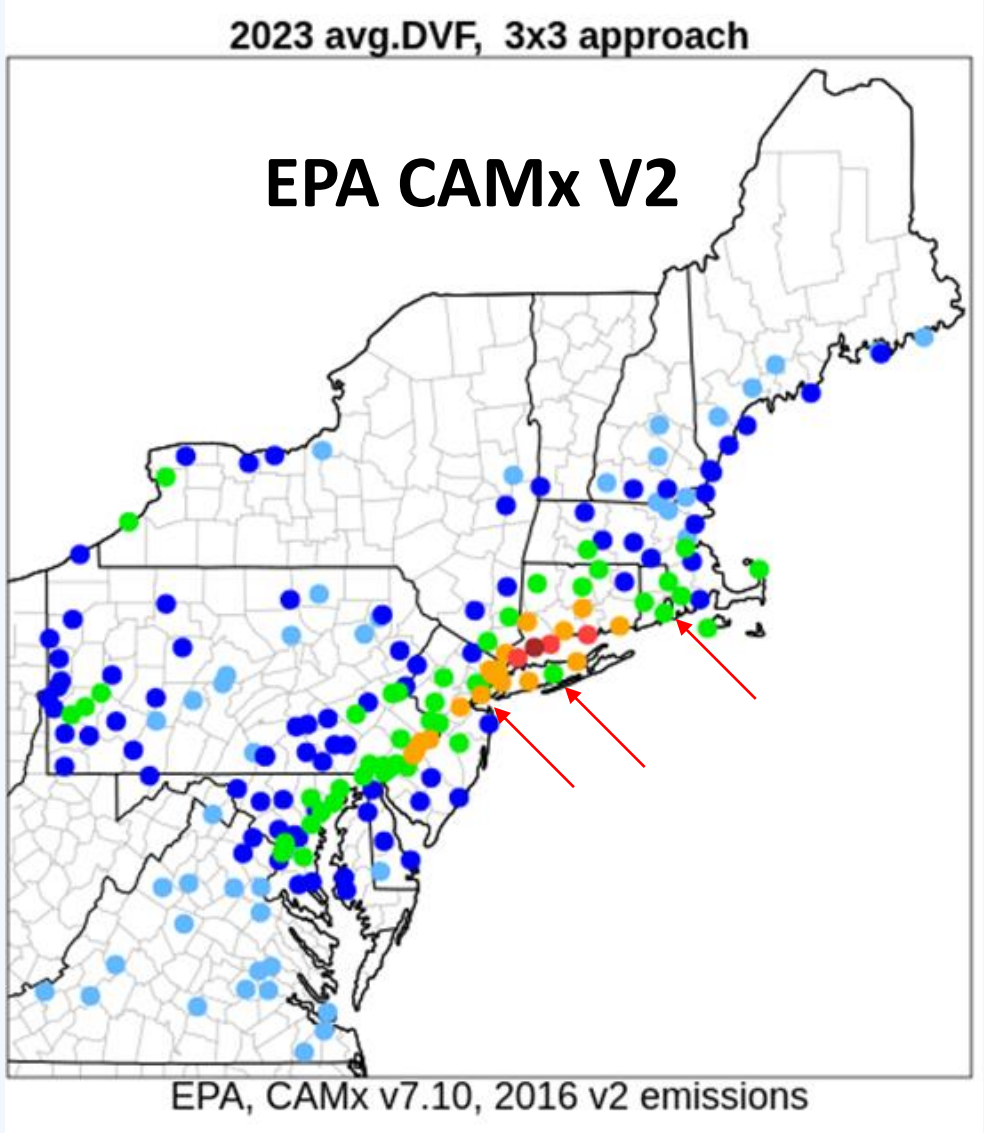




**3x3 DVF**
Standard 3x3 grid cell calculation

**No Water 1 DVF**
Excludes grid cells from 3x3 that are designated as water

# 2023 Predicted Design Values - OTC V1 vs EPA V2



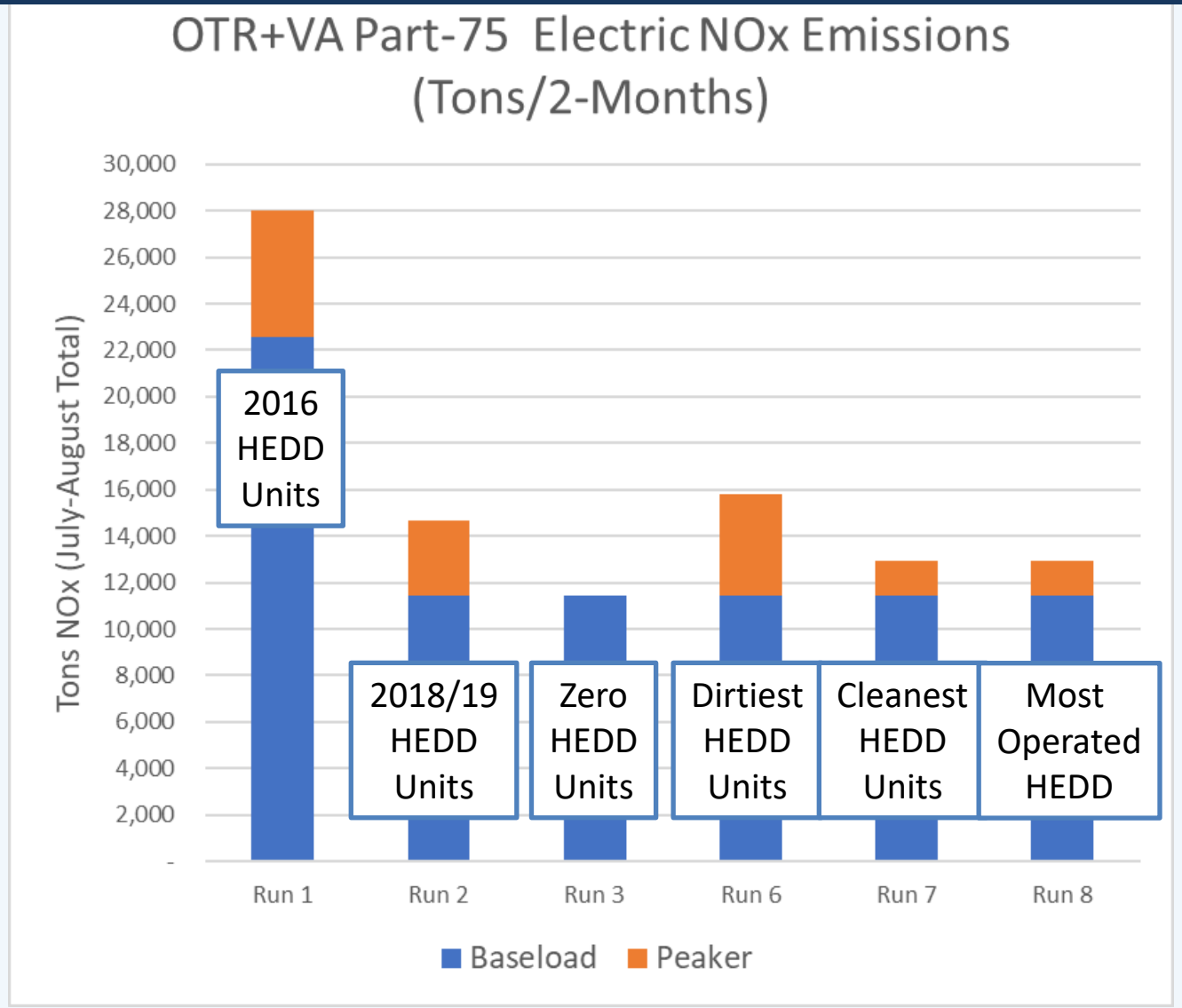
# HEDD Episodic Modeling

1. High Energy Demand Day (HEDD) electric generating units are units that are infrequently operated, and often high emitting, sources extra electricity during periods of high demand
2. The Modeling Committee developed innovative techniques for using real (actual 2018/19), rather than model predicted, HEDD EGU emissions
3. Sensitivity modeling indicates that there are existing cleaner options for dispatching cleaner generating HEDD units

# HEDD Episodic Modeling

## Total Part-75 Electric Generation NOx Emissions per scenario

- Large decrease between 2016 Run 1 and 2018/19 Run 2
- In sensitivity modeling cases, worst case HEDD EGU emissions are about 30% higher, and best case emissions are about 50% lower, than the 2018/19 Run 2

