

4kei OSAT Modeling Results

- Preliminary Report -

Prepared by:

Alpine Geophysics, LLC

387 Pollard Mine Road

Burnsville, NC 28714

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Alpine Geophysics, LLC was tasked by the Midwest Ozone Group to develop an independent source apportionment modeling analysis of its 4kei modeling platform¹. In this document, we have identified our methods and approaches to some of these analyses and review and provide results for key monitors in the 4km domains of study.

Our analysis has assessed multiple aspects of EPA’s modeling and our findings suggest that when applying equally credible and valid modeling choices to the same modeling platform, significantly differing results can be generated. This leads us to a conclusion that it may not be appropriate to apply deterministic modeling (i.e., using a single set of inputs to generate a single answer) for such a complex scientific and policy-oriented purpose.

Source Apportionment Modeling

For this assessment, we performed nationwide, state-level ozone source apportionment modeling using the CAMx OSAT technique to quantify the contribution of 2023 base case NOx and VOC emissions from anthropogenic source categories in each region to projected 2023 ozone concentrations at ozone monitoring sites based on EPA’s CSAPR “Closeout” base case scenario from EPA’s 2011/2023en modeling platform.

In addition to using 4km-processed emissions over the two 4km domains, a key difference in our modeling compared to EPA’s modeling is the selection of the Ozone Source Apportionment Technology (OSAT) technique instead of OSAT/ Anthropogenic Precursor Culpability Assessment (APCA) technique.

Our selection of OSAT over OSAT/APCA is a result of the purpose and intended use of the model results. According to the documentation for CAMx², APCA differs from OSAT in recognizing that certain emission categories are not controllable (e.g., biogenic emissions) and that apportioning ozone production to these categories using OSAT does not provide information that is relevant to development of control strategies. It is noted that development of control strategies is not a component of our analyses; the calculation of anthropogenic category contribution (i.e., significant contribution) is the purpose of the modeling presented here.

In situations where OSAT attributes ozone production to non-controllable emissions (e.g., biogenics), APCA re-allocates that ozone production to the controllable precursors that participated in ozone formation with the non-controllable precursor. For example, when ozone formation is due to biogenic VOC and anthropogenic NOx under VOC-limited conditions (a situation where OSAT would attribute ozone production to biogenic VOC), APCA attributes ozone production to the anthropogenic NOx present. Using APCA instead of OSAT results in more ozone formation attributed to anthropogenic NOx sources and less ozone formation attributed to biogenic VOC sources.

¹“Air Quality Modeling Technical Support Document for Midwest Ozone Group’s Updated 4km Modeling - Final Technical Support Document,” Alpine Geophysics, LLC, December 2018.

² http://www.camx.com/files/camxusersguide_v6-40.pdf

As the primary purpose for our simulation was to develop a region and source category specific anthropogenic-only contribution to each monitor, OSAT was selected as the preferred approach.

In the source apportionment model run, we tracked the ozone formed from each of the following contribution categories (i.e., “tags”):

- Regions –NOx and VOC emissions from each state or state group tracked individually using the category “tags” listed below;
 - Biogenic/Fires;
 - Anthropogenic Emissions;
- Boundary and Initial Concentrations – concentrations transported into the modeling domain (e.g., international transport, stratospheric intrusion, domain initialization conditions);
- Canada, Mexico, and over water domains – anthropogenic emissions from sources in the portions of Canada and Mexico included in the modeling domain and from sources in the Pacific and Atlantic Oceans or from the Gulf of Mexico or Great Lakes not otherwise associated with specific states.

The CAMx modeling domain was subdivided into 17 source regions as presented in Table 1 and Figure 1.

Table 1. OSAT source regions definition

Region Number	Region Name
1	Canada/Mexico/Water
2	CT
3	MD
4	NJ
5	NY
6	PA
7	VA/DC
8	IL
9	IN

Region Number	Region Name
10	MI
11	OH
12	WI
13	WV
14	KY
15	MO
16	TX
17	All Other

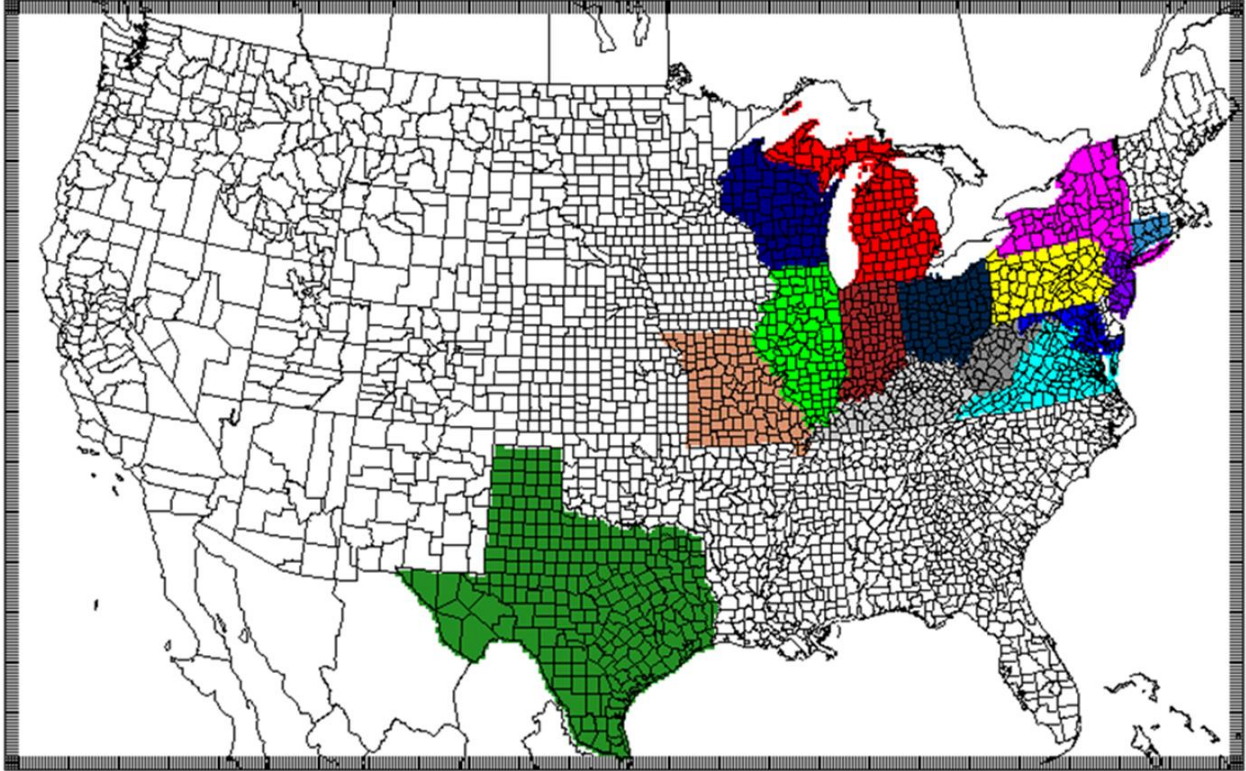


Figure 1. OSAT source region definition

Future Year Baseline Air Quality Simulations

As discussed in the 4kei TSD³, a 2023 future year base case CAMx simulation was conducted and 2023 ozone design value projection calculations were made for the 12US2 and two 4km modeling domains in this analysis.

Identification of Future Nonattainment and Maintenance Receptors

The ozone predictions from the 2011 and 2023 CAMx model simulations were used to project 2009-2013 average and maximum ozone design values to 2023. Using the approach in the final CSAPR Update as described below, we evaluated the 2023 projected average and maximum design values in conjunction with the most recent measured ozone design values (i.e., 2015-2017) to identify sites that may warrant further consideration as potential nonattainment or maintenance sites in 2023.

EPA's approach to determining nonattainment receptors in the CSAPR Update identifies those sites with 2023 average design values that exceed the NAAQS (i.e., 2023 average design values of 71 ppb or greater) and that are currently measuring nonattainment as nonattainment receptors in 2023. Similarly, under the CSAPR Update approach, monitoring sites with a projected 2023 maximum design value that exceeds the NAAQS would be projected to be maintenance receptors in 2023. In the CSAPR Update approach, maintenance-only receptors include both those monitoring sites where the projected 2023 average design value is below the NAAQS, but the maximum design value is above the NAAQS, and monitoring sites with projected 2023 average design values that exceed the NAAQS, but for which current design values based on measured data do not exceed the NAAQS.

As documented in EPA's March 2018 technical memorandum⁴, EPA used results of CAMx v6.40 to model emissions in 2011 and 2023 to project base period 2009-2013 average and maximum ozone design values to 2023 at monitoring sites nationwide. In projecting these future year design values, EPA applied its own modeling guidance, which recommends using model predictions from the "3x3" array of grid cells surrounding the location of the monitoring site. In response to comments submitted on the January 2017 NODA and other analyses, EPA also projected 2023 design values based on a modified version of the "3x3" approach for those monitoring sites located in coastal areas. This modeling was intended as an alternate approach to addressing complex meteorological monitor locations without having to rerun the simulations on finer grid scales.

Alpine's applied approach in developing and using 4km grid domains further followed EPA's guidance⁵ recommendation that "grid resolution finer than 12 km would generally be more

³ "Air Quality Modeling Technical Support Document for Midwest Ozone Group's Updated 4km Modeling - Final Technical Support Document," Alpine Geophysics, LLC, December 2018.

