State of Maine
Clean Air Act Section 176A(a)(2) Petition

February 6, 2020

Executive Summary

The State of Maine is submitting for United States Environmental Protection Agency (EPA) approval this Clean Air Act (CAA) Section 176A(a)(2) Ozone Transport Region Petition and State Implementation Plan Revision. This document presents the technical analysis justifying the removal of certain areas of the State of Maine from the Ozone Transport Region (OTR). Maine has been and continues to be in attainment with ozone National Ambient Air Quality Standards (NAAQS) in those areas petitioned for removal, and emissions from Maine sources have only a negligible impact on the ozone attainment status of any part of the OTR. The granting of this petition will not degrade the air quality in Maine or in any other state, and information presented in this petition justifies the exclusion of a portion of the State of Maine from the OTR.

Nitrogen oxides (NO_x) and volatile organic compounds (VOC) are ozone precursor pollutants which contribute to the formation of ground-level ozone. The Maine Department of Environmental Protection's (Maine DEP, the Department) analysis affirmatively demonstrates that Maine emissions are insignificant contributors to non-attainment of ozone for the 8-hour ozone NAAQS in other states and in those areas of Maine that will remain within the OTR under this proposal; reductions of NO_x or VOC emissions in those areas petitioned for removal from the OTR have little or no impact on the ozone attainment status of those areas. The analyses consist of back trajectories for 2016-2018 ozone exceedance days recorded at monitoring locations in southern New England and in Maine, EPA ozone apportionment modeling results, and emissions inventory data for Maine and the OTR.

Maine is requesting that the State of Maine be removed from the OTR per CAA Section 176A(a)(2), except for the 111 towns and cities comprising the Portland and Midcoast Ozone Maintenance Areas (see Table 1). Maine is also affirming its commitment to implement existing and future reasonably available control technology (RACT) requirements statewide and periodically review the impact of emissions from those areas removed from the OTR on the Portland and Midcoast Ozone Maintenance Areas and other jurisdictions within the OTR.

Table 1
Maine Towns and Cities to Remain in the Ozone Transport Region

Androscoggin County (includes only the following town): *Durham*
Cumberland County (includes only the following towns and cities): *Brunswick, Cape Elizabeth, Casco, Cumberland, Falmouth, Freeport, Frye Island, Gorham, Gray, Harpswell, Long Island, New Gloucester, North Yarmouth, Portland, Pownal, Raymond, Scarborough, South Portland, Standish, Westbrook, Windham, and Yarmouth*
Hancock County (includes only the following towns and cities): *Bar Harbor, Blue Hill, Brooklin, Brooksville, Cranberry Isles, Deer Isle, Frenchboro, Gouldsboro, Hancock, Lamoine, Mount Desert, Sedgwick, Sorrento, Southwest Harbor, Stonington, Sullivan, Surry, Swans Island, Tremont, Trenton, and Winter Harbor*

Knox County (includes only the following towns and cities): *Camden, Criehaven, Cushing, Friendship, Isle au Haut, Matinicus Isle, Muscle Ridge Shoals, North Haven, Owls Head, Rockland, Rockport, St. George, South Thomaston, Thomaston, Vinalhaven, and Warren*
Lincoln County (includes only the following towns and cities): *Alna, Boothbay, Boothbay Harbor, Breman, Bristol, Damariscotta, Dresden, Edgecomb, Monhegan, Newcastle, Nobleboro, South Bristol, Southport, Waldoboro, Westport, and Wiscasset*
Sagadahoc County (includes all towns and cities)
Waldo County (includes only the following town): *Islesboro*
York County (includes only the following towns and cities): *Alfred, Arundel, Berwick, Biddeford, Buxton, Dayton, Eliot, Hollis, Kennebunk, Kennebunkport, Kittery, Limington, Lyman, North Berwick, Ogunquit, Old Orchard Beach, Saco, Sanford, South Berwick, Wells, and York*

I. Introduction and Background

The EPA has established National Ambient Air Quality Standards (NAAQS) for several pollutants, including ozone. These standards are the basis for the designation of all geographic areas of the United States as either attainment areas (meeting the standard), or non-attainment areas (exceeding the standard) for each pollutant for which a NAAQS is specified.

Ozone is a pollutant formed by the reaction in the atmosphere of volatile organic compounds ("VOCs") and oxides of nitrogen ("NO_x") in the presence of sunlight. Ozone is highly unstable and has the tendency to react with whatever material it comes in contact, such as lung tissue. Ozone is not directly emitted from most sources. Instead, the control of ozone pollution is best accomplished by controlling emissions of ozone precursor pollutants, thereby reducing ambient concentrations of ozone to attainment levels in non-attainment areas. Once controls take effect and ambient levels of ozone drop and remain consistently at or lower than the standard, the EPA can change the designation of the area to attainment and modify required control strategies accordingly.

Ozone has been the subject of air pollution limitations since the Clean Air Act was first enacted in 1970. Large portions of the country, primarily urban areas, were identified as having unhealthy concentrations of ozone in the air. The problem of ozone attainment proved to be one of the most difficult in the environmental field. By 1990, despite considerable effort and a substantial reduction in VOC emissions, many areas remained in non-attainment for ozone. The most problematic were, and continue to be, the urban eastern states.

Recognizing that air pollutants crossing state boundaries can result in violations of standards in one state due to emissions originating in one or more other states, Congress first addressed the problem of regional ozone non-attainment through the creation of the Ozone Transport Region. Section 184(a) of the Clean Air Act Amendments of 1990 (CAA) established a single transport region comprised of the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New

Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, parts of Virginia, and the Consolidated Metropolitan Statistical Area that includes the District of Columbia. The Ozone Transport Region and the Ozone Transport Commission (OTC)[1] were created to develop regional control strategies for emissions of ozone precursor pollutants and thereby address regional ozone transport across state boundaries. Regional control requirements within the OTR are effectively equivalent to those required for designated ozone non-attainment areas, even though portions of the OTC are, in fact, designated ozone attainment areas and neither contribute to nonattainment nor interfere with maintenance of the ozone NAAQS in downwind areas.

In Maine, all areas of the state are effectively treated as “moderate” ozone nonattainment areas and are required to implement the following CAA-mandated controls:

1) Enhanced motor vehicle emissions inspection program in metropolitan statistical areas (or part thereof) with a population of 100,000 or more;

2) Reasonably available control technology with respect to all sources of volatile organic compounds in the State covered by a control techniques guideline;

3) Statewide Stage II vapor recovery control program or comparable measures;

4) Reasonably available control technology for major sources of VOCs and NO_x; and

5) Nonattainment new source review (NSR).[2]

The OTC members have also implemented a wide range of stationary, area, and mobile source controls on emissions of both volatile organic compounds and oxides of nitrogen. Since the OTC has no rulemaking authority, model rules and programs developed through the OTC process must be implemented by the individual states through their own rule adoption processes conforming to their state’s requirements.[3]

This proposal is founded on extensive atmospheric, monitoring, and other scientific data that demonstrates Maine emissions from those parts of the state being removed from the OTR do not significantly contribute to nonattainment of the ozone standard in Maine or any other state. When the OTR was first formed, parts of southern Maine were in non-attainment for ozone (northern Maine has always been in attainment of the ozone standard). Since then, as VOC and NO_x emission control measures and strategies have been implemented throughout the country, including more aggressive efforts within the OTR, corresponding ozone levels have decreased, and Maine no longer experiences the high ozone levels of the past.

Monitoring data demonstrates that all areas of the state proposed for removal from the OTR have been in attainment with the ozone NAAQS since 2004, and the entire state has been formally

[1] See CAA Section 176A.
[2] Nonattainment NSR requirements for Maine consists of lowest achievable emission rate (LAER) controls and emission offset requirements at a rate of at least 1.15:1.
[3] For an overview of ozone control programs developed by the OTC and their adoption and implementation by member jurisdictions, see https://otcair.org/document.asp?fview=modelrules

designated in attainment with the ozone NAAQS since 2007. Nevertheless, the entire state remains part of the OTR and is subject to the same air pollution control requirements as areas that continue to experience significant air quality problems such as the New York, New Jersey, and Connecticut nonattainment area. Maine is therefore petitioning the EPA to provide a more appropriate regulatory structure and programmatic flexibility by removing portions of the State from the OTR in accordance with CAA Section 176A(a)(2).

Legal Authority for This Petition and Its Approval

Under CAA Section 176A, the Administrator (of EPA) has the authority to remove any state or part of a state from the Ozone Transport Region when they have reason to believe that the control of emissions from this area will not significantly contribute to the attainment of the ozone standard anywhere within the OTR. CAA Section 176A states (emphasis added):

> 176A. Interstate transport commissions
>
> (a) Authority to establish interstate transport regions
>
> Whenever, on the Administrator's own motion or by petition from the Governor of any State, the Administrator has reason to believe that the interstate transport of air pollutants from one or more States contributes significantly to a violation of a national ambient air quality standard in one or more other States, the Administrator may establish, by rule, a transport region for such pollutant that includes such States. *The Administrator, on the Administrator's own motion or upon petition from the Governor of any State, or upon the recommendation of a transport commission established under subsection (b) of this Section, may—*
>
> (1) add any State or portion of a State to any region established under this subsection whenever the Administrator has reason to believe that the interstate transport of air pollutants from such State significantly contributes to a violation of the standard in the transport region, or
>
> *(2) remove any State or portion of a State from the region whenever the Administrator has reason to believe that the control of emissions in that State or portion of the State pursuant to this Section will not significantly contribute to the attainment of the standard in any area in the region*.
>
> The Administrator shall approve or disapprove any such petition or recommendation within 18 months of its receipt. The Administrator shall establish appropriate proceedings for public participation regarding such petitions and motions, including notice and comment.

This petition demonstrates that emissions from those areas of Maine being removed from the OTR will not significantly contribute to non-attainment of the standard in any area of the OTR, including the 111 cities, towns, and coastal islands in Maine’s ozone maintenance areas.

Maine’s Historical and Current Ozone Attainment Status

Ozone has been a pollutant of concern in Maine for many years. Under the 1990 Clean Air Act Amendments, nine Maine counties were designated as nonattainment of the 1-hour ozone NAAQS (0.12 parts per million (ppm)). Designated as "moderate nonattainment" were York, Cumberland, and Sagadahoc Counties (Planning Area 1); Androscoggin and Kennebec Counties (Planning Area 2); and Knox and Lincoln Counties (Planning Area 3); while Waldo and Hancock Counties (Planning Area 4) were designated as "marginal" nonattainment for ozone (see Figure 1).

After an extensive scientific review, EPA concluded that the 1-hour ozone standard did not provide sufficient health protection against extended periods of moderately elevated ozone, and on July 16, 1997, EPA issued updated final air quality standards for ozone. The 1997 8-hour ozone NAAQS (set at a level of 0.08 ppm) was based on an 8-hour average of ozone concentrations and more directly related to ozone concentrations associated with health effects.

Maine had two nonattainment areas under the 1997 ozone standard. The Portland Ozone Nonattainment Area consisted of 56 cities and towns in York, Cumberland, and Sagadahoc Counties along with the town of Durham in Androscoggin County and was designated as "marginal" nonattainment for the 1997 8-hour ozone standard (see Figure 2). The Midcoast Ozone Nonattainment Area consisted of 55 coastal towns and islands in Hancock, Knox, Lincoln, and Waldo counties and was designated as a "Basic/General" nonattainment area for the 8-hour ozone standard.

Based on 2003-2005 monitoring data, these areas were meeting the 1997 ozone NAAQS, and in 2006, the Department submitted a request to redesignate both areas to attainment and a 10-year maintenance plans pursuant to Section 175A of the CAA demonstrating that the areas will maintain compliance with the NAAQS for at least the next 10 years after EPA approval of the redesignation requests. The Department's redesignation requests were approved on December 11, 2006.[4]

In 2008, the national standard was again lowered to an 8-hour average of 75 parts per billion (ppb), and Maine was designated in attainment of this standard. In 2015, the standard was further lowered to an 8-hour average of 70 ppb, and again the state was designated in attainment for this standard. The following maps illustrate the progress made in lowering ozone levels in Maine (see Figure 3).[5]

[4] 71 FR 71489
[5] For an overview of Maine's ozone monitoring network, see Appendix A.

Figure 1: Maine's 1990 1-Hour Ozone Designations: Nonattainment & Maintenance Areas

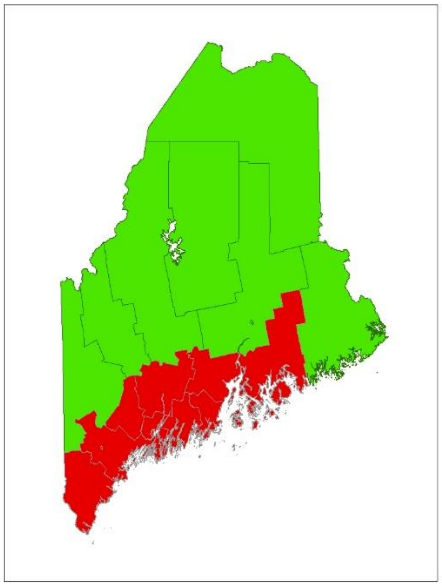


Figure 2: Maine's 1997 8-Hour Ozone Nonattainment Areas

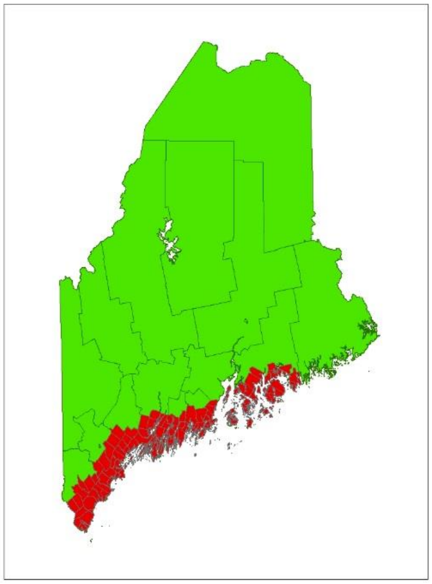


Figure 3: Maine's 2008 8-Hour Ozone Standard Designation: Attainment
Maine's 2015 8-Hour Ozone Standard Designation: Attainment/Unclassifiable Statewide

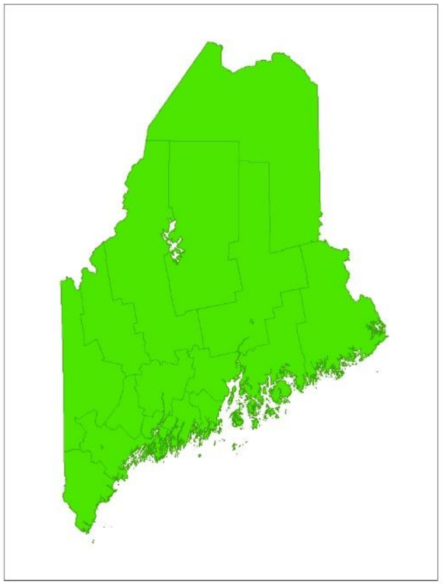
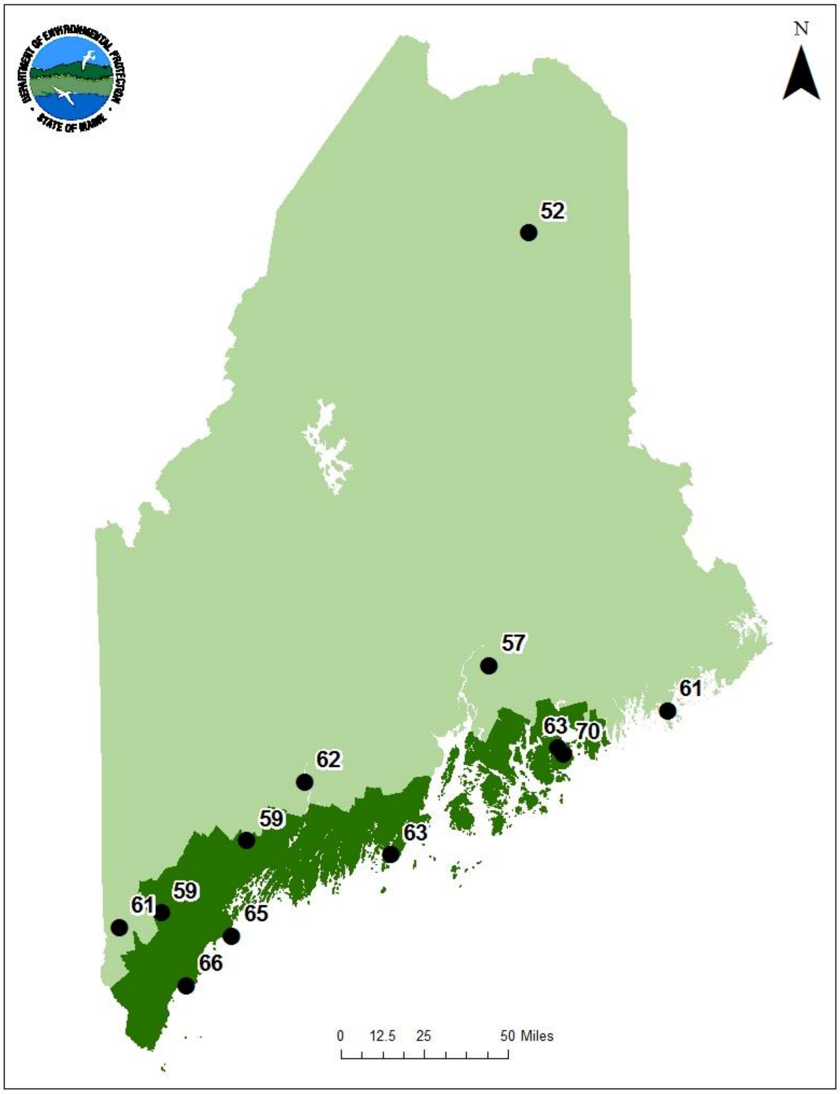


Figure 4 illustrates currently monitored ozone levels at monitoring sites throughout the State of Maine.[6] The areas proposed for removal from the OTR all have monitored ozone levels below 63 ppb, significantly below the 2015 ozone NAAQS of 70 ppb.[7]

Figure 4: Maine's Monitored Ozone 2016-2018 Design Values (based on data from 2016, 2017, and 2018)



[6] See Appendix B for a historical overview of Maine's ozone air quality status.

[7] Ozone air quality monitors within the State of Maine also confirm the presence and significance of transported ozone and its precursors. The ozone monitoring network in Maine extends along the coast from the photochemical assessment monitoring station (PAMS) located in Kittery, Maine (operated by the State of New Hampshire Department of Environmental Services) to as far as Acadia National Park. Maximum ozone concentrations along the Maine coast almost always follow a sequential pattern, with the most southerly sites monitoring daily ozone maximums in the mid to late afternoon and downwind sites experiencing maximum readings later in the day and into the evening hours.

Ozone Control Requirements in Maine

Due to its inclusion in the OTR, Maine has been required to implement the OTR regional requirements on a range of VOC and NO_x emission sources, including:

- Reasonably Available Control Technology (RACT) requirements for existing sources of VOC and NO_x emissions. (See Section 184(b)(1)(B) plan provisions for states in the OTR and Section 182(b)(C), VOC RACT).

- Reasonably available control technology with respect to all sources of volatile organic compounds in the state covered by a control techniques guideline issued before or after the date of enactment of the Clean Air Act Amendments of 1990 (See CAA Section 184 (b) (B)).

- Implementation of an enhanced motor vehicle emission inspection program in metropolitan statistical areas (or part thereof) with a population of 100,000 or more (See CAA Section 184 (b) (A)).

- Stage II vapor recovery program or equivalent. The CAA directs state or local air pollution control agencies with "moderate" or worse nonattainment areas for the ozone NAAQS to require Stage II vapor recovery systems at gasoline dispensing facilities as a control measure for VOC emissions.[8] (See CAA Section 182(b)).

- Nonattainment NSR requirements for new major stationary sources and major modifications for NO_x or VOC at existing sources, consisting of Lowest Achievable Emission Rate (LAER) control requirements and emission offset requirements. Specific control requirements are dependent upon the area's nonattainment designation. (See CAA Section 182(b)(5), Section 184(b)(2), Section 182 (f)).

These and other regulatory requirements are codified in the Department's 06-096 C.M.R. Chapters 100 through 166 which include several rules addressing the control of ozone precursors (See Appendix C).

OTR Nonattainment New Source Review Requirements and Impacts in Maine

Maine's inclusion in the OTR establishes a statewide requirement for nonattainment NSR pursuant to Section 184(b)(2) of the CAA. All areas of the state are treated as moderate nonattainment for ozone, and new major sources and major modifications of existing sources are subject to LAER control requirements and to offset their emissions at a 1.15:1 NSR offset ratio (i.e., new major

[8] Section 202(a)(6) of the CAA, 42 U.S.C. 7521(a)(6), provides the Environmental Protection Agency (EPA) with authority to waive the Stage II requirements of Section 182(b)(3) when on-board refueling vapor recovery (ORVR) systems are determined to be in widespread use throughout the motor vehicle fleet. EPA waived the Stage II requirements in Maine effective on August 14, 2017 (82 FR 32480).

sources and major modifications of existing sources must offset every ton of VOC and/or NO_x emissions by 1.15 tons of reductions).[9]

These statewide nonattainment NSR requirements have had an insignificant impact on ozone levels. Because of atmospheric transport patterns, Maine is overwhelmingly impacted by emissions of ozone and ozone precursors from upwind states.[10] While Maine DEP is supportive of regional approaches to controlling ozone and its precursor emissions, particularly the regional control of NO_x in those states and regions that have been shown to contribute significantly to downwind non-attainment and/or interfere with maintenance of the ozone standard, there is little or no technical justification for the application of these requirements throughout the entire State of Maine.

The statewide nonattainment NSR requirements in Maine have imposed additional regulatory hurdles for those wanting to invest in new and upgraded facilities and have failed to provide the intended environmental benefits. The cost of emission offsets, in conjunction with the requirement for the application of the most stringent emissions controls regardless of cost or disbenefits[11] is unwarranted for those areas of Maine that do not significantly impact any non-attainment areas.

The CAA provides tools to at least partially address this situation. Congress, in establishing the Section 182(f) NO_x waiver provisions of the CAA, recognized that additional NO_x emission reductions are not appropriate in certain cases, and that NO_x requirements shall not apply if the Administrator determines that any one of the following tests is met:

- In any area, the net air quality benefits are greater in the absence of NO_x reductions from the sources concerned;
- In nonattainment areas not within an ozone transport region, additional NO_x reductions would not contribute to ozone attainment in the area; or
- In nonattainment areas within an ozone transport region, additional NO_x reductions would not produce net ozone air quality benefits in the transport region.

Maine has applied for and received a Section 182(f) NO_x waiver on several previous occasions. On December 26, 1995[12], EPA approved the State of Maine's Section 182(f) NO_x waiver request for counties in northern and eastern Maine that were attaining the 1-hour ozone NAAQS applicable at that time (specifically, Aroostook, Franklin, Oxford, Penobscot, Piscataquis, Somerset, Washington, Hancock, and Waldo Counties). On February 3, 2006[13], EPA approved a Section 182(f) NO_x waiver request for a similar area in Maine (specifically, Aroostook, Franklin, Oxford, Penobscot, Piscataquis, Somerset, Washington, and portions of Hancock and Waldo Counties) in relation to the 1997 8-hour ozone NAAQS. Finally, on July 29, 2014, EPA approved

[9] Emission offsets are emission reductions, generally obtained from existing sources located in the vicinity of a proposed source which must (1) offset the emissions increase from the new major source or major modification; and (2) provide a net air quality benefit. EPA's initial emission offset policy (41 FR 55524, December 21, 1976) was developed to provide for industrial growth in areas not attaining the national ambient air quality standards.

[10] See Appendix D for a discussion of ozone transport to sites in Maine.

[11] Some VOC control options (e.g., thermal incineration) actually result in increased NO_x emissions.

[12] U.S. EPA, 1995a

[13] U.S. EPA, 2006a

a statewide Section 182(f) NO_x waiver for 2008 8-hour ozone NAAQS.[14] Thus, since December 1995, major stationary sources of NO_x in all or part of Maine have not been subject to either NOx RACT or the nonattainment NSR permitting requirements that are applicable throughout the OTR.[15]

Unfortunately, the CAA does not provide a similar VOC waiver process, and major stationary sources of VOC remain subject to nonattainment NSR requirements throughout the entire State of Maine, thereby providing the impetus for this petition.

II. Statement of Petition

Maine's Section 176(a)(2) Petition is based on a demonstration that NO_x and VOC emissions from those parts of Maine proposed for removal from the OTR are insignificant contributors to ozone nonattainment in other states. Maine DEP has also demonstrated that emissions from these areas are not significant contributors to nonattainment nor do they interfere with maintenance of the ozone NAAQS in those Maine municipalities that will remain in the OTR.

