LADCO | LAKE MICHIGAN AIR DIRECTORS CONSORTIUM

Assessing Potential Regulatory Significance of O_3 & $PM_{2.5}$ Episodes in the Great Lakes Region

Angie Dickens, Zac Adelman, & Tsengel Nergui

National Exceptional Events Workshop
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Goals and Outline

- Goal 1: Assess regulatory significance before the year is finished
- Goal 2: Evaluate which monitors/days have regulatory significance for EE demos within each CBSA in the Great Lakes Region

- Outline:
  - Approach for ozone (short)
  - Approach for $PM_{2.5}$

4415 West Harrison St., Suite 548
Hillside, IL 60162

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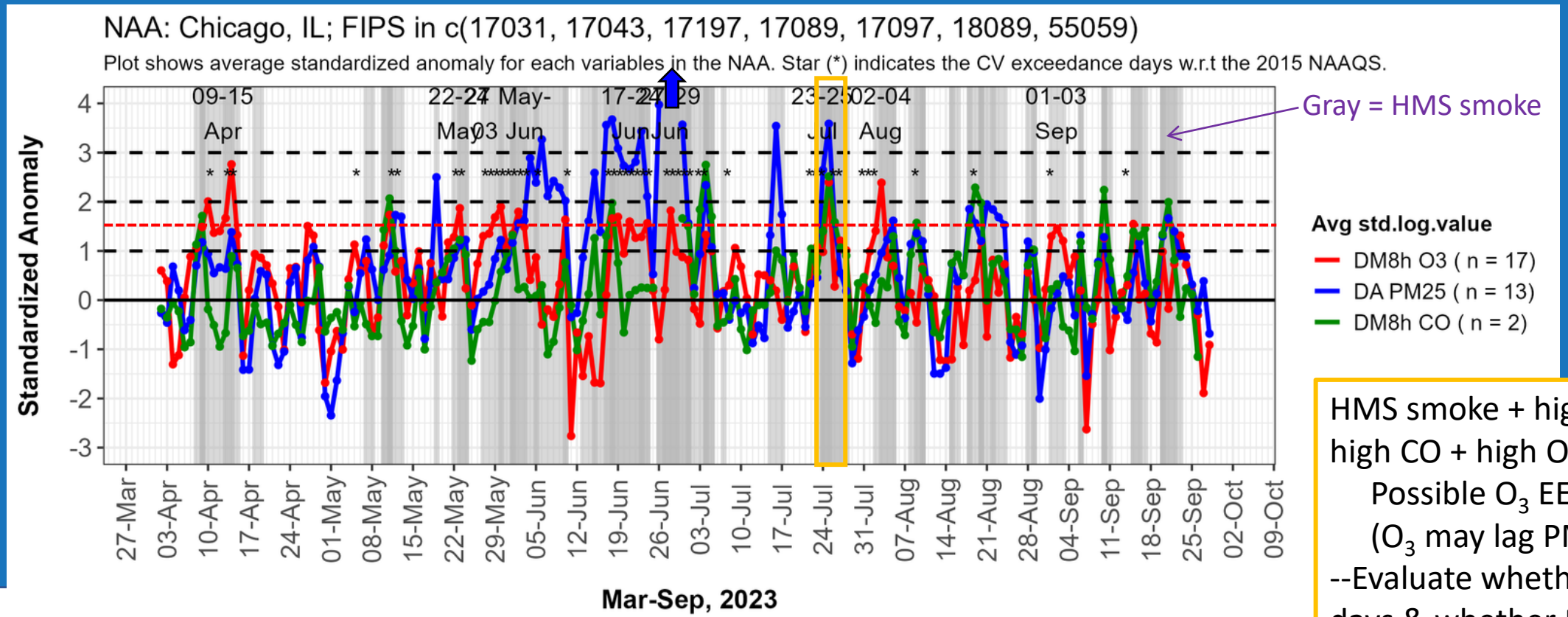
Screening metric for ozone exceptional events

- Update screening plots every month on our EE workgroup call



HMS smoke + high $PM_{2.5}$ + high CO + high O_3 → Possible O_3 EE demo target (O_3 may lag $PM_{2.5}$)
--Evaluate whether in top-4 days & whether DV > 70 ppb (tracking sheet for this)