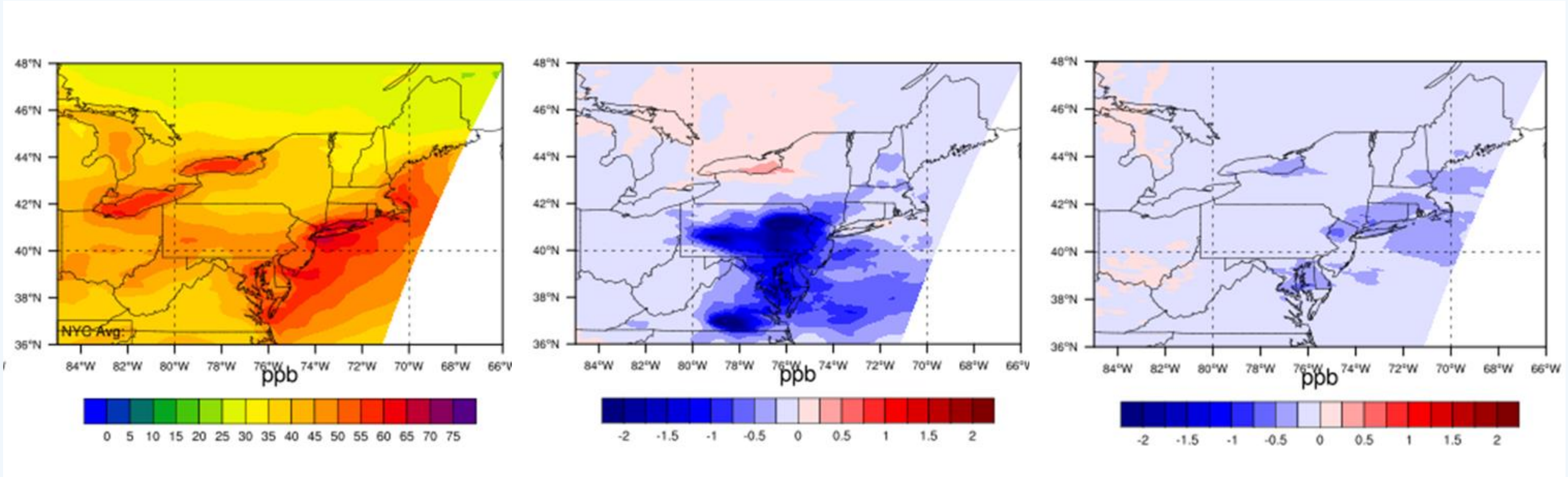


# HEDD Episodic Modeling
# Examples: Model Predicted Changes in 8-Hour Ozone

**(Re)Base**
**2018/19 Modeled Ozone**

**Modeled Ozone Change**
**2018/19 Difference from 2016**

**Modeled Ozone Change**
**2018/19 All Part-75 HEDD EGUs Off**



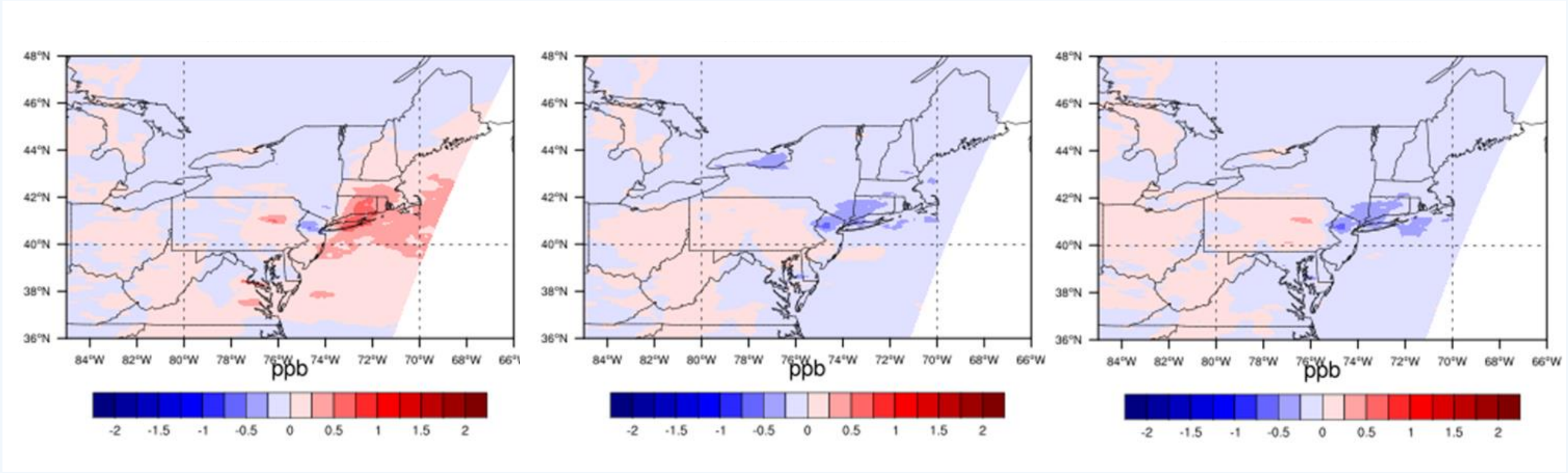

July Monthly Average Concentration Differences

# HEDD Episodic Modeled Change in 8-Hour Ozone Examples: 2018/19 Electric Load Maintained

**Dispatch Priority:**
**Dirtiest First**

**Dispatch Priority:**
**Cleanest First**

**Dispatch Priority:**
**Most Operated First**




July Monthly Average Concentration Differences

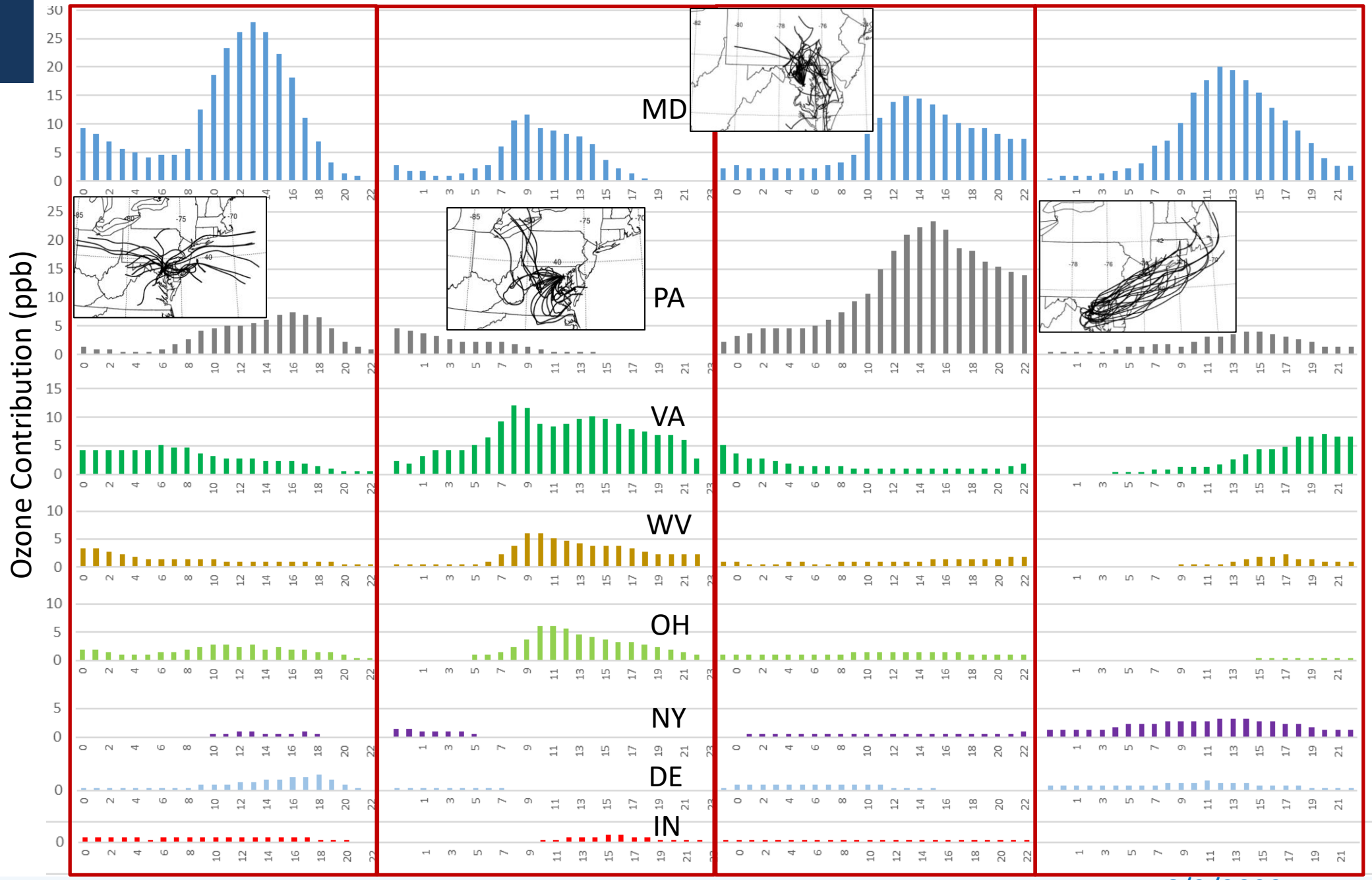
# Contribution Modeling

## Contributing State Variability

Variability
Day-to-Day
Hour-to-Hour

Beltsville, MD
4 High Ozone Days

