Designation Recommendation

2024 Revised
National Ambient Air Quality Standard
for
Sulfur Dioxide

Connecticut Department of Energy and Environmental Protection
December 2025

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Acronyms and Abbreviations

CAA	Clean Air Act
CAMPD	Clean Air Markets Program Data
CBSA	Core Based Statistical Area
CFR	Code of Federal Regulations
CSA	Combined Statistical Area
DEEP	Department of Energy and Environmental Protection
EPA	U.S. Environmental Protection Agency
FR	Federal Register
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
ppb	parts per billion
ppm	parts per million
SO_2	Sulfur Dioxide

1 Introduction and Background

1.1 Purpose

On December 11, 2024, the United States Environmental Protection Agency (EPA) promulgated a revision to the secondary National Ambient Air Quality Standard (NAAQS) for sulfur dioxide (SO_2).[1] Subsequent to promulgation of a new or revised NAAQS, States are required under Section 107 of the Clean Air Act (CAA) to submit recommendations to EPA regarding the State's attainment and nonattainment boundaries and designations for the standard. This document presents the Connecticut Department of Energy and Environmental Protection's (DEEP's) analysis of data relevant to the SO_2 NAAQS within and surrounding the state and concludes that EPA should designate the entire State of Connecticut attainment for the 2024 SO_2 NAAQS.

1.2 Regulatory Background

EPA sets primary and secondary NAAQS to be protective of public health and welfare, respectively. On December 11, 2024, based on review of the air quality criteria for ecological effects of sulfur oxides, the EPA revised the secondary national ambient air quality standard (NAAQS) for sulfur dioxide (SO_2) from the previous 0.5 parts per million (ppm) as a 3-hour average, not to be exceeded more than once in a year, to an annual standard with a level of 10 parts per billion (ppb), averaged over 3 years.[2] EPA did not, at the time, make any changes to the primary standard. The full list of current NAAQS can be found on EPA's website. The revised secondary SO_2 NAAQS became effective January 27, 2025.

Under CAA section 107(d), states are required to submit designation recommendations to EPA, no later than 1 year after promulgation of a primary or secondary NAAQS. Therefore, states are required to provide designation recommendations to EPA by December 11, 2025, for the revised SO_2 NAAQS. If EPA intends to promulgate a designation that deviates from the state recommendation, EPA must notify the state at least 120 days prior to promulgating the modified designation, and EPA must provide the state an opportunity to comment on the potential modification. Section 107(d)(1)(B) of the CAA requires completion of the designation process within two years of promulgation (i.e., by December 11, 2026) unless the Administrator finds that additional information is needed to make a final decision. In such a case, EPA may take up to an additional year to make the designations (i.e., by December 11, 2027).

In a memo dated January 16, 2025, EPA describes the five-factor framework it intends to use to determine area boundaries and designations.[3] EPA recommends the states use these five factors in making their recommendations. DEEP addresses each of the five factors in this document and concludes that the entire state should be designated attainment for the 2024 SO_2 NAAQS.

[1] Secondary National Ambient Air Quality Standards (NAAQS) for Nitrogen Dioxide (NO2) and Sulfur Dioxide (SO2) and Particulate Matter (PM) | US EPA
[2] Review of the Secondary National Ambient Air Quality Standards for Oxides of Nitrogen, Oxides of Sulfur, and Particulate Matter, 89 FR 105692 (December 27, 2024)
[3] https://www.epa.gov/system/files/documents/2025-07/2024-revised-secondary-so2-designations-memo-1-16b-24.pdf

2 Five Factor Analysis

The CAA requires that a nonattainment area must include not only the area that is violating the standard, but also nearby areas that contribute to the violation. Thus, for each ambient SO_2 monitor or group of monitors that indicate violations of the standard, EPA indicated their intent to determine the appropriate nearby areas to include within the nonattainment area boundary based on that area's emissions contribution to the monitored violations. Areas that meet the standard and do not contribute to nearby nonattainment should be designated as attainment, and areas with insufficient data should be designated unclassifiable.

EPA guidance recommends identifying each monitor in an area and identifying nonattainment monitors. Recommendations for nonattainment area designation should then be based on consideration of the following five factors:

1) air quality,
2) emissions and emissions-related data,
3) meteorology,
4) geography/topography, and
5) jurisdictional boundaries.

The factors are intended to inform EPA's analysis of the statutory definition of a nonattainment area, which is to include "any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet)" the SO_2 NAAQS.[4]

2.1 Factor 1: Air Quality

DEEP maintains a network of three SO_2 air quality monitors located in Cornwall, Bridgeport, and New Haven. The primary objective of this network is determining compliance with the SO_2 NAAQS. Furthermore, DEEP develops and submits annual network plans to EPA Region 1 to demonstrate that air monitoring operations meet or surpass all applicable federal requirements. The Cornwall monitor is located in the rural northwest portion of the state and the Bridgeport and New Haven monitors are located in the more densely populated coastal area along the Interstate-95 corridor.