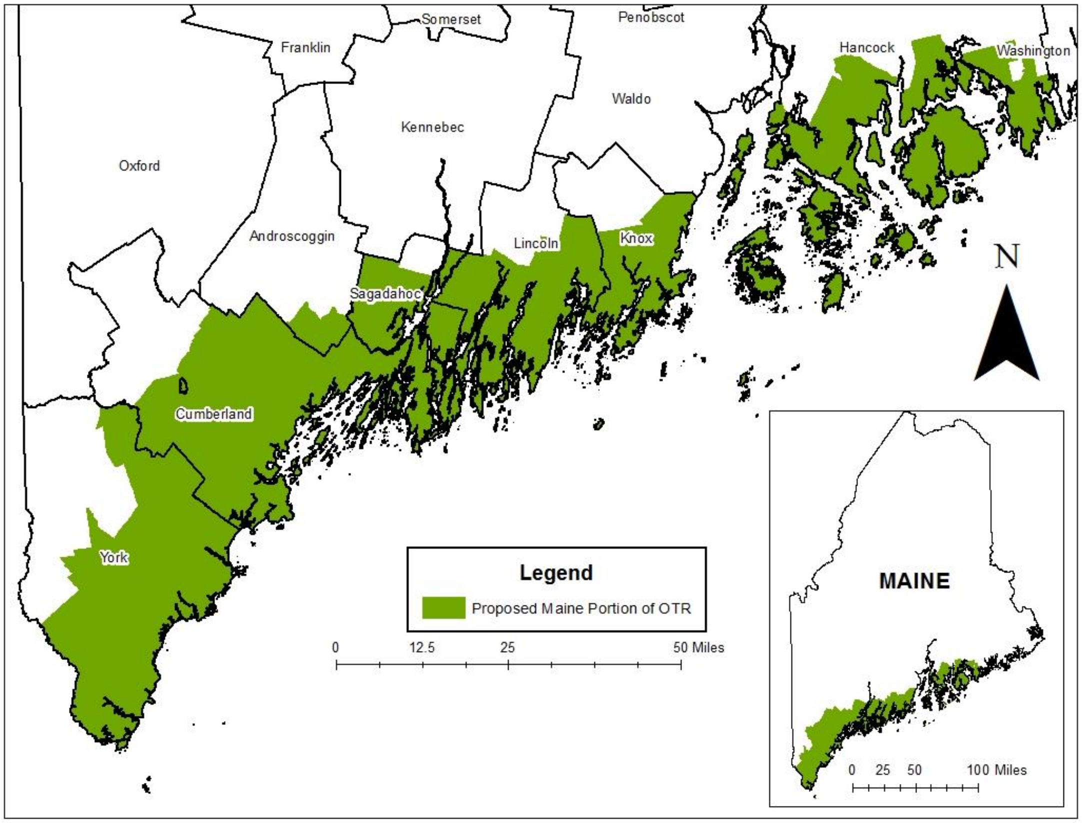
Maine DEP and EPA trajectory analyses demonstrate that Maine emissions were not transported toward the OTR on days when ozone exceedances were recorded. EPA's apportionment modeling for the 2008 and 2015 ozone NAAQS further demonstrates that Maine's contribution to every monitoring site in other states within the OTR is less than one percent of both the 2008 and the 2015 8-hour ozone NAAQS.

Maine hereby requests that the State of Maine be removed from the OTR per the CAA Section 176A(a)(2), except for Portland and Midcoast 8-hour Ozone Maintenance Areas as listed in Table 1 (above) and displayed in Figure 5, below.

Upon EPA's approval of this petition, nonattainment NSR will no longer be applicable except within the Portland and Midcoast Ozone Maintenance Areas. New major sources and major modifications of existing sources in those areas removed from the OTR will instead be subject to best available control technology (BACT) requirements that will allow the Department to fully consider both the environmental and economic impacts of specific emission control requirements. In addition, Maine is committing to the continued implementation of all other OTR requirements, including RACT for all sources of volatile organic compounds in the state covered by a control techniques guideline along with RACT for major sources of VOCs and NO_x and will periodically review the impact of emissions from those areas removed from the OTR on both other states and the Maine towns and cities remaining in the OTR.

[14] U.S. EPA, 2014
[15] Maine has not applied for Section 182(f) NO_x waiver under the 2015 8-hour ozone NAAQS.

Figure 5: Maine Municipalities to Remain in the OTR



III. Technical Analysis

Technical analyses included in this petition include 2016-2018 analyses of ozone exceedance day back trajectories, ozone apportionment modeling, and emissions data and an analysis of mobile source impacts. These analyses support the conclusion that NO_x and VOC emissions from that portion of Maine being removed from the OTR are insignificant contributors to ozone non-attainment in any other state and will not significantly impact ozone air quality within the 111 towns and cities of Maine remaining in the OTR.

A. Ozone Back Trajectory Analyses

A trajectory is a three-dimensional representation of the path an air parcel follows based on meteorological data. Forward trajectories are helpful for ascertaining if pollution was being transported from a single source to an area of interest, and back trajectories are helpful for ascertaining where transported pollution was being transported from multiple sources to a site of interest. The EPA's *Technical Guidance for Removing Areas from the Northeast Ozone Transport Region (OTR)* (U.S. EPA, 1995b) encourages the use of forward trajectories starting prior to an exceedance from the center of the area under consideration for removal from the OTR. Maine DEP, under EPA's guidance, used two-day back trajectories to exceedance monitor locations in the OTR. The primary reasons are to investigate whether or not Maine's emissions contribute to ozone levels at exceedance monitor locations in the OTR during exceedance days and to show the primary transport routes to those locations. Historically, EPA has accepted back trajectory analyses for the Maine NO_x Waiver requests, and EPA used back trajectories instead of forward trajectories for their modeling apportionment and 2015 ozone NAAQS proposed non-attainment area analyses. Science continues to support the use of back trajectory analyses for this petition. The two-day (48-hour) back trajectories for monitoring sites on exceedance days as included in this petition show conclusively that Maine's emissions do not significantly contribute to those monitored exceedances.

The National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory's Hybrid Single Particle Lagrangian Integrated Trajectory (HYSPLIT) Model (Draxler, 1997) is a computer model used to create and map trajectories. The model uses gridded meteorological data, which is selected with the online model's graphical user interface. For this analysis, the 'NAM 12km pressure' meteorological files were used, except for August 27, 2016, when no met data was available so the 'NAM 12km hybrid' meteorological data was used for that day. To ensure the hour of ozone matches with the correct hour of meteorology, the time of the ozone value was converted from Eastern Standard Time to Universal Time Code by adding 5 hours. The model was set to include vertical velocity. Using the HYSPLIT online version, Maine DEP staff meteorologists and an intern created the trajectories included in this analysis.

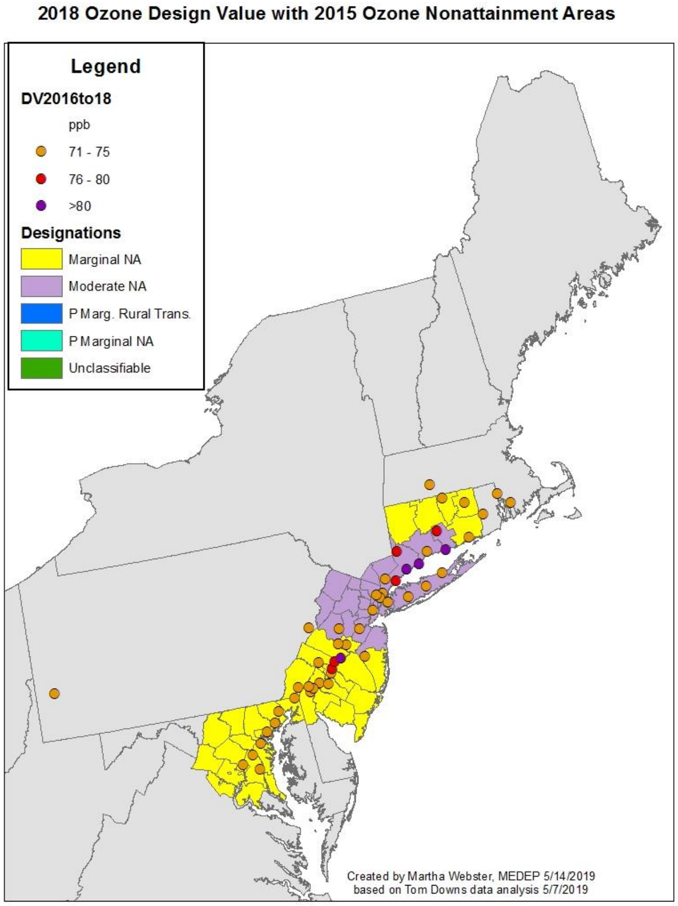
For each run, the HYSPLIT model generated both a graphical presentation of the trajectory, which was viewed as a quality check, and a text file of the hourly endpoints. The text file contains information about the hourly endpoints along each trajectory path including location in time and space. A total of 989 endpoint files were subsequently uploaded into an Access database for the analysis, resulting in 48,461 individual hourly endpoints for each height level, which was then mapped in ARCMAP, a geographical mapping tool used by Maine DEP.

<u>(1) 2016-2018 Back Trajectory Analyses for OTR Sites Monitoring Ozone Exceedances</u>

Maine DEP conducted back trajectory analyses for a total of 989 ozone exceedance days from the 2016 through 2018 ozone seasons at monitoring locations in the OTR with current Design Values exceeding the 2015 ozone NAAQS. These 48-hour back trajectories, using ending heights of 10 and 500 meters above ground level at a monitoring location, were created for the hour of maximum ozone for every day that an 8-hour ozone exceedance was recorded at the monitoring sites.

As shown by Figure 6, below, monitors that had 2016-2018 Design Values which exceeded the 2015 Ozone NAAQS in the OTR were the sites selected for the back trajectory analysis. (See Figures B-1 to B-3 in Appendix B for maps of design values for all monitoring sites within the northeast U.S. for each of the past three design value periods. The design value for a monitoring location is the average of each year's 4^{th} highest daily 8-hour maximum monitored concentration.)

Figure 6: Certain Ozone Monitors Recording Exceedances in the OTR



Figures 7 and 8 display the count per 25-mile square grid cell of hourly endpoints from all modeled back trajectories calculated for all days during the 2016-2018 ozone seasons when certain monitors in OTR exceeded the 2015 ozone NAAQS ending at 10m & 500m, respectively. This method demonstrates that Maine emissions are clearly insignificant contributors to ozone exceedances at OTR monitors outside the State of Maine. In addition, these maps highlight common transport paths from the southwest and the west, as illustrated by the darker colors. The area containing the greatest number of hours of atmospheric transport leading to ozone exceedances at those certain monitors is concentrated to the southwest, with almost no trajectory paths from Maine. Those that do originate over Maine are not near the surface but aloft and subsequently continue on over higher emission source areas before reaching the monitor site as presented in Figure 9.

Figures 7 & 8: HYSPLIT 2016-2018 48-hr Back Trajectory Frequencies for 10m and 500m ending heights for Monitors with DV Exceedances in the OTR

(a) **(b)**

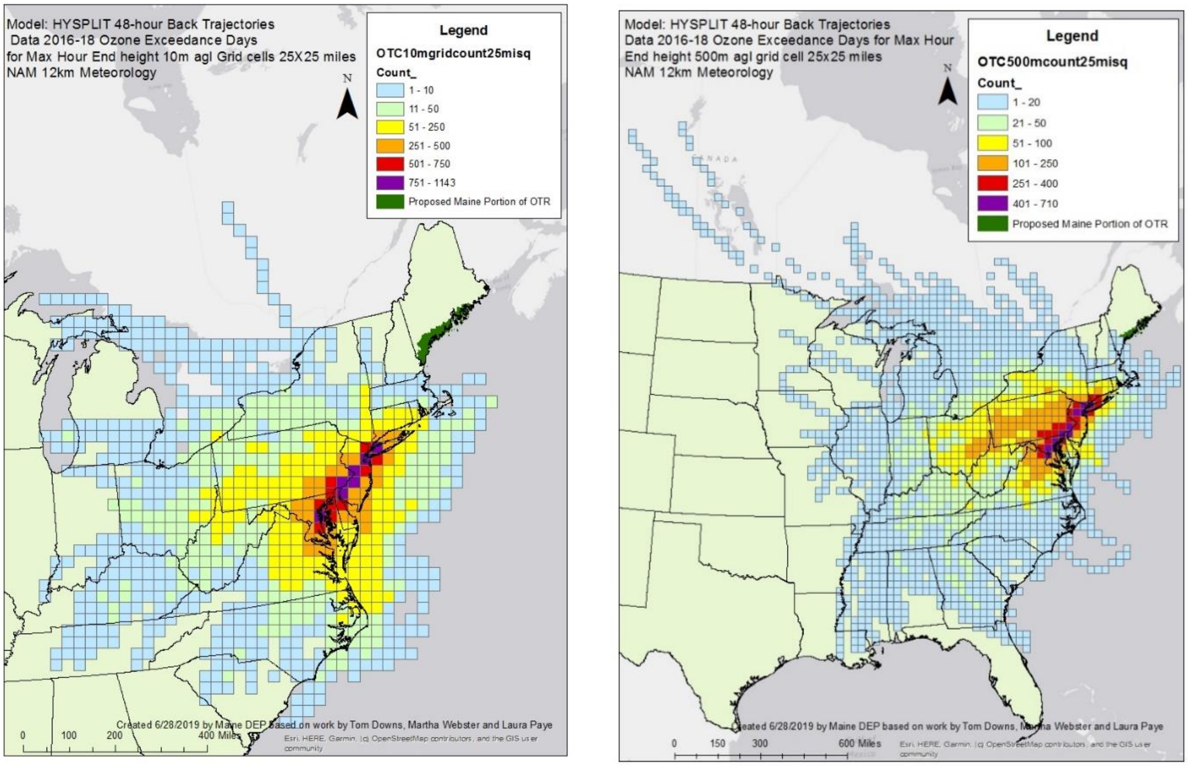
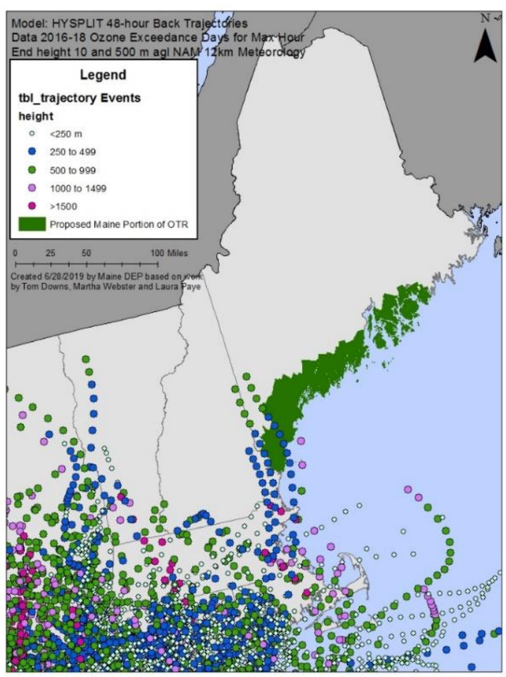


Figure 9: Close-Up of Trajectory Hourly Endpoints In or Near Maine

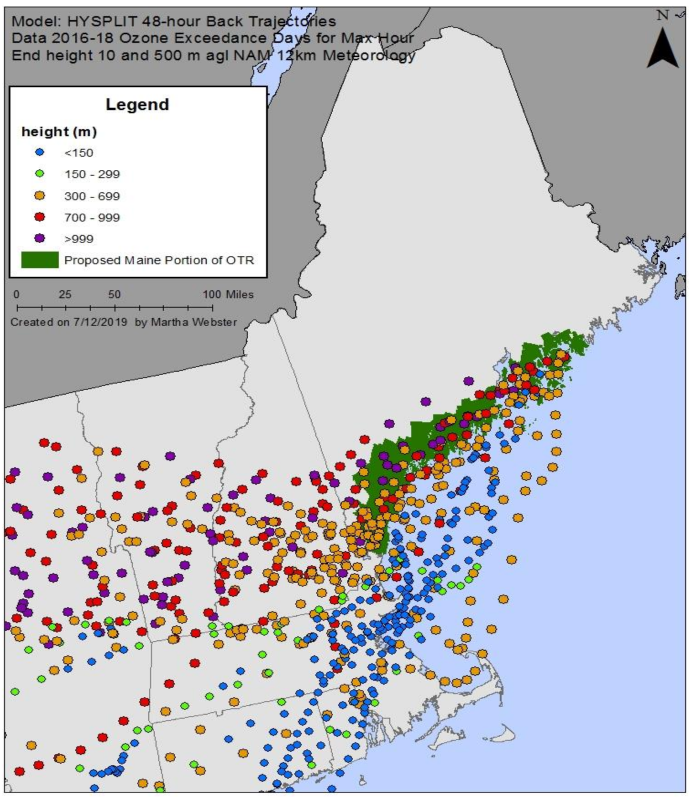


The trajectory analyses for monitors recording exceedances in the OTR demonstrate that emissions from Maine sources do not significantly contribute to ozone exceedances in the OTR outside of Maine.[16]

(2) 2016-2018 Back Trajectory Analyses for Maine Sites Monitoring Ozone Exceedances

Although 48-hour back trajectories conclusively demonstrate that Maine emissions do not significantly contribute to ozone exceedances in the OTR outside of Maine, an additional analysis is necessary to identify the source of transported emissions affecting the Portland and MidCoast Ozone Maintenance Areas. To that end, Maine DEP again utilized the HYSPLIT model to develop 48-hour back trajectories using ending heights of 10 and 500 meters above ground level for the hour of maximum ozone for every day that an 8-hour ozone exceedance was recorded at the monitoring sites in the maintenance areas. The results of this analysis are illustrated in Figure 10, which shows 1) transported emissions from areas south and west of Maine are significant contributors to elevated ozone levels along Maine's coast; and 2) emission from those areas of Maine being removed from the OTR do not significantly contribute to ozone levels in the maintenance areas.[17]

Figure 10: Close-Up of Trajectory Hourly Endpoints in the Portland and Midcoast Ozone Maintenance Areas



[16] See Appendix E for additional detailed New England 2013-2017 ozone back trajectory information.

(3) Back Trajectory Analyses Synthesis

Back trajectories utilizing the HYSPLIT model demonstrate that NO_x and VOC emissions from Maine sources are insignificant contributors to ozone NAAQS exceedances at OTR monitoring locations both outside and within Maine.

B. EPA Ozone Apportionment Modeling Results

EPA ozone apportionment modeling (U.S. EPA, 2018) can be used to help states determine ozone transport contributions from their state to other state's non-attainment and maintenance areas. Results from the Cross-State Air Pollution Rule (CSAPR) Update modeling for the 2008 ozone NAAQS and results from the recently released interstate transport modeling for the 2015 ozone NAAQS were evaluated in this document to determine Maine's contributions to non-attainment and maintenance monitors in the OTR. These results are useful to illustrate that emissions from Maine are insignificant contributors to ozone formation at certain monitors recording ozone exceedances in the OTR outside of Maine.

On September 7, 2016, EPA released results of ozone apportionment modeling and supporting documentation for the 2008 75 ppb 8-hour ozone NAAQS as part of the Cross-State Air Pollution Rule (CSAPR) Update (U.S. EPA, 2016a). The CSAPR Update modeling estimated 2017 emissions by growing out the 2011 base year emissions using 'on-the-books' regulations. The 2017 modeling case used the 'ek' version of the emission inventory. On March 27, 2018, EPA released a memo and supplemental information regarding Interstate Transport SIPs for the 2015 70 ppb 8-hour ozone NAAQS. In May 2018, EPA revised the contribution metric spreadsheet to include the most recent design values and information regarding state contributions.[18] The 2015 interstate transport modeling estimated 2023 emissions by growing out revised 2011 base year emissions using additional federal rules. The 2023 modeling case used the 'en' version of the emission inventory. Details of the 2011 Version 6.3 Platform 2011, 2017, and 2023 emission inventories used in the modeling analyses are located on the following EPA website: https://www.epa.gov/air-emissions-modeling/2011-version-63-platform. Among the key differences between 2011 emissions data used in CSAPR Update modeling and 2015 ozone NAAQS transport contribution modeling are updates to mobile source emissions, updated electric generating units (EGU) emissions, inclusion of forest fire emissions from border countries (Canada and Mexico), and additional federal rules.

Table 2 displays modeling results from both models. EPA's CSAPR Update modeling determined ozone design values in 2017 and each state's contribution to that value for the 2008 8-hr ozone NAAQS of 75 ppb. The same was done in the 2015 ozone NAAQS of 70 ppb interstate transport assessment for the year 2023. Information in Table 2 is the maximum contribution from Maine to any site in each OTR state that was included in either modeling, listed in descending order of Maine's ozone contribution based on CSAPR Update modeling data.

[18] https://www.epa.gov/airmarkets/memo-and-supplemental-information-regarding-interstate-transport-sips-2015-ozone-naaqs

Table 2: Maine's Maximum Modeled Ozone Contribution

OTR State	**2008 Ozone NAAQS CSAPR Update for 2017** (ppb)	**2015 Ozone NAAQS Transport Assessment for 2023 'en'** (ppb)
New Hampshire	0.47	n/a
Massachusetts	0.18	0.13
New Jersey	0.11	0.06
Connecticut	0.03	0.02
Pennsylvania	0.02	0.03
Rhode Island	0.02	0.02
New York	0.01	0.09
Virginia	0.01	0.00
Maryland	0.00	0.01
Delaware	0.00	0.00
District of Columbia	0.00	0.00

EPA uses a one percent threshold to identify a state as a significant contributor to ozone levels in another area. For the 2008 ozone NAAQS and 2015 ozone NAAQS, one percent equals 0.75 ppb and 0.70 ppb, respectively. In the CSAPR Update modeling, Maine's largest contribution to any other state is to New Hampshire (which is in attainment) at 0.47 ppb, which is less than one percent of the 2008 ozone NAAQS. In the 2015 Ozone Transport Assessment modeling, Maine's largest contribution to any other state is to Massachusetts at 0.13 ppb, which is less than one percent of the 2015 ozone NAAQS. Maine concludes that both modeling results for the 2008 8-hour ozone NAAQS and modeling results for the 2015 8-hour ozone NAAQS demonstrate that Maine emissions are insignificant contributors to ozone non-attainment issues in other states.

EPA's CSAPR Update modeling also determined 'non-attainment' and 'maintenance' monitor designations. In Table 3, sites determined to be either non-attainment or maintenance monitors within the OTR are listed in descending order of Maine's contribution. Modeling results in this table show Maine's highest contribution at these sites is 0.01 ppb, with all other sites displaying a zero contribution from Maine.

Table 3: CSAPR Update Model Determined Non-attainment and Maintenance Sites in the OTR

Monitor ID	State	County	2009-2013 Base Period Average Design Value (ppb)	2009-2013 Base Period Maximum Design Value (ppb)	2017 Modeled Average Design Value (ppb)	2017 Modeled Maximum Design Value (ppb)	Maine's Contri-bution (ppb)
90010017	Connecticut	Fairfield	80.3	83	74.1	76.6	0.01
90013007	Connecticut	Fairfield	84.3	89	75.5	79.7	0.00
90019003	Connecticut	Fairfield	83.7	87	76.5	79.5	0.00
90099002	Connecticut	New Haven	85.7	89	76.2	79.2	0.00
240251001	Maryland	Harford	90.0	93	78.8	81.4	0.00
360850067	New York	Richmond	81.3	83	75.8	77.4	0.00
361030002	New York	Suffolk	83.3	85	76.8	78.4	0.00
421010024	Pennsylvania	Philadelphia	83.3	87	73.6	76.9	0.00

EPA's 2015 Ozone NAAQS Interstate Ozone Transport Modeling also determined 'non-attainment' and 'maintenance' monitors, none of which are located within the State of Maine. In Table 4, the sites determined to be either non-attainment or maintenance monitors within the OTR are listed in descending order of Maine's contribution. The modeling results in this table show Maine's highest contribution at these sites is 0.01 ppb, with all other sites displaying a zero contribution from Maine. Although no sites in Maine were determined to be non-attainment or maintenance sites, modeling results are available for the Kennebunkport monitoring site on the coast in York County. The maximum modeled 2023 design value for the Kennebunkport site is 60.7 ppb, Maine's contribution to which was modeled to be 1.08 ppb. The total anthropogenic ozone contribution from upwind states was 96.9%. For both ozone standards, Maine emissions are insignificant contributors to non-attainment and maintenance within the OTR outside the State of Maine. Maine sources in southern and coastal Maine are a small but not insignificant contributor to ozone concentrations in the Portland and Midcoast Ozone Maintenance Areas that will remain in the OTR.

