

DATE: March 24, 2022 FILE REF: 4862

TO: File

FROM: David Bizot, Olivia Salmon

SUBJECT: Implementation of the contingent response plan for the Door County, Wisconsin 2015 ozone NAAQS maintenance area

This memo describes the actions taken by the DNR Air Management Program in response to the reviolation of the 2015 ozone National Ambient Air Quality Standard (NAAQS) in the Door County, Wisconsin maintenance area for that NAAQS.

Background.

In April 2018, EPA designated a portion of Door County as a marginal nonattainment, rural transport area (RTA) for the 2015 ozone NAAQS (83 FR 25776). This rulemaking was based on EPA's review of ozone monitoring data collected during the years 2014 to 2016. The nonattainment area consisted of the boundary of Newport State Park, and was effective August 3, 2018.¹

In January 2020, DNR submitted a SIP revision to EPA that requested that the Door County 2015 ozone NAAQS nonattainment area be redesignated to attainment. This request was based on certified monitoring data from 2017-2019 that demonstrated the area had attained the 2015 ozone NAAQS. EPA finalized its approval of this request on June 10, 2020 (85 FR 35377).

As part of its redesignation request, DNR included the elements and commitments required by Clean Air Act Section 175A to demonstrate continued attainment of the NAAQS for at least ten years after redesignation. This "maintenance plan" included projected future emissions inventories as well as contingency measures designed to ensure prompt correction of any future violation of the NAAQS. EPA approved this maintenance plan as part of its redesignation of the area to attainment in June 2020.²

Door County 2015 ozone NAAQS maintenance plan contingency response requirements.

DNR's maintenance plan for Door County committed the state to two levels of contingency response if monitoring data in the area showed a renewed exceedance and/or violation of the 2015 ozone NAAQS (see Section 7.3). The plan contained specific measures that would be implemented if one or both of those events occurred, described in more detail below:

¹ EPA revised the Door County 2015 ozone NAAQS nonattainment area on June 14, 2021. The resulting "Door County-Revised, WI" nonattainment area includes the portion of Door County north of the Sturgeon Bay canal excluding Newport State Park. The revised area does not include the Door County maintenance area being addressed in this memo; likewise, the actions described in this memo do not affect the Door County-Revised 2015 ozone NAAQS nonattainment area.

² The complete Door County 2015 ozone NAAQS redesignation request and maintenance plan is available at: <https://dnr.wisconsin.gov/sites/default/files/topic/AirQuality/DoorCountyRedesignation2020.pdf>.

Warning level response

The “warning level” response would be initiated if the annual (one year) fourth highest monitored value is above the level of the 2015 ozone NAAQS.

A warning level response would initiate a study to determine whether the high ozone concentrations indicate a trend towards higher ozone levels and whether emissions are significantly higher than projected in the maintenance plan. The study is to include the following elements:

- An assessment of whether actual emissions have deviated significantly from the emissions projections contained in the maintenance plan for the area, along with an evaluation of which sectors and states are responsible for any emissions increases; and
- A study of whether unusual meteorological conditions during the high-ozone year led to the high monitored ozone concentrations.

Should it be determined through the warning level study that action is necessary to ensure maintenance, Wisconsin committed to follow the procedures for control selection and implementation outlined under the action level response (see below). The warning level study would be completed no later than the beginning of the following summer ozone control period (May 1).

Action level response

The “action level” response would be initiated in the three-year design value exceeded the level of the 2015 ozone NAAQS.

This response would follow a study to determine whether additional control measures are needed to assure attainment and maintenance of the 2015 ozone NAAQS. This analysis would examine the following factors for the contributing area:

- The level, distribution, and severity of ambient ozone concentrations;
- The weather patterns contributing to ozone levels;
- Potential contributing emission sources;
- The geographic applicability of possible contingency measures;
- Upwind emission trends, including the impact of existing or forthcoming control measures that have not yet been implemented; and
- Air quality contributions from outside the maintenance area.

Should it be determined through the action level study that existing and on-the-way measures are inadequate to return the area to attainment, DNR committed to identify and implement candidate control measures as necessary to assure attainment and maintenance of the area within 18 months of certification of the monitoring data that triggered the action level response. A list of potential state measures that could be considered is included in the plan.

The plan notes that Wisconsin has an extremely limited ability to affect ozone concentrations in the Door County 2015 ozone NAAQS area due to the influence of emissions originating in upwind states. For that reason, additional controls on NO_x and VOC emissions from Wisconsin are likely to have very little, if any, impact on ozone concentrations in this area.

Reviolation of the 2015 ozone NAAQS during the 2020 ozone season.

Based on air quality data collected during 2020 at the ozone monitor located at Newport State Park, both the 2020 fourth highest value and the resulting 2018-2020 design value exceeded the 2015 ozone NAAQS (see table). This data was certified by DNR on April 20, 2021. Based on this data, both the warning and action level contingent response criteria were met during the 2020 ozone season.