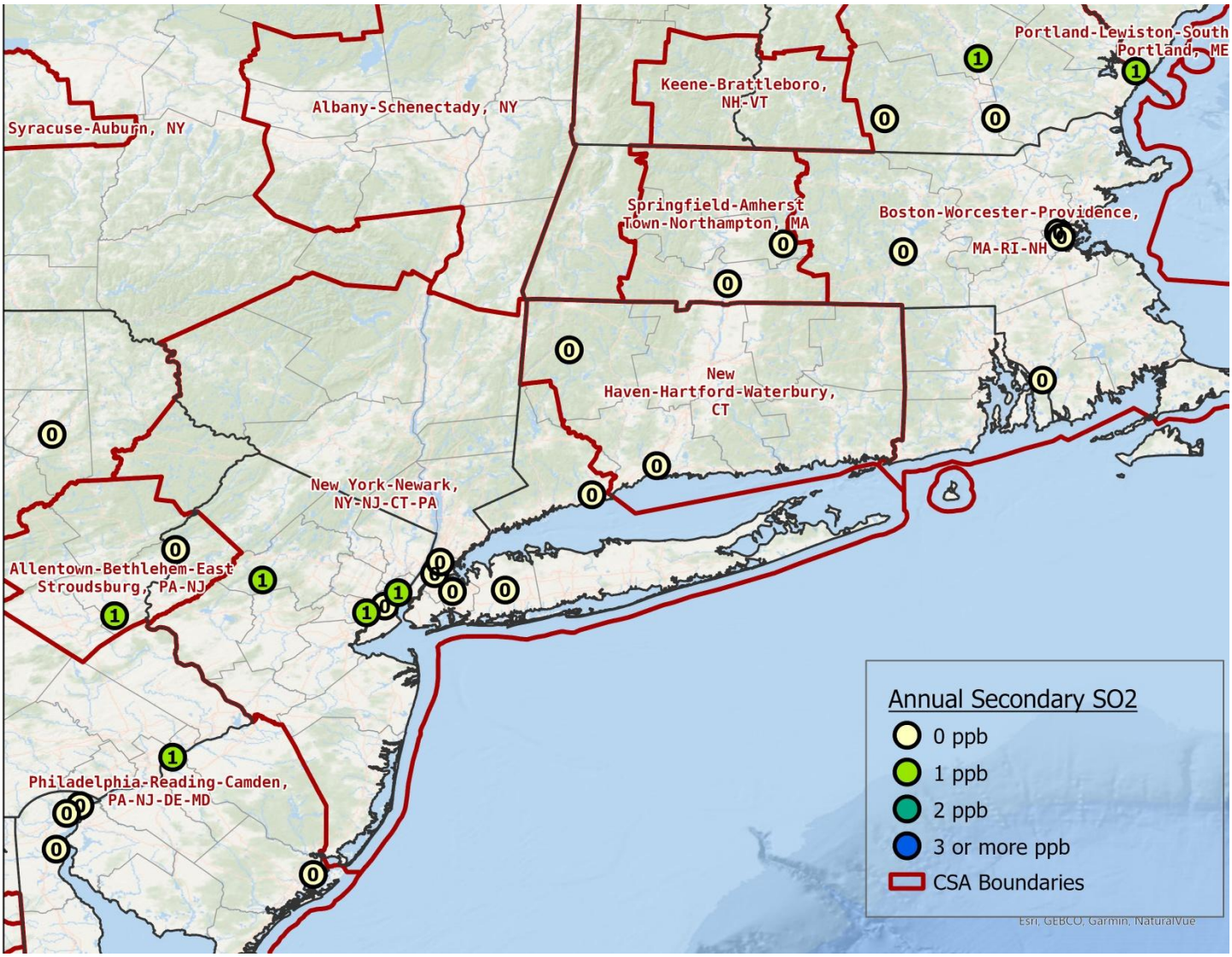
Figure 2-1 depicts 2024 annual secondary SO_2 design values at Connecticut and nearby monitor locations in adjacent Core Based Statistical Areas (CBSA). Design values, obtained from the EPA, represent monitored data in the proper averaging time which can be compared to the level of the standard.[5] A monitor's 3-year average SO_2 design value is listed as 0 ppb when the concentration is less than 0.5 ppb, which then rounds to 0 ppb.[6] As shown in Figure 2-1, all monitors in areas near and adjacent to Connecticut are in attainment with the new

[4] CAA Sections 107(d)(4)(A)(v)
[5] Air Quality Design Values | US EPA
[6] U.S. Environmental Protection Agency. 40 CFR Part 50, Appendix T – Interpretation of the Secondary National Ambient Air Quality Standards for Oxides of Sulfur (Sulfur Dioxide). Effective December 11, 2024.

10 ppb SO_2 standard with values of 1 ppb or less. Nearly all other monitors in the country have design values that are less than half the standard and the nearest nonattainment monitor to Connecticut is in Missouri.

EPA recognizes that the current SO_2 monitoring network is adequate to provide the data needed to implement the revised secondary standard.[7] The distance of the nearest nonattainment monitor to Connecticut, the adequacy of the monitoring network, and the extent to which monitor data indicates compliance with the standard, provide strong evidence that Connecticut should be designated attainment.

Figure 2-1. Connecticut and surrounding area SO_2 monitors showing 2024 design values for the secondary standard.



Very low SO_2 design values have been the trend in Connecticut as shown in Table 2-1 where each monitor for the most recent five years consistently show zeros for design values. Table 2-2 shows the five-year trend in statewide maximum design values for both the primary and secondary NAAQS providing further emphasis of the very low concentrations of SO_2 measured.

[7] https://www.epa.gov/system/files/documents/2025-07/2024-revised-secondary-so2-designations-memo-1-16b-24.pdf

Table 2-1. Secondary annual SO_2 NAAQS design values for each monitor in Connecticut for each of the most recent five years.

State Name	AQS Site ID	Local Site Name	2020 Annual DV (ppb)	2021 Annual DV (ppb)	2022 Annual DV (ppb)	2023 Annual DV (ppb)	2024 Annual DV (ppb)
Connecticut	090010010	Bridgeport	0	0	0	0	0
Connecticut	090050005	Cornwall	0	0	0	0	0
Connecticut	090090027	New Haven	0	0	0	0	0

Table 2-2. Connecticut statewide maximum design values for the primary and secondary SO_2 NAAQS for each of the most recent five years.