⁴ https://www.epa.gov/sites/production/files/2018-03/documents/transport_memo_03_27_18_1.pdf

⁵ https://www3.epa.gov/ttn/scram/guidance/guide/O3-PM-RH-Modeling_Guidance-2018.pdf

appropriate for areas with a combination of complex meteorology, strong gradients in emissions sources, and/or land-water interfaces in or near the nonattainment area(s).”

Accordingly, we used the finer grid resolution and the Software for the Modeled Attainment Test - Community Edition⁶ (SMAT-CE) tool consistent with EPA’s 12km attainment demonstration modeling methods calculating relative response factors and “3x3” neighborhoods. Alpine also prepared 2023 projected average and maximum design values in conjunction with the most recent measured ozone design values (2015-2017) to identify sites in these 4km domains that may warrant further consideration as potential nonattainment or maintenance sites in 2023.

After applying the approach outlined in the final CSAPR update (and described above) to evaluate the projected design values from the 4km analysis, we developed a list of nonattainment and maintenance monitors located within these two eastern 4km domains resulting from the approach. The last remaining modeled nonattainment monitor from the two 4km domains as defined using Alpine’s 4km simulation is provided in Table 2 along with its calculated 2023 average and maximum design values from both EPA’s “no water” calculation approach and Alpine’s 4km simulation and most current 2015-2017 design value.

Table 2. Alpine 4km Modeling-identified nonattainment monitor in the 4km domains.

Monitor	State	County	DVb (2011)	Ozone Design Value (ppb)				2015-2017 DV
				EPA "No Water" 12km Modeling		Alpine Updated 4km Modeling		
				DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	
551170006	WI	Sheboygan	84.3	72.8	75.1	71.5	73.8	80

Similarly, Table 3 presents the modeled maintenance monitors with their calculated average and maximum design values from both simulations and the most current 2015-2017 design value data. Monitors originally designated as nonattainment or maintenance by EPA using their “no water” calculation and found to be neither nonattainment or maintenance using Alpine’s 4km modeling are presented in Table 4.

⁶ <https://www.epa.gov/scram/photochemical-modeling-tools>

Table 3. Alpine 4km Modeling-identified maintenance monitors in the 4km domains.

Monitor	State	County	Ozone Design Value (ppb)					2015-2017 DV
			DVb (2011)	EPA "No Water" 12km Modeling		Alpine Updated 4km Modeling		
				DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	
90013007	CT	Fairfield	84.3	71.0	75.0	69.2	73.1	83
90019003	CT	Fairfield	83.7	73.0	75.9	68.3	71.0	83
90099002	CT	New Haven	85.7	69.9	72.6	68.9	71.5	82
240251001	MD	Harford	90.0	70.9	73.3	70.9	73.3	75
260050003	MI	Allegan	82.7	69.0	71.7	70.0	72.8	73
340150002	NJ	Gloucester	84.3	68.2	70.4	68.8	71.0	74
360850067	NY	Richmond	81.3	67.1	68.5	69.6	71.0	76
361030002	NY	Suffolk	83.3	74.0	75.5	70.6	72.0	76

Table 4. Alpine 4km modeling-identified attainment monitors in the 4km domains previously identified by EPA as nonattainment or maintenance.

Monitor	State	County	Ozone Design Value (ppb)					2015-2017 DV
			DVb (2011)	EPA "No Water" 12km Modeling		Alpine Updated 4km Modeling		
				DVf (2023) Ave	DVf (2023) Max	DVf (2023) Ave	DVf (2023) Max	
90010017	CT	Fairfield	80.3	68.9	71.2	66.8	69.0	79
90110124	CT	New London	80.3	67.3	70.4	66.0	69.1	76
360810124	NY	Queens	78.0	70.2	72.0	68.5	70.2	74
421010024	PA	Philadelphia	83.3	67.3	70.3	67.5	70.5	78
550790085	WI	Milwaukee	80.0	71.2	73.0	67.1	68.8	71

A full list of monitor locations and modeled average and maximum ozone design values for the 4km domain modeling is provided in Appendix A of the TSD⁷.

⁷ "Air Quality Modeling Technical Support Document for Midwest Ozone Group's Updated 4km Modeling - Final Technical Support Document," Alpine Geophysics, LLC, December 2018.

Source Apportionment Results

Our OSAT source apportionment modeling provided relative contributions to modeled ozone concentrations from NOx and VOC emissions by region and source category as defined above.

Table 5 and Figure 2 provide examples of our results showing the region and source category contribution at the Sheboygan, WI monitor (551170006).

Table 5. Example monitor and 2023 base case 4kei dv-scaled source apportionment output.

Monitor	551170006	Sheboygan, Wisconsin			CSAPR DV (Ave)		71.5
2023 OSAT Results (Modeled ppb) -- Future MATS Method							
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total
CT	0.00	0.00	0.00	0.00	0.00	0.00	0%
MD	0.06	0.01	0.00	0.00	0.00	0.07	0%
NJ	0.01	0.00	0.00	0.00	0.00	0.01	0%
NY	0.11	0.02	0.00	0.00	0.00	0.13	0%
PA	0.31	0.04	0.00	0.00	0.00	0.35	0%
VA/DC	0.13	0.02	0.00	0.00	0.00	0.16	0%
IL	6.53	1.38	0.00	0.00	0.00	7.90	11%
IN	0.32	0.06	0.00	0.00	0.00	0.38	1%
MI	2.97	1.29	0.08	0.00	0.00	4.34	6%
OH	0.37	0.07	0.00	0.00	0.00	0.44	1%
WI	9.50	3.02	0.00	0.00	0.00	12.52	18%
WV	0.17	0.02	0.00	0.00	0.00	0.19	0%
KY	0.22	0.06	0.00	0.00	0.00	0.28	0%
MO	1.39	1.55	0.00	0.00	0.00	2.94	4%
TX	2.73	0.94	0.07	0.00	0.00	3.74	5%
All Other	15.05	5.61	0.35	0.00	0.00	21.01	29%
BC	0.00	0.00	0.00	15.39	0.00	15.39	22%
IC	0.00	0.00	0.00	0.00	0.00	0.00	0%
Can/Mex/Water	1.22	0.41	0.00	0.00	0.00	1.63	2%
Monitor Total	41.09	14.51	0.51	15.39	0.00	71.50	100%

Using the example table above, we note the following keys in the highlighting of the anthropogenic contribution column. If the value is highlighted in red, the region-anthropogenic contribution to the monitor is equal to or in excess of 1.0 ppb. Yellow values (not seen in this example) indicate a region-anthropogenic contribution equal to or in excess of 1% of NAAQS (0.70 ppb) but less than the 1.0 ppb threshold. The green highlighted cell indicates that “but for” contributions from Canadian, Mexican, and over water identified emissions, the receptor would show a demonstrated, modeled attainment of the 70 ppb NAAQS in 2023 (CSAPR DV – Can/Mex/Water <= 70.9 ppb).

A full list of nonattainment and maintenance monitor OSAT results as calculated with the 4kei modeling platform is presented in Appendix A of this document.