Site (Site ID)	4th high 8-hr ozone (ppm)			Design value (ppm)
	2018	2019	2020	2018-20
Newport (55-029-0004)	0.075	0.066	0.075	0.072

Actions taken to satisfy contingency response requirements.

The action-level contingency response included in the Door County 2015 ozone NAAQS maintenance plan requires DNR to complete a study that assesses emissions trends (and the efficacy of existing control measures) as well as the impact of meteorology on monitored ozone concentrations. DNR completed this study in the fall of 2021, and has attached the results to this memo.

This study shows ozone concentrations measured in the Door County 2015 ozone NAAQS maintenance area continue to be dominated by out-of-state emissions transported to the area via prevailing meteorological conditions. It is likely that the elevated ozone concentrations observed in 2020 were the result of slightly higher-than-average regional temperatures, which caused increased ozone formation in areas upwind of Door County. That ozone was then transported to the Door County peninsula via well-documented lake breeze and mesoscale scale metrological processes, thereby resulting in higher ozone values at the Newport monitor. Despite this annual result, this study also shows that ozone values both in Door County and regionally continue to decrease independent of annual temperature variations. This indicates that regional reductions of ozone precursor emissions are decreasing ozone values throughout the region, including those measured at the Newport monitor.

Despite above-average regional temperatures during the 2021 ozone season, the latest monitoring data shows the Door County 2015 ozone NAAQS area is again showing attainment, with a certified 2019-2021 design value at the Newport monitor of 70 ppb. This indicates that current control measures throughout the region are satisfactory to ensure continued maintenance of the standard in this area. Emissions of ozone precursors from upwind areas, especially the Chicago area, are anticipated to continue to decrease in future years. This will help ensure continued reduction in ozone levels throughout the region, including in the Door County 2015 ozone NAAQS area.

Conclusion

The DNR's approved Door County 2015 ozone NAAQS maintenance plan only requires additional actions to be taken by the state if the results of the action-level study indicate additional control measures were necessary to return the area to attainment. Given the results of the study, and recognizing that the area is again measuring ozone levels that attain the standard, DNR concludes that it is unnecessary for Wisconsin to implement additional emission reduction measures to return the area to attainment of the 2015 ozone standard. The contingency response requirements of the Door County 2015 ozone NAAQS maintenance plan are therefore satisfied.

Door County 2015 Ozone National Ambient Air Quality Standard (NAAQS) Maintenance Plan Contingency Response Study

March 2022

This analysis was conducted to satisfy “action level” maintenance plan contingency response requirements for the Door County 2015 Ozone NAAQS Maintenance Area. As described in the maintenance plan for that area, DNR committed to conducting a study to determine if existing and on-the-way measures are inadequate to return the area to attainment. This study would include an assessment of the following factors:

- The level, distribution, and severity of ambient ozone concentrations
- The weather patterns contributing to ozone levels
- Potential contributing emission sources
- The geographic applicability of possible contingency measures
- Upwind emission trends, including the impact of existing or forthcoming control measures that have not yet been implemented
- Air quality contributions from outside the maintenance area

The origins of Door County ozone, including the complex meteorological processes that drive ozone formation, transport, and fate in this area, have been extensively documented in recent years, including in the following regulatory documents:

- Redesignation request and maintenance plan for the Door County 2015 ozone NAAQS area (Jan. 27, 2020)¹
- Redesignation request and maintenance plan for the Door County-Revised 2015 ozone NAAQS area (Jan. 5, 2022)²
- DNR’s supplemental information for the 2015 ozone NAAQS area designations (Apr. 20, 2017)³
- DNR’s response to EPA’s intended area designations for the 2015 ozone NAAQS (Feb. 28, 2018)⁴
- EPA’s 2015 ozone NAAQS final designations technical support document for the Door County area (April 2018)⁵
- EPA’s 2015 ozone NAAQS designations technical support document for Wisconsin counties remanded to EPA, including the Door County area (May 2021)⁶

Because these previous documents contain useful information applicable to many of the above-mentioned factors, they are referenced as appropriate throughout this analysis. They can also be referenced for more information on the topic.

¹ Available at: <https://dnr.wisconsin.gov/sites/default/files/topic/AirQuality/DoorCountyRedesignation2020.pdf>.

² Available at: <https://dnr.wisconsin.gov/sites/default/files/topic/AirQuality/Door2022RedesigRequestLetter.pdf>.

³ Available at: <https://dnr.wisconsin.gov/sites/default/files/topic/AirQuality/OzoneTSD20170420.pdf>.

⁴ Available at: <https://dnr.wisconsin.gov/sites/default/files/topic/AirQuality/DNRResponse120DayLetter20180228.pdf>.