Design Value Year	2020	2021	2022	2023	2024
Primary 1-Hour NAAQS = 75 (ppb)	4	3	3	3	4
Secondary Annual NAAQS = 10 (ppb)	0	0	0	0	0

2.2 Factor 2: Emissions and Emissions Related Data

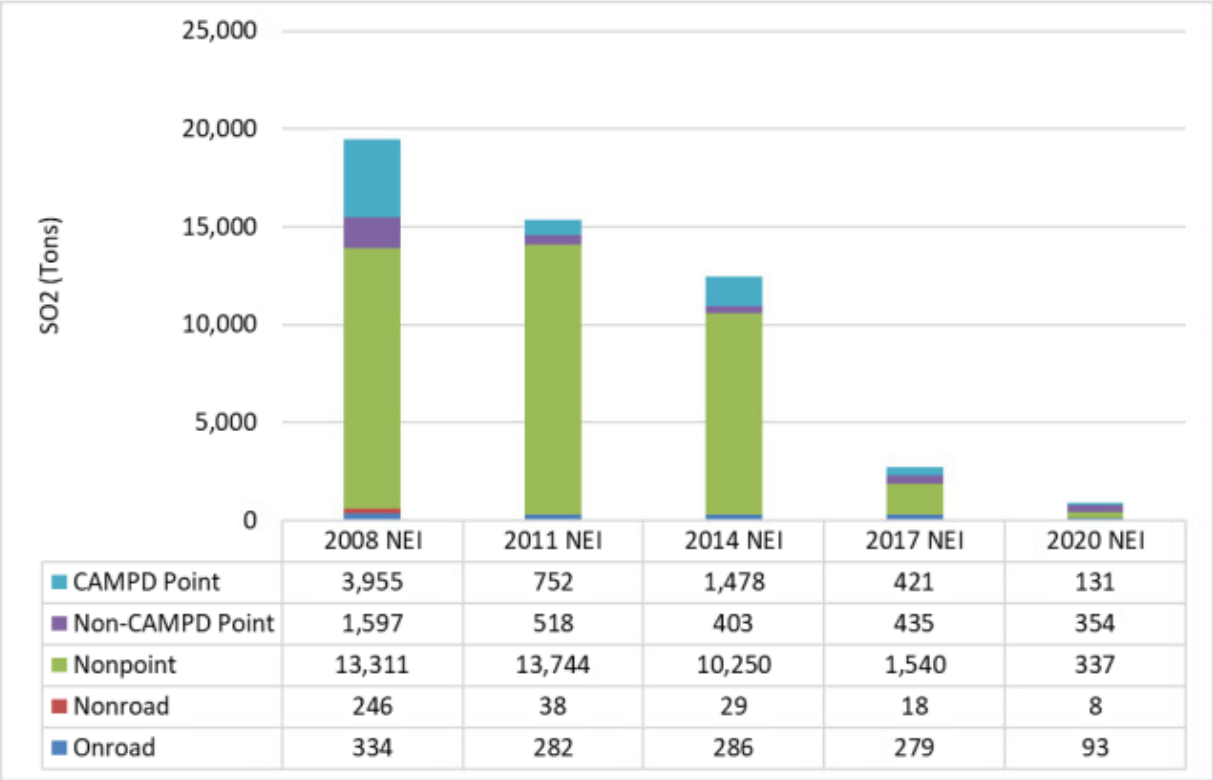
The National Emissions Inventory (NEI) is an EPA compendium of emissions reported every three years.[8] Emissions data from the NEI was assessed for the period from 2008 to 2020.

Figure 2-2 shows Connecticut SO_2 emissions by NEI year demonstrating significant reductions in all emission source categories. As shown in Table 2-3, from 2008 to 2020, emissions have been reduced from between 72.2% to 97.5% depending on source category.

Locally and regionally, these reductions are the result of SO_2 emissions controls on upwind coal-fired power plants, the retirement of coal-fired power plants in upwind states as well as in Connecticut, and market forces that have led to increased use of natural gas by the electric generating sector. A significant decline in SO_2 emissions, particularly evident in the nonpoint sector, is due to the adoption of low sulfur fuel standards.

[8] National Emissions Inventory (NEI) | US EPA

Figure 2-2: SO_2 source emissions (tons) by NEI year (2008 - 2020) for Connecticut.