- Monthly anomalies relative to previous 5 years
- Consider anomaly > 1.5 sigma to be likely smoke – averaged across all sites in the NAA

Annual $PM_{2.5}$ Approach

- Determine how much each day contributes to the annual DV and rank days in order of contribution
  - Focus on the highest days → explore which helped push an estimated DV over the NAAQS
  - Data sources:
    - AQS when available
    - AirNow when AQS data isn't available
    - Monthly mean values from 2020-2022 when neither AQS nor AirNow data is available

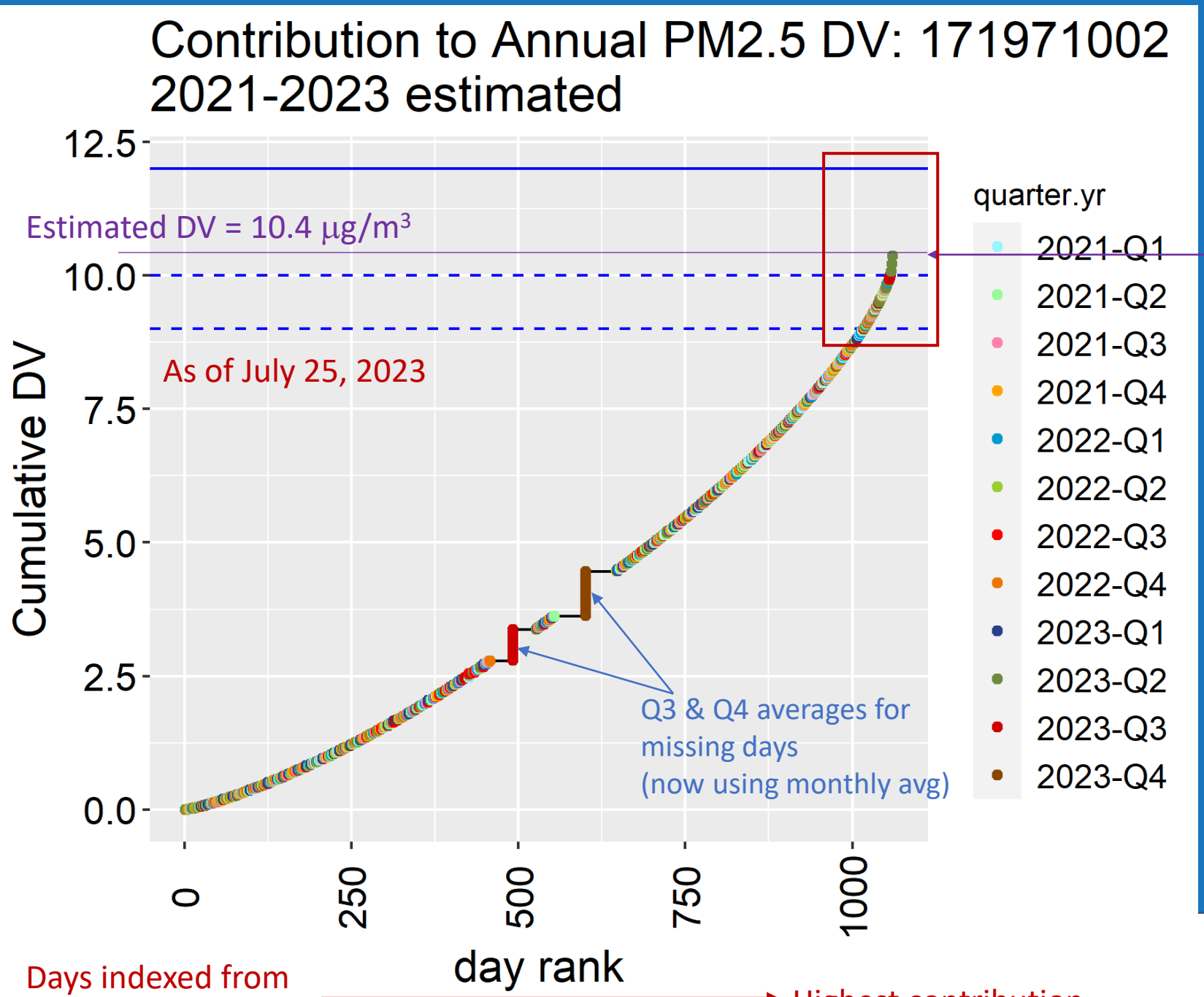
Annual mean