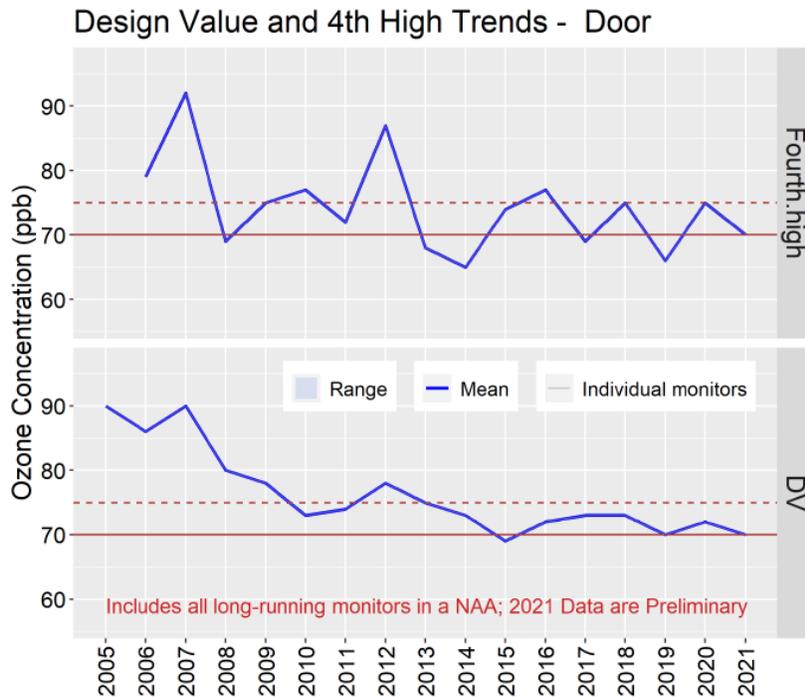
⁵ Available at: https://www.epa.gov/sites/default/files/2018-05/documents/wi_tsd_final.pdf.

⁶ Available at: https://www.epa.gov/sites/default/files/2021-05/documents/wi_tsd_remand_final.pdf.

1. The level, distribution, and severity of ambient ozone concentrations

There is one ambient ozone air quality monitor located in Door County. It is located within the Door County 2015 ozone NAAQS maintenance area at Newport State Park. Ozone concentrations at the Newport monitor have been decreasing since 2006, with the rate of decrease slowing starting in the 2013-2014 timeframe. Figure 1 shows both the fourth highest ozone values and design values from 2005 through 2021.

Figure 1. Ozone concentrations measured at the Door County Newport monitor, 2005-2021. Courtesy of LADCO.

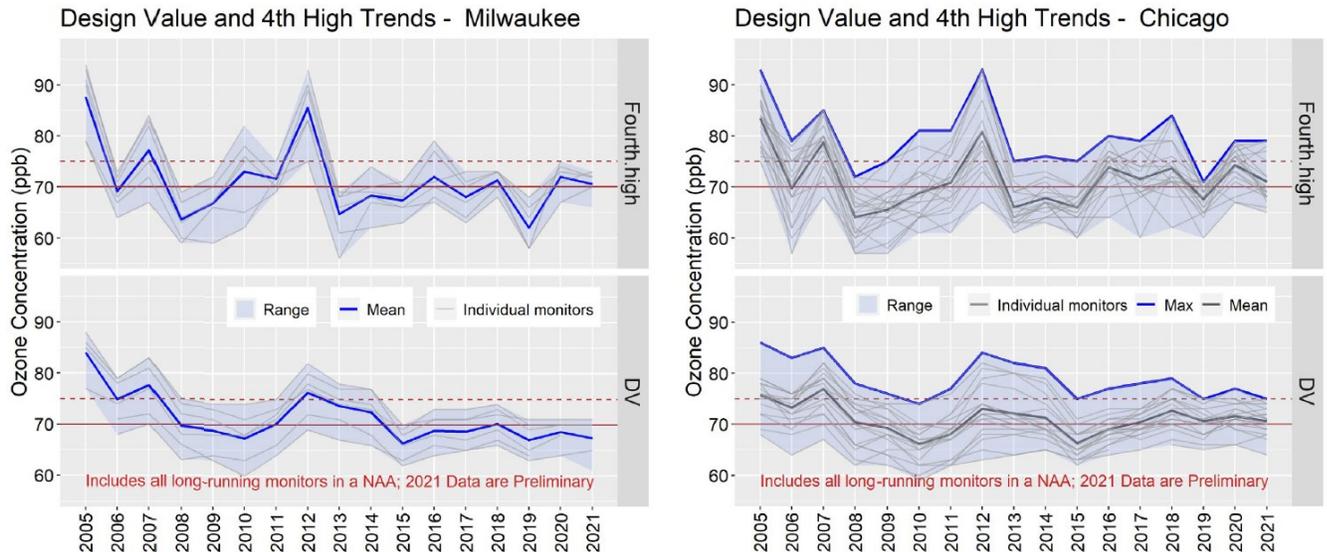


The level of the 2015 ozone NAAQS is 70 ppb. The Door County 2005 ozone NAAQS area was designated nonattainment in April 2018 based on a 2014-2016 design value at the Newport monitor of 72 ppb. The 2017-2019 design value decreased to 70 ppb, which allowed the area to be redesignated to attainment in 2020. The 2018-2020 value was 72 ppb, which is above the standard and which prompted this maintenance plan study. The Newport monitor is currently attaining the 2015 ozone NAAQS, with a 2019-2021 design value of 70 ppb.