Contributions are highly variable



# 2023 Modeling Summary

1. OTC modeling projects 4 to 5 monitors will fail to meet the 2015 ozone NAAQS and 1 will fail to meet the 2008 NAAQS in 2023
   A. EPA V2 modeling projects a slightly lower ozone at high ozone monitors in the OTR
   B. OTC 4km modeling and No-Water calculations show potential to improve predicted design values at several high ozone locations in the OTR
2. OTC episodic modeling indicates that HEDD EGUs:
   A. Can produce important contributions to ozone exceedance in the region
   B. There may be cleaner options for peak period generation
3. OTC contribution modeling indicates that:
   A. Contributing states to the OTR are highly variable and dependent on wind flows
   B. States as far away as Texas contribute more than 1% of the NAAQS to ozone exceedances in the OTR on some days
   C. OnRoad, Area, NonRoad, and EGUs are the top contributing emission sectors in the OTR (account for about 70% of NOx emissions)

# Moving Forward

- The Modeling Committee will continue to track ozone levels and attainment status across the region
- New modeling may include:
    - Update to V2 emissions with projections to 2023 and 2026
    - Episodic sensitivity modeling for urban VOCs, MWCs, wood-fired ICI units and other scenarios identified by the other committees and Air Directors

# Contact Information

- **Committee Chair:** **Jeff Underhill (NH)** (603) 271-1102
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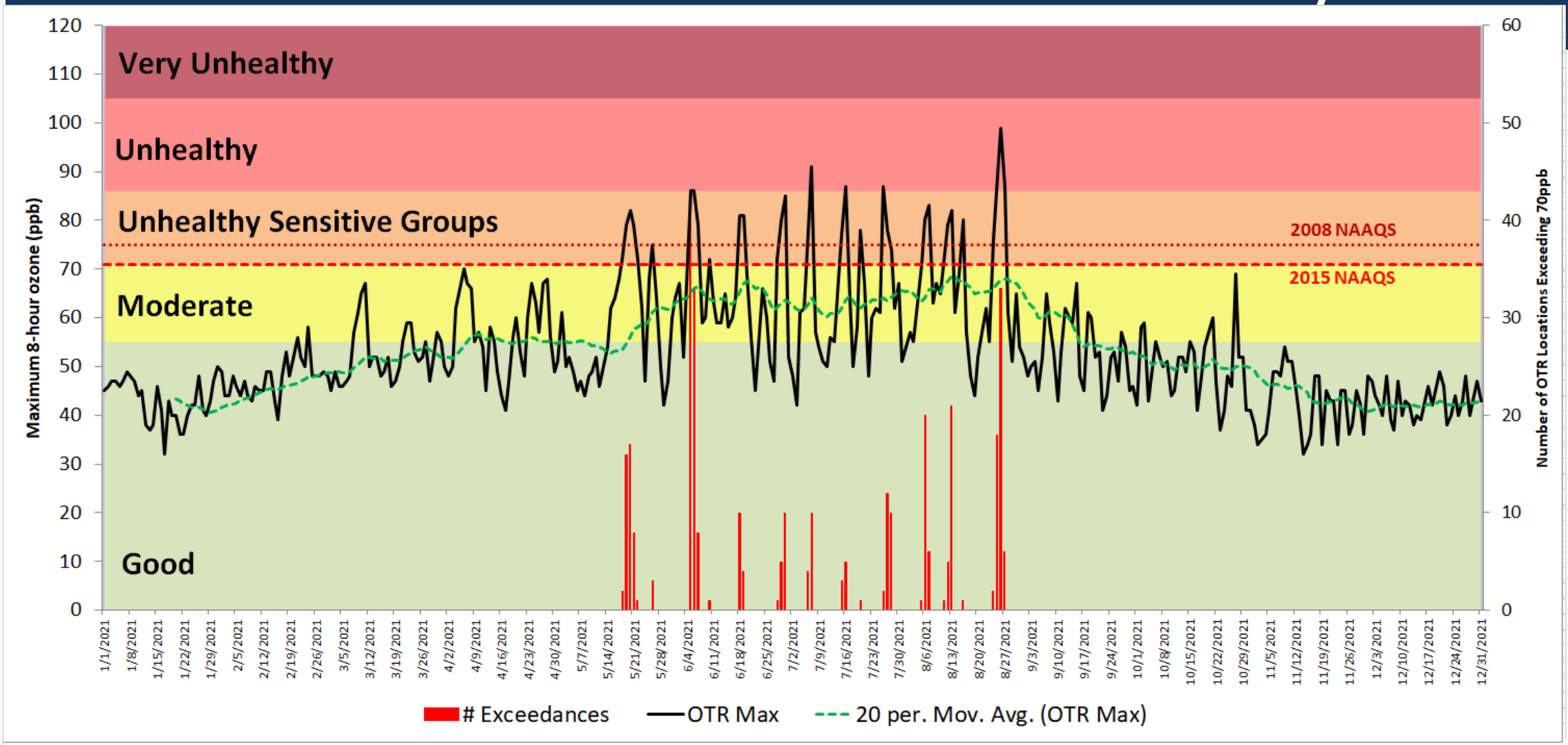
- **OTC Committee Lead:** **Alex Karambelas (OTC/NESCAUM)**
  *AKarambelas@nescaum.org* (224) 805-1100