Table 4: Interstate Ozone Transport Model Determined Non-Attainment and Maintenance Sites in the OTR

Monitor ID	State	County	2009-2013 Base Period Maximum Design Value (ppb)	2023 Modeled Average Design Value (ppb)	2023 Modeled Maximum Design Value (ppb)	2014-2016 Design Value (ppb)	Maine's Contri-bution (ppb)
09-001-0017	Connecticut	Fairfield	83	68.9	71.2	80	0.01
09-001-3007	Connecticut	Fairfield	89	71.0	75.0	81	0.01
09-001-9003	Connecticut	Fairfield	87	73.0	75.9	85	0.00
09-009-9002	Connecticut	New Haven	89	69.9	72.6	76	0.01
24-025-1001	Maryland	Harford	93	70.9	73.3	73	0.00
36-081-0124	New York	Queens	80	70.2	72.0	69	0.00
36-103-0002	New York	Suffolk	85	74.0	75.5	72	0.01

Based on a combination of geography, ozone-event meteorology, and EPA modeling results, Maine DEP concludes that Maine's emissions are insignificant contributors to non-attainment areas in any other state. [19]

[19] To further solidify this conclusion, the Department has included trajectory analyses as found in EPA's Air Quality Modeling Technical Support Document (U.S. EPA, 2016b) for the CSAPR Update and EPA's 2017 Responses to States' Ozone NAAQS Designation Recommendations (EPA 2017) in Appendix F and G, respectively. EPA's own trajectory analyses further demonstrate that Maine does not significantly contribute to non-attainment within any other state. Trajectory analyses in the 2015 modeling technical support documents, Maine DEP's trajectory analyses, and EPA 2015 ozone designation trajectory analyses show no major transport pattern changes since 2012, the last year used in the CSAPR Update trajectory analysis.

C. Emissions Data Analysis

Using 2014 Version 2 National Emissions Inventory (NEI) emissions data (U.S. EPA, 2014b), NO_x and VOC emissions data for all states in the OTR were tallied by state into anthropogenic and biogenic source categories. Total annual anthropogenic NO_x emissions for the entire State of Maine are less than 3% of the OTR total, as displayed in Table 5. Total annual anthropogenic VOC emissions for the entire State of Maine are about 3% of the OTR total, as displayed in Table 5. [20]

Table 5: OTR 2014 NEI NO_x and VOC Emissions Inventory by State

OTR State	Annual NO_x Emissions (TPY)		Annual VOC Emissions (TPY)	
	Anthropogenic	Biogenic	Anthropogenic	Biogenic
Connecticut	63,019.90	576.08	82,522.18	60,645.85
Delaware	27,721.35	719.97	20,565.97	21,962.85
District of Columbia	8,566.19	12.26	8,938.94	1,350.28
Maine	52,408.39	2,413.13	58,856.94	436,878.38
Maryland	138,794.29	2,992.36	124,580.94	142,009.23
Massachusetts	127,360.88	868.61	85,986.39	97,680.93
New Hampshire	38,104.78	657.61	40,914.50	104,256.71
New Jersey	156,590.33	1,255.00	175,443.25	102,877.18
New York	330,989.12	8,620.89	413,841.85	381,551.21
Pennsylvania	493,292.79	9,343.22	486,451.82	439,423.86
Rhode Island	24,719.70	159.57	23,540.81	16,899.26
Vermont	15,717.13	1,205.02	27,669.60	79,524.71
Virginia	276,721.13	8,806.88	279,167.81	801,123.60
OTR Total	1,754,005.97	37,630.61	1,828,480.99	2,686,184.05
Maine's Portion	2.99%	6.41%	3.22%	16.26%

In addition to NEI total emissions data presented in Table 5, it is appropriate to consider emissions from within Maine that would be targeted for further reductions if all of Maine was to remain in the OTR. To provide perspective to Maine's emissions, Maine's point source emissions from the Maine Air Emissions Inventory Reporting System (MAIRIS) for NO_x and VOC have been trending downward over the last 25 years, as presented in Table 6 and Figure 11.

Table 6: Maine Point Source MAIRIS Emissions

Year	Annual VOC Emissions (Tons)	Annual NO_x Emissions (Tons)		Year	Annual VOC Emissions (Tons)	Annual NO_x Emissions (Tons)
1990	9,183	30,712		2007	5,022	17,743
1995	5,857	24,273		2008	4,253	16,557
2000	6,540	23,523		2009	3,267	13,359
2001	5,969	21,622		2010	3,767	13,814
2002	5,232	20,232		2011	3,429	13,101
2003	4,937	19,414		2012	3,397	13,469
2004	5,045	17,918		2013	3,629	12,569
2005	4,789	19,980		2014	3,042	11,962
2006	4,783	18,020		2015	2,839	10,850
				2016	2,623	9,829

[20] While other states in the OTR also have low emissions, Maine's emissions occur over a relatively large geographical area, and not only are emission levels from Maine sources comparatively small, but these emissions are not transported toward areas in the OTR when and where ozone exceedances are occurring.

Figure 11: Maine Point Source Emissions Trends

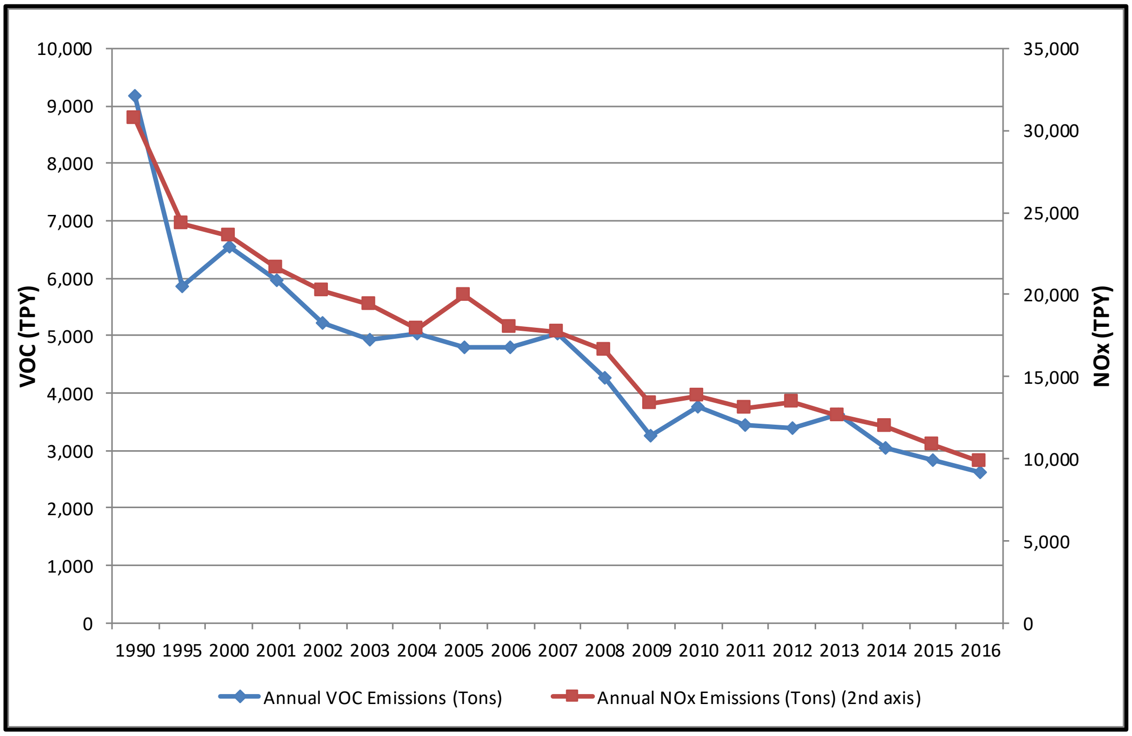


Table 7 along with Figures 12 and 13 show the latest 2011 and 2023 modeling emission inventories[21] for Maine's anthropogenic emissions using data for the sectors and from sources as identified in the table. Results show that emissions will remain significantly below 2011 levels in 2023, especially in the mobile source category that currently is the highest contributor.

Table 7: OTC 2011 Base Year Emissions / 2023 Gamma Emissions (tons per year)

Type	**Anthropogenic Emissions Sector**	**2023 Gamma Inventory**	**2011 NO_x**	**2011 VOC**	**2023 NO_x**	**2023 VOC**
Point	ERTAC Electric Generating Units (EGU)	ERTAC v2.7	575	44	240	19
Point	Non-EGU	MARAMA Gamma	12,942	3,458	11,766	3,280
Point	Oil & Gas	EPA v6.3 en	64	51	56	51
Subtotal			**13,581**	**3,552**	**12,062**	**3,351**
Mobile	Locomotive Marine (C1C2)	EPA v6.3 en	5,210	140	2,328	60
Mobile	Locomotive Rail	EPA v6.3 el			1,365	53
Mobile	Commercial Marine Vessels (C3)	EPA v6.3 en	1,215	41	1.079	71
Mobile	Non-road	EPA v6.3 en	6,734	26,464	4,552	15,427
Mobile	On-road	EPA v6.3 el	27,770	13,503	7,687	4,523
Subtotal			**40,928**	**40,148**	**17,011**	**20,134**
Area	Agricultural Burning (Agfire)	EPA v6.3 ek	1	2	1	1

[21] https://otcair.org/upload/Documents/Reports/OTC%20MANE-VU%202011%20Based%20Modeling%20Platform%20Support%20Document%20October%202018%20-%20Final.pdf

Type	Anthropogenic Emissions Sector	2023 Gamma Inventory	2011 NO_x	2011 VOC	2023 NO_x	2023 VOC
Area	Non-point	EPA v6.3 ek	4,367	13,216	2,723	12,242
Area	Prescribed Burning	2011 MARAMA Beta	43	971	43	971
Area	Residential Wood Combustion	EPA v6.3 el	485	7,048	458	6,342
Subtotal			**4,896**	**21,236**	**3,224**	**19,556**
TOTAL			**59,405**	**64,937**	**32,298**	**43,040**

Figure 12
Statewide VOC Emissions (tons per day)

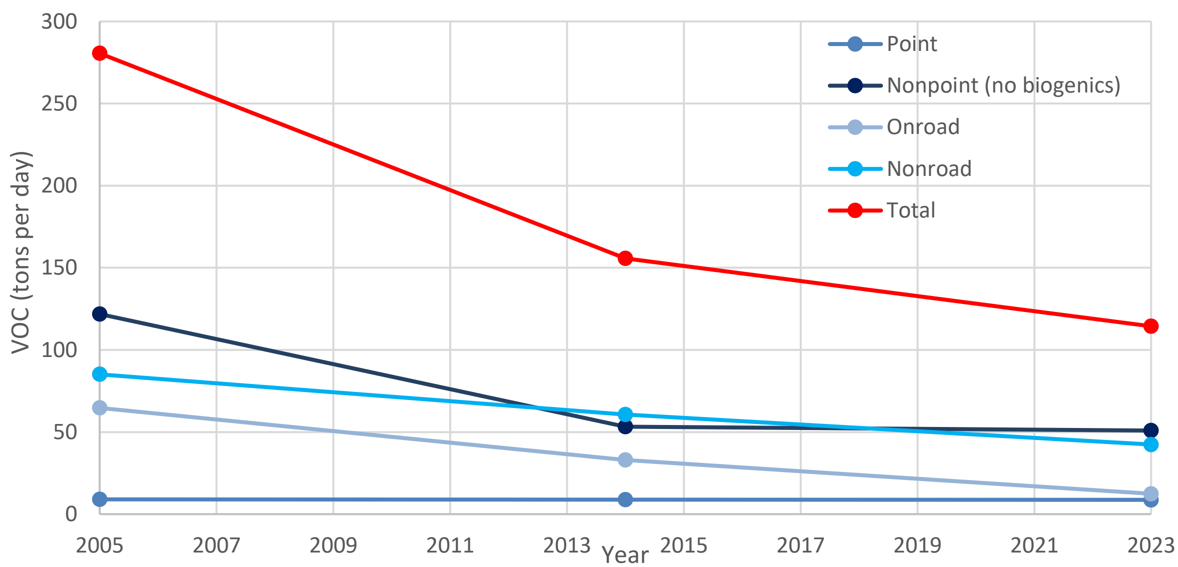
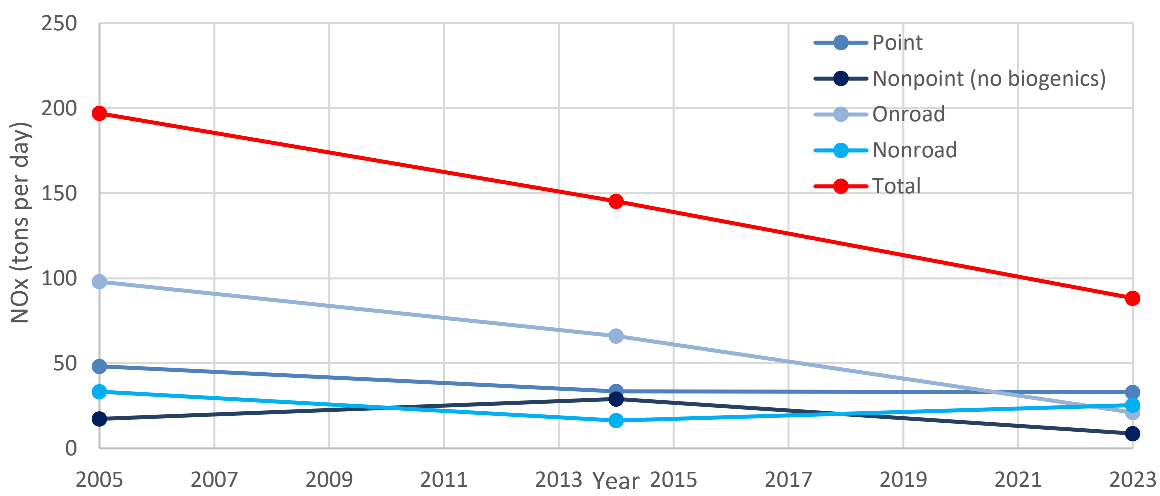


Figure 13
Statewide NO_x Emissions (tons per day)



Comparison of the 2005, 2014, and 2028 Inventories for the Portland and Midcoast Ozone Maintenance Areas

Figures 14 and 15 provide a comparison of the 2005 (redesignation), 2014, and 2028 (projected) NO_x and VOC inventories for the Portland and Midcoast Ozone Maintenance Areas and demonstrate in graphical form that emissions in this area have and will continue to decline. By 2028, total VOC emissions for the Portland ozone Maintenance Area are forecast to decline by more than 65 percent. NO_x emissions are forecast to decline even further, with the four-county area seeing a more than 72 percent decrease between 2005 and 2028. In the Midcoast Ozone Maintenance Area, VOC and NO_x emissions are forecast to decline by 67% and 59%, respectively.

Figure 14: Portland Ozone Maintenance Area
Total VOC and NO_x (tons per summer day)

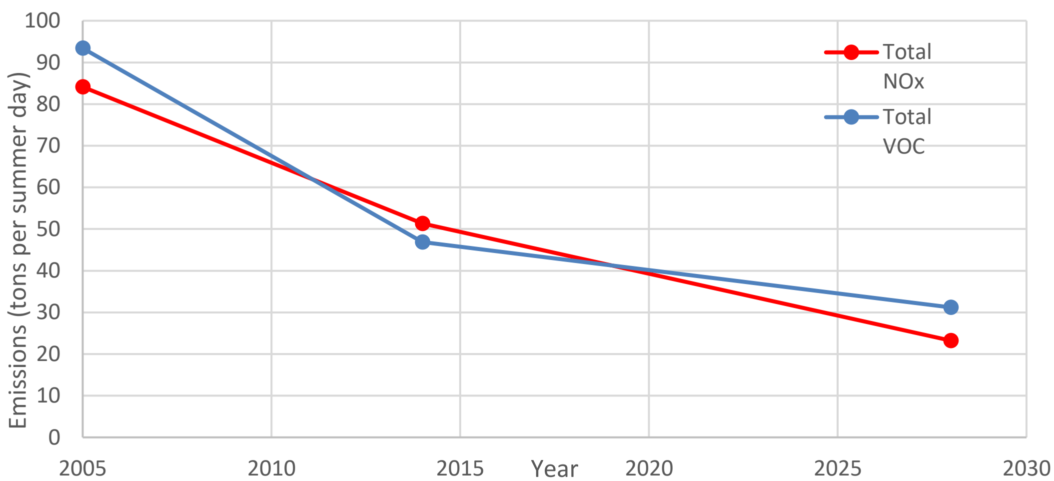
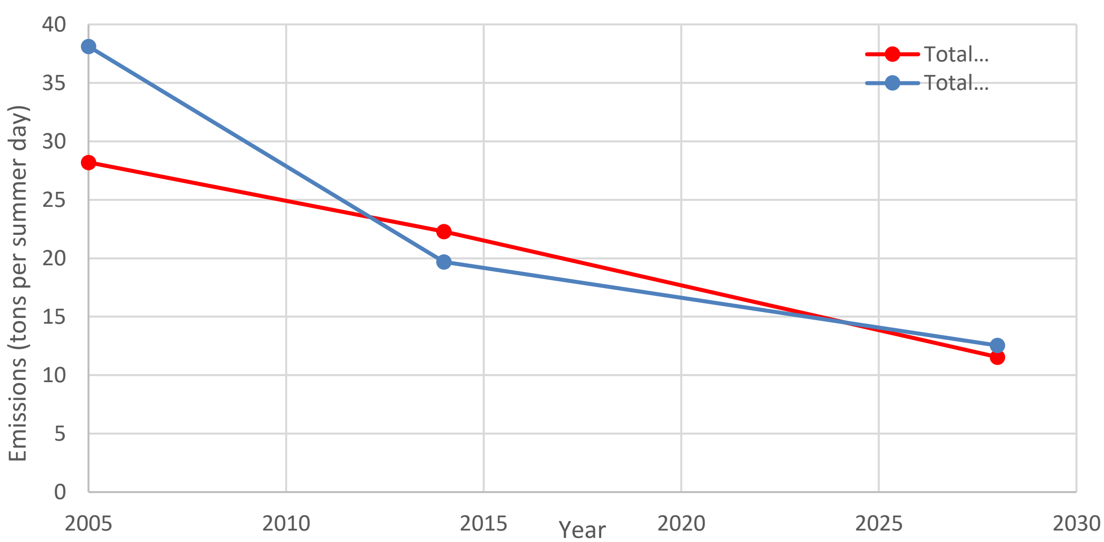


Figure 15: Midcoast Ozone Maintenance Area
Total VOC and NO_x (tons per summer day)



D. Mobile Source Impacts

EPA's technical guidance for removing regions from the OTR (U.S. EPA 1995b) encourages states to demonstrate that emissions from vehicles sold in the state will not impact air quality if driven in other OTR states.

Vehicles sold in the United States must be certified under one of two certification programs: the federal program (Tier 3) or the California program (the LEV Program). Section 177 of the Clean Air Act Amendments of 1990 provides states the ability to adopt the California program in lieu of the federal program as long as the adopted state program is identical to the California program and the state allows two model years' lead time from adoption to implementation. Maine is one of 13 states (along with the District of Columbia)[22] to adopt the more stringent LEV standards. Since Maine will continue to participate in the LEV program, vehicles purchased in Maine and driven in other OTR states will not emit more than vehicles purchased in other participating OTR states.

III. Anti-Backsliding Provisions and Emission Control Requirements

The "anti-backsliding" provisions in Section 110(l) of the CAA help to ensure that modifications to a state's SIP will not interfere with the attainment and maintenance of any of the NAAQS, reasonable further progress, or any applicable requirement of the CAA:

> "Each revision to an implementation plan submitted by a State under this chapter shall be adopted by such State after reasonable notice and public hearing. The Administrator shall not approve a revision of a plan if the revision would interfere with any applicable requirement concerning attainment and reasonable further progress (as defined in Section 171 of this title), or any other applicable requirement of this Act."

Maine's Section 176(A)(a)(2) Petition does not modify or remove existing programs or control measures currently in the Maine SIP[23], and controls for existing facilities in Maine will not be reduced upon removal of portions of the state from the OTR, thus ensuring that air quality does not degrade. This will also eliminate any potential for backsliding, consistent with anti-backsliding provisions of the CAA.

Regulatory requirements for new or expanding facilities in the Portland and Midcoast Ozone Maintenance Areas will not be relaxed from those currently required. New minor sources and modifications at minor sources in these areas will continue to be subject to Best Available Control Technology (BACT)[24], while new major sources and major modifications of existing sources will

[22] As of August 2019, nine states have adopted both California's zero emission vehicle (ZEV) program as well as the LEV standards: Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont. These nine "ZEV states" are following California's lead in requiring automakers to produce ZEVs to improve local air quality and reduce the emissions contributing to climate change. Four other states – Colorado, Delaware, Pennsylvania, and Washington – and the District of Columbia are following California's LEV standards but have not adopted the ZEV program.

[23] See 42 CFR Subpart U

[24] "Best Available Control Technology" means an emission limitation (including a visible emissions standard) based on the maximum degree of reduction for each pollutant emitted from or which results from the new or modified

still be subject to Lowest Achievable Emission Rate (LAER)[25] control requirements. Major new sources and major modifications of existing sources in these areas will also need to offset significant emissions increases of NO_x and of VOC. For that portion of the state removed from the OTR, minor and major new and modified sources will be subject to BACT control requirements.[26]

Furthermore, because the control of VOC and NO_x emissions provides a wide variety of health and environmental benefits (in addition to ozone reductions)[27], Maine will continue to implement the reasonably available control technology requirements (RACT) of CAA Section 182 on a statewide basis as a SIP strengthening measure.[28, 29]

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emissions unit which the Department, on a case-by-case basis and taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such emissions unit through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combination techniques for control of each pollutant. In no event shall application of BACT result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 C.F.R. Part 60 and 61 or any applicable emission standard established by the Department. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emission standard infeasible, a design, equipment, work practice, operational standard, or combination thereof may be prescribed instead to satisfy the requirement for the application of BACT. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.

[25] "Lowest Achievable Emission Rate" means the more stringent of the following: (a) The most stringent emission limitation contained in the implementation plan of any State for that class or category of source, unless the owner or operator of the proposed source demonstrates that those limitations are not achievable; or (b) The most stringent emission limitation which is achieved in practice by that class or category of source. In no event may LAER result in emission of any pollutant in excess of those standards and limitations promulgated pursuant to Section 111 or 112 of the United States Clean Air Act as amended, or any emission standard established by the Department.

[26] For Maine facilities, LAER emissions controls are not substantially different from those required by BACT. Controls for emissions from new or modified Maine sources after removal from the OTR will not appreciably differ from those required now; the most notable difference will be removal of the requirement to obtain emissions offsets for emissions of ozone precursors.

[27] NO_x causes a wide variety of health and environmental impacts because of the various compounds and derivatives constituting this class of compounds, such as nitrogen dioxide, nitric acid, nitrous acid, nitrates, and nitric oxide. In addition to ozone formation, NO_x is a contributor to acid rain, nitrogen deposition (eutrophication) in water bodies, particulate pollution, visibility impairment, global warming (nitrous oxide), and toxic chemicals (e.g., nitrate radicals, nitrosamines, and nitroarenes). VOC emissions contribute to particulate pollution and visibility degradation, and many VOCs are also hazardous air pollutants.

[28] The EPA has defined RACT as the lowest emission limitation a source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility (44 FR 53761, September 17, 1979).

[29] Section 182 of the CAA establishes two separate RACT requirements for ozone nonattainment areas. The first requirement, contained in Section 182(a)(A) of the CAA and referred to as RACT fix-up, requires the correction of RACT rules for which EPA identified deficiencies before the CAA was amended in 1990. The second requirement, set forth in Section 182(b)(2) of the CAA, applies to moderate or worse ozone nonattainment areas as well as to marginal and attainment areas in Ozone Transport Regions (OTRs) established pursuant to Section 184 of the CAA, and requires these nonattainment and OTR areas to implement RACT controls on all major VOC and NO_x emission sources and on all sources and source categories covered by a Control Techniques Guideline (CTG) or Alternative Control Techniques document issued by EPA.

IV. Periodic Implementation Plan Review

The Department is also committing to periodically review the contribution of emissions from those portions of Maine being removed from the OTR on non-attainment and maintenance of the ozone standard within the OTR, including the Portland and Midcoast Ozone Maintenance Areas. This review shall be conducted every five calendar years following the approval of Maine's Section 176A(a)(2) Petition or whenever the National Ambient Air Quality Standards for ozone are revised and shall include, at a minimum, a technical analysis utilizing back trajectories, available air quality apportionment modeling, and emissions data.