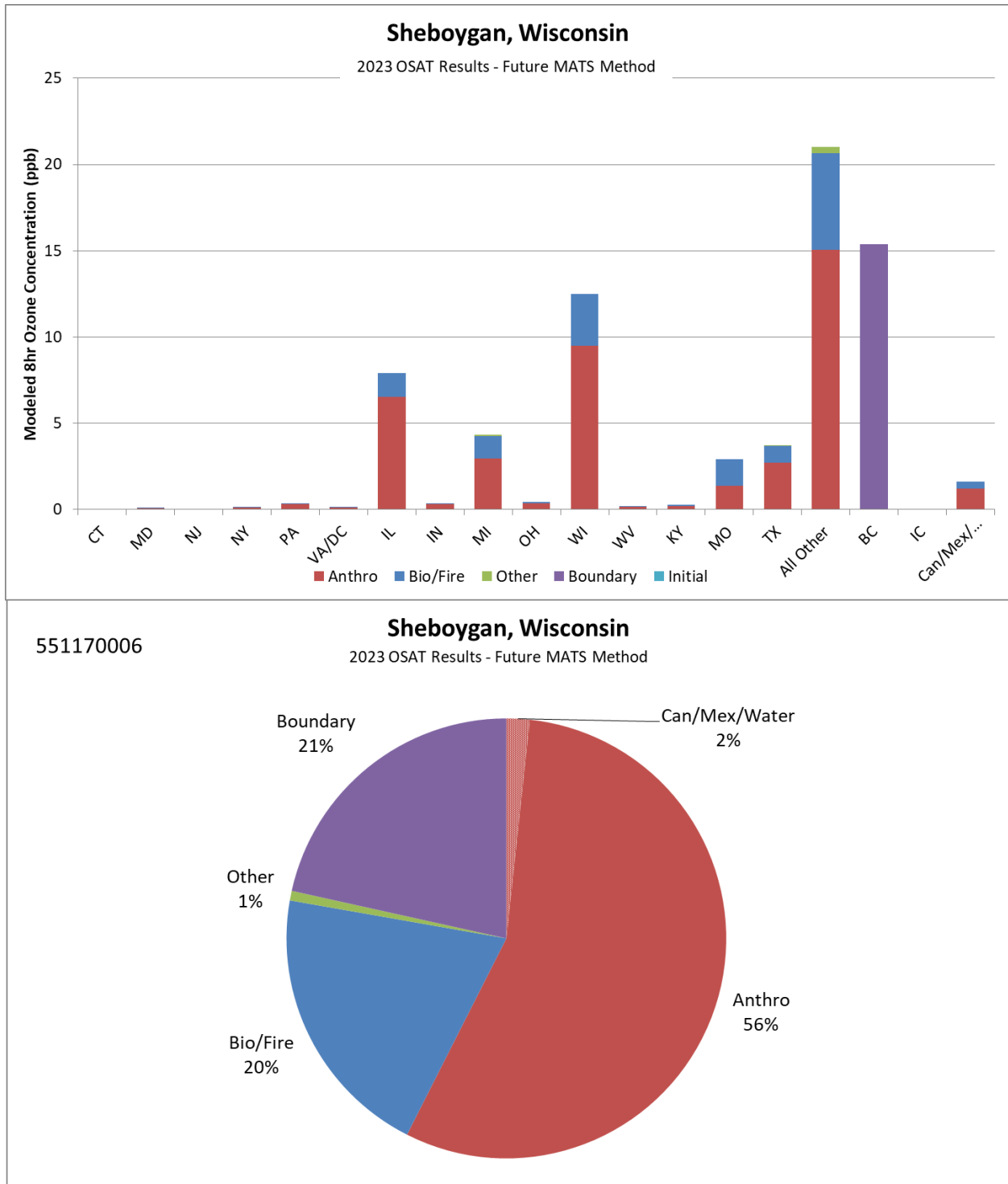


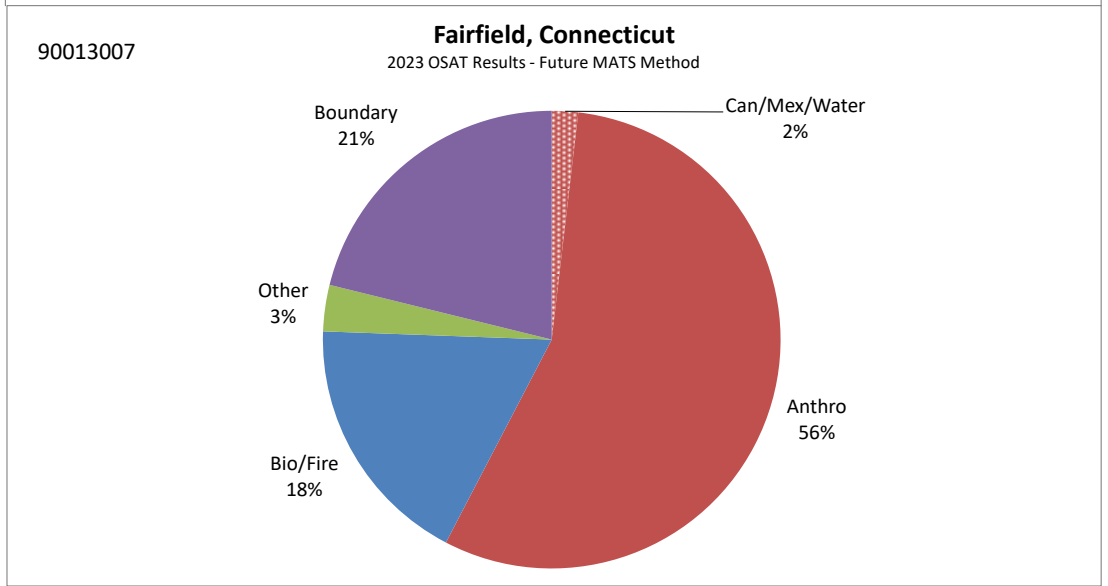
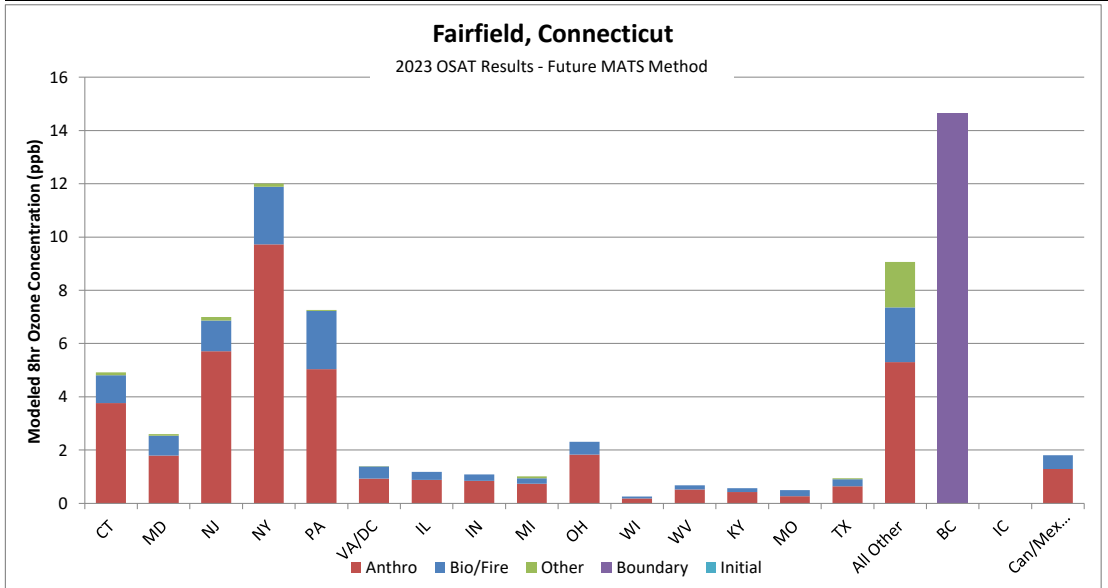
Figure 2. Example monitor and 2023 base case 4kei source apportionment output by region and sector.

Appendix A

Source Apportionment Results for 4kei Modeled Nonattainment and Maintenance Monitors

MOG OSAT 2023en
Monitor Level Design Value Summary and Significant Contribution Calculation
Future MATS OSAT Method

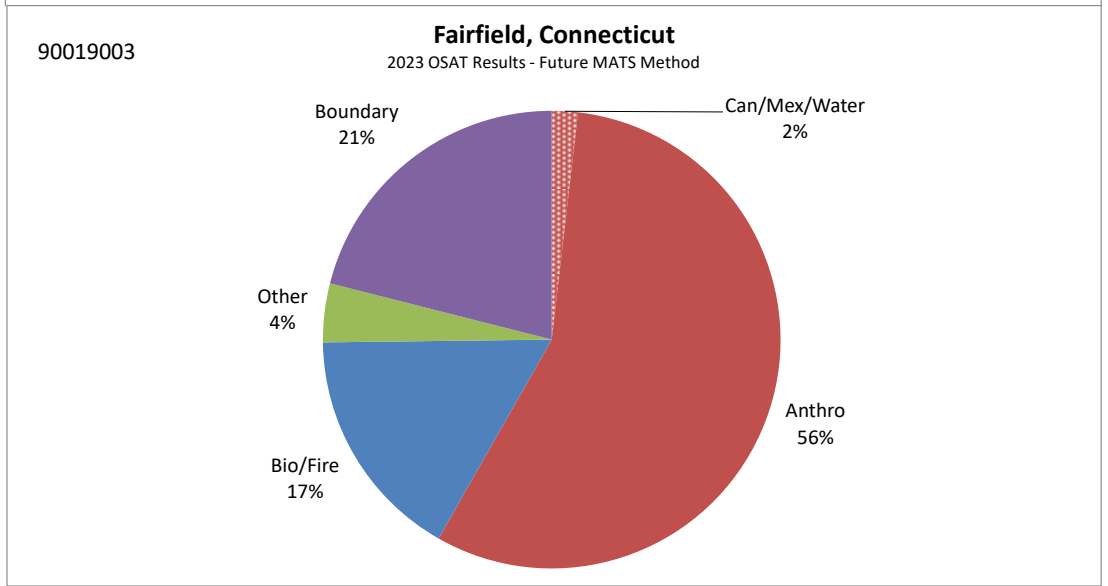
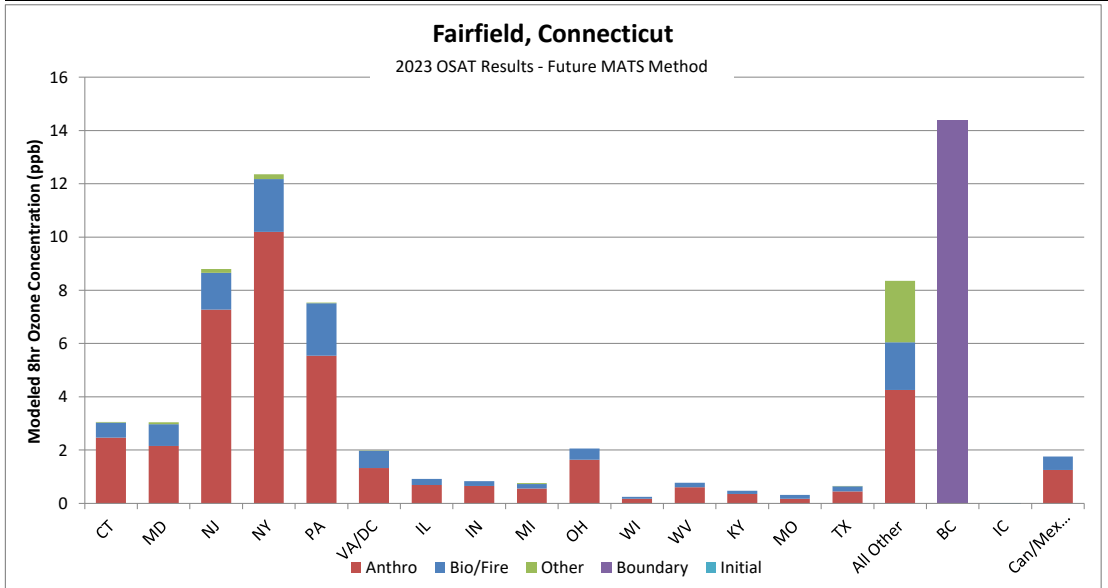
Monitor	90013007	Fairfield, Connecticut	CSAPR DV (Ave)				69.2
2023 OSAT Results (Modeled ppb) -- Future MATS Method							
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total
CT	3.77	1.05	0.11	0.00	0.00	4.92	7%
MD	1.80	0.74	0.06	0.00	0.00	2.60	4%
NJ	5.71	1.16	0.13	0.00	0.00	7.00	10%
NY	9.73	2.16	0.12	0.00	0.00	12.01	17%
PA	5.04	2.18	0.03	0.00	0.00	7.26	10%
VA/DC	0.93	0.45	0.01	0.00	0.00	1.39	2%
IL	0.88	0.30	0.00	0.00	0.00	1.18	2%
IN	0.85	0.24	0.00	0.00	0.00	1.09	2%
MI	0.73	0.21	0.07	0.00	0.00	1.01	1%
OH	1.83	0.48	0.00	0.00	0.00	2.31	3%
WI	0.18	0.08	0.00	0.00	0.00	0.26	0%
WV	0.52	0.15	0.00	0.00	0.00	0.67	1%
KY	0.43	0.14	0.00	0.00	0.00	0.56	1%
MO	0.27	0.23	0.00	0.00	0.00	0.49	1%
TX	0.64	0.27	0.03	0.00	0.00	0.94	1%
All Other	5.31	2.05	1.71	0.00	0.00	9.06	13%
BC	0.00	0.00	0.00	14.64	0.00	14.64	21%
IC	0.00	0.00	0.00	0.00	0.00	0.00	0%
Can/Mex/Water	1.28	0.52	0.00	0.00	0.00	1.81	3%
Monitor Total	39.89	12.40	2.26	14.64	0.00	69.20	100%