- DV = $\dfrac{\frac{Q1_{2021}+Q2_{2021}+Q3_{2021}+Q4_{2021}}{4}+\frac{Q1_{2022}+Q2_{2022}+Q3_{2022}+Q4_{2021}}{4}+\frac{Q1_{2021}+Q2_{2021}+Q3_{2021}+Q4_{2021}}{4}}{3}$
  - Where Q = quarterly mean = $\dfrac{\sum PM_{24hr}}{n\ days}$
    - Daily contributions = $\dfrac{24\text{-}hour\ PM2.5\ concentration}{12\ x\ (n\ days\ in\ quarter)}$

→ Adding up all daily contributions = Design Value

Graph this

Annual NAAQS



Cumulative sum of all daily contributions adds up to the estimated design value

Days indexed from lowest contribution → Highest contribution

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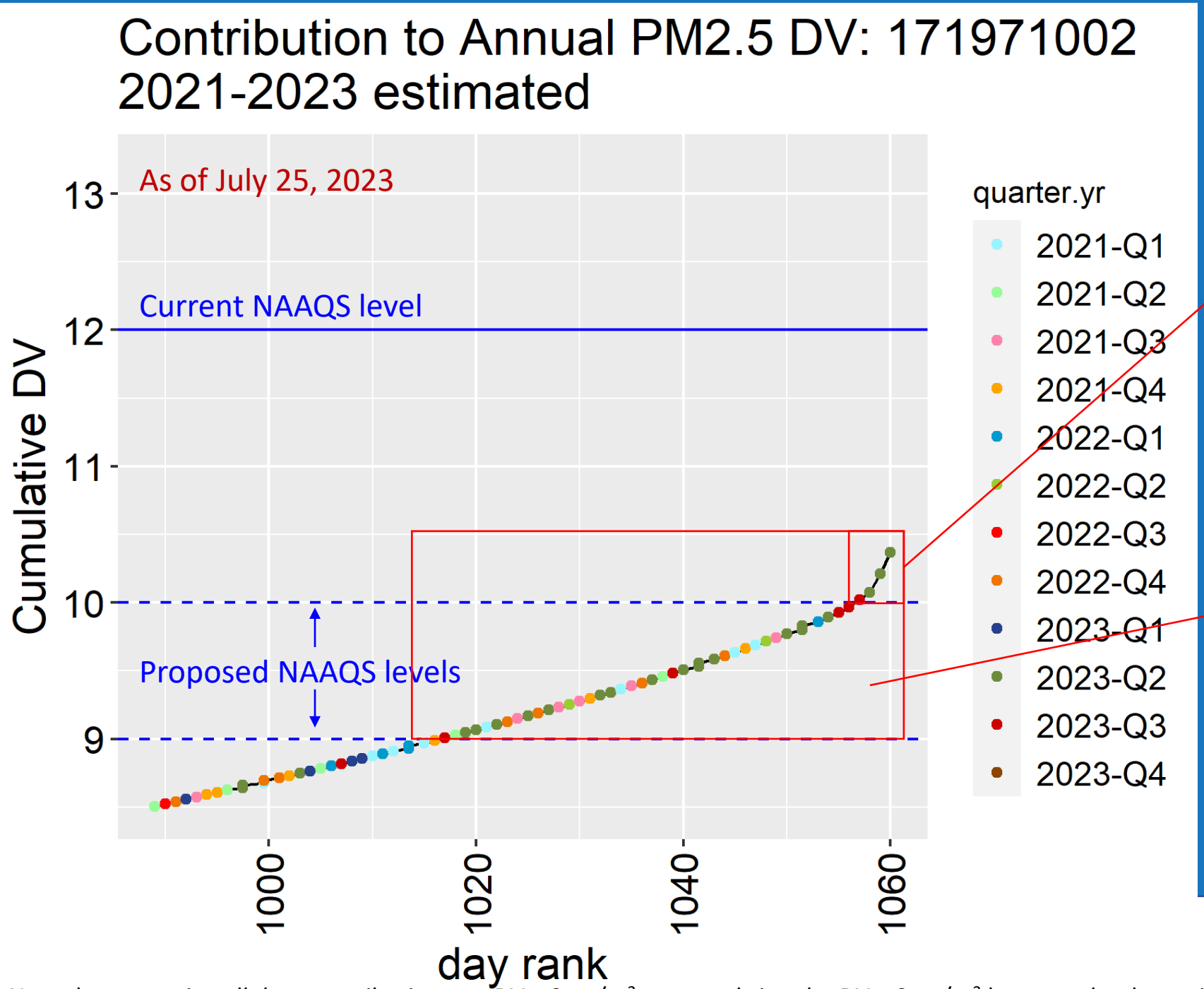