# Bonus Slides

# 2021 Ozone Season - Preliminary




34 days exceeding 70ppb
26 days exceeding 75ppb
9 days exceeding 84ppb

103 different monitors in
56 different monitors in
9 different monitors in

12 states (including DC) exceeded 70ppb
11 states (+DC) exceeded 75ppb
4 states exceeded 84 ppb

# 2019-2021 Ozone Attainment Status - Preliminary

**Specific to Highest Ozone Monitor in Area**

| Nonattainment Area | # Monitors Exceeding in NAA | High Concentration Monitor | | | Preliminary 2019-21 DV | 2021 NonAttainment Area Statistics | | | | | # Days >NAAQS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Agency | Site Name | AQS Code | | NAAQS | Max | Max 2nd High | Max 3rd High | Max 4th High | |
| Greater CT | 1 | CT | Groton Fort Griswold | 90110124 | 73 | 70 | 82 | 76 | 76 | 75 | 9 |
| NYC | 4 | CT | Madison-combined (9002 3002 | 90099002 | 82 | 75 | 99 | 89 | 87 | 86 | 25 |
| Philadelphia | 2 | PA | Bristol | 420170012 | 71 | 70 | 86 | 80 | 77 | 77 | 14 |
| Baltimore | 1 | MD | Edgewood | 240251001 | 72 | 70 | 82 | 78 | 78 | 75 | 15 |
| Washington | 0 | MD | Beltsville | 240339991 | 70 | 70 | 82 | 77 | 74 | 72 | 8 |

| All Violating Monitors | | | Preliminary | | 2021 | | | | # Days |
|---|---|---|---|---|---|---|---|---|---|
| AQS Code | Agency | Site Name | 2019-21 pDV | NAAQS | Max | 2nd High | 3rd High | 4th High | >NAAQS |
| 90010017 | CT | Greenwich | 79 | 75 | 94 | 82 | 78 | 78 | 8 |
| 90013007 | CT | Stratford | 81 | 75 | 91 | 87 | 87 | 86 | 8 |
| 90019003 | CT | Westport | 80 | 75 | 99 | 89 | 87 | 86 | 10 |
| 90099002 | CT | Madison-combined (9002 | 82 | 75 | 89 | 85 | 84 | 83 | 10 |
| 90110124 | CT | Groton Fort Griswold | 73 | 70 | 79 | 76 | 76 | 75 | 6 |
| 240251001 | MD | Edgewood | 72 | 70 | 74 | 73 | 73 | 73 | 6 |
| 420170012 | PA | Bristol | 71 | 70 | 83 | 80 | 77 | 77 | 10 |
| 421010024 | PA | NEA | 71 | 70 | 86 | 78 | 74 | 72 | 7 |