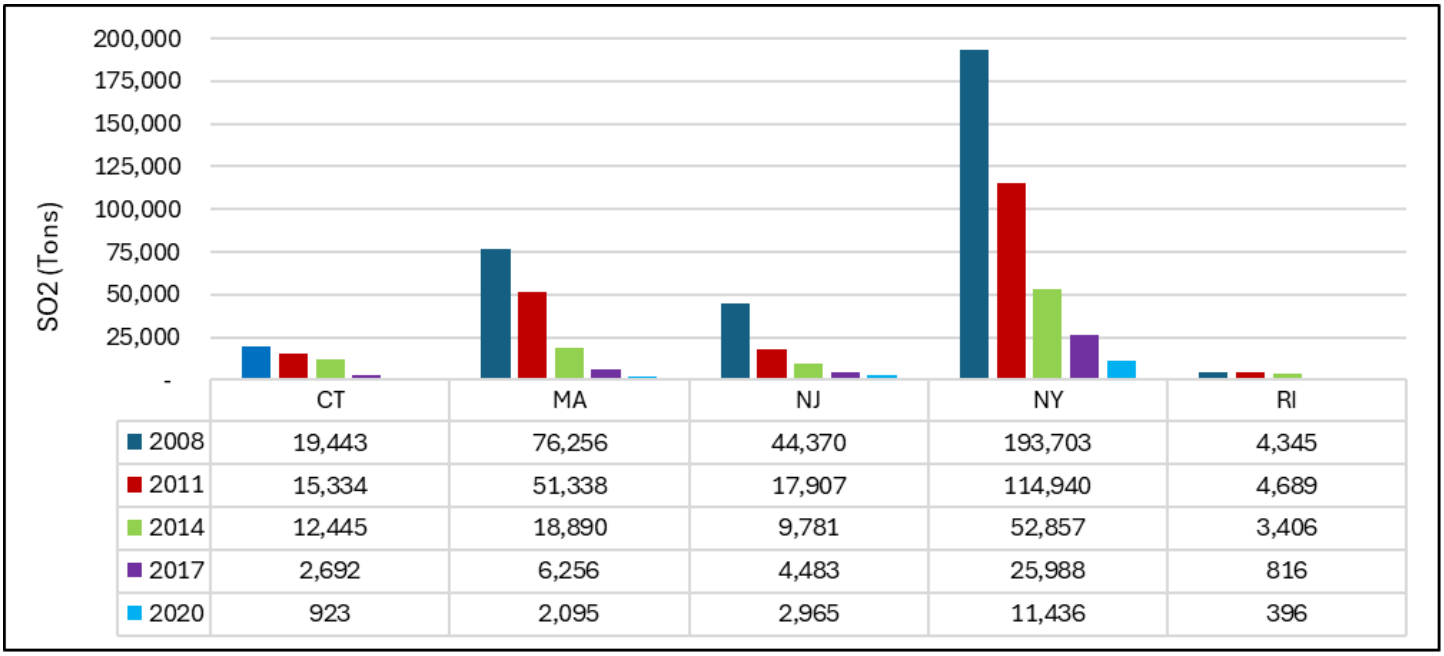
	2008 NEI	2011 NEI	2014 NEI	2017 NEI	2020 NEI
CAMPD Point	3,955	752	1,478	421	131
Non-CAMPD Point	1,597	518	403	435	354
Nonpoint	13,311	13,744	10,250	1,540	337
Nonroad	246	38	29	18	8
Onroad	334	282	286	279	93

Table 2-3: NEI emission source category totals and percent reductions from 2008 – 2020.

NEI Year	2008 (tons)	2020 (tons)	Total Difference (tons)	Percent Reduction (%)
CAMPD Point	3,995	131	**3,864**	**96.7**
Non-CAMPD Point	1,597	354	**1,243**	**77.8**
Nonpoint	13,311	337	**12,974**	**97.5**
Nonroad	246	8	**238**	**96.8**
Onroad	334	93	**241**	**72.2**

Figure 2-3 shows emission trends for Connecticut and nearby states. Notably, Massachusetts and New Jersey have significantly higher emissions than Connecticut yet also monitor SO_2 levels that are well within the standard.

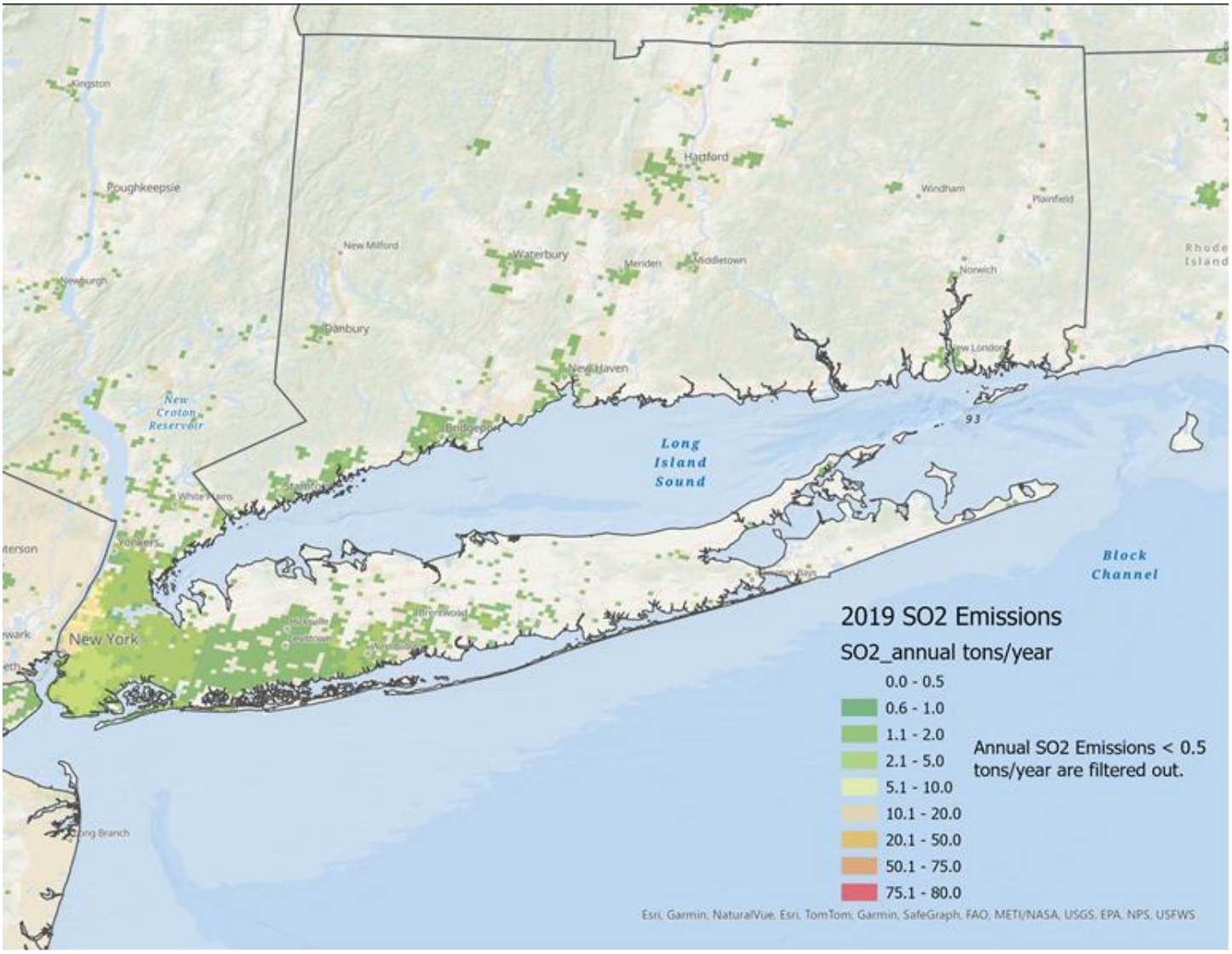
Figure 2-3. Regional SO_2 emissions by state.