Annual NAAQS

- Four days pushed the DV above 10 µg/m³
  - All in Q2 or Q3 of 2023 → likely smoke influenced
  - If the NAAQS were 10 µg/m³, could be feasible to do an EE demo
- 44 days pushed the DV above 9 µg/m³
  - In many different years and quarters
  - Given the NAAQS at 9 µg/m³, an EE demo would be less helpful

Note that removing all days contributing to a DV > 9 ug/m³ may not bring the DV < 9 ug/m³ because the denominator of the average will also decrease.

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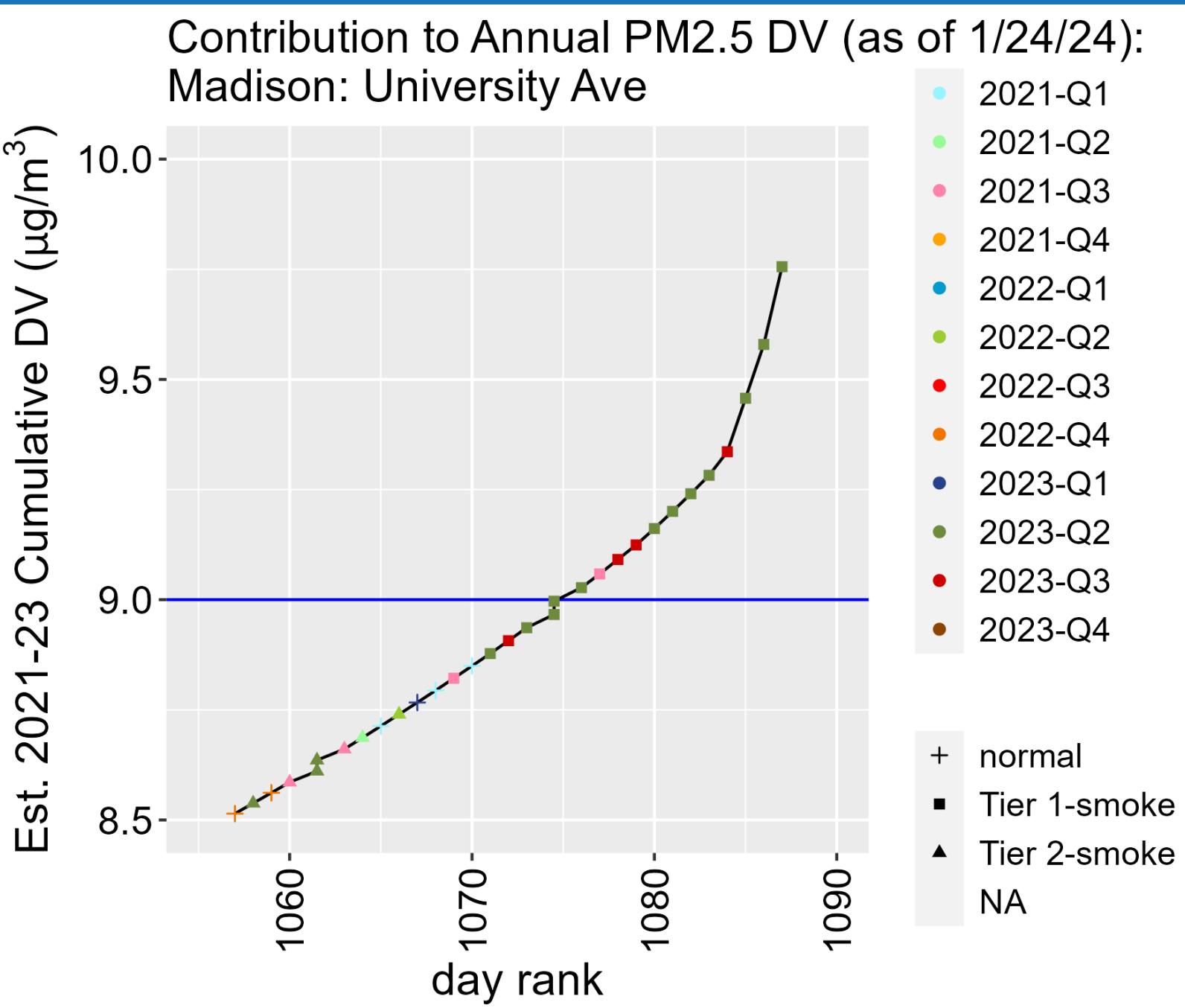