Indicates contribution of => 1 ppb
Indicates contribution => 1% of NAAQS
Indicates "but for" Can/Mex contribution enough to attain NAAQS

MOG OSAT 2023en
Monitor Level Design Value Summary and Significant Contribution Calculation
Future MATS OSAT Method

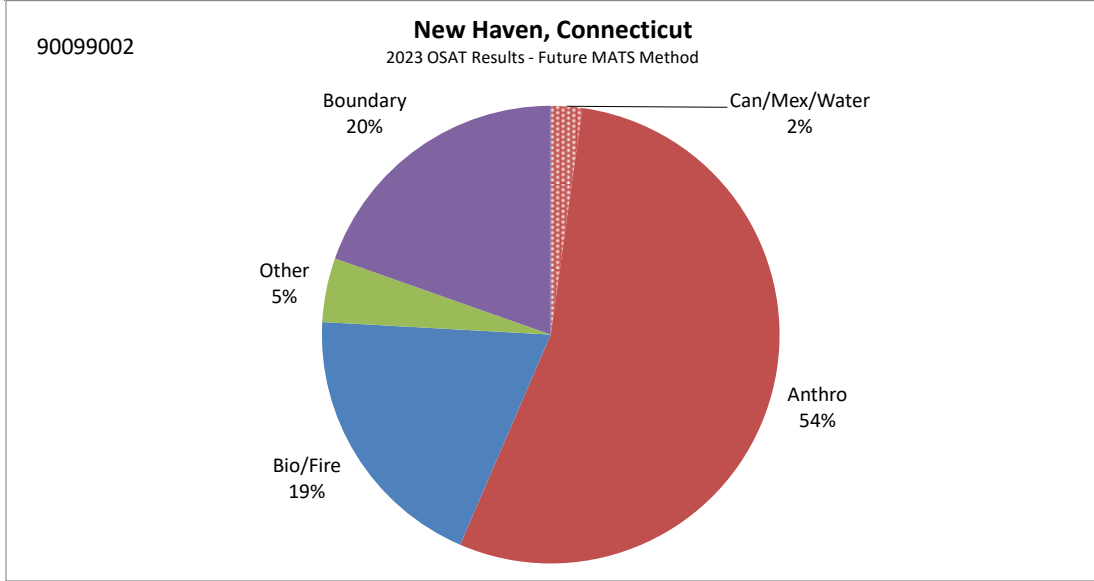
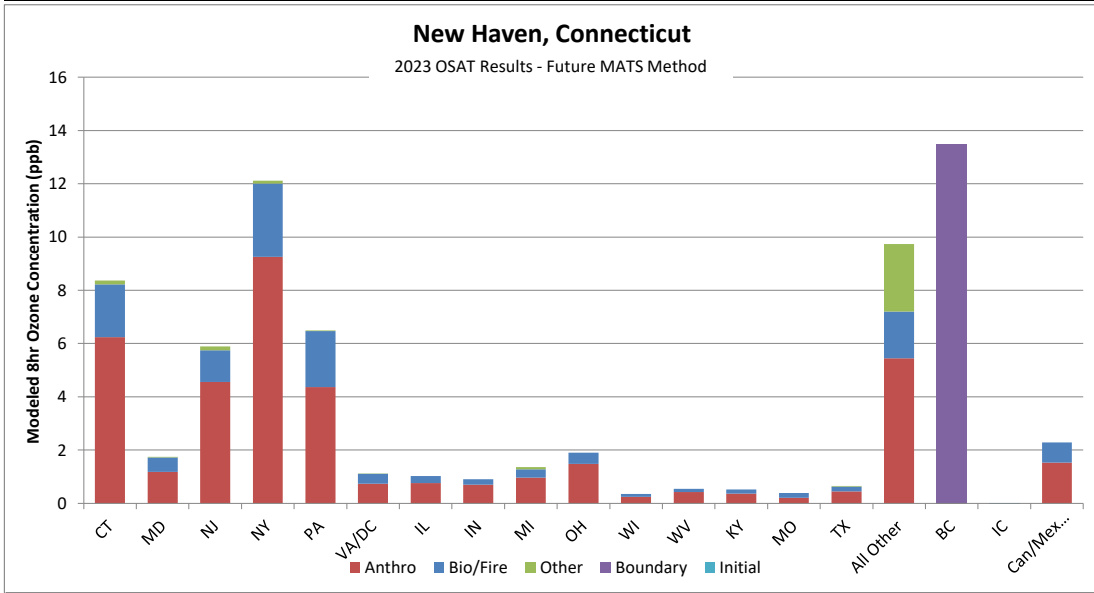
Monitor	90019003	Fairfield, Connecticut	CSAPR DV (Ave)				68.3
2023 OSAT Results (Modeled ppb) -- Future MATS Method							
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total
CT	2.47	0.56	0.03	0.00	0.00	3.06	4%
MD	2.16	0.81	0.07	0.00	0.00	3.04	4%
NJ	7.28	1.37	0.15	0.00	0.00	8.80	13%
NY	10.19	1.98	0.18	0.00	0.00	12.35	18%
PA	5.54	1.97	0.03	0.00	0.00	7.54	11%
VA/DC	1.32	0.65	0.01	0.00	0.00	1.98	3%
IL	0.69	0.23	0.00	0.00	0.00	0.91	1%
IN	0.65	0.19	0.00	0.00	0.00	0.83	1%
MI	0.56	0.17	0.04	0.00	0.00	0.77	1%
OH	1.64	0.42	0.00	0.00	0.00	2.06	3%
WI	0.18	0.07	0.00	0.00	0.00	0.25	0%
WV	0.61	0.17	0.00	0.00	0.00	0.77	1%
KY	0.35	0.12	0.00	0.00	0.00	0.47	1%
MO	0.17	0.15	0.00	0.00	0.00	0.31	0%
TX	0.45	0.19	0.02	0.00	0.00	0.66	1%
All Other	4.26	1.79	2.31	0.00	0.00	8.36	12%
BC	0.00	0.00	0.00	14.37	0.00	14.37	21%
IC	0.00	0.00	0.00	0.00	0.01	0.01	0%
Can/Mex/Water	1.26	0.50	0.00	0.00	0.00	1.76	3%
Monitor Total	39.77	11.32	2.83	14.37	0.01	68.30	100%



Indicates contribution of => 1 ppb
Indicates contribution => 1% of NAAQS
Indicates "but for" Can/Mex contribution enough to attain NAAQS

MOG OSAT 2023en
Monitor Level Design Value Summary and Significant Contribution Calculation
Future MATS OSAT Method