	CT	MA	NJ	NY	RI
2008	19,443	76,256	44,370	193,703	4,345
2011	15,334	51,338	17,907	114,940	4,689
2014	12,445	18,890	9,781	52,857	3,406
2017	2,692	6,256	4,483	25,988	816
2020	923	2,095	2,965	11,436	396

The geographical distribution of SO_2 emissions for 2019 is shown in Figure 2-4. Emissions are at their highest on Manhattan and western Long Island. As shown earlier in Figure 2-1, multiple monitors within the densest area of emissions comfortably attain the standard. It is therefore unlikely that air quality in and around Connecticut would fail to remain in compliance with the standard.

Figure 2-4. High resolution emissions density map for SO_2 in in and around Connecticut. Data is presented for 2019 and apportioned to 1-kilometer square grids.



Source: Ma, Siqi & Tong, Daniel. (2022). Neighborhood Emission Mapping Operation (NEMO): A 1-km anthropogenic emission dataset in the United States. Scientific Data. 9. 10.1038/s41597-022-01790-9.

Population Growth Rates and Patterns

EPA recommends that population density analyses examine the location and, when available, trends in population growth as potential indicators of the probable location and magnitude of emissions sources that may contribute to SO_2 concentrations in a given nonattainment area. DEEP includes this analysis as further weight of evidence that the entire state is, and will remain, in attainment of the standard.

Table 2-4 summarizes population growth estimates for 2020-2040 as projected by the Connecticut Data Center.[9] Overall population growth in Connecticut during this period is estimated at 1.37 percent. Fairfield, Litchfield, Middlesex, New London, and Tolland Counties' population rates are estimated to decline, with the

[9] https://www.ctdata.org/

lowest being Litchfield County with an estimated -8.74 percent growth rate (8.74% population decline). The projected fastest growing county (on a percentage basis) is Windham County, located in rural northeast Connecticut.

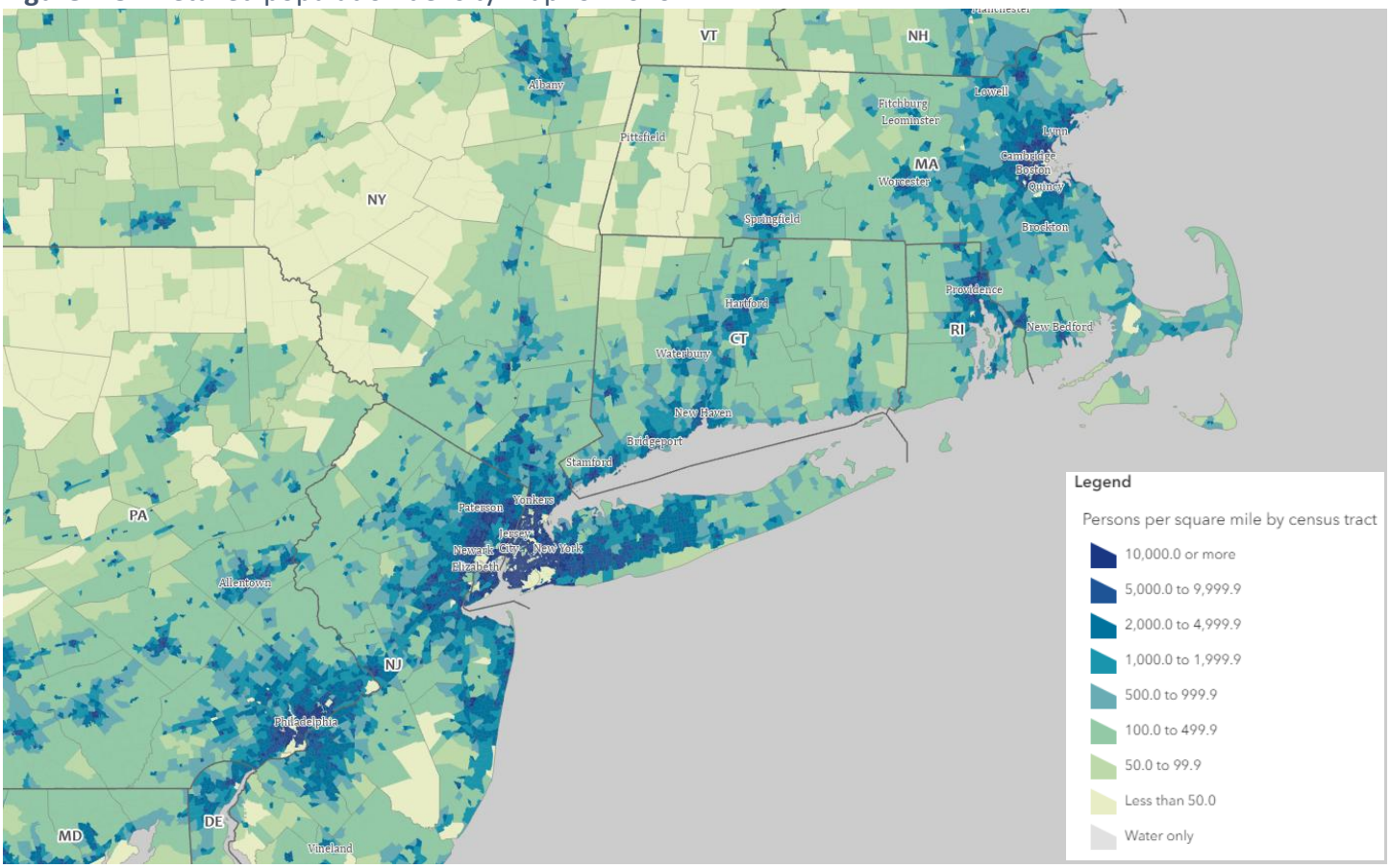
Table 2-4. Population growth estimates by county for Connecticut.