# EPA 2015 Ozone NAAQS Good Neighbor Modeling

| | | | | CMAQ 12 km | | | | CAMX 12 km | | | | CAMx 4 km | | | | EPA CAMx 12 km | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3x3 | | 3x3 no water 1 | | 3x3 | | 3x3 no water 1 | | 3x3 | | 3x3 no water 1 | | 3x3 | | 3x3 no water 1 | |
| Site ID | State | Site name | 2019-2021 pDV | DVFavg.pre-trunc AVG | DVFmax.pre-trunc MAX | DVFavg.pre-trunc AVG | DVFmax.pre-trunc MAX | DVFavg.pre-trunc AVG | DVFmax.pre-trunc MAX | DVFavg.pre-trunc AVG | DVFmax.pre-trunc MAX | DVFavg.pre-trunc AVG | DVFmax.pre-trunc MAX | DVFavg.pre-trunc AVG | DVFmax.pre-trunc MAX | DVFavg.pre-trunc AVG | DVFmax.pre-trunc MAX | DVFavg.pre-trunc AVG | DVFmax.pre-trunc MAX |
| 90019003 | CT | Westport | 80 | 80.6 | 80.9 | 75.5 | 75.8 | 78.3 | 78.6 | 76 | 76.2 | 77.9 | 78.2 | 77.8 | 78 | 76.8 | 77 | 76.1 | 76.4 |
| 90013007 | CT | Stratford | 81 | 74.6 | 75.5 | 75.1 | 76 | 75.8 | 76.7 | 75 | 75.9 | 77.1 | 78.1 | 77.1 | 78.1 | 74.7 | 75.6 | 74.2 | 75.1 |
| 90010017 | CT | Greenwich | 79 | 71.7 | 72.4 | 78.8 | 79.5 | 74.1 | 74.7 | 74.6 | 75.2 | 75.2 | 75.8 | 75.5 | 76.2 | 75.3 | 75.9 | 73 | 73.7 |
| 90099002 | CT | Madison-combined (90 | 82 | 71.8 | 73.9 | 70.8 | 72.8 | 71.6 | 73.7 | 72.3 | 74.4 | 73.7 | 75.8 | 73.6 | 75.8 | 72.1 | 74.2 | 71.8 | 73.9 |
| 420170012 | PA | Bristol | 71 | 69.1 | 70.6 | 69.1 | 70.6 | 71.1 | 72.6 | 71.1 | 72.6 | 72.4 | 73.9 | 72.4 | 73.9 | 70.7 | 72.2 | 70.7 | 72.2 |
| 360850067 | NY | NYC-Susan Wagner HS | | 74.2 | 74.2 | 70.3 | 70.3 | 71.3 | 71.3 | 70.5 | 70.5 | 69.9 | 69.9 | 69.7 | 69.7 | 69.9 | 69.9 | 69.5 | 69.5 |
| 90079007 | CT | Middletown-combined | 74 | 68.9 | 69.2 | 68.9 | 69.2 | 70.2 | 70.5 | 70.2 | 70.5 | 70.9 | 71.2 | 70.9 | 71.2 | 69.8 | 70.1 | 69.8 | 70.1 |
| 421010024 | PA | NEA | 71 | 68.2 | 68.4 | 68.2 | 68.4 | 69.5 | 69.8 | 69.5 | 69.8 | 70.9 | 71.1 | 70.9 | 71.1 | 69.5 | 69.8 | 69.5 | 69.8 |
| 90090027 | CT | New Haven-B | 72 | 69.3 | 70.5 | 68.4 | 69.6 | 69.5 | 70.7 | 68.7 | 69.9 | 70.6 | 71.8 | 69.7 | 70.9 | 68.2 | 69.4 | 68 | 69.1 |
| 90011123 | CT | Danbury | 70 | 68.8 | 69.7 | 68.8 | 69.7 | 69.3 | 70.2 | 69.3 | 70.2 | 69.7 | 70.6 | 69.7 | 70.6 | 68.6 | 69.5 | 68.6 | 69.5 |
| 361030002 | NY | Babylon | 73 | 68.3 | 70.1 | 67.6 | 69.4 | 69.7 | 71.6 | 68.3 | 70.1 | 69.2 | 71.1 | 69.2 | 71.1 | 69 | 70.9 | 67.6 | 69.4 |