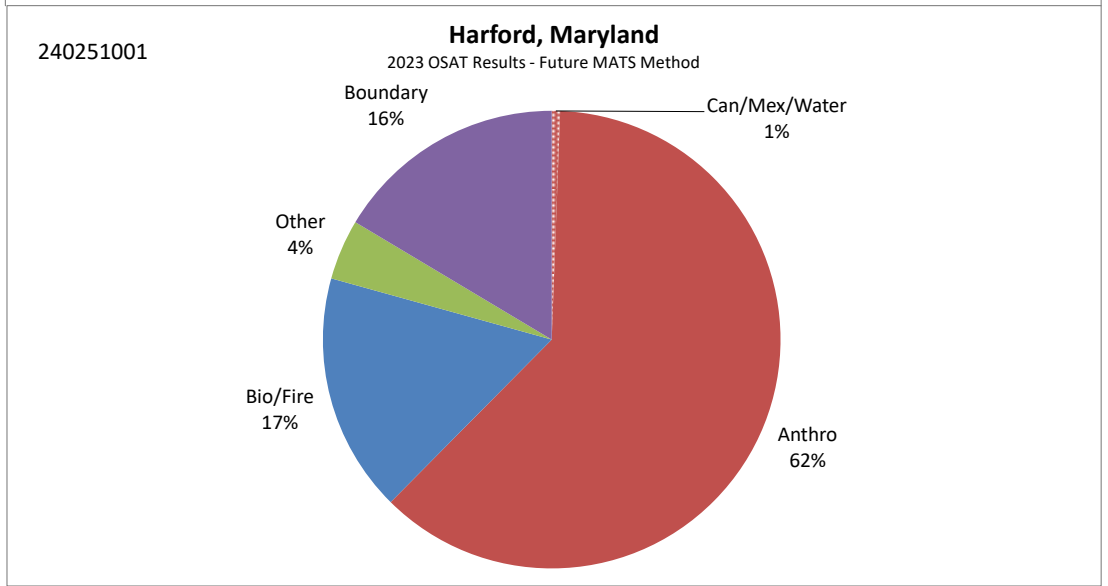
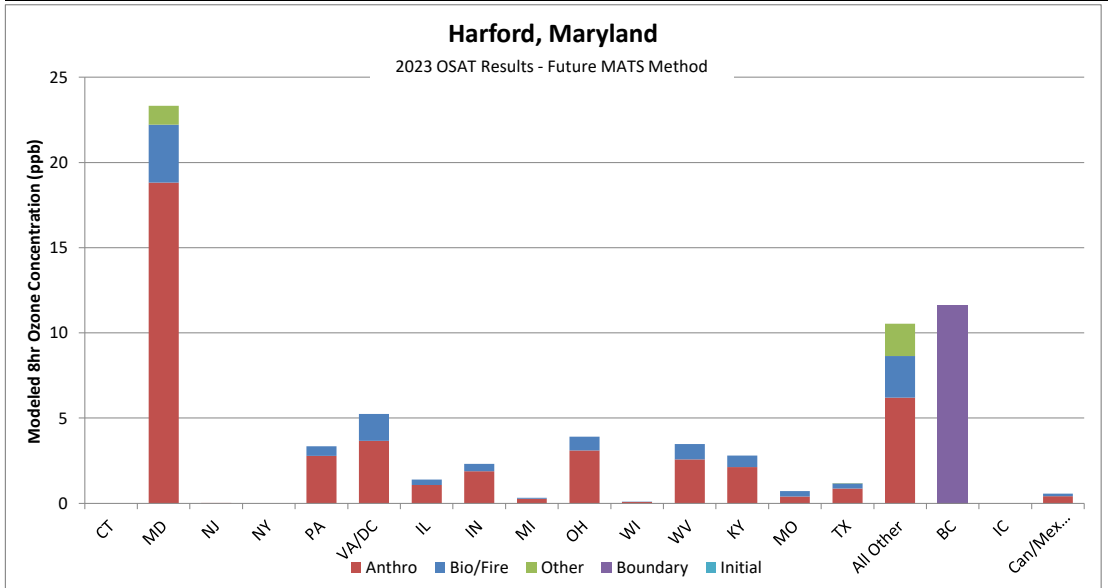
Monitor	90099002	New Haven, Connecticut				CSAPR DV (Ave)		68.9
2023 OSAT Results (Modeled ppb) -- Future MATS Method								
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total	
CT	6.25	1.97	0.16	0.00	0.00	8.37	12%	
MD	1.18	0.54	0.03	0.00	0.00	1.75	3%	
NJ	4.56	1.19	0.15	0.00	0.00	5.90	9%	
NY	9.26	2.75	0.11	0.00	0.00	12.11	18%	
PA	4.36	2.11	0.03	0.00	0.00	6.50	9%	
VA/DC	0.74	0.37	0.01	0.00	0.00	1.12	2%	
IL	0.76	0.26	0.00	0.00	0.00	1.02	1%	
IN	0.70	0.20	0.00	0.00	0.00	0.90	1%	
MI	0.96	0.31	0.09	0.00	0.00	1.36	2%	
OH	1.49	0.42	0.00	0.00	0.00	1.90	3%	
WI	0.24	0.11	0.00	0.00	0.00	0.35	1%	
WV	0.43	0.12	0.00	0.00	0.00	0.54	1%	
KY	0.37	0.15	0.00	0.00	0.00	0.51	1%	
MO	0.21	0.17	0.00	0.00	0.00	0.39	1%	
TX	0.45	0.18	0.02	0.00	0.00	0.65	1%	
All Other	5.45	1.75	2.53	0.00	0.00	9.73	14%	
BC	0.00	0.00	0.00	13.50	0.00	13.50	20%	
IC	0.00	0.00	0.00	0.00	0.01	0.01	0%	
Can/Mex/Water	1.52	0.76	0.00	0.00	0.00	2.28	3%	
Monitor Total	38.91	13.36	3.12	13.50	0.01	68.90	100%	



Indicates contribution of => 1 ppb
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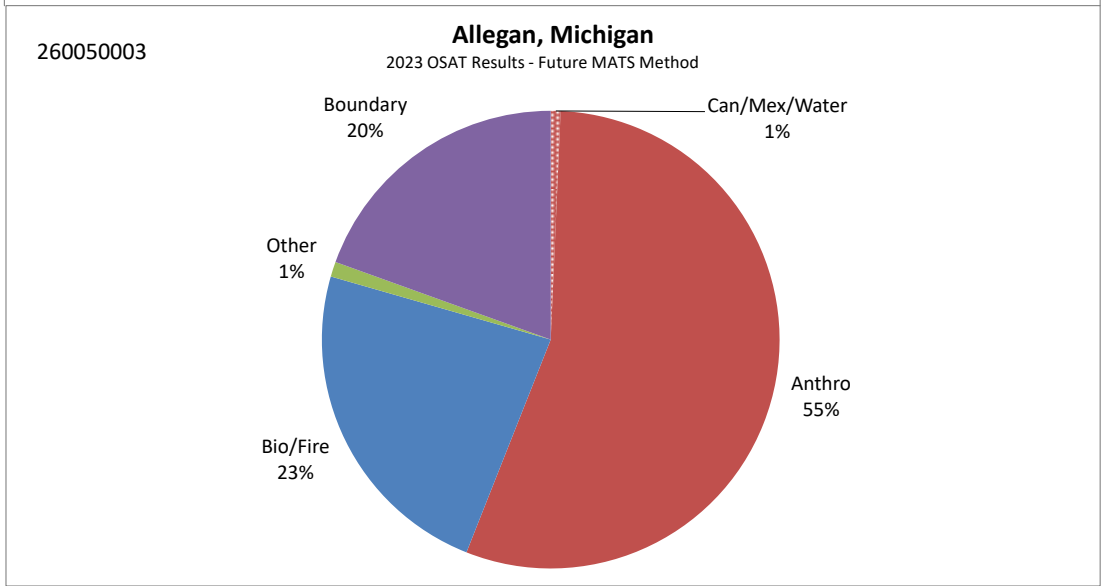
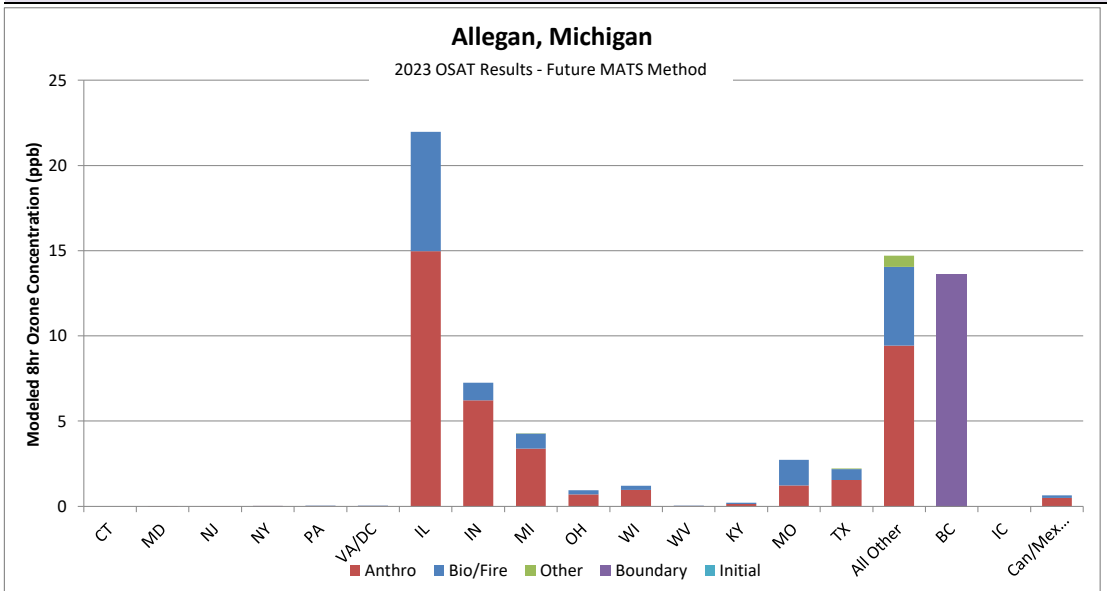
Monitor	240251001	Harford, Maryland	CSAPR DV (Ave)				70.9
2023 OSAT Results (Modeled ppb) -- Future MATS Method							
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total
CT	0.00	0.00	0.00	0.00	0.00	0.00	0%
MD	18.82	3.39	1.11	0.00	0.00	23.33	33%
NJ	0.02	0.00	0.00	0.00	0.00	0.02	0%
NY	0.00	0.00	0.00	0.00	0.00	0.00	0%
PA	2.78	0.58	0.00	0.00	0.00	3.35	5%
VA/DC	3.66	1.59	0.00	0.00	0.00	5.25	7%
IL	1.07	0.32	0.00	0.00	0.00	1.39	2%
IN	1.88	0.43	0.00	0.00	0.00	2.31	3%
MI	0.27	0.06	0.00	0.00	0.00	0.33	0%
OH	3.09	0.82	0.00	0.00	0.00	3.92	6%
WI	0.08	0.02	0.00	0.00	0.00	0.10	0%
WV	2.57	0.90	0.00	0.00	0.00	3.47	5%
KY	2.13	0.66	0.00	0.00	0.00	2.80	4%
MO	0.41	0.31	0.00	0.00	0.00	0.71	1%
TX	0.86	0.31	0.02	0.00	0.00	1.19	2%
All Other	6.20	2.44	1.89	0.00	0.00	10.53	15%
BC	0.00	0.00	0.00	11.64	0.00	11.64	16%
IC	0.00	0.00	0.00	0.00	0.00	0.00	0%
Can/Mex/Water	0.42	0.15	0.00	0.00	0.00	0.57	1%
Monitor Total	44.26	11.97	3.02	11.64	0.00	70.90	100%