County	2020 Total	2025 Total	2030 Total	2035 Total	2040 Total	Area (Square Miles)	Population Density 2020	2040-2020 %Change
Fairfield	907,603	900,662	897,553	899,423	905,219	624.9	1,452.4	**-0.26%**
Hartford	909,671	920,241	930,629	9397,54	948,876	735.1	1,237.5	**4.31%**
Litchfield	186,611	184,190	180,866	176,170	170,303	920.6	202.7	**-8.74%**
Middlesex	167,213	166,827	166,533	165,033	163,365	369.3	452.8	**-2.30%**
New Haven	873,659	882,552	891,371	897,492	900,635	604.5	1,445.3	**3.09%**
New London	278,756	280,497	280,847	279,403	276,187	664.9	419.2	**-0.92%**
Tolland	156,588	156,249	155,697	155,266	154,560	410.2	381.7	**-1.30%**
Windham	124,498	127,547	130,497	132,818	134,876	512.9	242.7	**8.34%**
State Total	**3,604,599**	**3,618,765**	**3,633,993**	**3,645,359**	**3,654,021**	**4,842.4**	**744.4**	**1.37%**

Population density was assessed for the region surrounding Connecticut using data from the 2020 Census Demographic Data Map Viewer.[10] Connecticut's population density is highest along Interstate-91 through New Haven and Hartford counties and along the coastal Interstate-95 corridor between New York and Rhode Island (Figure 2-5).

[10] 2020 Census Demographic Data Map Viewer

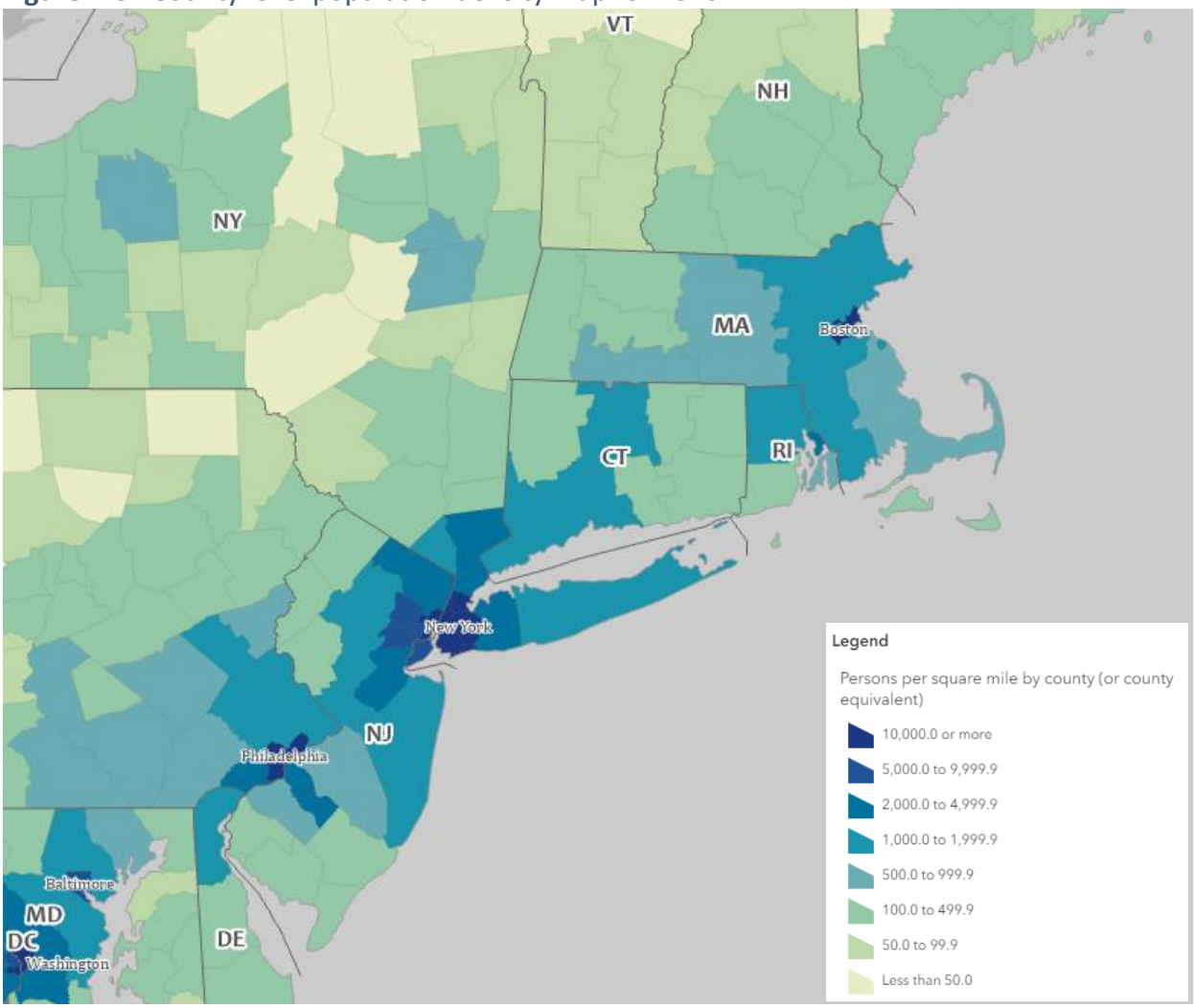
Figure 2-5. Detailed population density map for 2020.