Door County is heavily impacted by upwind ozone formation and transport to the Door County peninsula via lake breeze circulations and southerly winds over Lake Michigan. This study assesses ozone concentration trends in these upwind areas. Figure 2 shows the long-term ozone values in both the Milwaukee and the three-state Chicago areas. Like the Newport monitor, monitors in these areas also have measured long-term reductions in ambient ozone concentrations, with 2020 ozone levels slightly above 2021 levels. Based on 2021 ozone values, several upwind ozone nonattainment areas, including the three-state 2008 ozone NAAQS Chicago nonattainment area, are eligible for redesignation to attainment.

Figure 2. Ozone concentrations measured at Milwaukee and Chicago area monitors, 2005-2021.

Courtesy of LADCO. Some monitor data preliminary.



The higher ozone values measured at both the Newport monitor and at upwind monitors in 2020 were likely influenced by slightly above average regional temperatures that year (see #2). However, as is also described in that section, long-term ozone values at Door County continue to decline even when year-over-year temperature variations are accounted for.

2. Weather patterns contributing to ozone levels

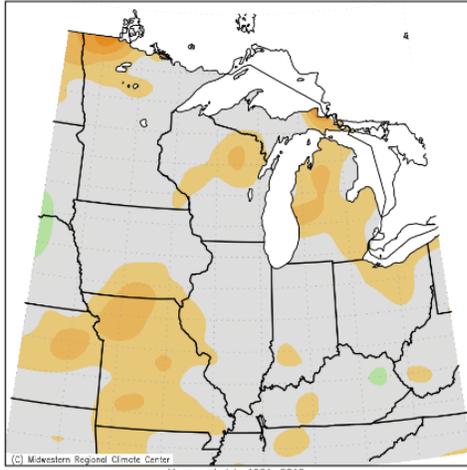
Regional annual temperature trends

Ozone formation in the Lake Michigan area is heavily influenced by meteorological conditions, especially temperature. Figure 3 shows regional temperature variability relative to the climatological average during the June-August peak ozone season for the years 2018 through 2021. This figure demonstrates that the upper Midwest experienced temperatures slightly above average in 2020, particularly as compared to the more average temperatures observed in 2019. These figures also show that above-average temperatures persisted across much of the region in 2021.

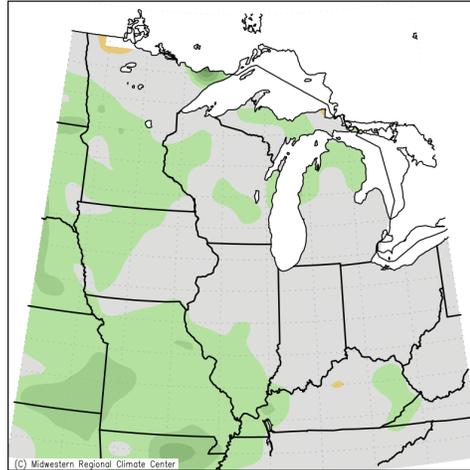
Above-average temperatures in 2020 helped contribute to additional ozone formation in areas located upwind of Door County. These elevated ozone concentrations, when transported to the Newport monitor, would have contributed to the higher ozone values measured at the monitor in 2020. However, despite continued above-average seasonal temperatures in 2021 (Figure 3), ozone values at the Newport monitor and elsewhere in the region decreased in 2021. This could suggest that ozone concentrations in 2020 were anomalously high or that continued reductions in anthropogenic ozone precursor emissions and/or changes in ozone chemistry led to attainment level ozone concentrations in 2021, despite the above-average temperatures.

Figure 3. Regional average maximum temperature departure from mean (June-August), 2018-2021.
Data from Midwest Regional Climate Center. Provided courtesy of LADCO.

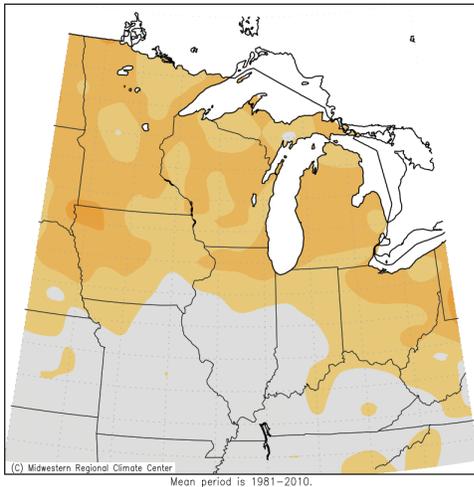
Average Maximum Temp. (°F): Departure from Mean
June 1, 2018 to August 31, 2018