Indicates contribution of => 1 ppb
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MOG OSAT 2023en
Monitor Level Design Value Summary and Significant Contribution Calculation
Future MATS OSAT Method

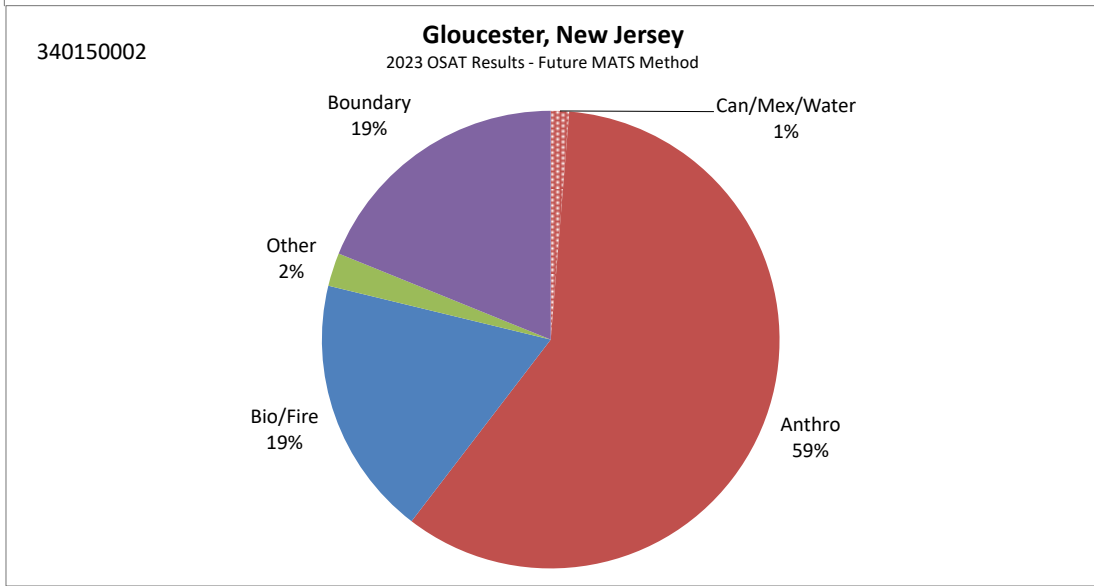
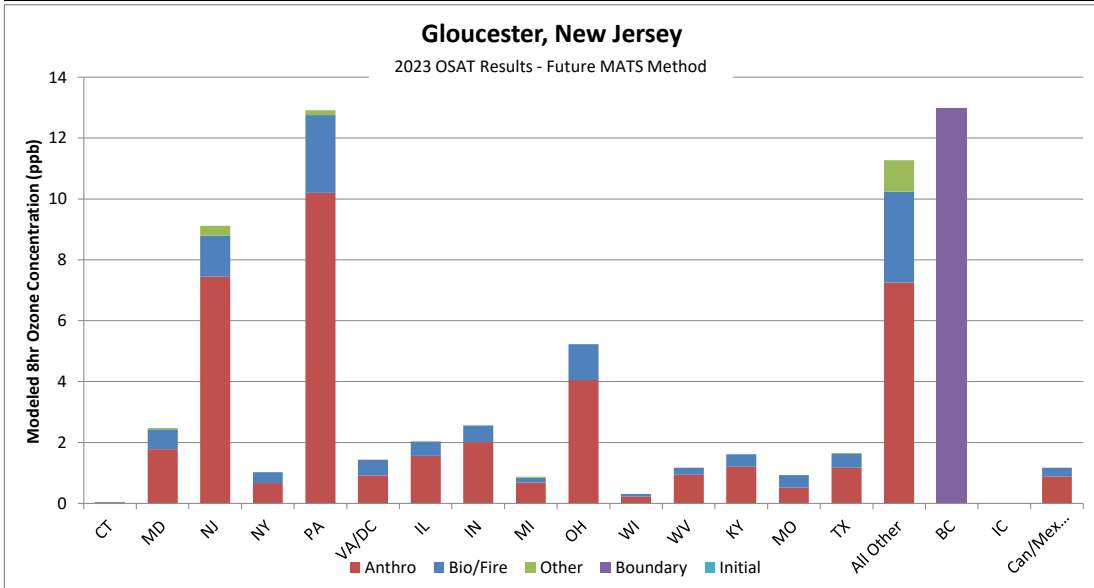
Monitor	260050003	Allegan, Michigan				CSAPR DV (Ave)		70
2023 OSAT Results (Modeled ppb) -- Future MATS Method								
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total	
CT	0.00	0.00	0.00	0.00	0.00	0.00	0%	
MD	0.01	0.00	0.00	0.00	0.00	0.01	0%	
NJ	0.01	0.00	0.00	0.00	0.00	0.01	0%	
NY	0.02	0.01	0.00	0.00	0.00	0.03	0%	
PA	0.03	0.01	0.00	0.00	0.00	0.04	0%	
VA/DC	0.03	0.01	0.00	0.00	0.00	0.04	0%	
IL	14.97	7.01	0.00	0.00	0.00	21.98	31%	
IN	6.23	1.02	0.00	0.00	0.00	7.25	10%	
MI	3.38	0.88	0.03	0.00	0.00	4.29	6%	
OH	0.70	0.24	0.00	0.00	0.00	0.94	1%	
WI	0.97	0.25	0.00	0.00	0.00	1.22	2%	
WV	0.03	0.01	0.00	0.00	0.00	0.04	0%	
KY	0.13	0.08	0.00	0.00	0.00	0.21	0%	
MO	1.23	1.50	0.00	0.00	0.00	2.73	4%	
TX	1.55	0.62	0.05	0.00	0.00	2.22	3%	
All Other	9.43	4.62	0.66	0.00	0.00	14.71	21%	
BC	0.00	0.00	0.00	13.64	0.00	13.64	19%	
IC	0.00	0.00	0.00	0.00	0.00	0.00	0%	
Can/Mex/Water	0.48	0.16	0.00	0.00	0.00	0.64	1%	
Monitor Total	39.20	16.41	0.74	13.64	0.00	70.00	100%	



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MOG OSAT 2023en
Monitor Level Design Value Summary and Significant Contribution Calculation
Future MATS OSAT Method