Updates

- Add HMS smoke markers → smoke in column
- Add EPA's tiers
  - Would be helpful for EPA to provide tables of tiering thresholds once years (or months) are complete
- Best EE targets: Tier 1 or 2, high day rank, & smoke in column

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Evaluations for Potential Exceptional Events Demonstrations

- For each CBSA, combine:
  - Maximum estimated design values
  - Days contributing most to high annual DVs
  - Days with smoke
  - EPA's tiering categories

CBSA	Maximum Estimated Annual DV (ug/m3)	# days contributing to DV >9 ug/m3	# contributing days with smoke (HMS)	# Tier 1 contributing smoke days	# Tier 2 contributing smoke days
	10.1	39	26	18	8
	9.8	12	12	12	0

- Provides a quick estimate of the degree of smoke impact at a site and of how effective EE demos would likely be at bringing an area into attainment of the NAAQS
  - Greater fraction of contributing days with smoke & more of these days as Tier 1 → Easier & more likely

Providing Tabulated Data to States

- Made a searchable, sortable google sheet
  - Estimated design values
  - Counts and lists of the days that contributed to pushing annual design values over 9 μg/m³.
  - Will add in tiering levels and smoke presence/absence

Total:

	A	B	C
1	Site	Estimated DV (ug/m3)	# Contributing days (NAAQS = 9 ug/m3)
2	170310001	9.5	3
3	170310022	9.7	8
4	170310052	9.5	7
5	170310057	9.5	3

By quarter:

	A	B	C	D
1	Site	year-quarter	Estimated DV (ug/m3)	# Contributing days (NAAQS = 9 ug/m3)
8	170310052	2021-Q1	9.4	2
9	170310052	2021-Q2	9.5	1
10	170310052	2021-Q3	9.1	1
11	170310052	2022-Q4	9.2	1
12	170310052	2023-Q2	9.2	2

By day:

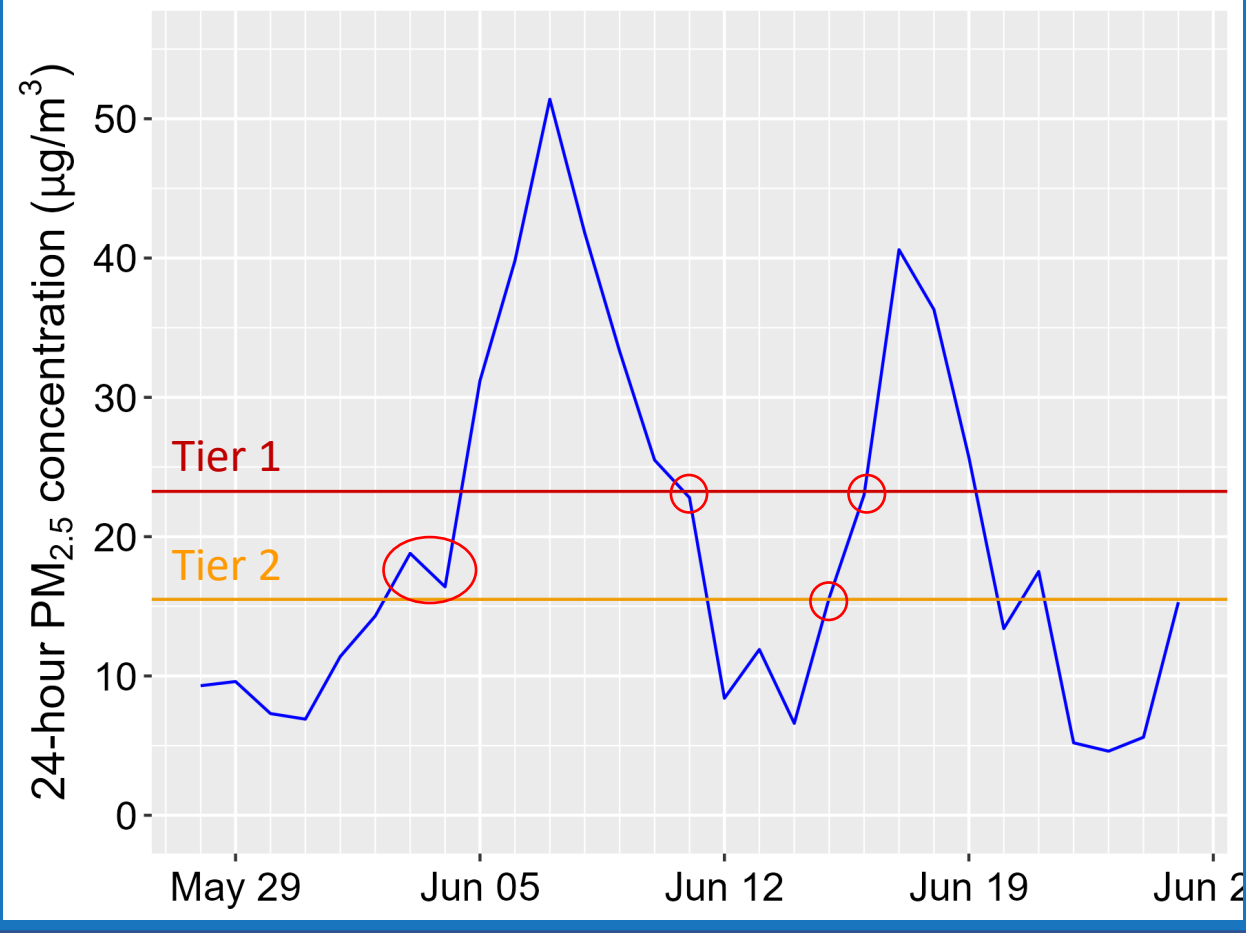
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Site	State	County	Date	year	Avg.24hr	quarter	Year-Quarter	day.weight	day.rank	Site.Name	cbsa	cum.DV
13	170310052	17	31	2023-06-23	2023	23.8	Q2	2023-Q2	0.06611111111	337	MAYFAIR PUMP STATION	Chicago-Naperville-Elgin, IL-IN-WI	9.018941629
14	170310052	17	31	2021-07-24	2021	22.9	Q3	2021-Q3	0.0681547619	338	MAYFAIR PUMP STATION	Chicago-Naperville-Elgin, IL-IN-WI	9.087096391
15	170310052	17	31	2022-12-07	2022	27.1	Q4	2022-Q4	0.07527777778	339	MAYFAIR PUMP STATION	Chicago-Naperville-Elgin, IL-IN-WI	9.162374169
16	170310052	17	31	2023-06-26	2023	29	Q2	2023-Q2	0.08055555556	340	MAYFAIR PUMP STATION	Chicago-Naperville-Elgin, IL-IN-WI	9.242929725

Applications for this work

- Getting an idea how much regulatory significance smoke events may have shortly after they happen
- Evaluating which sites are most impacted by smoke
  - Indicates where exceptional events demonstrations may be most useful and where they may not help

Caveat: due to complex data substitution rules for $PM_{2.5}$, it's very tricky to estimate design values accurately, even after a year has ended

Question for EPA:



- Type of demonstration needed for Tier 2 days that are part of a Tier 1 episode?
  - Our understanding is they would need a Tier 2 demonstration
  - Ask EPA to clarify this in writing
  - Would make sense to allow Tier 1 demonstration for entire episode

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Thank you!
Questions?
dickens@ladco.org