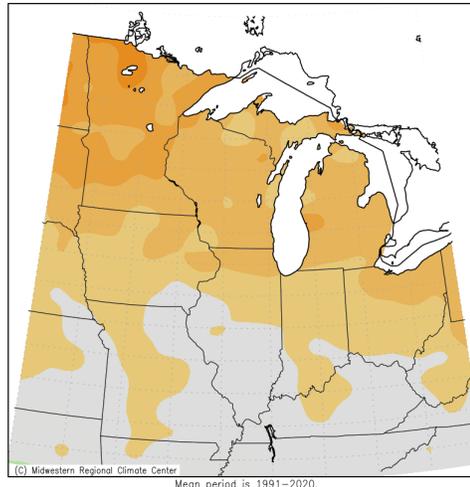
Average Maximum Temp. (°F): Departure from Mean
June 1, 2019 to August 31, 2019



Average Temperature (°F): Departure from Mean
June 1, 2020 to August 31, 2020



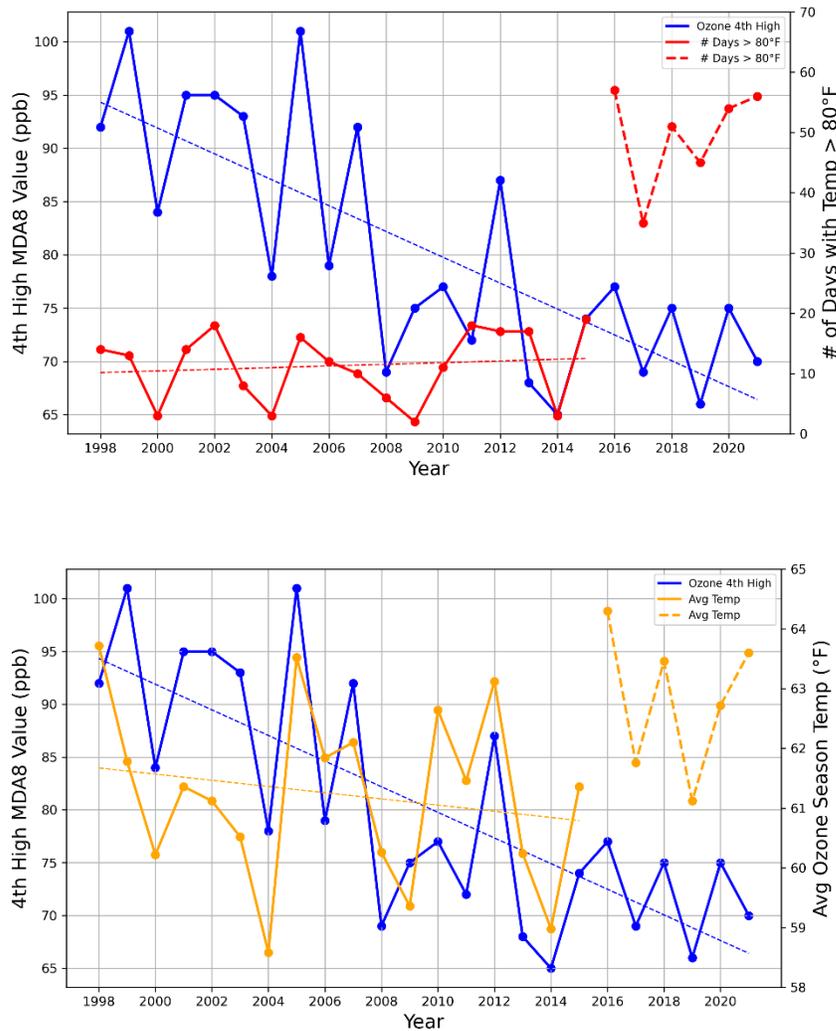
Average Temperature (°F): Departure from Mean
June 1, 2021 to August 31, 2021



Long term ozone levels compared to temperature

Critically for the purposes of this maintenance plan assessment, long-term trends indicate that ozone values at the Newport monitor are decreasing independent of temperature. Figure 4 shows that ozone concentrations at the Newport monitor have decreased substantially since 1998, while temperatures have remained relatively constant. Note that the temperature probe at the Newport monitoring site was relocated in 2016 from 15 meters to 5 meters above ground to align with EPA guidance. This change led to noticeable increases in the temperatures recorded, such that the 1998 to 2015 record should not be directly compared with the 2016 to 2021 temperature record. The evidence from the 18-year record from 1998 to 2015 indicates that even with year-to-year variability, the overall long-term temperature trend has been relatively stable, with a slight increase in the number of hot days and a slight decrease in the average season temperature. This finding suggests that reductions in emissions, rather than meteorology, are driving the long-term reduction in ozone concentrations at the Newport monitor.

Figure 4. Comparison of Door County ozone values to temperature (1998-2021). Annual fourth highest maximum daily 8-hour average ozone concentrations plotted with (top) the number of days with temperatures over 80 °F and (bottom) the average May through September temperatures for the Newport monitor. Dotted lines are best-fit linear regressions.