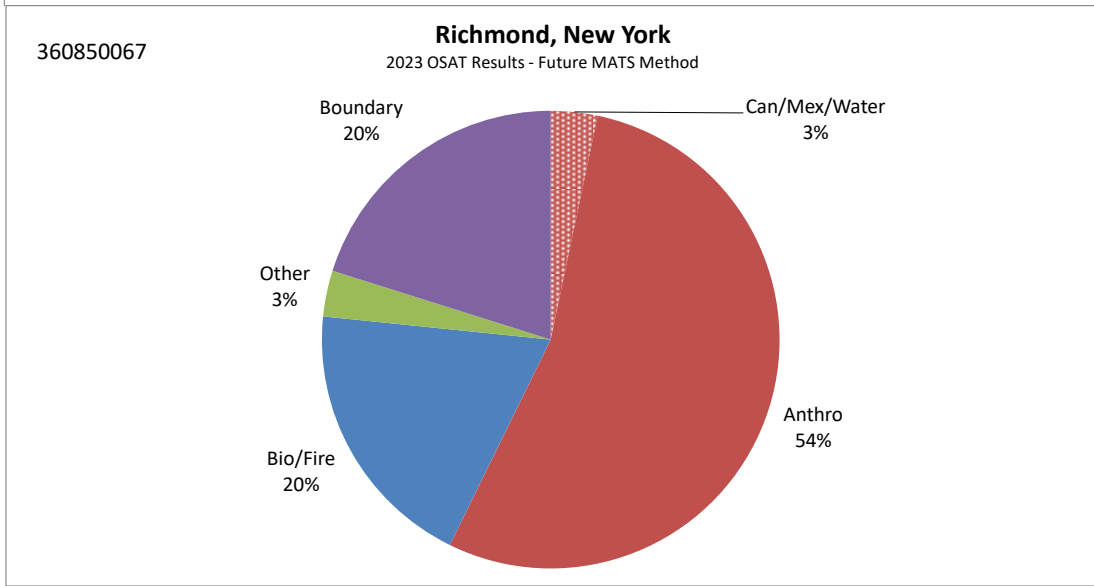
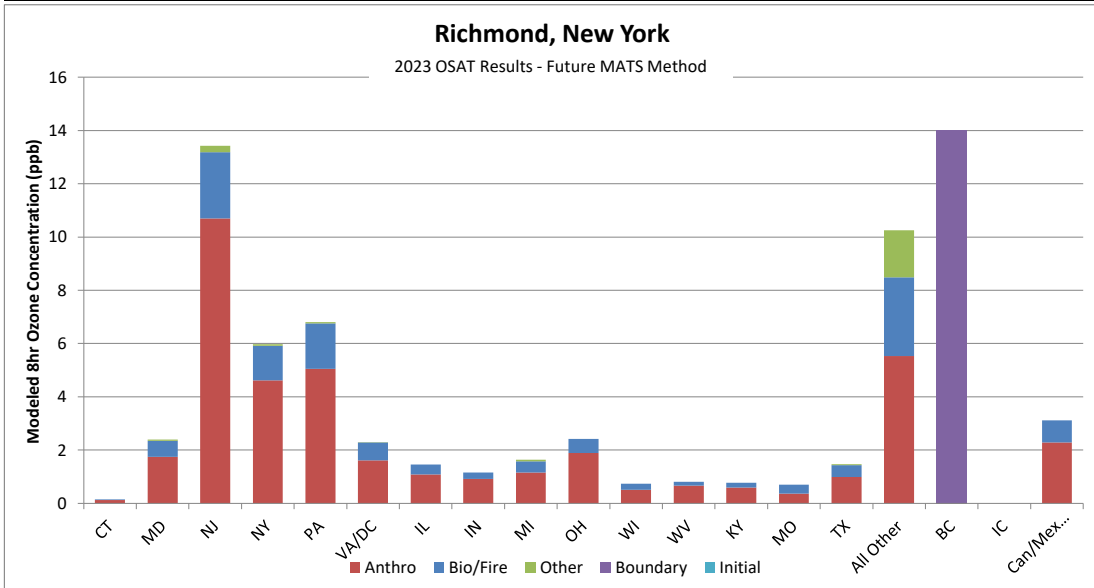
Monitor	340150002	Gloucester, New Jersey				CSAPR DV (Ave)		68.8
2023 OSAT Results (Modeled ppb) -- Future MATS Method								
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total	
CT	0.04	0.01	0.00	0.00	0.00	0.05	0%	
MD	1.78	0.66	0.04	0.00	0.00	2.48	4%	
NJ	7.45	1.35	0.33	0.00	0.00	9.12	13%	
NY	0.66	0.36	0.00	0.00	0.00	1.03	1%	
PA	10.20	2.55	0.16	0.00	0.00	12.91	19%	
VA/DC	0.92	0.51	0.00	0.00	0.00	1.43	2%	
IL	1.56	0.47	0.00	0.00	0.00	2.03	3%	
IN	2.01	0.54	0.00	0.00	0.00	2.55	4%	
MI	0.69	0.16	0.03	0.00	0.00	0.88	1%	
OH	4.05	1.17	0.00	0.00	0.00	5.23	8%	
WI	0.23	0.08	0.00	0.00	0.00	0.31	0%	
WV	0.94	0.24	0.00	0.00	0.00	1.17	2%	
KY	1.20	0.40	0.00	0.00	0.00	1.61	2%	
MO	0.52	0.40	0.00	0.00	0.00	0.93	1%	
TX	1.17	0.44	0.04	0.00	0.00	1.66	2%	
All Other	7.26	2.99	1.03	0.00	0.00	11.27	16%	
BC	0.00	0.00	0.00	12.98	0.00	12.98	19%	
IC	0.00	0.00	0.00	0.00	0.00	0.00	0%	
Can/Mex/Water	0.89	0.29	0.00	0.00	0.00	1.17	2%	
Monitor Total	41.56	12.64	1.62	12.98	0.00	68.80	100%	



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MOG OSAT 2023en
Monitor Level Design Value Summary and Significant Contribution Calculation
Future MATS OSAT Method

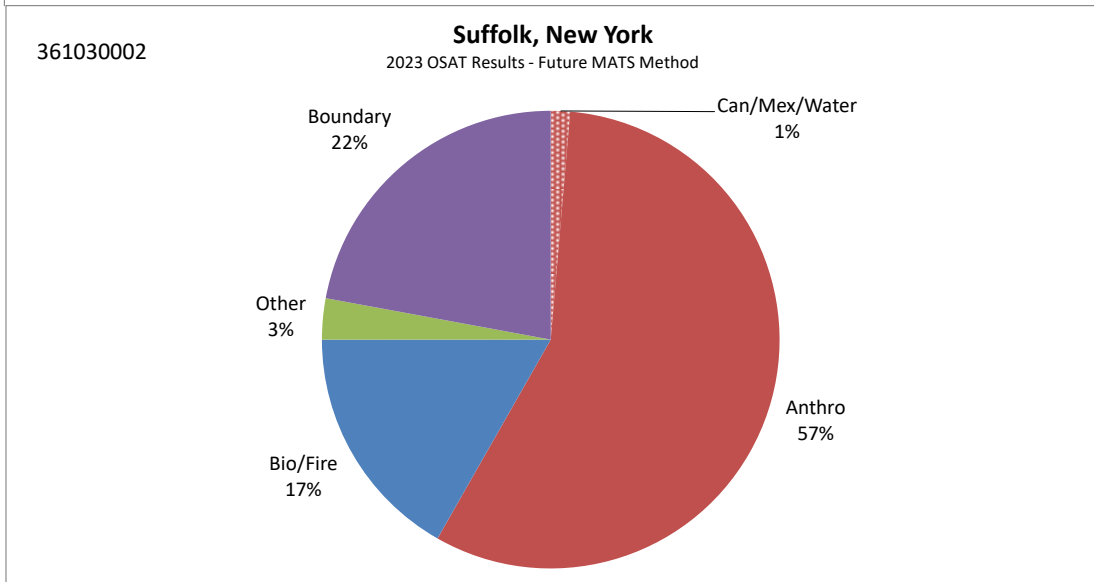
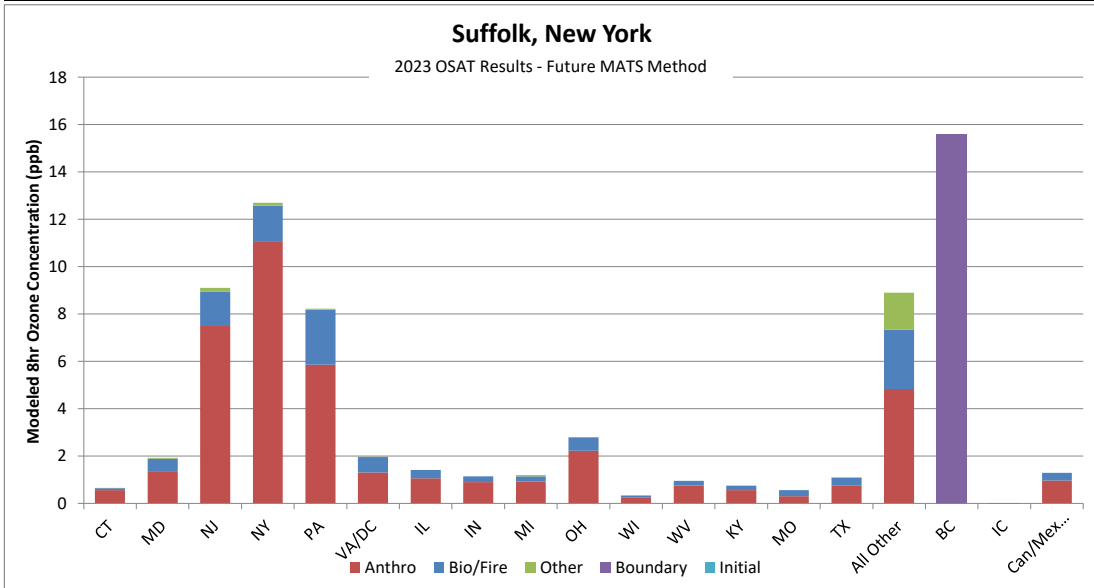
Monitor	360850067	Richmond, New York	CSAPR DV (Ave)				69.6
2023 OSAT Results (Modeled ppb) -- Future MATS Method							
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total
CT	0.13	0.02	0.00	0.00	0.00	0.15	0%
MD	1.75	0.60	0.05	0.00	0.00	2.40	3%
NJ	10.70	2.49	0.24	0.00	0.00	13.43	19%
NY	4.61	1.30	0.06	0.00	0.00	5.97	9%
PA	5.05	1.71	0.05	0.00	0.00	6.80	10%
VA/DC	1.62	0.67	0.01	0.00	0.00	2.30	3%
IL	1.09	0.37	0.00	0.00	0.00	1.46	2%
IN	0.92	0.24	0.00	0.00	0.00	1.16	2%
MI	1.16	0.42	0.06	0.00	0.00	1.64	2%
OH	1.88	0.54	0.00	0.00	0.00	2.42	3%
WI	0.51	0.23	0.00	0.00	0.00	0.73	1%
WV	0.66	0.15	0.00	0.00	0.00	0.81	1%
KY	0.60	0.18	0.00	0.00	0.00	0.77	1%
MO	0.37	0.34	0.00	0.00	0.00	0.70	1%
TX	0.99	0.45	0.03	0.00	0.00	1.47	2%
All Other	5.53	2.96	1.77	0.00	0.00	10.25	15%
BC	0.00	0.00	0.00	14.01	0.00	14.01	20%
IC	0.00	0.00	0.00	0.00	0.00	0.00	0%
Can/Mex/Water	2.29	0.82	0.00	0.00	0.00	3.11	4%
Monitor Total	39.86	13.47	2.26	14.01	0.00	69.60	100%