Population density by county is presented in Figure 2-6. Fairfield county has 1,000-1,999 persons per square mile, while New York's highest county shown has a population density of 10,000 or more persons per square mile. New Jersey's most populous county has a population density of 5,000-9,999 persons per square mile. Even these high population density areas, as shown in Figure 2-1, monitor attainment of the standard.

Emission trends and future growth indicate that Connecticut is, and is likely to remain, in statewide attainment of the SO_2 NAAQS.

Figure 2-6. County level population density map for 2020.



2.3 Factor 3: Meteorology

The evaluation of meteorological data helps to determine the effect on the fate and transport of emissions contributing to SO_2 concentrations and to identify areas potentially contributing to increases in monitored values. A simple approach is to use wind data from monitoring sites to create wind roses. Figure 2-7 shows quarterly wind roses at three sites dispersed throughout Connecticut. Wind direction appears to be predominately from the northwest apart from the second and third quarters which show an increase in southerly winds.

Figure 2-7. 2024 quarterly wind roses depicting wind speed and direction at Connecticut locations. Data from AirNow-Tech.

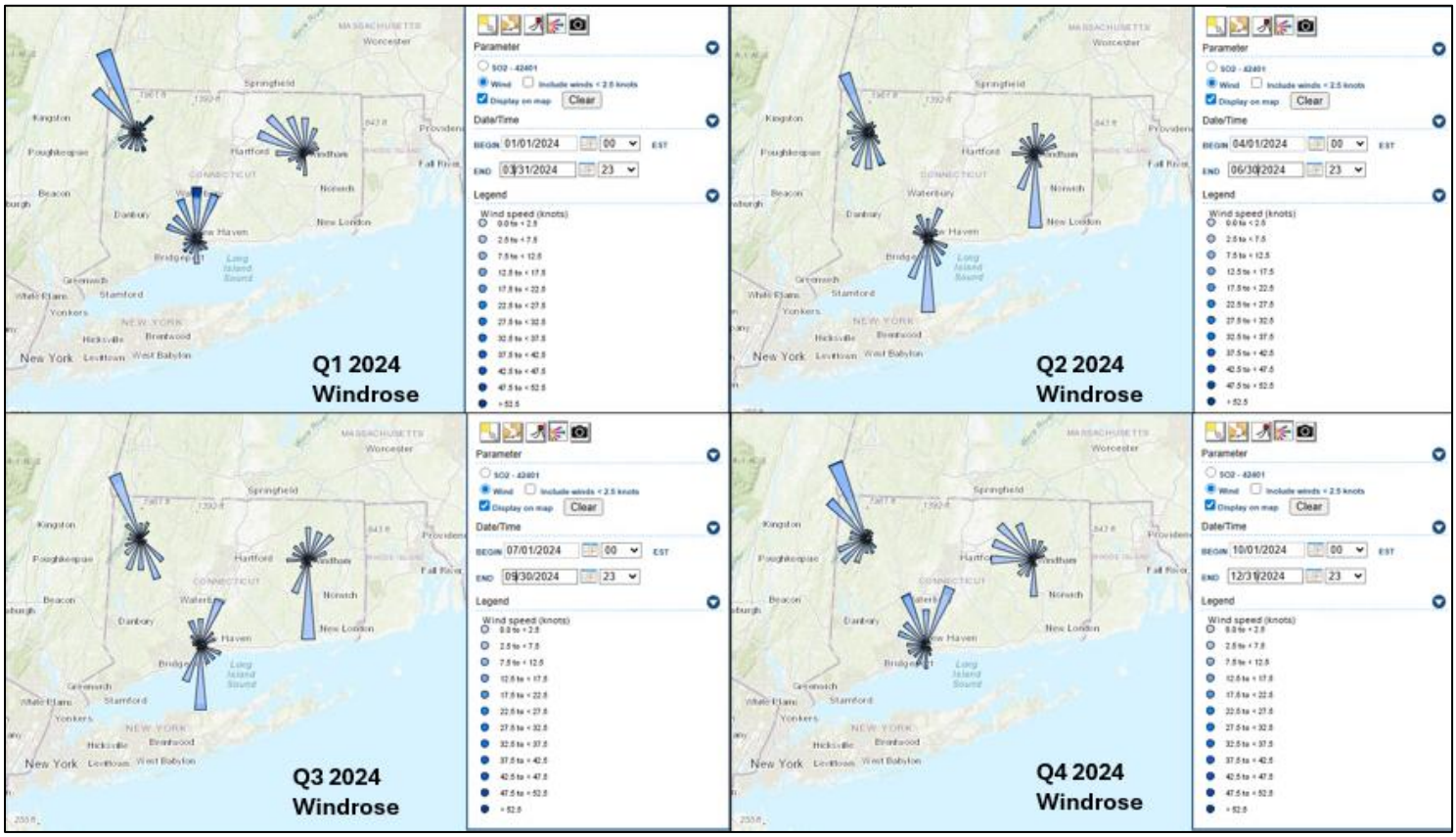
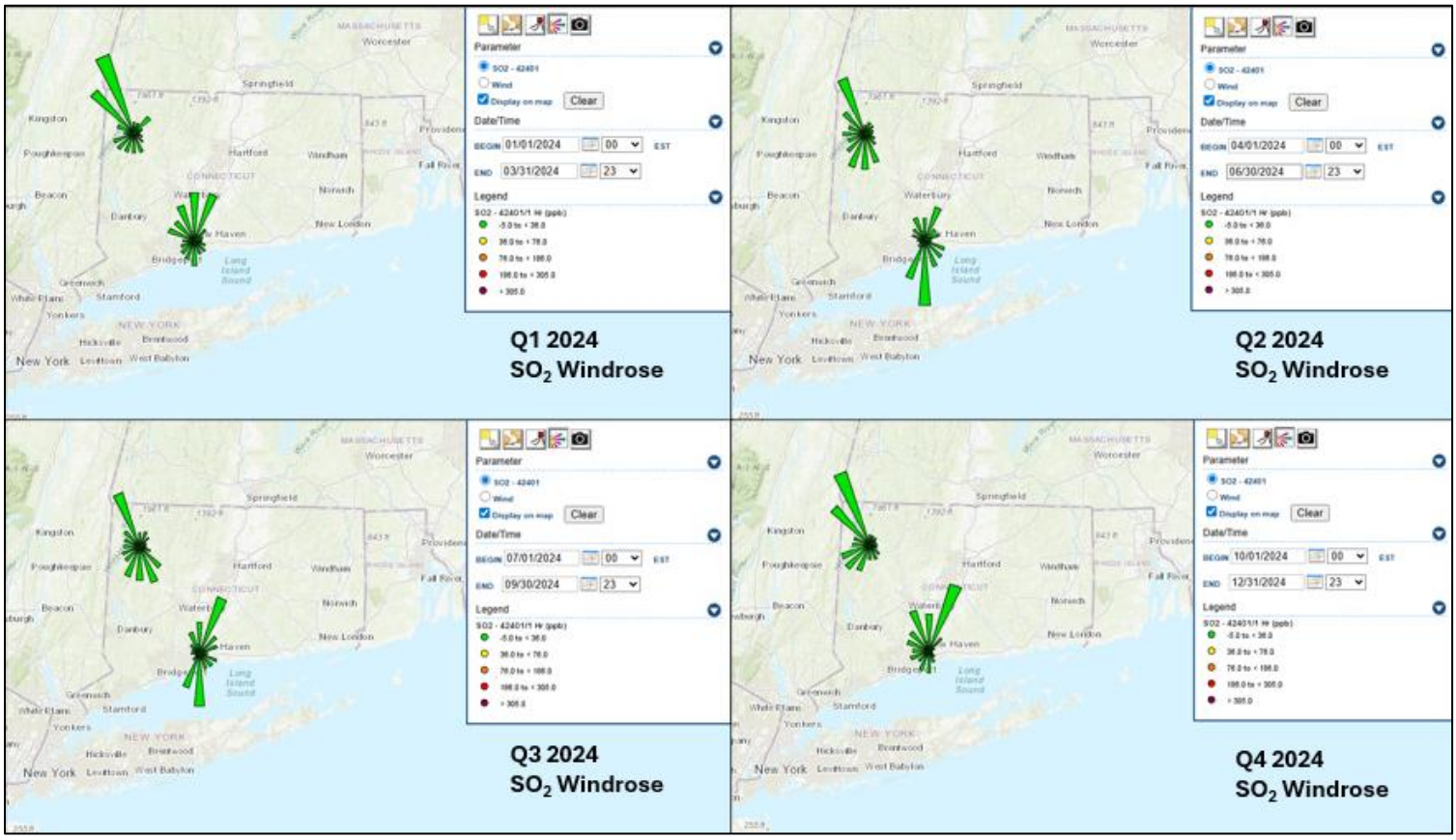