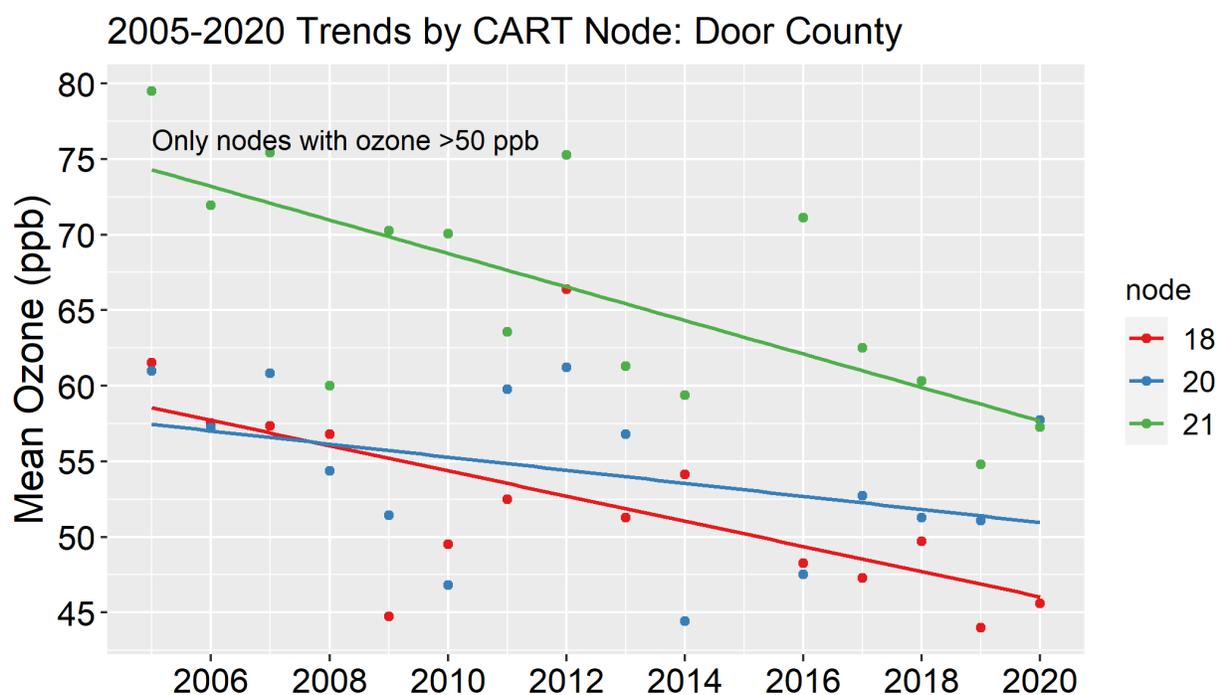
Classification and regression tree (CART) analysis of ozone levels and meteorology

A classification and regression tree (CART) analysis completed by LADCO in 2021 also analyzed the impact of temperature on ozone values at the Newport monitor.⁷ LADCO conducted this analysis to determine the meteorological conditions most associated with high ozone days in Door County.

⁷ A CART analysis normalizes the influence of year-to-year meteorological variability on ozone concentrations, and any remaining trend is assumed to be the result of non-meteorological factors, such as reductions in emissions of ozone precursors. This is done by comparing ozone values over time associated with specific sets of meteorological conditions (“nodes”), such as temperature, wind direction, and humidity.

Figure 5 shows the results of LADCO’s CART analysis for Door County during periods of high ozone (i.e., nodes associated with ozone levels greater than 50 ppb). This figure supports several conclusions: first, that ozone levels have consistently decreased since 2005 when considering the specific meteorological conditions (nodes) associated with high ozone levels; second, that the high-ozone nodes from the CART analysis for the Door County monitor are associated with southerly winds/transport and hot temperatures. This further reinforces that elevated ozone levels in the Door County 2015 ozone NAAQS maintenance area are dominated by transported ozone originating from outside the area.⁸ Together, these indicate that upwind emissions are driving ozone reductions at Door County, and that, should ozone need to be further decreased, it would be necessary to reduce emissions further in these upwind areas.

Figure 5. CART analysis results for Door County (2005-2020). The nodes represent specific groupings of meteorological factors associated with ozone levels above 50 ppb as measured at the Newport air quality monitor in Door County.



3. Potential contributing emission sources

As described extensively in the references, there are few sources of ozone-causing emissions in Door County, and essentially no contributing emissions from the Door County maintenance area itself. Any emissions sources contributing to Door County ozone values would be located outside and upwind of the Door County area. This includes point, area, onroad and nonroad sources located in upwind areas and, especially, upwind states like Illinois. More information on contributing emission sources is included in #5.

⁸ For more information about this analysis, including a more complete description of the methodology employed and a description of the various nodes, see LADCO’s complete report at: <https://www.ladco.org/wp-content/uploads/Workgroups/Ozone-TWG/ozone-trends-figures-fall-2021-for-ozone-WG.pdf>.

4. The geographic applicability of possible contingency measures

As described in the maintenance plan, Wisconsin has an extremely limited ability to affect ozone concentrations in the Door County 2015 ozone NAAQS area due to the influence of emissions originating in upwind areas. Because of this, any contingency measures deemed necessary to bring the area back into attainment would need to be applied outside of the area. This would include the upwind metropolitan areas of Green Bay, Milwaukee, and Chicago. Since Chicago-area emissions are significantly larger than the emissions from the upwind Wisconsin areas (see #5), the implementation of additional emissions reductions measures at both the state and federal level within the Chicago area, particularly in Illinois, would be most effective at reducing ozone levels further in Door County. This is further supported by source apportionment modeling results, which indicate the outsized contributions of Illinois sources to ozone concentrations measured at the Newport monitor (see #6).