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MOG OSAT 2023en
Monitor Level Design Value Summary and Significant Contribution Calculation
Future MATS OSAT Method

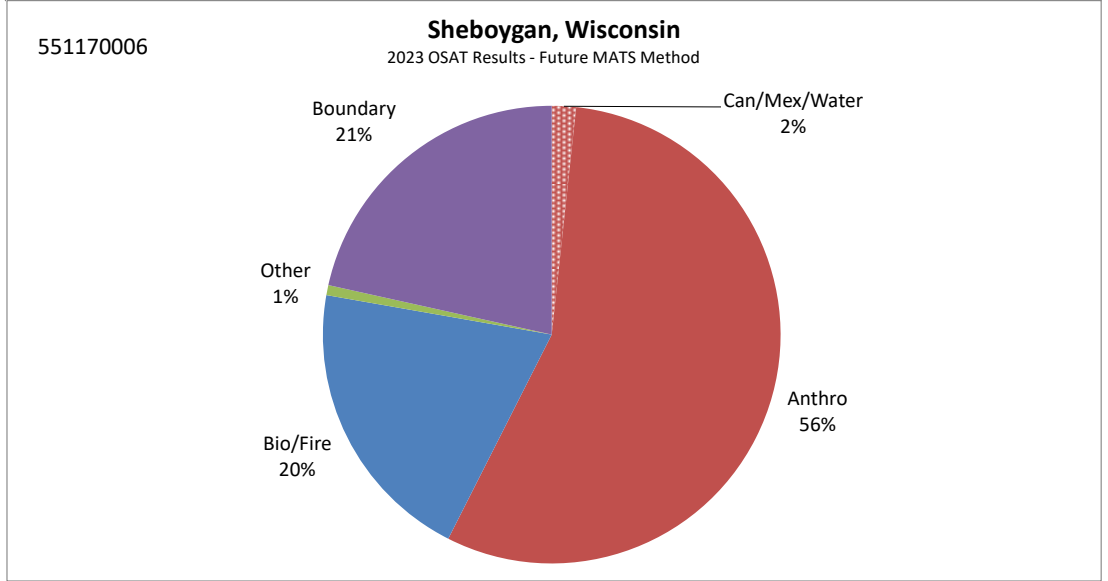
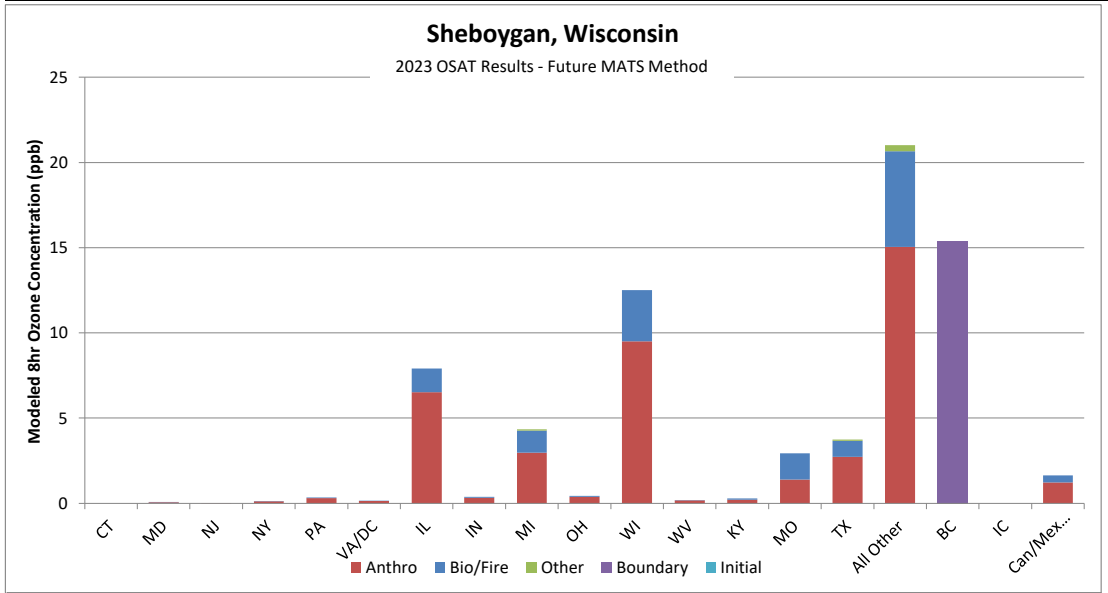
Monitor	361030002	Suffolk, New York	CSAPR DV (Ave)				70.6
2023 OSAT Results (Modeled ppb) -- Future MATS Method							
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total
CT	0.55	0.08	0.02	0.00	0.00	0.65	1%
MD	1.33	0.55	0.04	0.00	0.00	1.92	3%
NJ	7.49	1.45	0.17	0.00	0.00	9.11	13%
NY	11.08	1.49	0.12	0.00	0.00	12.69	18%
PA	5.85	2.34	0.03	0.00	0.00	8.22	12%
VA/DC	1.31	0.65	0.01	0.00	0.00	1.97	3%
IL	1.06	0.36	0.00	0.00	0.00	1.42	2%
IN	0.90	0.24	0.00	0.00	0.00	1.14	2%
MI	0.92	0.22	0.06	0.00	0.00	1.20	2%
OH	2.23	0.56	0.01	0.00	0.00	2.80	4%
WI	0.24	0.09	0.01	0.00	0.00	0.34	0%
WV	0.74	0.21	0.00	0.00	0.00	0.95	1%
KY	0.55	0.19	0.00	0.00	0.00	0.74	1%
MO	0.31	0.26	0.00	0.00	0.00	0.56	1%
TX	0.76	0.32	0.02	0.00	0.00	1.10	2%
All Other	4.83	2.50	1.56	0.00	0.00	8.90	13%
BC	0.00	0.00	0.00	15.60	0.00	15.60	22%
IC	0.00	0.00	0.00	0.00	0.01	0.01	0%
Can/Mex/Water	0.96	0.33	0.00	0.00	0.00	1.29	2%
Monitor Total	41.11	11.83	2.05	15.60	0.01	70.60	100%



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MOG OSAT 2023en
Monitor Level Design Value Summary and Significant Contribution Calculation
Future MATS OSAT Method

Monitor	551170006	Sheboygan, Wisconsin	CSAPR DV (Ave)				71.5
2023 OSAT Results (Modeled ppb) -- Future MATS Method							
Region	Anthro	Bio/Fire	Other	Boundary	Initial	Total	% of Total
CT	0.00	0.00	0.00	0.00	0.00	0.00	0%
MD	0.06	0.01	0.00	0.00	0.00	0.07	0%
NJ	0.01	0.00	0.00	0.00	0.00	0.01	0%
NY	0.11	0.02	0.00	0.00	0.00	0.13	0%
PA	0.31	0.04	0.00	0.00	0.00	0.35	0%
VA/DC	0.13	0.02	0.00	0.00	0.00	0.16	0%
IL	6.53	1.38	0.00	0.00	0.00	7.90	11%
IN	0.32	0.06	0.00	0.00	0.00	0.38	1%
MI	2.97	1.29	0.08	0.00	0.00	4.34	6%
OH	0.37	0.07	0.00	0.00	0.00	0.44	1%
WI	9.50	3.02	0.00	0.00	0.00	12.52	18%
WV	0.17	0.02	0.00	0.00	0.00	0.19	0%
KY	0.22	0.06	0.00	0.00	0.00	0.28	0%
MO	1.39	1.55	0.00	0.00	0.00	2.94	4%
TX	2.73	0.94	0.07	0.00	0.00	3.74	5%
All Other	15.05	5.61	0.35	0.00	0.00	21.01	29%
BC	0.00	0.00	0.00	15.39	0.00	15.39	22%
IC	0.00	0.00	0.00	0.00	0.00	0.00	0%
Can/Mex/Water	1.22	0.41	0.00	0.00	0.00	1.63	2%
Monitor Total	41.09	14.51	0.51	15.39	0.00	71.50	100%



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