V. Summary of Results and Conclusions

CAA Section 176A(a)(2) states that EPA's Administrator may remove any state or portion of a state from the OTR whenever control of emissions in that state or portion of the state will "not significantly contribute to the attainment of the standard in any area in the region" (i.e., emissions without OTR-mandated controls will not contribute to non-attainment in any area in the OTR). Maine herein has provided conclusive proof that emissions from that portion of Maine to be removed from the OTR are insignificant contributors to non-attainment in any portion of the OTR, including Maine's Portland and Midcoast Ozone Maintenance Areas. Maine's technical demonstration includes the following:

- Back trajectories conducted by Maine DEP and EPA illustrating Maine's emissions are insignificant contributors to ozone transport in any non-attainment areas within the OTR. Thus, reductions of either NO_x or VOC emissions in Maine are irrelevant to bringing other areas of the OTR into attainment and do not impact ozone air quality in Maine's Portland and Midcoast Ozone Maintenance Areas.

- EPA's source apportionment modeling results for both the 2008 and 2015 ozone standards demonstrate that Maine's contribution to other states in the OTR is less than one percent.

- An analysis of Maine's emissions demonstrates that statewide VOC and NO_x emissions in 2023 are forecast to decline by more than 32% and 45%, respectively, from 2011 levels.

Removal of portions of Maine from the OTR and the elimination of nonattainment NSR requirements in this region will not interfere with attainment and maintenance of the ozone NAAQS or any other applicable requirement of the CAA in the 111 Maine towns and cities that will remain in the OTR. The application of VOC and NO_x RACT on a statewide basis as a SIP strengthening measure will help to guarantee the continued maintenance of ozone air quality throughout the state while providing ancillary benefits addressing a variety of air quality concerns, including regional haze, fine particulates, hazardous air pollutants, eutrophication, and acid deposition. Finally, the Department's Limited Maintenance Plans for the Portland and Midcoast Ozone Maintenance Areas and implementation plan review will ensure that ozone air quality throughout the state is reassessed on a periodic basis and that Maine DEP will swiftly address any violations of the ozone NAAQS.

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U.S. EPA, 2018, Interstate Air Pollution Transport website: https://www.epa.gov/airmarkets/interstate-air-pollution-transport

Appendix A: Maine's Ozone Monitoring Network

The DEP currently operates ground level ozone monitoring sites throughout the state in accordance with EPA SLAMS[30] network requirements. Three of the Maine DEP sites operate year-round while the remainder are "seasonal sites." The EPA operates a year-round ozone site in Ashland as part of CASTNet.[31] The ozone site in Howland is at tree top level, and the Portland Deering Oaks site is within a metropolitan setting, so the data from these two sites are not used for regulatory purposes. Two other ozone sites in Maine are operated by Maine Indian tribes. Situating an ozone monitor somewhere on the coast of Maine within the large gap between ozone sites at Cape Elizabeth and Port Clyde remains a Bureau of Air Quality objective. Although the federally required ozone season for Maine runs from April through September, most of the Maine sites now operate from the first of March through the first of October, weather permitting. The Maine sites are scattered throughout the state, with most of them situated along the coast and in southern Maine. The highest ozone concentrations tend to occur along the coast because plumes of contaminated air are often transported into the Gulf of Maine from metropolitan areas to the south. These air masses are subsequently blown ashore and carried inland. In addition to determining attainment/nonattainment status, the ozone sites in Maine collect data that is used by the mapping and forecasting programs to provide the public and scientific community with quality data in a timely fashion and to forecast air quality alerts when necessary. Table A-1 provides an overview of Maine DEP ozone monitoring sites.

[30] State & Local Air Monitoring Stations. The SLAMS in Maine are part of a standardized, national network administered by the EPA in accordance with the Clean Air Act and subsequent Federal Regulations. Every state must monitor for criteria air pollutants following strict criteria set by EPA that govern all aspects of the monitoring and reporting process. SLAMS sites must meet stringent monitor siting requirements and utilize specified equipment types. The pollution monitoring instruments at these sites must be approved by the EPA and be designated as either Federal Reference Method (FRM) or Federal Equivalence Method (FEM). In addition, SLAMS site operators must follow all quality assurance criteria and submit detailed quarterly and annual monitoring results to EPA. Data from SLAMS stations are used to determine attainment/nonattainment areas.

[31] The CASTNet (Clean Air Status and Trends Network) is a nationwide monitoring operation that collects air pollutant concentrations to evaluate the effectiveness of national and regional emission control programs, to determine compliance with the National Ambient Air Quality Standards for ozone, and to determine rural trends in ozone, nitrogen, and sulfur concentrations. It was established in 1991 as a cooperative program with the EPA, the National Park Service, and state and local partners. CASTNet site locations in Maine are in Ashland and Acadia. The data are now incorporated in several regional air quality models. https://www.epa.gov/castnet

Table A-1: Maine DEP Ozone Monitoring Sites

Ozone Monitoring Site Address	Monitoring Objective	Sampling Frequency
Ashland - Loring AFB	Background	Continuous
Bar Harbor - McFarland Hill	Transport, Background	Continuous
Bar Harbor - Top of Cadillac Mountain	Transport	Continuous - Seasonal
Bethel, Smith Farm Road	Max. Conc., Transport	Continuous - Seasonal
Cape Elizabeth - Two Lights State Park	Transport	Continuous
Durham - Fire Station - Route 9	Max. Concentration	Continuous - Seasonal
Gardiner - Pray Street, Schoolyard	Max. Conc., Transport	Continuous - Seasonal
Holden - Rider Bluff	Max. Conc., Transport	Continuous - Seasonal
Jonesport - Public Landing	Max. Concentration	Continuous - Seasonal
Kennebunkport - Parsons Way	Max. Conc., Transport	Continuous - Seasonal
Perry - Pleasant Point/Sipayik, 184 County Road	Tribal	Continuous
Port Clyde - Marshall Point Lighthouse	Max. Conc., Transport	Continuous - Seasonal
Portland - Deering Oaks	High Pop. Exposure	Continuous
Presque Isle - 8 Northern Road	-	Continuous
Shapleigh - Ball Park, West Newfield Road	Max. Conc., Transport	Continuous - Seasonal
West Buxton - Plains Road Fire Dept.	Transport	Continuous - Seasonal

Appendix B: 8-Hour Ozone Design Values in Maine and the Northeast U.S.

Figures B-1, B-2, and B-3 provide a geographic understanding of the region displaying the past three 2015 Ozone NAAQS design value periods. The core of the OTR (Washington, DC to southern New England) continues to experience the highest ozone levels in the northeast with monitors that record exceedances throughout that area. Figure B-3 represents the latest design value period of 2016-2018 and shows that the monitors nearest to Maine recording exceedances are in Rhode Island, Connecticut, and Massachusetts. Note that sites in Massachusetts and Rhode Island as well as the site on the summit of Cadillac Mountain in Maine were not exceeding the NAAQS during the 2014-2016 design value period, and the 2016-2018 design value is below the NAAQS at the summit of Cadillac Mountain.

Figure B-1: 2014-2016 8-hr Ozone Design Values

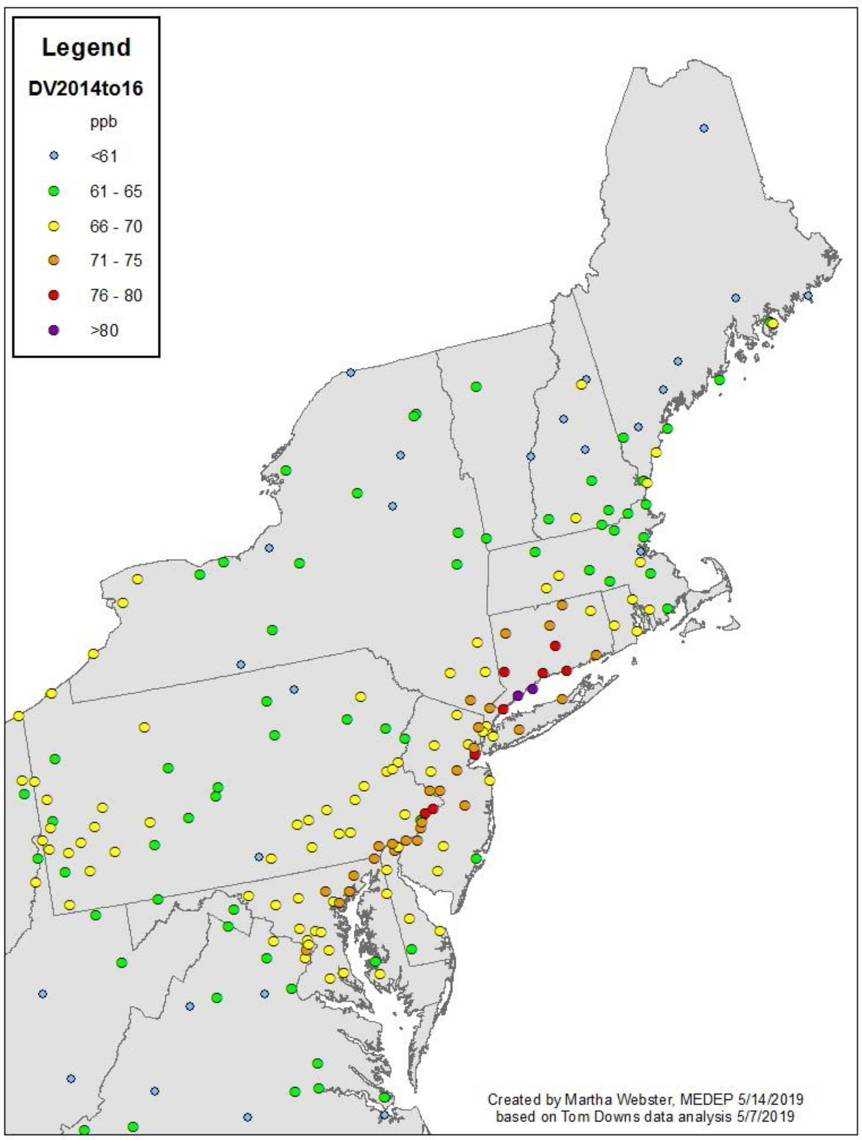


Figure B-2: 2015-2017 8-hr Ozone Design Values

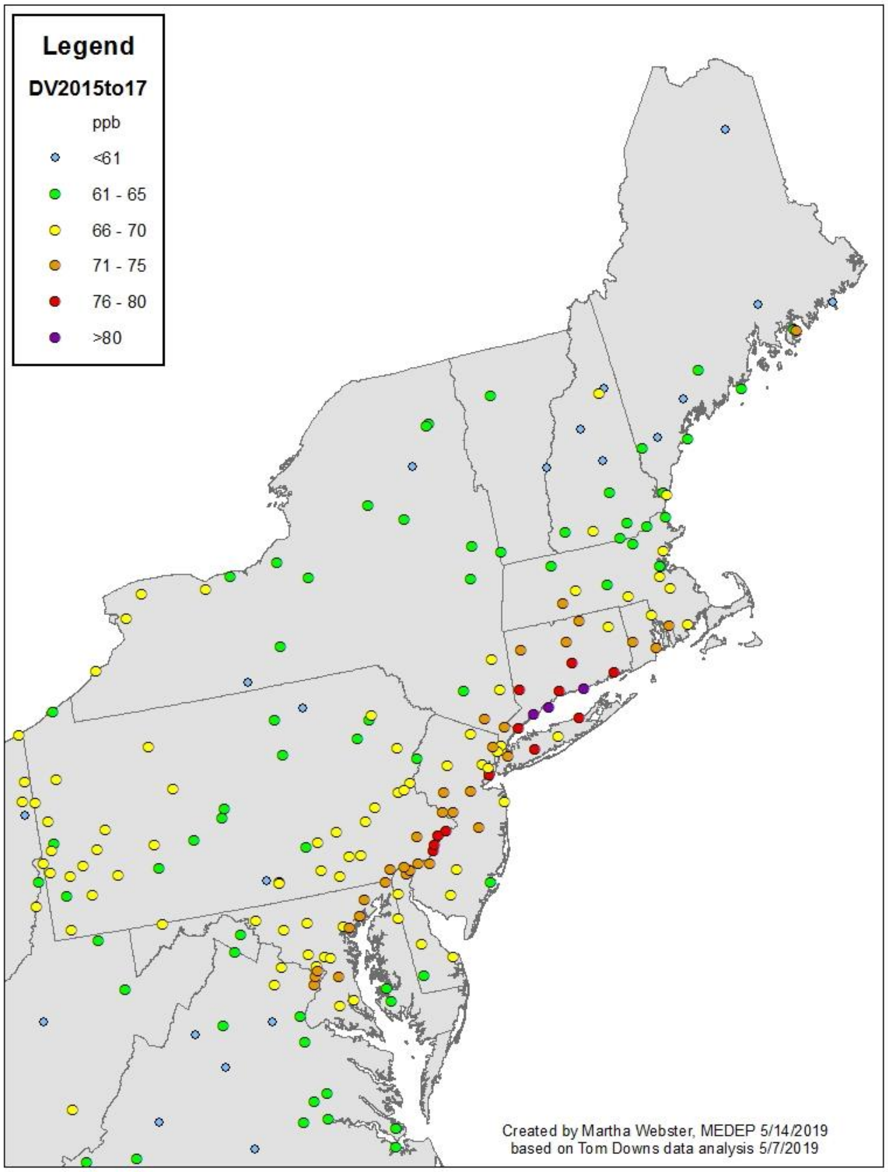
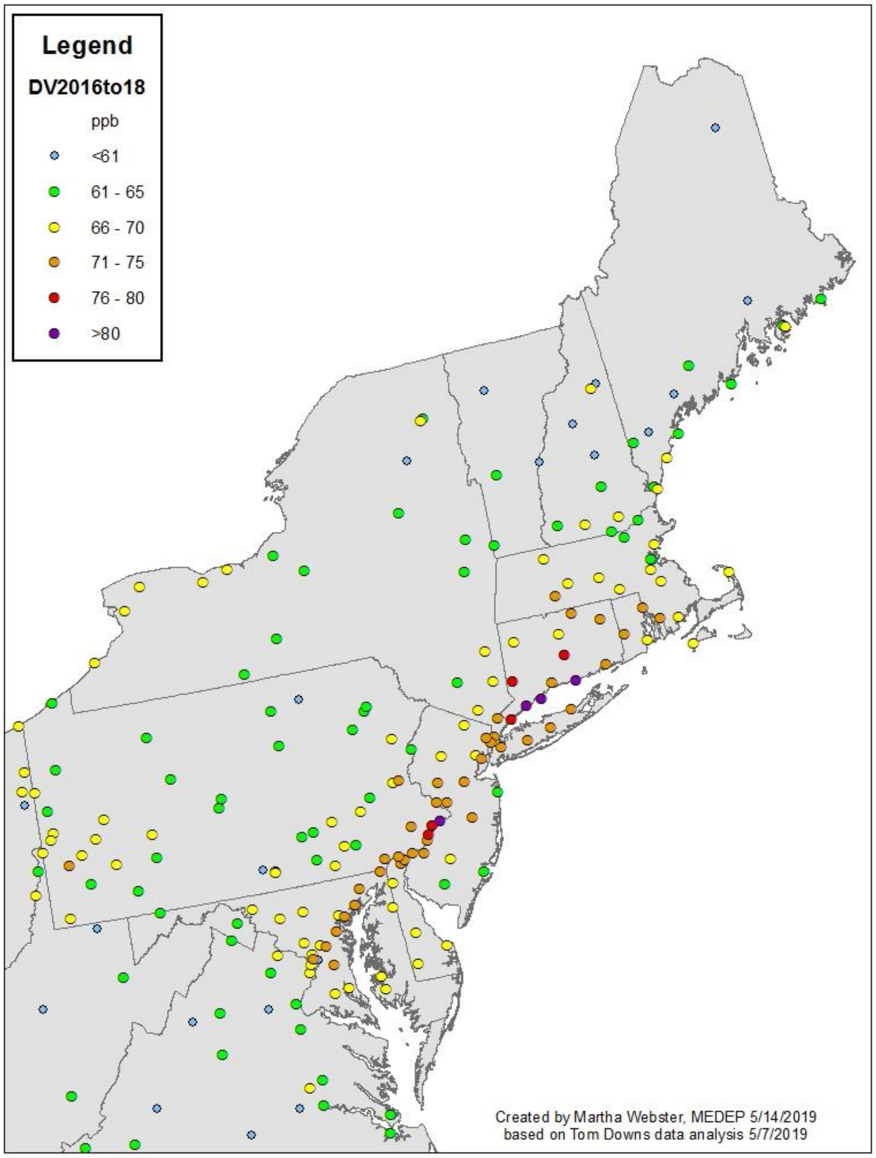


Figure B-3: 2016-2018 8-hr Ozone Design Values



Ozone values in Maine have been trending downward for years. Figure B-4 shows Maine's ozone design value trend. Table B-1 shows ozone data from the last five ozone seasons for all monitoring sites in Maine. Ozone design values for the entire State of Maine are currently below the 2015 8-hr Ozone NAAQS, as presented in Table B-1. Before 2017, the last year an ozone season 4th highest daily maximum ozone concentration was greater than 70 ppb at the summit of Cadillac Mountain was in 2010. Since 2017 was an anomalous year for transport to high elevations of Acadia National Park, Maine DEP fully expects the summit of Cadillac Mountain design value to continue to remain below 70 ppb.

Figure B-4: Maine's Statewide Maximum 8-hour Ozone Design Value Trends

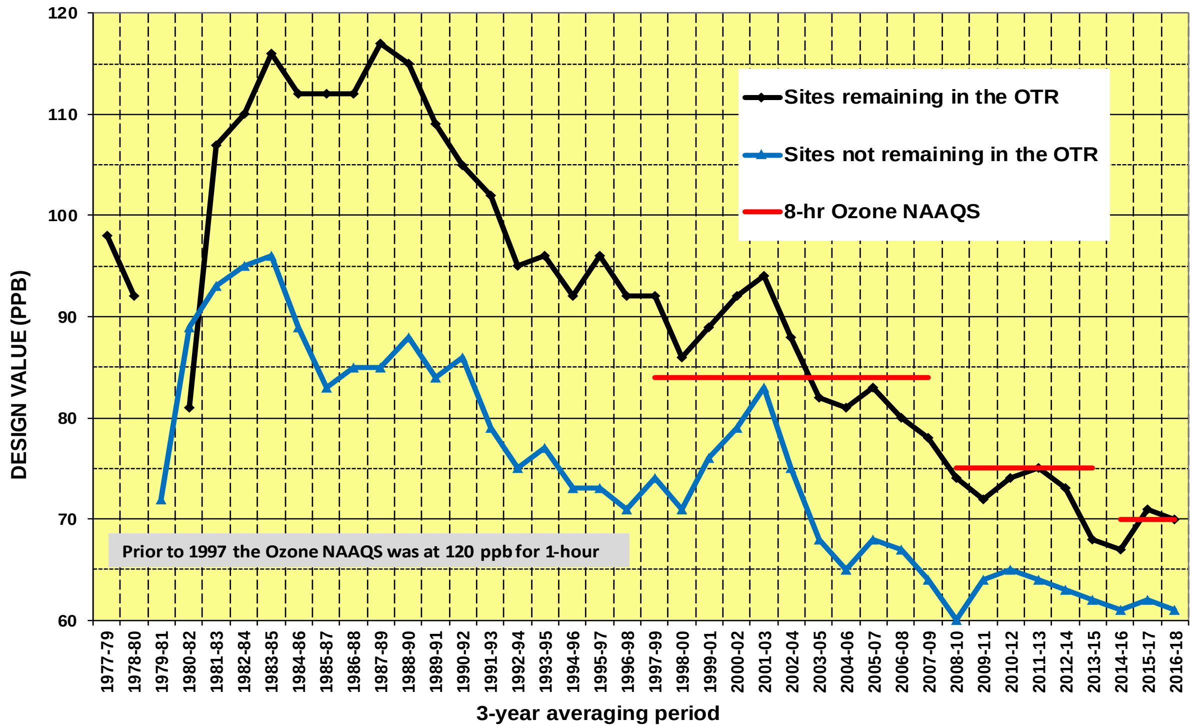


Table B-1: Maine's Ozone Data 2014-2018, Inclusive

Site Name	2014 4th Highest	2015 4th Highest	2016 4th Highest	2017 4th Highest	2018 4th Highest	2014-2016 Design Value	2015-2017 Design Value	2016-2018 Design Value
Sites in areas proposed to remain in the OTR								
Cadillac Mt Summit	65	69	66	80	64	66	71	70
Kennebunkport	66	67	68	62	68	67	65*	66
Cape Elizabeth	66	64	65	64	67	65	64	65
Port Clyde-Marshall Pt	61	67	63	62	64	63	64	63
McFarland Hill	62	65	60	67	64	62	64	63
Hollis/West Buxton	59	58	58	63	56	58	59	59
Bowdoinham	58	57						
Durham	65	58	57	62	59	60	59	59
Sites in areas proposed to be excluded from the OTR								
Gardiner-Pray	57	63	59	67	60	59	63	62
Shapleigh-Ballpark	61	62	61	64	60	61	62	61
Jonesport	54	62	57	62	65	57	60	61
Holden-Riders Bluff	54	63	57	60	56	58	60	57
Ashland	51	55	52	51	55	52	52	52
Bethel			54	59	58			
Sipayik	56	50		54	55			
MicMac	49		48					
North Lovell	53	53						
Penobscot Nation	51							

* Data recovery did not meet 3-year 90% requirements

Table B-2 Historic Ozone Actions and Status for Maine

Date	Action
1979	EPA promulgated a 1-hour Ozone NAAQS of 0.12 ppm.
1991	After promulgation of the Clean Air Act Amendments of 1990, EPA classified nine counties in Maine as non-attainment for the 1979 1-hour Ozone NAAQS: · Portland ME Non-Attainment Area (York, Cumberlan,d and Sagadahoc Counties), moderate non-attainment; · Lewiston-Auburn ME Non-Attainment Area (Androscoggin and Kennebec Counties), moderate non-attainment; · Knox & Lincoln Counties, moderate non-attainment; and · Hancock & Waldo Counties, marginal non-attainment.
December 26, 1995	*EPA granted a Section 182(f) NO_x Waiver for Maine for the 1979 1-hour Ozone NAAQS.*
April 28, 1997	EPA re-designated the Hancock & Waldo Counties area to attainment.
1997	EPA promulgated an 8-hour Ozone NAAQS of 0.08 ppm.
2004	EPA designated and classified 8-hour Ozone NAAQS non-attainment areas in Maine based on the 1997 Ozone NAAQS of an 8-hour average of 0.08 parts per million, as follows: · Portland, ME – Subpart 2 marginal non-attainment (includes Sagadahoc County and parts of Cumberland, York, and Androscoggin Counties); and · Hancock, Knox, Lincoln, and Waldo Counties, ME – Subpart 1 non-attainment (includes parts of each of the counties listed in the name).
June 15, 2005	EPA revoked the 1979 1-hour Ozone NAAQS.
2006	*EPA granted a Section 182(f) NO_x Waiver to Maine based on the 1997 8-hour Ozone NAAQS.*
January 10, 2007	Effective this date, Portland, ME and Hancock, Knox, Lincoln, and Waldo Counties, ME 8-hour ozone non-attainment areas were re-designated as attainment, becoming 175A maintenance areas.
2008	The 8-hour Ozone NAAQS was promulgated at 0.075 parts per million, which is equivalent to 75 parts per billion (ppb).
July 20, 2012	Maine was designated as attainment/unclassifiable for the 2008 NAAQS.
2014	*EPA granted a third Section 182(f) NO_x Waiver to Maine based on the 2008 8-hour Ozone NAAQS.*
April 6, 2015	EPA revoked the 1997 8-hour Ozone NAAQS.
October 2015	The 8-hour Ozone NAAQS was promulgated at 0.070 parts per million, which is equivalent to 70 parts per billion (ppb).
January16, 2018	Maine was designated as attainment/unclassifiable for the 2015 NAAQS

Appendix C: Maine Rules Addressing Ozone Precursors

A number of the Department's rules address the emissions and control of ozone precursors, including the following:

06-096 CMR Chapter 100 Definitions Regulation
06-096 CMR Chapter 110 Ambient Air Quality Standards
06-096 CMR Chapter 111 Petroleum Liquid Storage Vapor Control
06-096 CMR Chapter 112 Petroleum Liquids Transfer Vapor Recovery
06-096 CMR Chapter 113 Growth Offset Regulation
06-096 CMR Chapter 114 Classification of Air Quality Control Regions
06-096 CMR Chapter 115 Major and Minor Source Air Emission License Regulations
06-096 CMR Chapter 116 Prohibited Dispersion Techniques
06-096 CMR Chapter 117 Source Surveillance
06-096 CMR Chapter 118 Gasoline Dispensing Facilities Vapor Control
06-096 CMR Chapter 119 Motor Vehicle Fuel Volatility Limit
06-096 CMR Chapter 120 Gasoline Tank Truck Tightness Self-Certification
06-096 CMR Chapter 123 Paper Coating Regulation
06-096 CMR Chapter 126 Capture Efficiency Test Procedures
06-096 CMR Chapter 127 New Motor Vehicle Emission Standards
06-096 CMR Chapter 129 Surface Coating facilities
06-096 CMR Chapter 130 Solvent Degreasers
06-096 CMR Chapter 131 Cutback Asphalt and Emulsified Asphalt
06-096 CMR Chapter 132 Graphic Arts-Rotogravure and Flexography
06-096 CMR Chapter 133 Petroleum Liquids Transfer Vapor Recovery at Bulk Gasoline Plants
06-096 CMR Chapter 134 Reasonably Available Control Technology for Facilities that Emit Volatile Organic Compounds
06-096 CMR Chapter 137 Emission Statements
06-096 CMR Chapter 138 Reasonably Available Control Technology for Facilities that Emit Nitrogen Oxides
06-096 CMR Chapter 139 Transportation Conformity
06-096 CMR Chapter 140 Part 70 Air Emission License Regulations
06-096 CMR Chapter 143 New Source Performance Standards (NSPS)
06-096 CMR Chapter 145 NO_x Control Program
06-096 CMR Chapter 148 Emissions from Smaller-Scale Electric Generating Resources
06-096 CMR Chapter 151 Architectural and Industrial Maintenance (AIM) Coatings
06-096 CMR Chapter 152 Control of Emissions of Volatile Organic Compounds from Consumer Products
06-096 CMR Chapter 153 Mobile Equipment Repair and Refinishing
06-096 CMR Chapter 154 Control of Volatile Organic Compounds from Flexible Package Printing
06-096 CMR Chapter 159 Control of Volatile Organic Compounds from Adhesives and Sealants
06-096 CMR Chapter 161 Graphic Arts- Offset Lithography and Letterpress Printing
06-096 CMR Chapter 162 Control for Fiberglass Boat Manufacturing Materials
06-096 CMR Chapter 166 Industrial Cleaning Solvents

Appendix C-1: Control Techniques Guidelines Applicable to Maine Sources

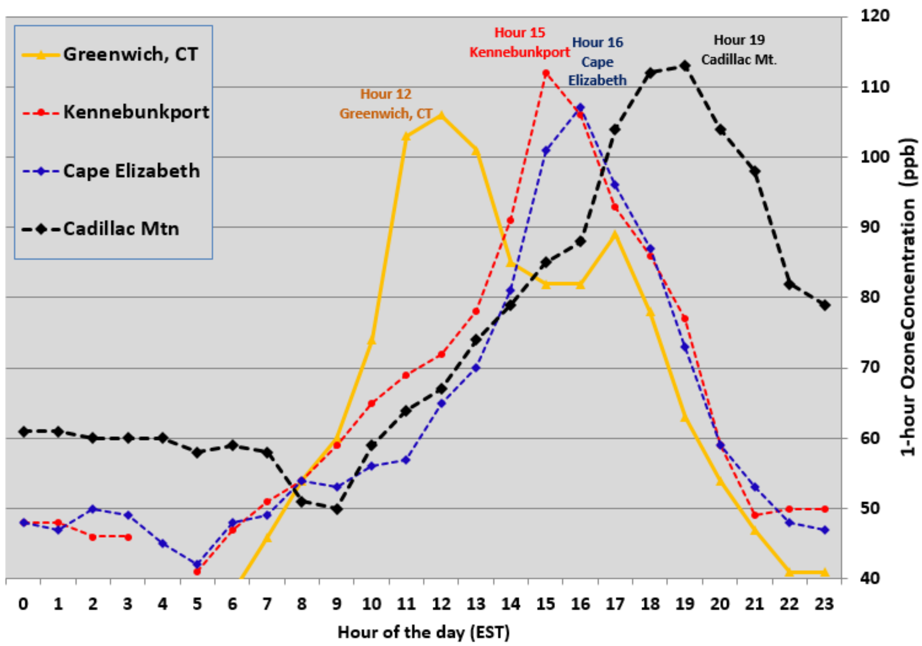
The following Control Techniques Guidelines (CTGs) currently apply to Maine:

- Design Criteria for Stage I Vapor Control Systems – Gasoline Service Stations
- Control of Volatile Organic Emissions from Existing Stationary Sources – Volume I: Control Methods for Surface Coating Operations
- Control of Volatile Organic Emissions from Existing Stationary Sources – Volume II: Surface Coating of Cans, Coils, Paper, Fabrics, Automobiles, and Light-Duty Trucks
- Control of Volatile Organic Emissions from Solvent Metal Cleaning
- Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VI: Surface Coating of Miscellaneous Metal Parts and Products
- Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VII: Factory Surface Coating of Flat Wood Paneling
- Control of Hydrocarbons from Tank Truck Gasoline Loading Terminals
- Control of Volatile Organic Emissions from Existing Stationary Sources – Volume III: Surface Coating of Metal Furniture
- Control of Volatile Organic Emissions from Existing Stationary Sources – Volume VIII: Graphic Arts-Rotogravure and Flexography
- Control of Volatile Organic Emissions from Bulk Gasoline Plants
- Control of Volatile Organic Emissions from Storage of Petroleum Liquids in Fixed-Roof Tanks
- Control of Volatile Organic Emissions from Use of Cutback Asphalt
- Control of Volatile Organic Emissions from Petroleum Liquid Storage in External Floating Roof Tanks
- Control of Volatile Organic Emissions from Perchloroethylene Dry Cleaning Systems
- Control of Volatile Organic Compound Leaks from Gasoline Tank Trucks and Vapor Collection Systems
- Control of Volatile Organic Compound Emissions from Wood Furniture Manufacturing Operations
- Control Techniques Guidelines for Shipbuilding and Ship Repair Operations (Surface Coating)
- Control Techniques Guidelines for Offset Lithographic Printing and Letterpress Printing
- Control Techniques Guidelines for Flexible Package Printing
- Aerospace (CTG & MACT)
- Control Techniques Guidelines for Flat Wood Paneling Coatings
- Control Techniques Guidelines for Paper, Film, and Foil Coatings
- Control Techniques Guidelines for Large Appliance Coatings
- Control Techniques Guidelines for Metal Furniture Coatings
- Control Techniques Guidelines for Miscellaneous Metal and Plastic Parts Coatings
- Control Techniques Guidelines for Fiberglass Boat Manufacturing Materials
- Control Techniques Guidelines for Miscellaneous Industrial Adhesives
- Ozone Transport Commission Model Rule for Architectural and Industrial Maintenance (AIM) Coatings
- Ozone Transport Commission Model Rule for Consumer Products
- Ozone Transport Commission Model Rule for Mobile Equipment Repair and Refinishing
- Ozone Transport Commission Model Rule for Portable Fuel Containers

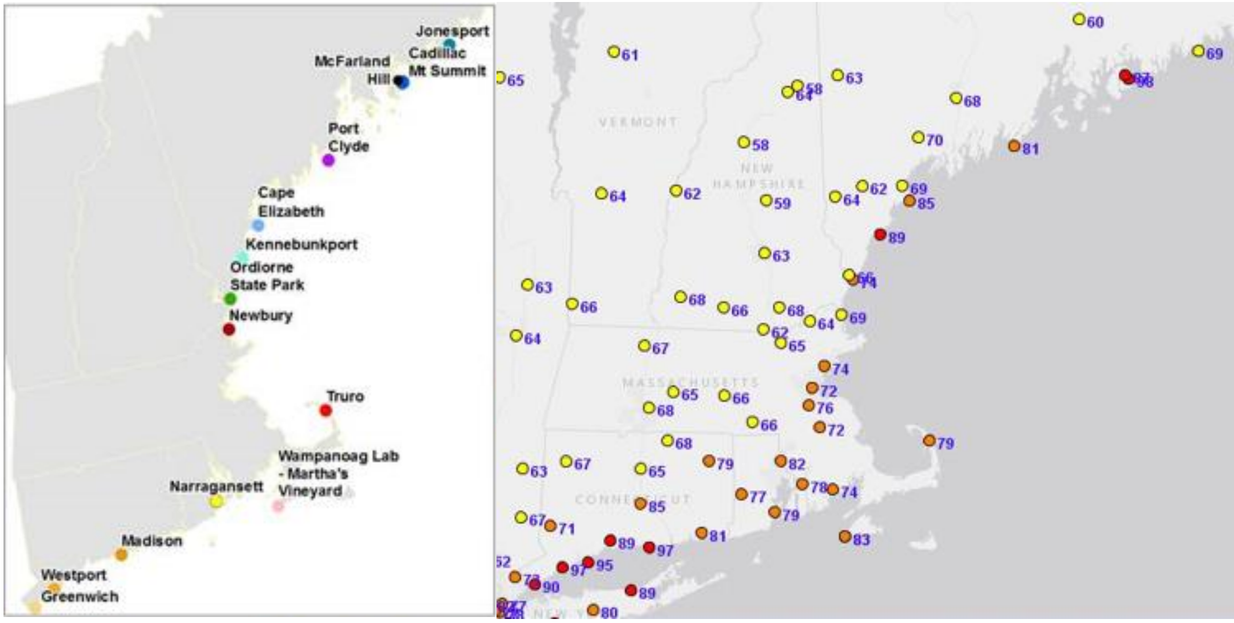
Appendix D: Time Series Analysis of Ozone Transport to Sites Along the Maine Coast

The primary ozone transport route to high elevations of Acadia National Park is over the Gulf of Maine and along the Maine coastline. Historically, during ozone events in Maine, peak ozone levels are monitored first along the southern Maine coast, then they are monitored later in the day at downwind locations as the air mass moves along the coastline to the Northeast. As an example, Figure D-1 shows the coastal track of a high-ozone air mass which occurred during the June 12, 2017, event, with peak ozone levels monitored at the summit of Cadillac Mountain four (4) hours after the peak ozone level was recorded at the Kennebunkport monitoring site and seven (7) hours after the peak ozone level was recorded at a Connecticut monitoring site just outside of New York City. Figure D-2(a) shows the locations of those sites, and Figure D-2(b) shows maximum 8-hour ozone concentrations in New England where exceedances occurred from southern New England to along the coast of Maine. Figure D-3(a), from NARSTO 2000 (formerly North American Research Strategy for Tropospheric Ozone), citing Blumenthal *et al*, 1997, shows typical transport patterns when ozone events occur in the Northeast (Blumenthal and NARSTO). Long-range (synoptic scale) transport aloft occurs from the Midwestern states. Regional scale transport occurs in nocturnal low-level jets over the northeast urban corridor, and sea breezes can transport ozone to coastal Maine. Trajectory analyses for Maine 2016-2018 ozone events in Figure 12 (previously shown in this document) show a similar transport pattern at the surface and aloft. Figure D-3(b) shows surface wind streams during the afternoon of June 12, 2017, where the sea breeze transport pattern matches the historical transport pattern for ozone events along the Maine coast.

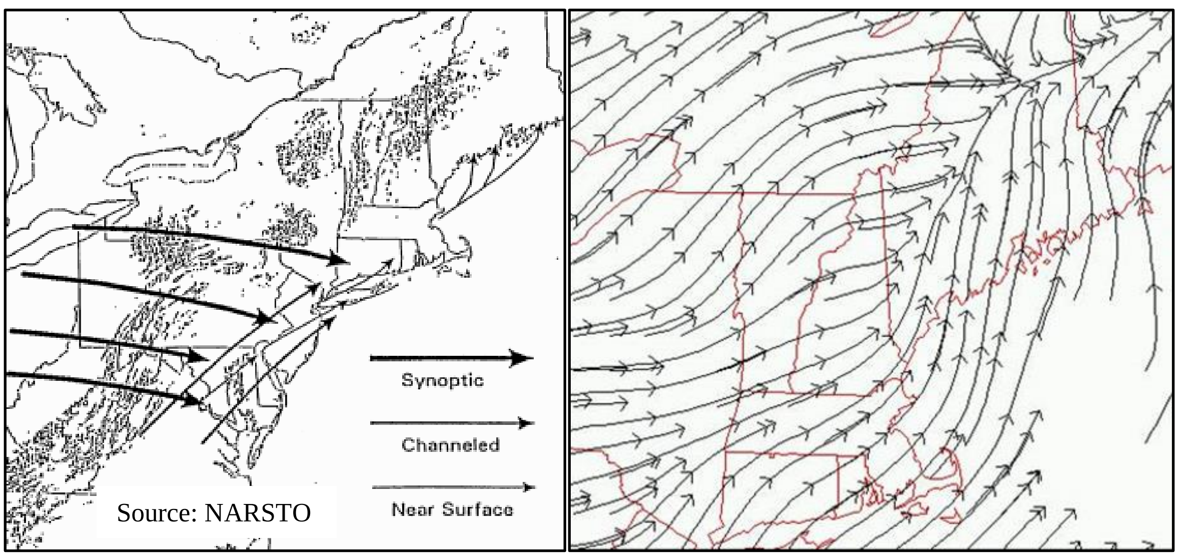
Figure D-1: June 12, 2017 Hourly Ozone Concentrations (ppb) at a Site Near New York City and at Sites Along the Coast of Maine



Figures D-2(a) and (b): Coastal Ozone Monitoring Sites in New England and Maximum 8-Hour Ozone Levels (ppb) During June 12, 2017



Figures D-3(a) and (b): Historical Ozone Transport Routes in the Northeast and June 12, 2017 1 PM (18Z) Surface Wind Streamlines



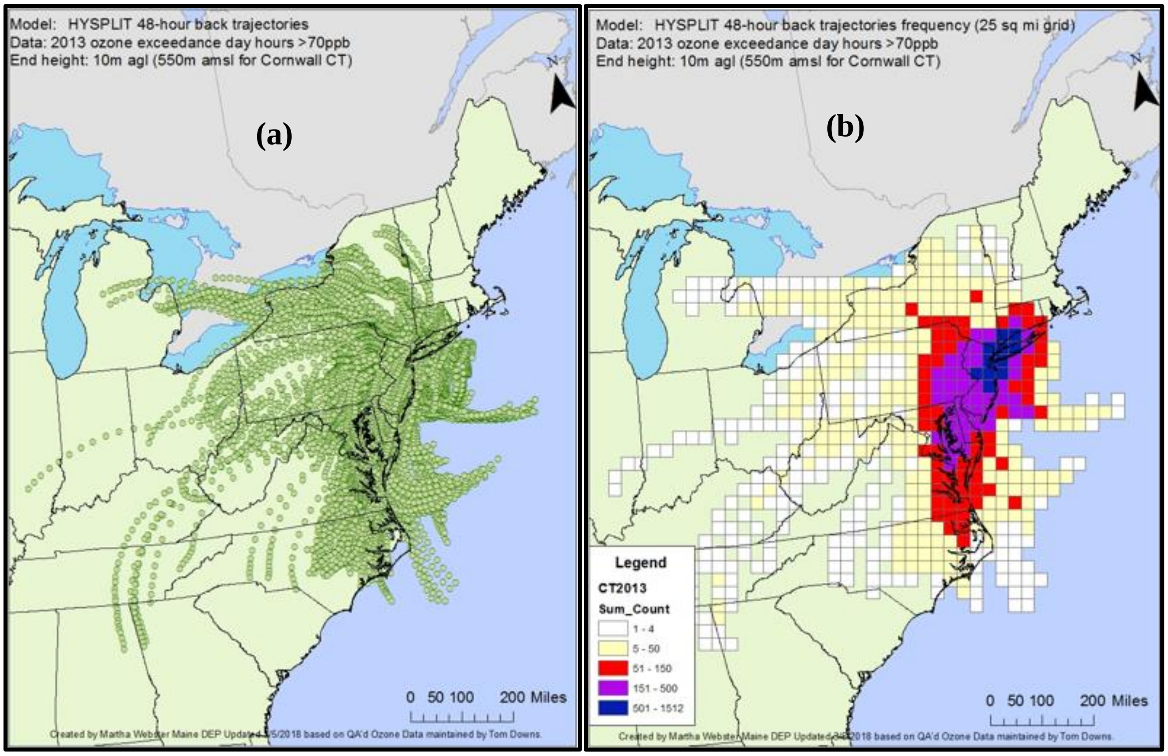
Appendix E: New England Ozone Back Trajectory Information

The National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory's HYSPLIT is a computer model used to create and map trajectories. The model uses gridded meteorological data, which is selected with the online model's graphical user interface. Using the HYSPLIT online version, Maine DEP staff meteorologists created the trajectories included in this analysis.

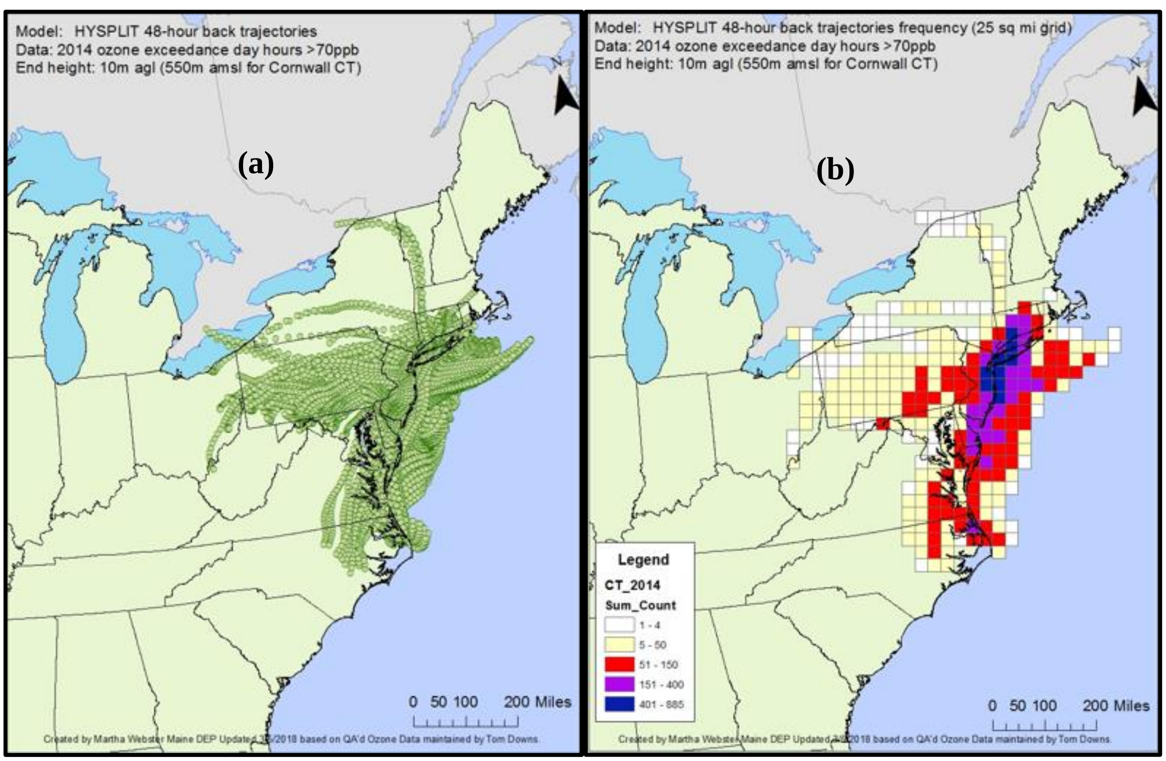
The 48-hour back trajectories created for this petition were only for hours when ozone levels exceeded 70 ppb for every day that an 8-hour ozone exceedance was recorded during 2013-2017 ozone seasons at certain monitoring sites (based on 2015-2017 ozone design values) in Massachusetts, Rhode Island, and Connecticut. To ensure the end hour of ozone matches with the end hour of meteorology, the time of the ozone value was converted from Eastern Standard Time (EST) to Universal Time Code (UTC) by adding 5 hours. Archived Eta Data Assimilation System (EDAS) meteorological data at 40 kilometers grid resolution was used. The model was set to include vertical velocity. For most sites, trajectories were initialized at 10-meters above ground level. For high elevation sites in Maine and Connecticut, trajectories were initialized at the elevation of the site above mean sea level. For example, the ending height at the Cornwall Site in Connecticut was 505 meters above mean sea level.

For each run, the HYSPLIT model generated both a graphical presentation of the trajectories and a text file. The text file contains information about the hourly endpoints along each trajectory path including location in time and space. Hundreds of endpoint text files were subsequently loaded into an Access database for the analysis, which was then mapped in ARCMAP, a geographic mapping tool used by the Maine DEP. Figures E-1 to E-11 show the resulting trajectories and trajectory frequency plots by state by year.

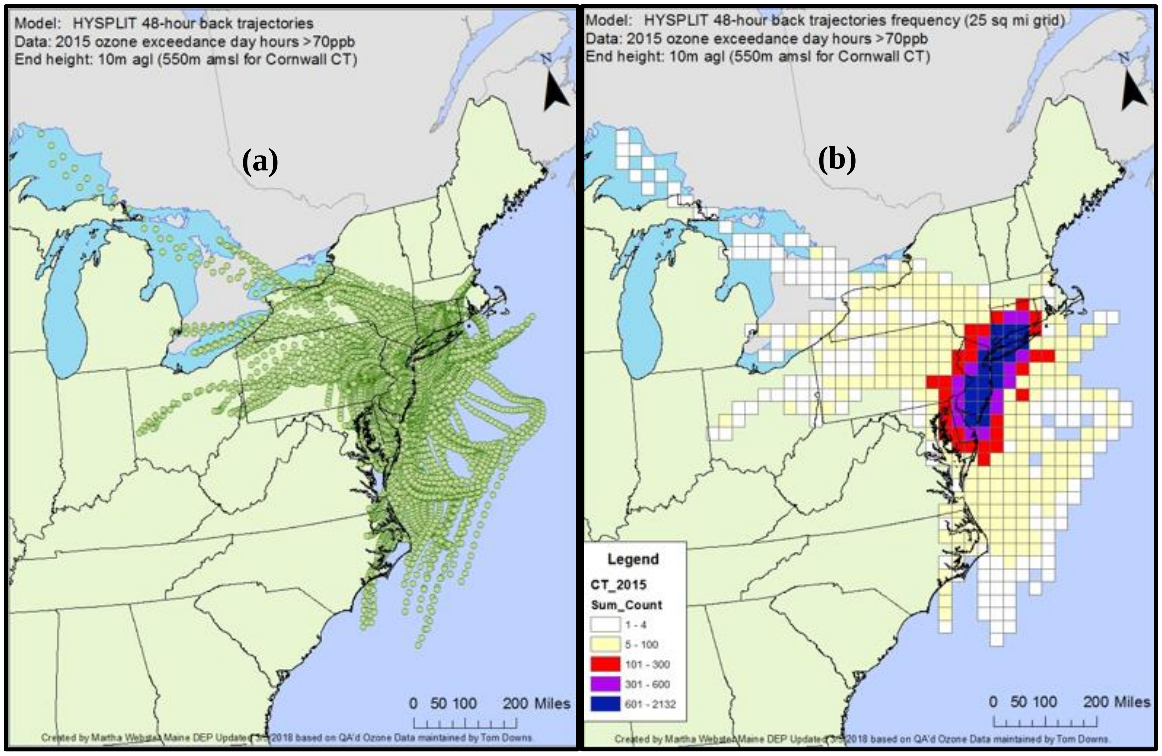
Figures E-1(a) and (b): HYSPLIT 2013 48-hour Back Trajectories and Trajectory Frequencies for Monitors in Connecticut