5. Upwind emission trends, including the impact of existing or forthcoming control measures that have not yet been implemented

In both of its designation-related technical support documents for the 2015 ozone standard for Door County, EPA determined that emissions in Door County do not significantly contribute to ozone concentrations in the area itself. Instead, Door County ozone levels are driven by emissions occurring outside and upwind of the county. Therefore, for the purposes of this maintenance plan study, assessing upwind emission trends is important.

In its designation for the area, EPA analyzed ozone precursor emissions from the highest emitting areas upwind of Door County: Green Bay, Milwaukee, and Chicago. EPA noted that the five-county Milwaukee metro area (Ozaukee, Washington, Waukesha, Milwaukee, and Racine counties) has emissions approximately 14 times greater than Door County, and the multistate Chicago ozone nonattainment area collectively has emissions over 80 times greater.

Consistent with EPA's assessment, DNR evaluated NO_x and VOC emission trends in these upwind areas for 2019, a year in the design value period in which this area reviolated, as well as projections for the years 2030 and 2035 (see Tables 1 and 2).⁹ These figures show that precursor emissions from these areas are expected to continue to decrease substantially in future years, based on current control measures. These reductions will help ensure the Door County area continues to attain the NAAQS in the future.

⁹ From the Redesignation Request and Maintenance Plan for the Door County-Revised 2015 ozone NAAQS area (2022).

Table 1. NOx emissions in upwind metropolitan areas.

	Total NOx emissions (tons per ozone season day)			
	2019	2030	2035	Net Change (2019-2035)
Chicago Metropolitan Area				
Point	117.05	101.84	102.13	-14.92 (-13%)
Area	95.23	89.52	86.83	-8.40 (-9%)
Onroad	171.02	69.03	40.91	-130.11(-76%)
Nonroad	131.72	113.96	110.87	-20.85 (-16%)
TOTAL	515.02	374.35	340.75	-174.27 (-34%)
Green Bay Metropolitan Area				
Point	6.30	5.61	5.64	-0.66 (-10%)
Area	2.60	2.56	2.54	-0.06 (-2%)
Onroad	6.49	1.86	0.46	-6.03 (-93%)
Nonroad	2.58	1.48	1.00	-1.58 (-61%)
TOTAL	17.98	11.51	9.65	-8.33 (-46%)
Milwaukee Metropolitan Area				
Point	17.39	17.90	17.78	0.39 (2%)
Area	17.66	17.11	16.89	-0.77 (-4%)
Onroad	29.15	10.17	4.94	-24.21 (-83%)
Nonroad	16.49	13.31	12.58	-3.91 (-24%)
TOTAL	80.68	58.48	52.19	-28.49 (-35%)

Table 2. VOC emissions in upwind metropolitan areas.

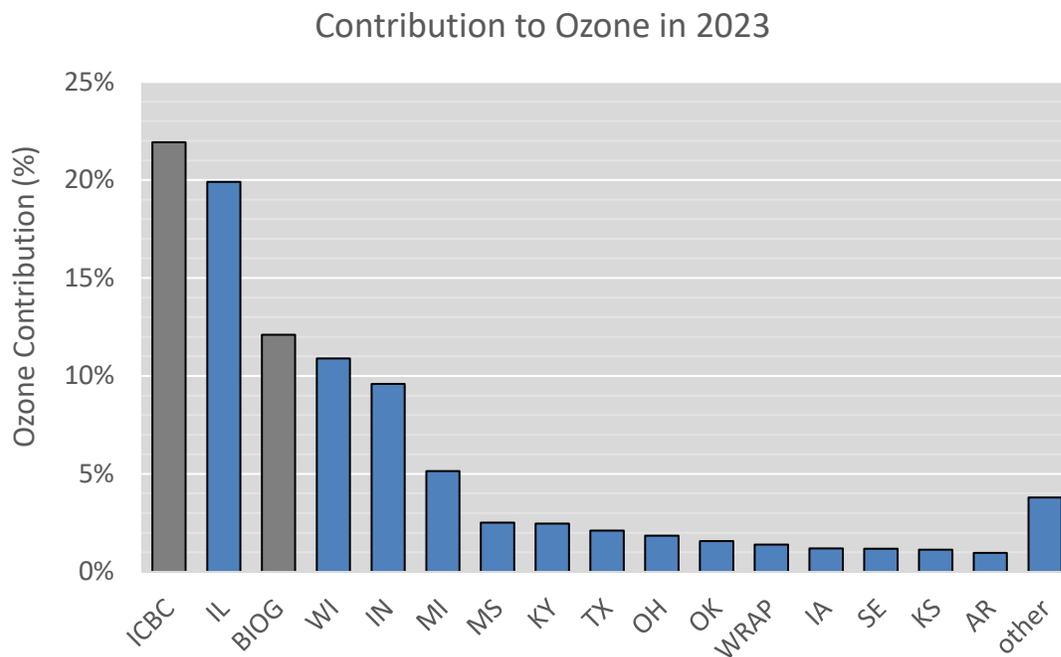
	Total VOC emissions (tons per ozone season day)			
	2019 attainment year	2030 interim year	2035 maintenance year	Net Change (2019-2035)
Chicago Metropolitan Area				
Point	47.73	46.45	46.23	-1.50 (-3%)
Area	242.83	249.38	252.30	9.47 (4%)
Onroad	99.75	49.96	33.82	-65.93 (-66%)
Nonroad	68.78	66.68	67.68	-1.1 (-2%)
TOTAL	459.10	412.46	400.02	-59.08 (-13%)
Green Bay Metropolitan Area				
Point	4.54	4.55	4.56	0.02 (0%)
Area	9.01	9.38	9.54	0.53 (6%)
Onroad	3.78	1.97	1.43	-2.35 (-62%)
Nonroad	1.64	1.41	1.35	-0.29 (-18%)
TOTAL	18.97	17.30	16.87	-2.10 (-11%)
Milwaukee Metropolitan Area				
Point	9.41	9.75	9.73	0.32 (3%)
Area	50.81	51.43	51.70	0.89 (2%)
Onroad	16.42	8.68	6.20	-10.2 (-62%)
Nonroad	11.51	10.82	10.79	-0.72 (-6%)
TOTAL	88.15	80.69	78.42	-9.73 (-11%)