Figure 2-8 shows the 2024 quarterly SO_2 wind roses at the Cornwall and New Haven monitor locations. SO_2 concentrations are low (green) from all directions throughout each individual quarter and indicate influence from nearby or upwind sources have very little effect on SO_2 concentrations in Connecticut.

Figure 2-8. 2024 quarterly SO_2 wind roses depicting pollutant concentration by wind speed and direction at the Cornwall and New Haven monitors. Data from AirNow-Tech.



2.4 Factor 4: Geography/Topography

Connecticut is a small state geographically, with topographical features that do not have a significant effect on air shed boundaries. Long Island Sound plays a role in ozone production but is insignificant regarding SO_2 attainment area boundaries.

2.5 Factor 5: Jurisdictional Boundaries

As there are no nonattainment areas in or near Connecticut, the entire state should be designated attainment.

3 Summary and Conclusions

The analyses presented above demonstrate that all monitors in and near Connecticut attain the 2024 secondary SO_2 NAAQS.

DEEP evaluated air quality, emissions trends and regional data to determine the state's status under the 2024 revised secondary annual sulfur dioxide (SO_2) standard. Monitoring data from 2020–2024 shows all SO_2 concentrations well below the 10 ppb standard, with the highest design value effectively rounding to 0 ppb. Regional data from neighboring states indicate that Connecticut neither contributes to exceedances elsewhere nor is impacted by cross-boundary SO_2 transport.

Long-term emissions reductions of 72–98% across major source categories reflect the effectiveness of state and federal control programs. Taken together, the monitoring data, regional assessments, and emissions trends demonstrate that the entire state should be designated attainment for the standard. Therefore, in accordance with CAA Section 107(d)(1), DEEP recommends that EPA designate the entire state of Connecticut as attainment for the 2024 secondary SO_2 NAAQS.