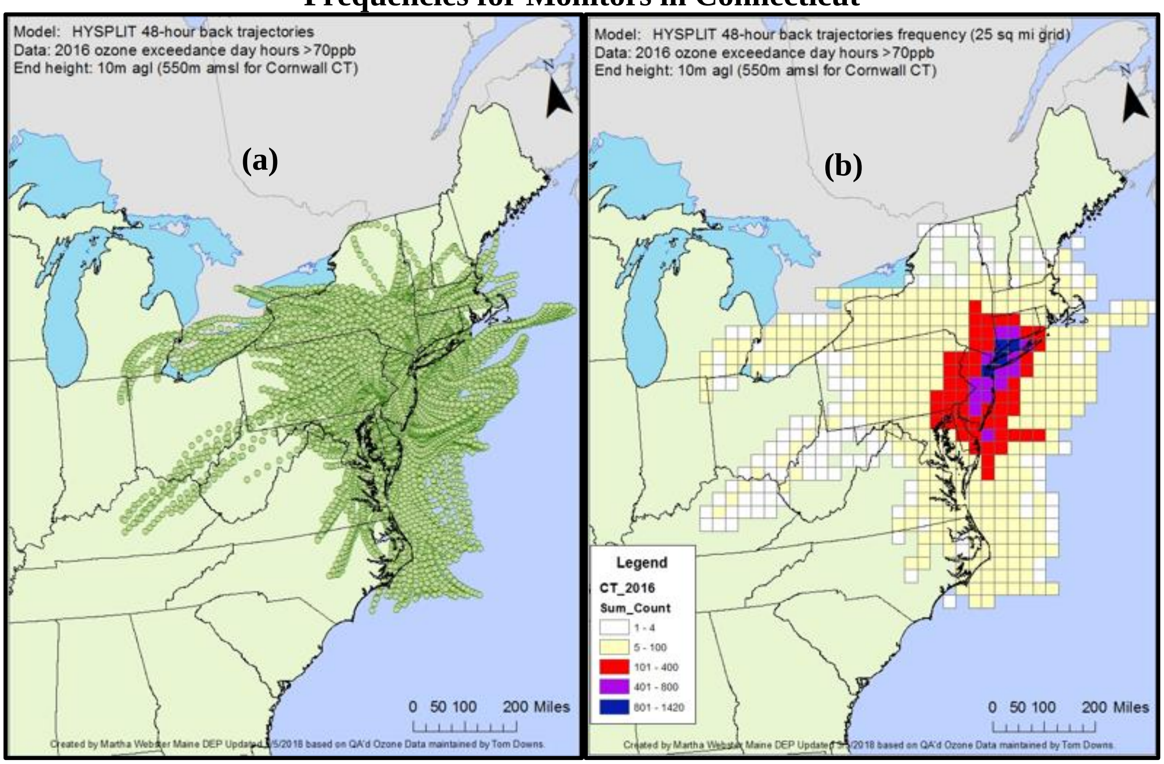
Figures E-2(a) and (b): HYSPLIT 2014 48-hour Back Trajectories and Trajectory Frequencies for Monitors in Connecticut



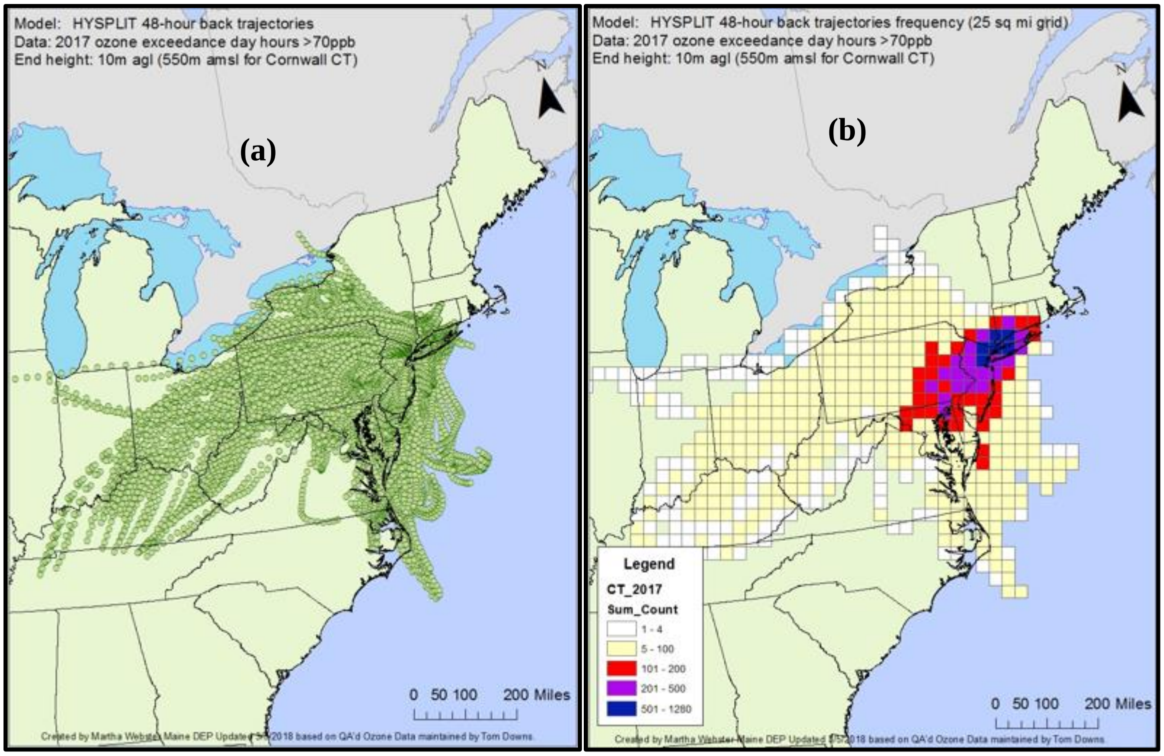
Figures E-3(a) and (b): HYSPLIT 2015 48-hour Back Trajectories and Trajectory Frequencies for Monitors in Connecticut



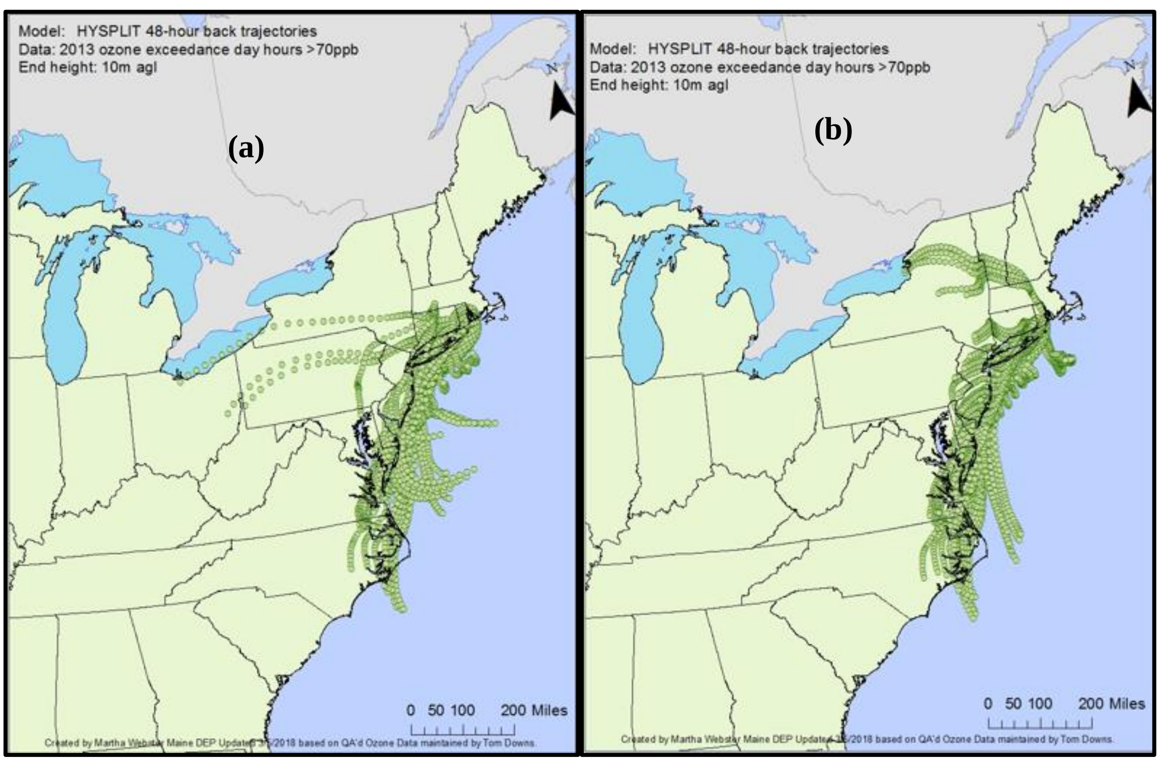
Figures E-4(a) and (b): HYSPLIT 2016 48-hour Back Trajectories and Trajectory Frequencies for Monitors in Connecticut



Figures E-5(a) and (b): HYSPLIT 2017 48-hour Back Trajectories and Trajectory Frequencies for Monitors in Connecticut

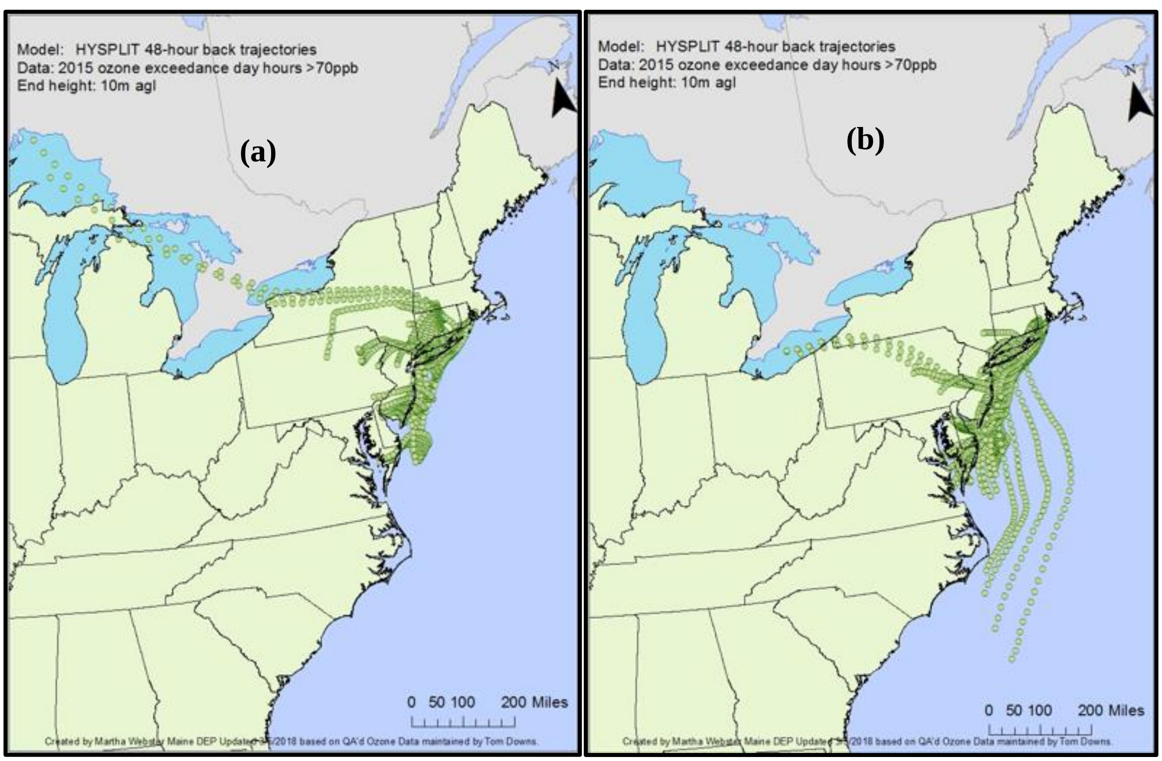


Figures E-6(a) and (b): HYSPLIT 2013 48-hour Back Trajectories for Certain Monitors Recording Exceedances in Massachusetts and Rhode Island

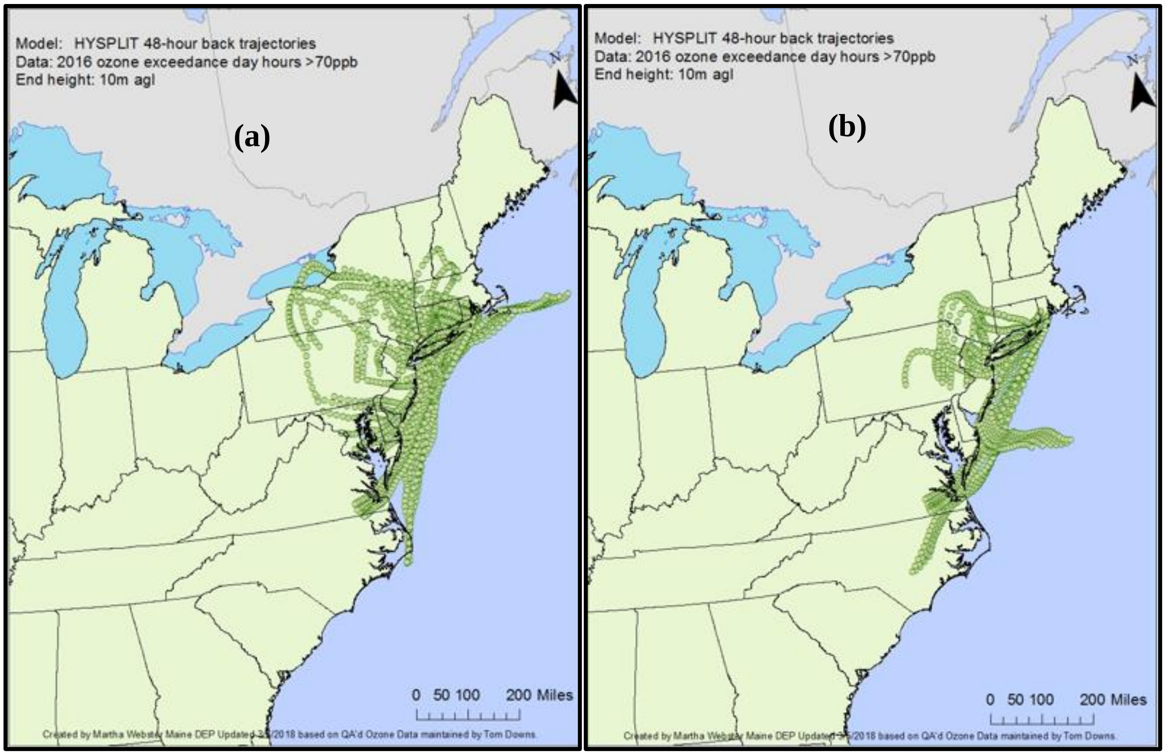


Figures E-7: HYSPLIT 2014 48-hour Back Trajectories for a Certain Monitor in Rhode Island (no Exceedances in Massachusetts)

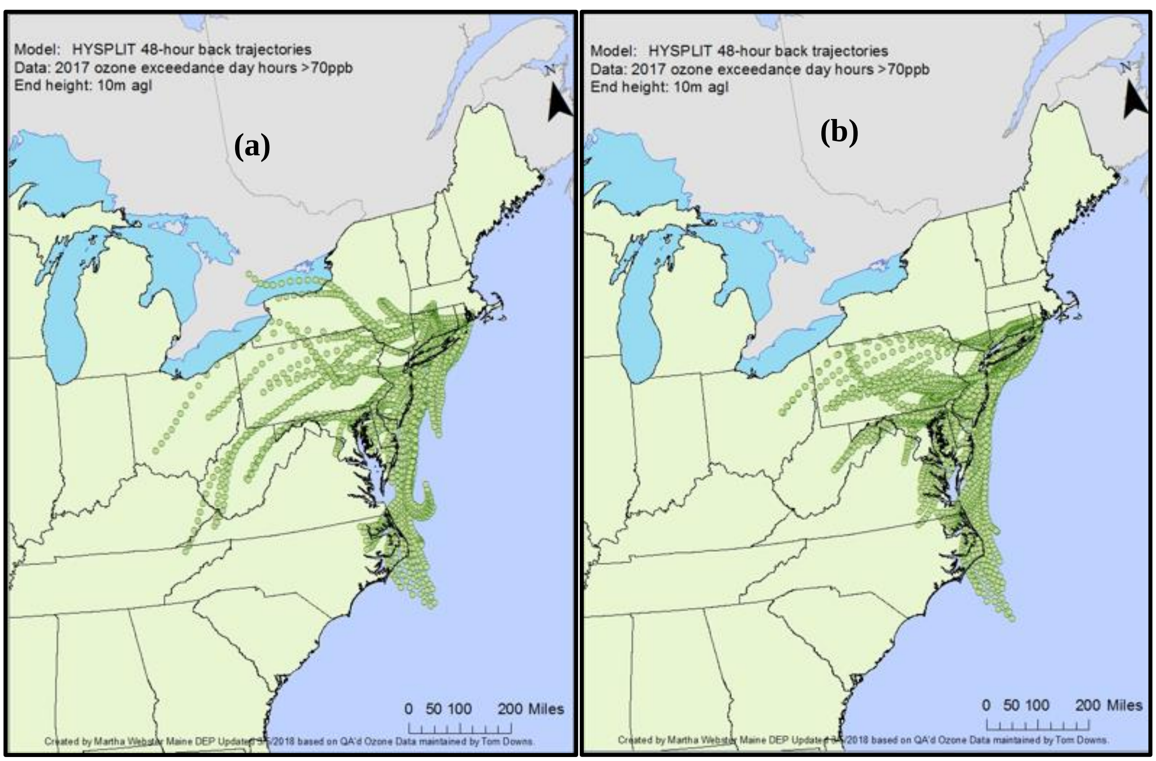
Figures E-8(a) and (b): HYSPLIT 2015 48-hour Back Trajectories for Certain Monitors Recording Exceedances in Massachusetts and Rhode Island



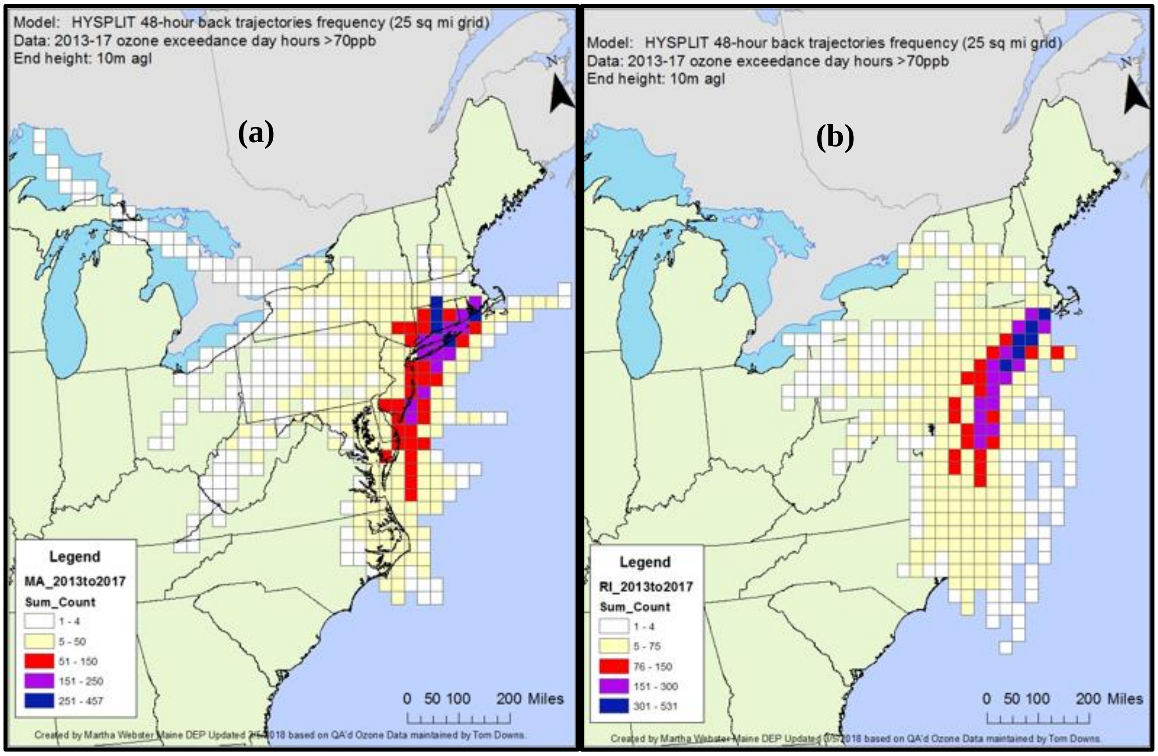
Figures E-9(a) and (b): HYSPLIT 2016 48-hour Back Trajectories for Certain Monitors Recording Exceedances in Massachusetts and Rhode Island



Figures E-10(a) and (b): HYSPLIT 2017 48-hour Back Trajectories for Certain Monitors Recording Exceedances in Massachusetts and Rhode Island



Figures E-11(a) and (b): HYSPLIT 2013-2017 48-hour Back Trajectories Frequencies for Certain Monitors in Massachusetts and Rhode Island


Model: HYSPLIT 48-hour back trajectories frequency (25 sq mi grid)
Data: 2013-17 ozone exceedance day hours >70ppb
End height: 10m agl
(a)
Legend
MA_2013to2017
Sum_Count
1 - 4
5 - 50
51 - 150
151 - 250
251 - 457
0 50 100 200 Miles
Model: HYSPLIT 48-hour back trajectories frequency (25 sq mi grid)
Data: 2013-17 ozone exceedance day hours >70ppb
End height: 10m agl
(b)
Legend
RI_2013to2017
Sum_Count
1 - 4
5 - 75
76 - 150
151 - 300
301 - 531
0 50 100 200 Miles

Appendix F: Trajectory Analyses as Found in EPA's December 22, 2017, Responses to States' 2015 Ozone NAAQS Designation Recommendations (EPA 2017b)

There are HYSPLIT back trajectory analyses available in each of EPA's technical support documents of responses (U.S. EPA 2017b) to states' 2015 Ozone NAAQS designation recommendations. Here is EPA's description of those analyses:

> *…Evaluation of meteorological data helps to assess the fate and transport of emissions contributing to ozone concentrations and to identify areas potentially contributing to the monitored violations. Results of meteorological data analysis may inform the determination of non-attainment area boundaries. In order to determine how meteorological conditions, including, but not limited to, weather, transport patterns, and stagnation conditions, could affect the fate and transport of ozone and precursor emissions from sources in the area., EPA evaluated 2014-2016 HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) trajectories at 100, 500, and 1000 meters (m) above ground level (AGL) that illustrate the three-dimensional paths traveled by air parcels to a violating monitor…*

The following is a list of OTR monitoring sites with their corresponding design values.