6. Air quality contributions from outside the maintenance area

The contributions to ozone levels from outside the area can be assessed in several ways. First, since ozone formation is driven by precursor emissions, evaluating the location and level of those emissions can help determine the relative degree upwind areas are contributing to the area. EPA provides an extensive evaluation of this in both of its designation-related technical support documents for the 2015 ozone standard for Door County, including an assessment of upwind area emissions as described in #5.

Source apportionment modeling can also determine which states and regions are contributing to ozone levels in the area. Figure 6 shows the relative contributions of different states and regions to ozone levels at the Newport monitor for 2023, based on current control measures. This figure shows that Illinois is the dominant contributor to concentrations (around 20 percent), while emissions sources in Wisconsin are estimated to contribute only about 11 percent. Indiana sources are also relatively large contributors to Door County ozone levels. Reductions in emissions from upwind areas are therefore likely to have a greater impact on ozone concentrations measured at the Newport monitor than reductions from Wisconsin sources.

Figure 6. Ozone source apportionment modeling for the Newport monitor.¹⁰



¹⁰ 2023 projected contributions are from LADCO 2015 Interstate Transport Modeling (with water). For information on 2023 modeling methodology see: LADCO 2015 O3 NAAQS Transport Modeling TSD. https://www.ladco.org/wp-content/uploads/Documents/Reports/TSDs/O3/LADCO_2015O3iSIP_TSD_13Aug2018.pdf. Source regions were grouped differently for the different modeling efforts and do not include states that are broken out specifically due to their significant independent contributions. The “SE” (Southeast) region includes MS, AL, GA, FL, TN, VA, NC and SC. The “WRAP” (West) region includes WA, OR, CA, NV, ID, MT, WY, UT, CO, AZ, NM, ND and SD. “ICBC” refers to “initial/boundary conditions”, which are contributions that cannot otherwise be attributed to a state or source region, such as emissions originating outside the U.S. “BIOG” represents biogenic emissions. “Other” represents other states or regions not otherwise listed.

Conclusion

This study shows ozone concentrations measured in the Door County 2015 ozone NAAQS maintenance area continue to be dominated by out-of-state emissions transported to the area via prevailing lake breeze circulations and mesoscale meteorological conditions. It is likely that the elevated ozone concentrations observed in 2020 were the result of slightly higher-than-average regional temperatures, which caused increased ozone formation in areas upwind of Door County. That ozone was then transported to the Door County peninsula via well-documented meteorological processes, resulting in higher ozone values at the Newport monitor. Despite this annual result, this study also shows that ozone values both in Door County and regionally continue to decrease independent of annual temperature variations. This indicates that regional reductions of ozone precursor emissions are resulting in decreased ozone values throughout the region, including those measured at the Newport monitor.

Despite above-average regional temperatures during the 2021 ozone season, the latest monitoring data shows the Door County 2015 ozone NAAQS area is again showing attainment, with a 2019-2021 design value at the Newport monitor of 70 ppb. This indicates that current control measures throughout the region are satisfactory to ensure continued maintenance of the standard in this area. Emissions of ozone precursors from upwind areas, especially the Chicago area, are anticipated to continue to decrease in future years. It is therefore unnecessary to implement additional control measures in the Door County 2015 ozone NAAQS nonattainment area to ensure continued attainment of the NAAQS, and the contingency requirements of the 2015 ozone NAAQS maintenance plan for this area are satisfied.