| 340030006 | NJ | Leonia | 71 | 68.1 | 68.7 | 68.1 | 68.7 | 69.2 | 69.9 | 69.2 | 69.9 | 68.4 | 69 | 68.4 | 69 | 68.5 | 69.2 | 68.5 | 69.2 |
| 90110124 | CT | Groton Fort Griswold | 73 | 67.9 | 69.5 | 71.3 | 72.9 | 67 | 68.5 | 68 | 69.6 | 67.5 | 69.1 | 67.6 | 69.2 | 67 | 68.5 | 67.5 | 69.1 |
| 361192004 | NY | White Plains | 69 | 66.9 | 67.8 | 67.9 | 68.8 | 70.1 | 71.1 | 67.9 | 68.8 | 68.4 | 69.3 | 68.4 | 69.3 | 69.6 | 70.6 | 67 | 67.9 |
| 360810124 | NY | NYC-Queens | 71 | 66.5 | 68.1 | 65.7 | 67.2 | 67.9 | 69.5 | 68.1 | 69.7 | 68.9 | 70.5 | 68.9 | 70.5 | 67.8 | 69.4 | 67.5 | 69.1 |
| 340070002 | NJ | Camden-Spruce St | 66 | 66.2 | 67.6 | 66.2 | 67.6 | 67.6 | 69.1 | 67.6 | 69.1 | 69.2 | 70.8 | 69.2 | 70.8 | 67.4 | 68.9 | 67.4 | 68.9 |
| 361030004 | NY | Riverhead | 69 | 66.4 | 67.9 | 66.8 | 68.4 | 68.3 | 69.8 | 67.3 | 68.8 | 67.7 | 69.2 | 67.7 | 69.3 | 67.9 | 69.5 | 66.8 | 68.3 |
| 421010048 | PA | NEW | | 66.3 | 66.9 | 66.3 | 66.9 | 67.4 | 68 | 67.4 | 68 | 69.2 | 69.9 | 69.2 | 69.9 | 67.2 | 67.8 | 67.2 | 67.8 |
| 360610135 | NY | NYC-CCNY | 70 | 64.7 | 66.2 | 64.9 | 66.5 | 66.3 | 67.9 | 65.9 | 67.5 | 66.1 | 67.7 | 66.1 | 67.7 | 66.9 | 68.6 | 65.9 | 67.5 |
| 360050133 | NY | NYBG-Bronx-combined | 70 | 64 | 65.2 | 65.5 | 66.7 | 67.2 | 68.5 | 66.5 | 67.7 | 65.5 | 66.7 | 65.5 | 66.7 | 67.2 | 68.5 | 65.7 | 66.9 |
| 340230011 | NJ | Rutgers U | 68 | 65.7 | 66 | 65.7 | 66 | 66.7 | 66.9 | 66.7 | 66.9 | 66.9 | 67.1 | 66.9 | 67.1 | 66.2 | 66.4 | 66.2 | 66.4 |
| 361030009 | NY | Suffolk County-combin | 70 | 66.9 | 68.7 | 64.2 | 66 | 66.2 | 68.1 | 64.6 | 66.5 | 65.1 | 66.9 | 65.1 | 66.9 | 65.2 | 67 | 64.5 | 66.3 |
| 340150002 | NJ | Clarksboro | | 65.8 | 66 | 65.8 | 66 | 66.1 | 66.4 | 66.1 | 66.4 | 66.6 | 66.9 | 66.6 | 66.9 | 65.3 | 65.6 | 65.3 | 65.6 |
| 340170006 | NJ | Bayonne | 66 | 68.2 | 69.1 | 64.8 | 65.7 | 66 | 66.9 | 65.1 | 66 | 65.7 | 66.7 | 65.7 | 66.7 | 64.5 | 65.4 | 64.5 | 65.4 |
| 250051004 | MA | Fall River | | 68.5 | 70.7 | 63.3 | 65.3 | 64.5 | 66.6 | 64.4 | 66.5 | | | | | 64.2 | 66.3 | 64 | 66 |
| 340219991 | NJ | Wash Crossing | 66 | 64.8 | 65.4 | 64.8 | 65.4 | 65.8 | 66.4 | 65.8 | 66.4 | 65.8 | 66.5 | 65.8 | 66.5 | 65.2 | 65.8 | 65.2 | 65.8 |