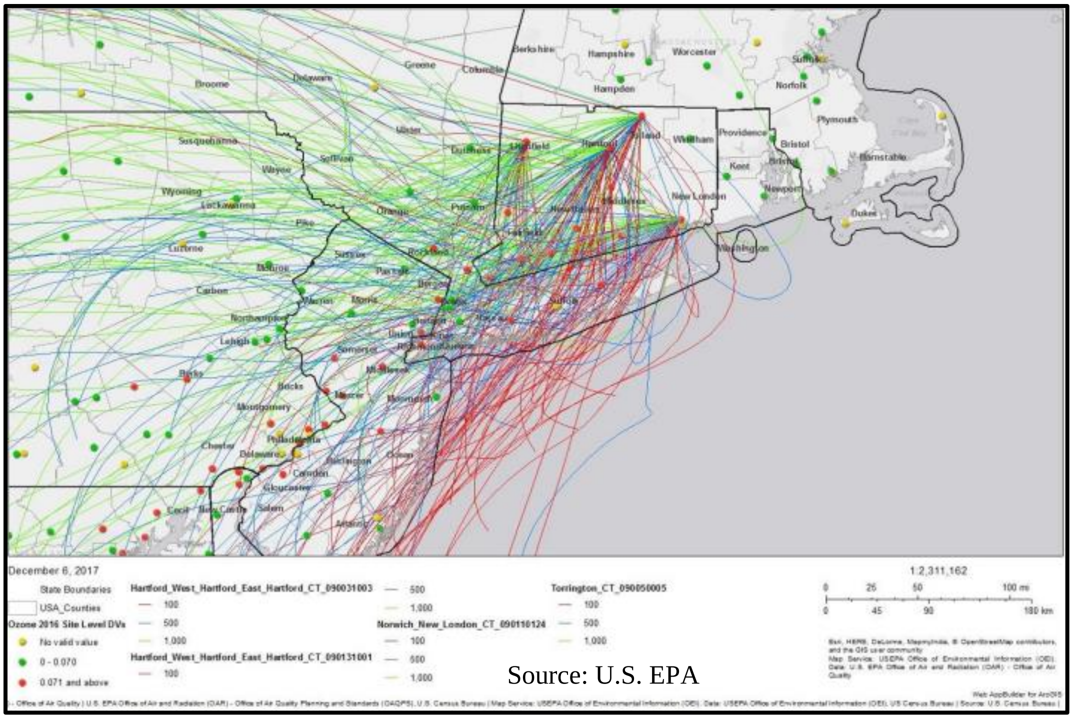
Table F-1: 2015 Ozone NAAQS Site Design Values

County, State	AQS Site ID	2014-2016 Design Value (ppb)	2015-2017 Design Value (ppb)
Greater Connecticut Area			
Hartford, CT	09-003-1003	74	72
Litchfield, CT	09-005-0005	72	72
New London, CT	09-011-0124	72	76
Tolland, CT	09-013-1001	73	71
New York-Northern New Jersey-Long Island, NY-NJ-CT Area			
Fairfield, CT	09-001-0017	80	79
	09-001-1123	78	77
	09-001-3007	81	83
	09-001-9003	83	83
Middlesex, CT	09-007-0007	79	79
New Haven, CT	09-009-0027	76	77
	09-009-9002	76	82
Queens, NY	36-081-0124	69	74
Richmond, NY	36-085-0067	76	76
Rockland, NY	36-087-0005	72	72
Suffolk, NY	36-103-0002	72	76
	36-103-0004	72	76
Westchester, NY	36-119-2004	74	73
Bergen, NJ	34-003-0006	74	74
Hudson, NJ	34-017-0006	72	70
Middlesex, NJ	34-023-0011	74	75
Hunterdon, NJ	34-019-0001	70	72

County, State	AQS Site ID	2014-2016 Design Value (ppb)	2015-2017 Design Value (ppb)
Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE			
Camden, NJ	34-007-0002	74	77
Gloucester, NJ	34-015-0002	73	74
Mercer, NJ	34-021-0005	71	71
	34-021-9991	73	73
Ocean, NJ	34-029-0006	72	73
New Castle, DE	10-003-1010	74	74
	10-003-1013	70	71
	10-003-2004	71	72
Cecil, MD	24-015-0003	74	74
Bucks, PA	42-017-0012	77	80
Chester, PA	42-029-0100	73	73
Delaware, PA	42-045-0002	72	71
Montgomery, PA	42-091-0013	70	72
Philadelphia, PA	42-101-0024	77	78
	42-101-0048	74	76
Baltimore, MD Area			
Baltimore, MD	24-005-1007	72	No data for 2017
	24-005-3001	72	73
Harford, MD	24-025-1001	72	75
	24-025-9001	73	73
Washington, DC-MD-VA Area			
Prince George’s, MD	24-033-8003	70	71
District of Columbia	11-001-0043	70	71
Arlington, VA	51-013-0020	72	71
Fairfax, VA	51-059-0030	70	71

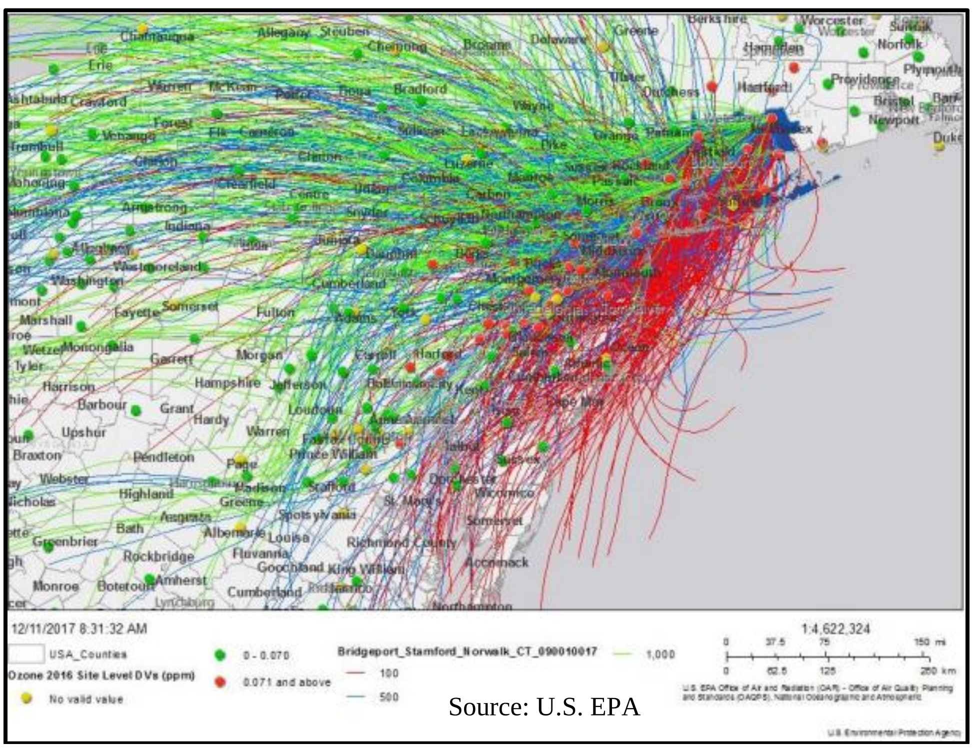
Figures F-1 to F-23 in the following pages contain EPA’s trajectory analysis results for the proposed non-attainment areas. In each figure’s title, the non-attainment area sites are specified.

Figure F-1: HYSPLIT Back Trajectories for Monitors in the Greater Connecticut Non-Attainment Area



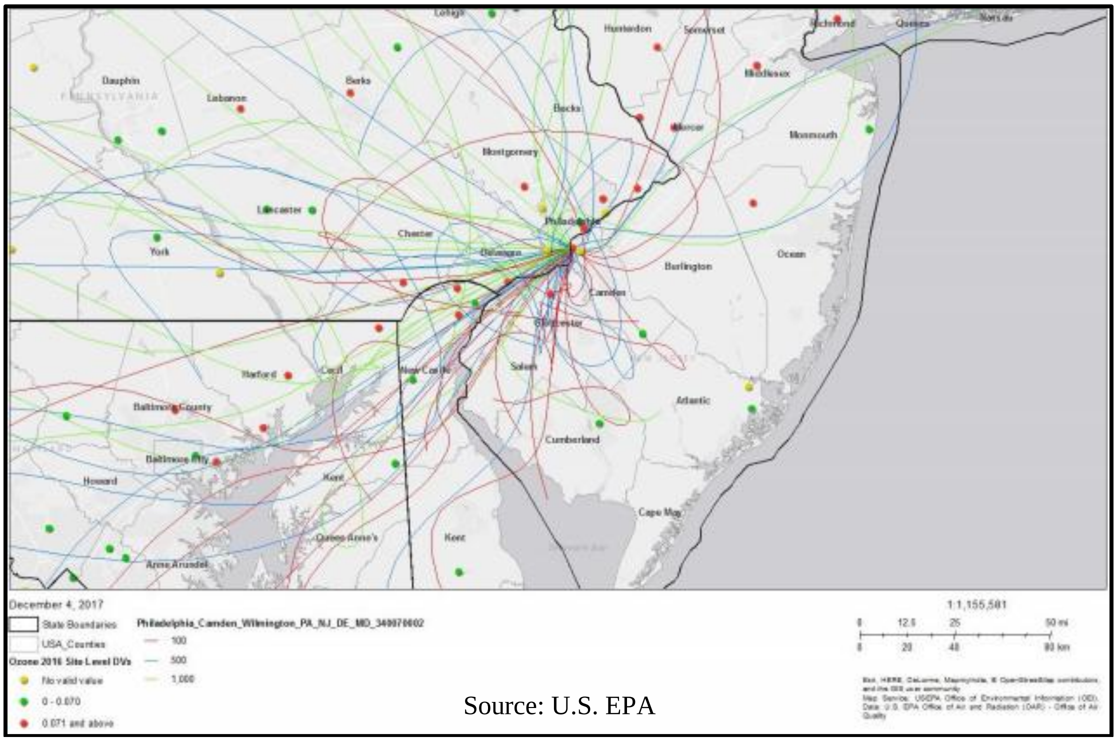
Source: U.S. EPA

Figure F-2: HYSPLIT Back Trajectories for Monitors in the New York-Northern New Jersey-Long Island, NY-NJ-CT Non-Attainment Area



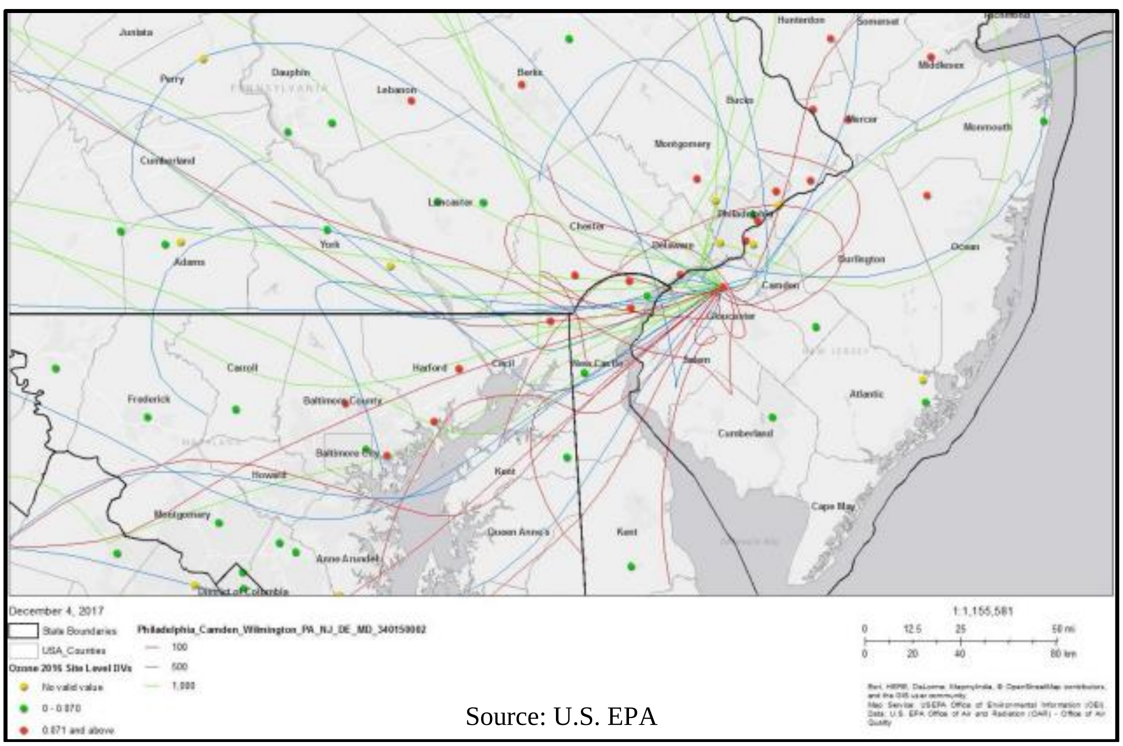
Source: U.S. EPA

Figure F-3: HYSPLIT Back Trajectories for Monitor 34-007-0002 Camden County, NJ
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



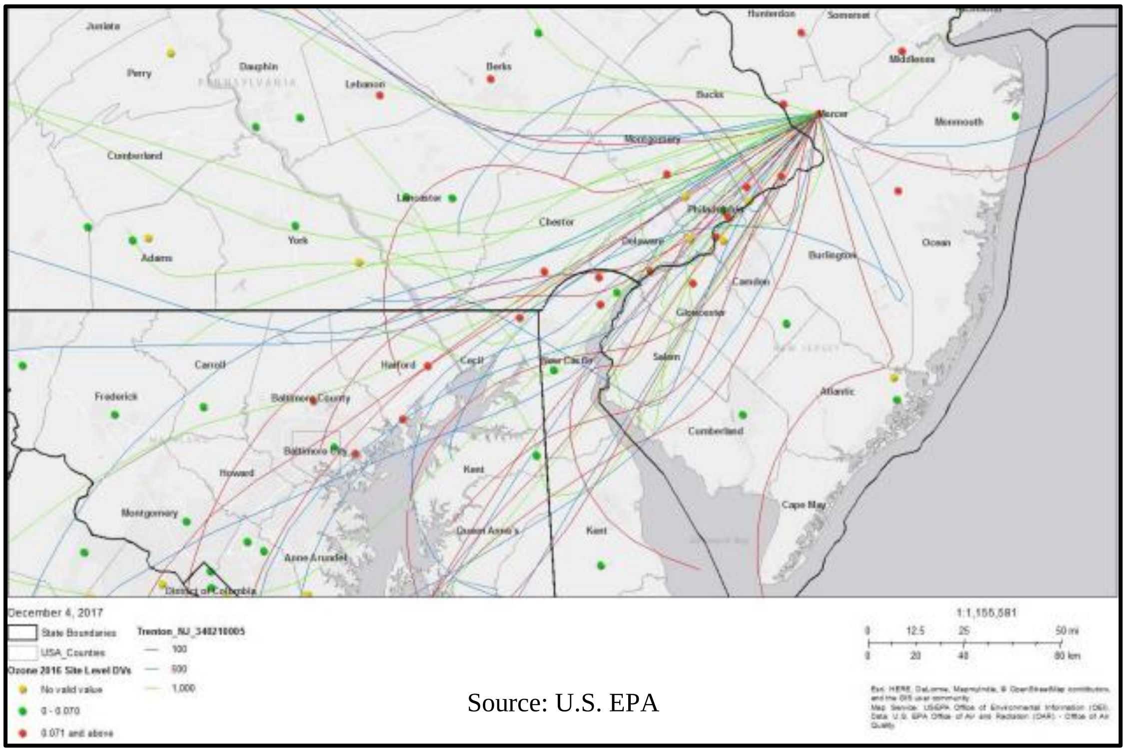
Source: U.S. EPA

Figure F-4: HYSPLIT Back Trajectories for Monitor 34-015-0002 Gloucester County, NJ
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



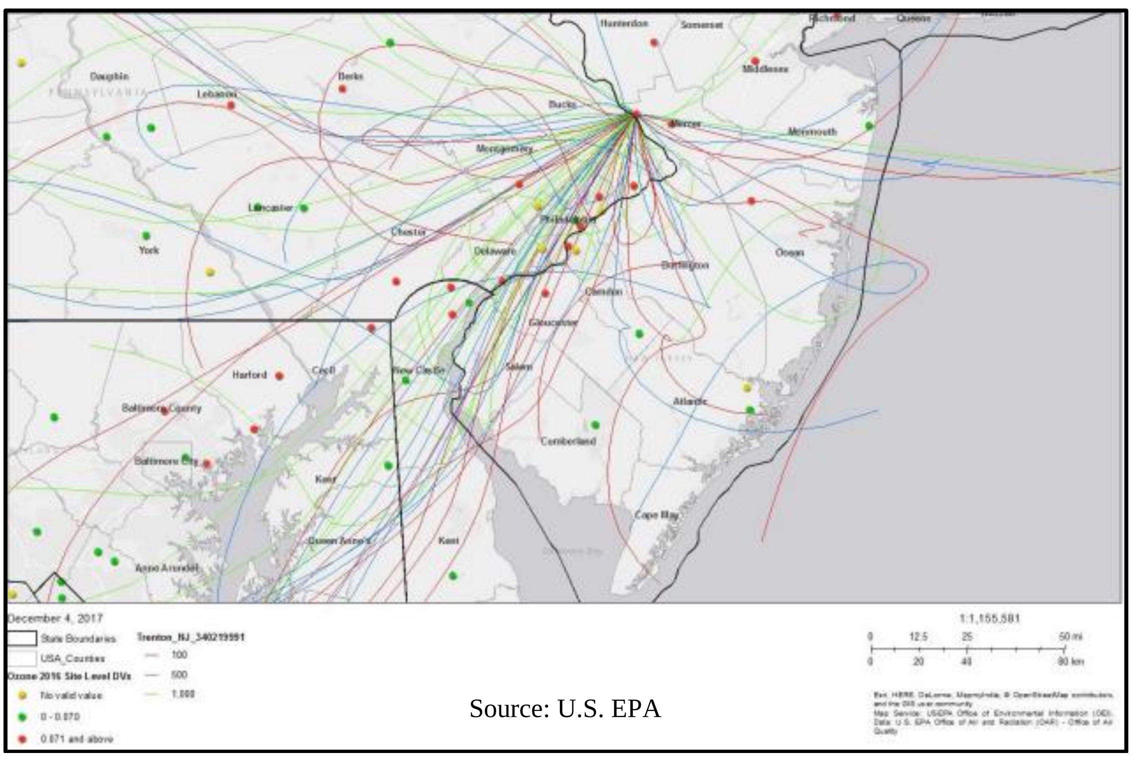
Source: U.S. EPA

Figure F-5: HYSPLIT Back Trajectories for Monitor 34-021-0005 Mercer County, NJ
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



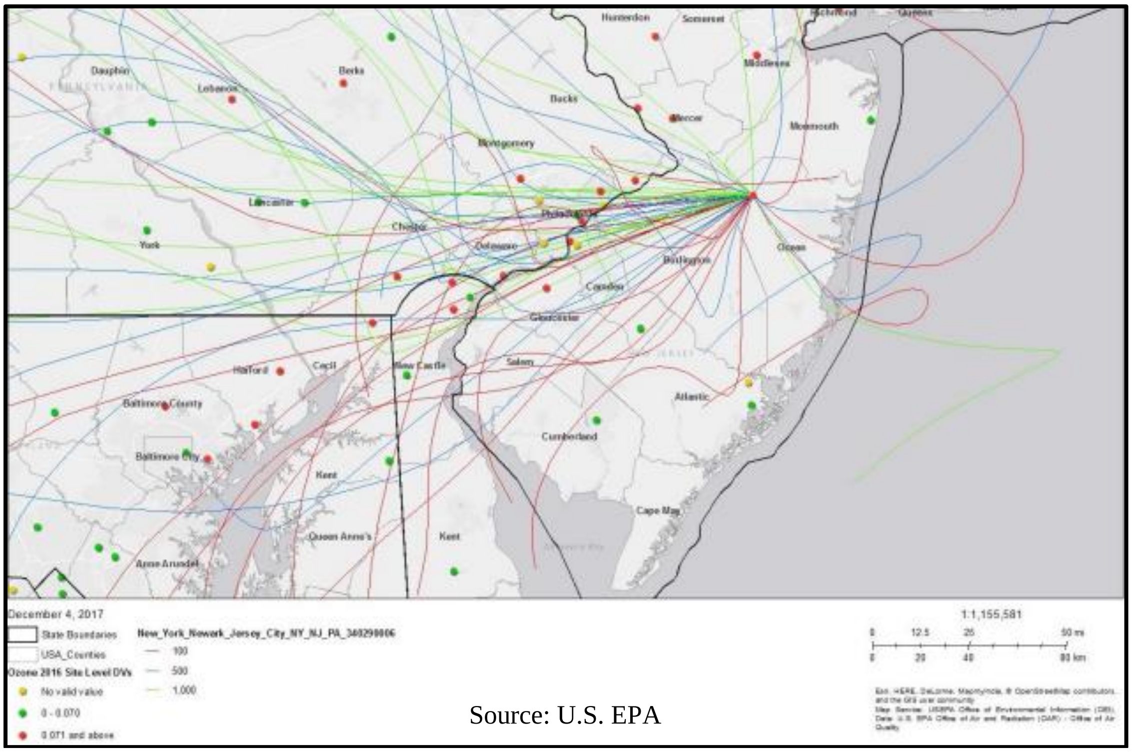
Source: U.S. EPA

Figure F-6: HYSPLIT Back Trajectories for Monitor 34-021-9991 Mercer County, NJ
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



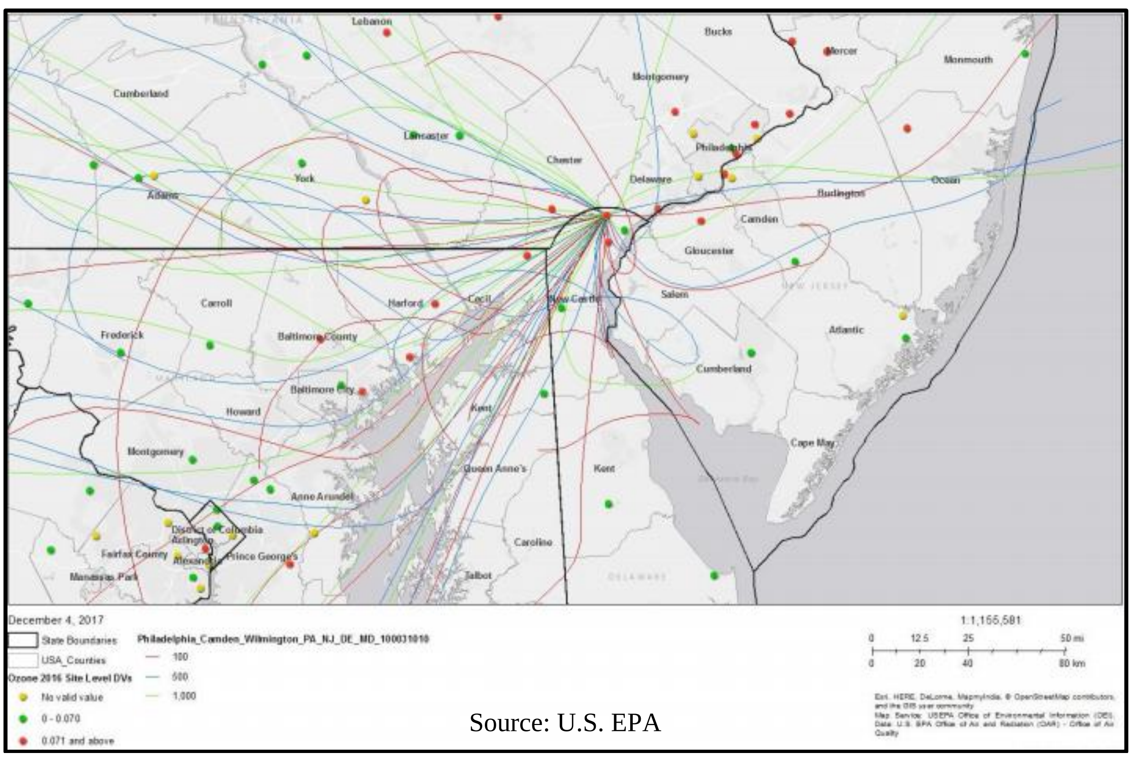
Source: U.S. EPA

Figure F-7: HYSPLIT Back Trajectories for Monitor 34-029-0006 Ocean County, NJ
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



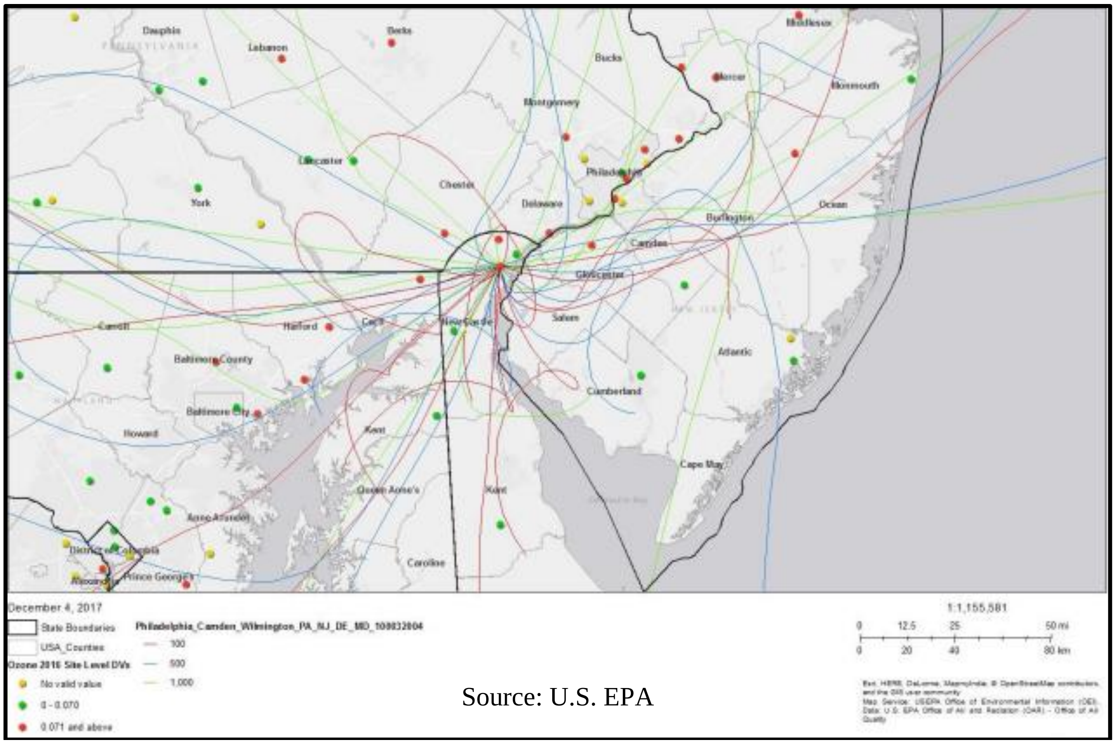
Source: U.S. EPA

Figure F-8: HYSPLIT Back Trajectories for Monitor 10-003-1010 New Castle County, DE
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



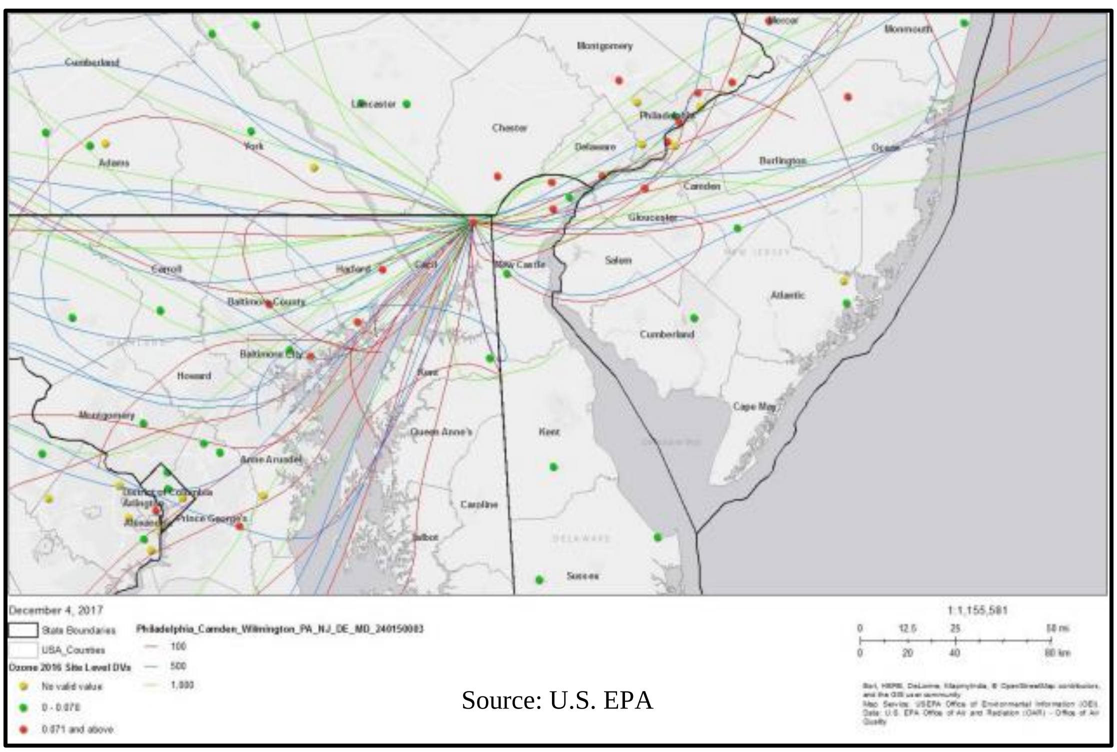
Source: U.S. EPA

Figure F-9: HYSPLIT Back Trajectories for Monitor 10-003-2004 New Castle County, DE
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



Source: U.S. EPA

Figure F-10: HYSPLIT Back Trajectories for Monitor 24-015-0003 Cecil County, MD
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



Source: U.S. EPA

Figure F-11: HYSPLIT Back Trajectories for Monitor 42-017-0012 Bucks County, PA

(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)

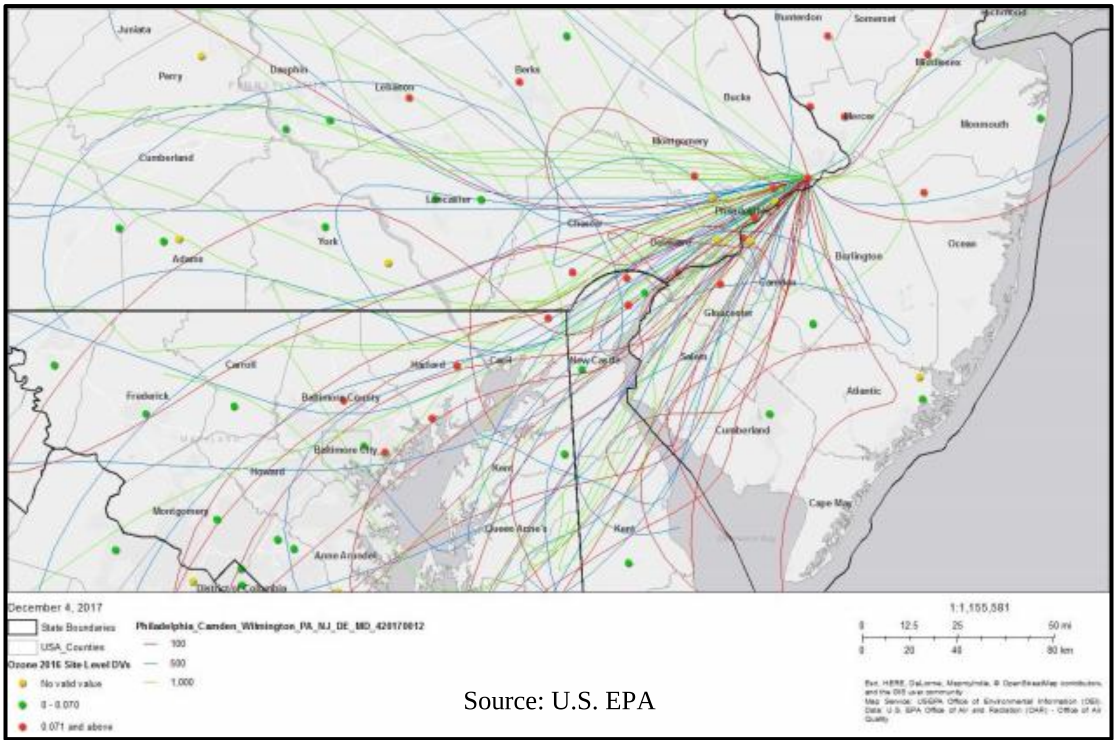


Figure F-12: HYSPLIT Back Trajectories for Monitor 42-029-0100 Chester County, PA
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)

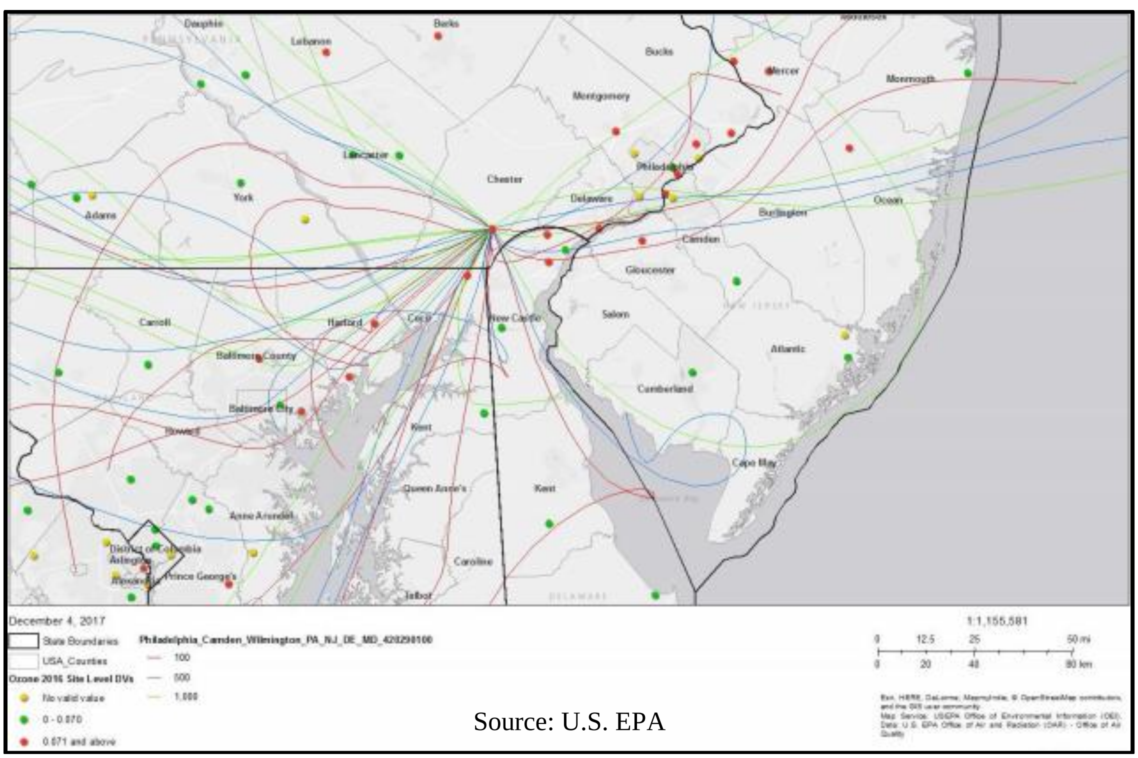
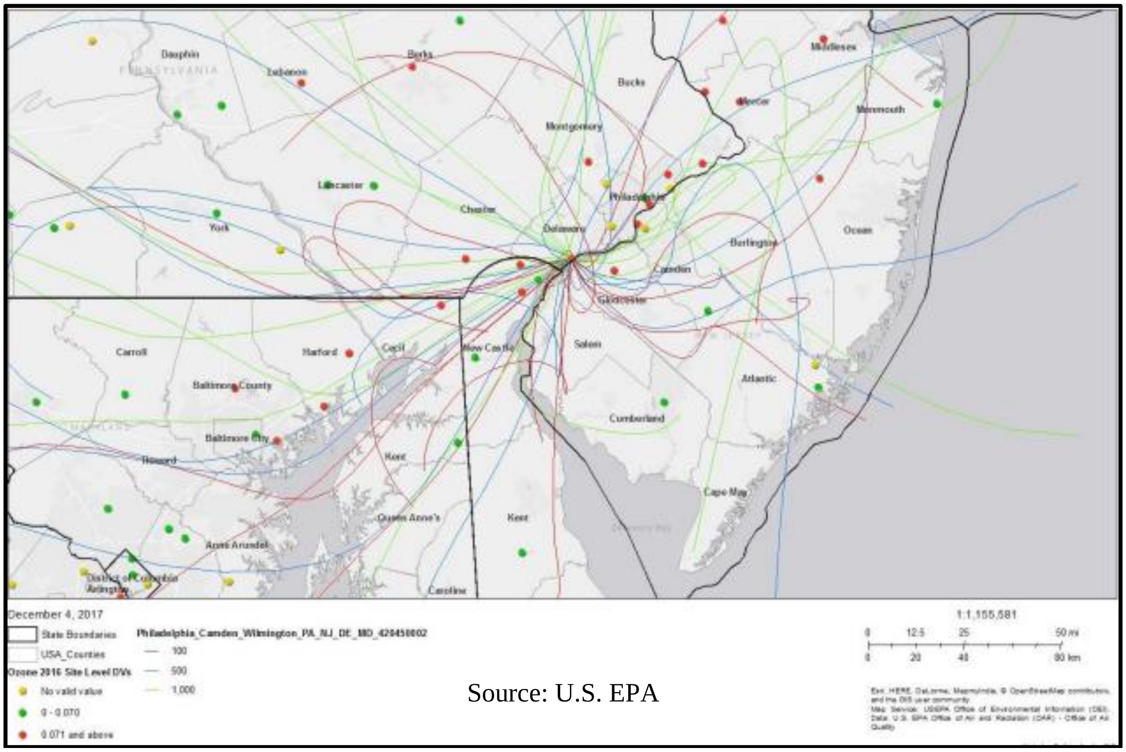
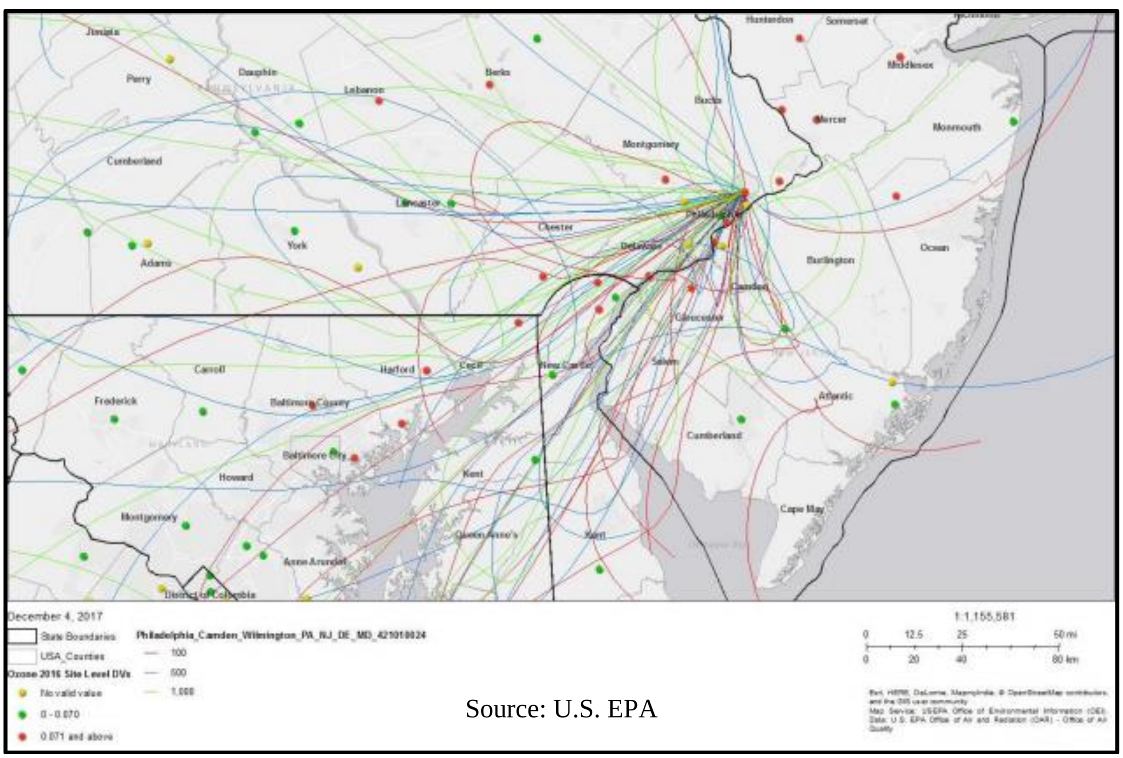


Figure F-13: HYSPLIT Back Trajectories for Monitor 42-045-0002 Delaware County, PA
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



Source: U.S. EPA

Figure F-14: HYSPLIT Back Trajectories for Monitor 42-101-0024 Philadelphia County, PA
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)



Source: U.S. EPA

Figure F-15: HYSPLIT Back Trajectories for Monitor 42-101-0048 Philadelphia County, PA
(in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Non-Attainment Area)

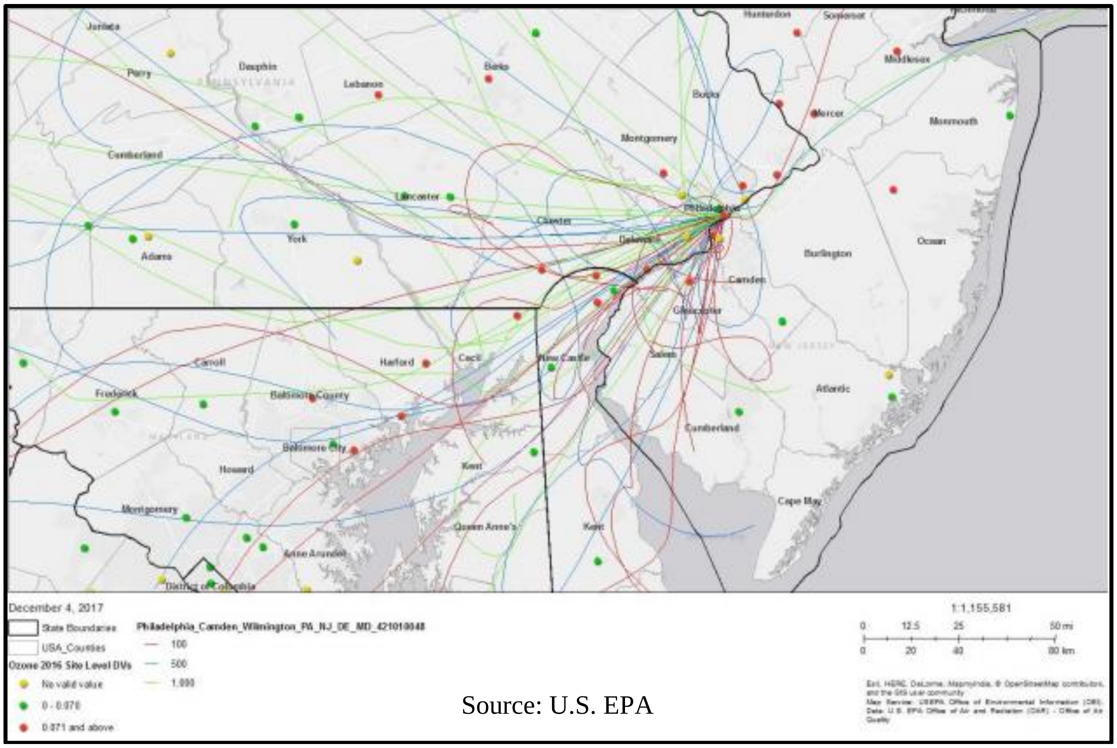
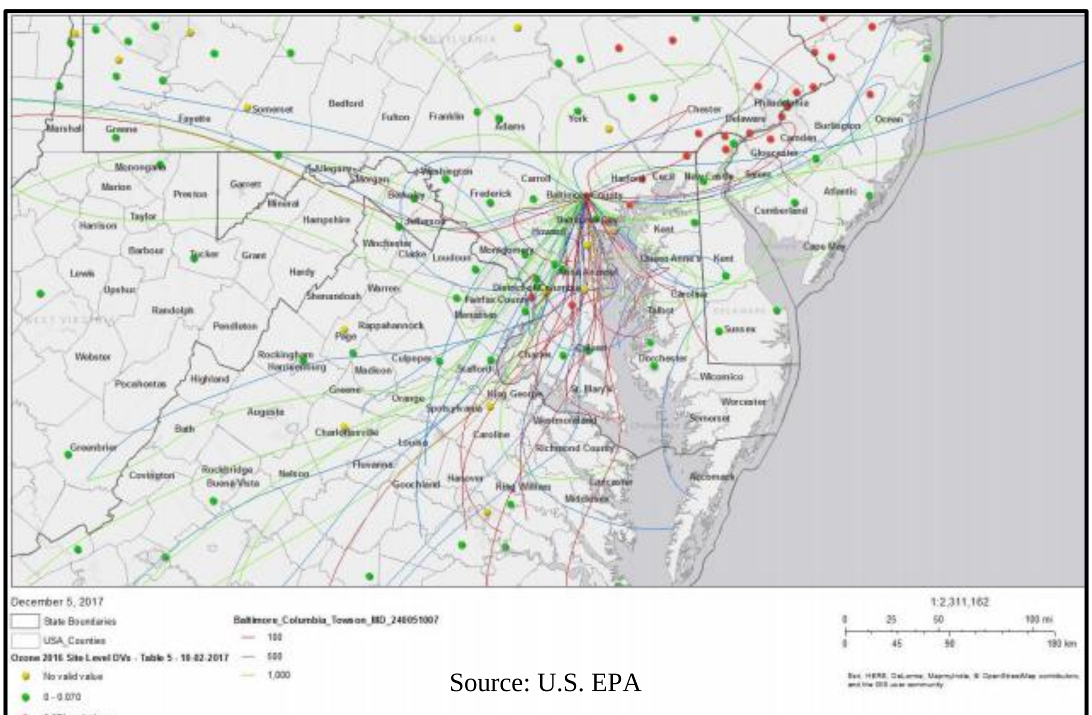
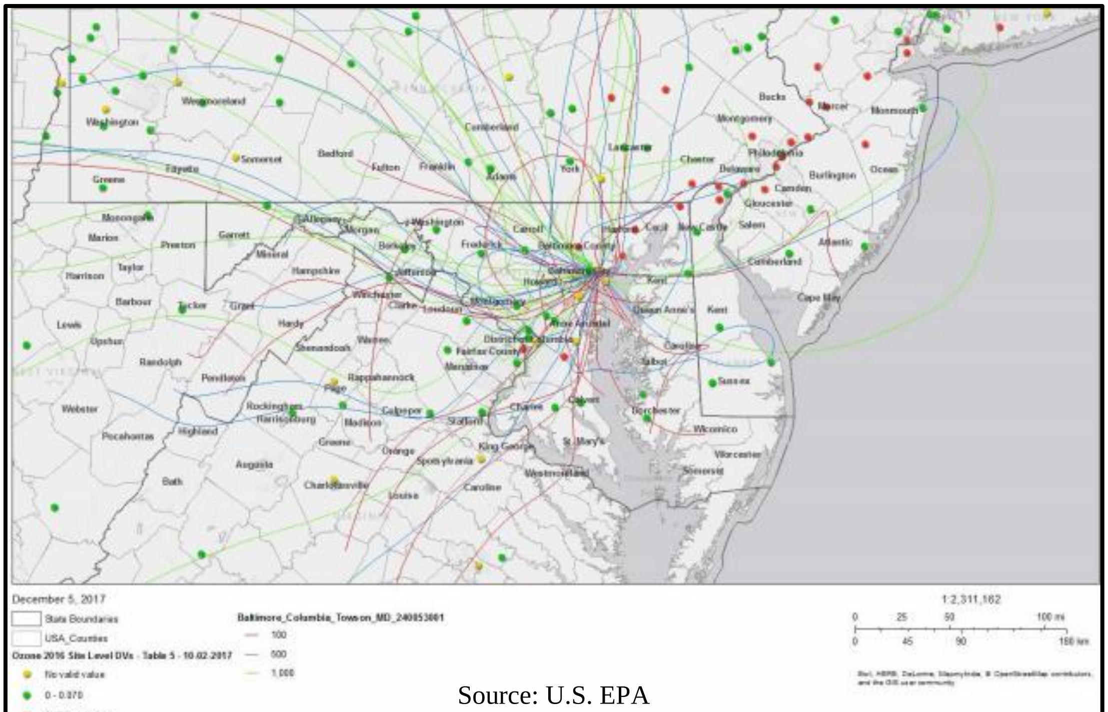


Figure F-16: HYSPLIT Back Trajectories for Monitor 24-005-1007 Baltimore County, MD
(in the Baltimore, MD Non-Attainment Area)



[a] Trajectories are based on HYSPLIT runs for the 2014-2016 design value period.

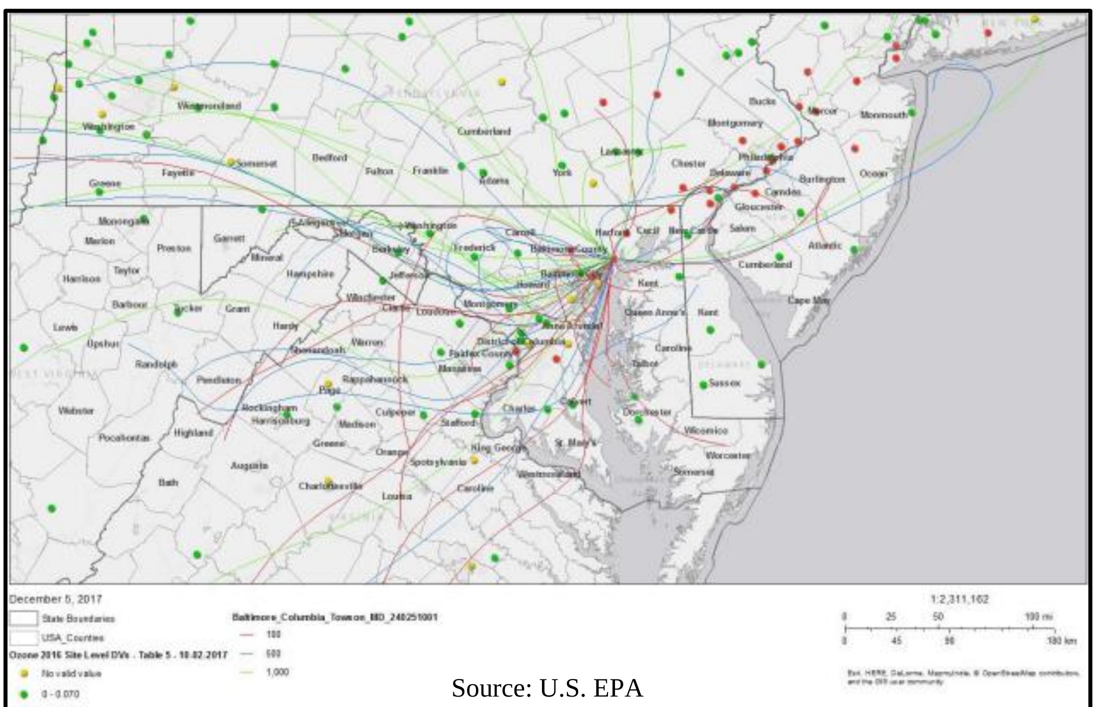
Figure F-17: HYSPLIT Back Trajectories for Monitor 24-005-3001 Baltimore County, MD
(in the Baltimore, MD Non-Attainment Area)



Source: U.S. EPA

[a] Trajectories are based on HYSPLIT runs for the 2014-2016 design value period.

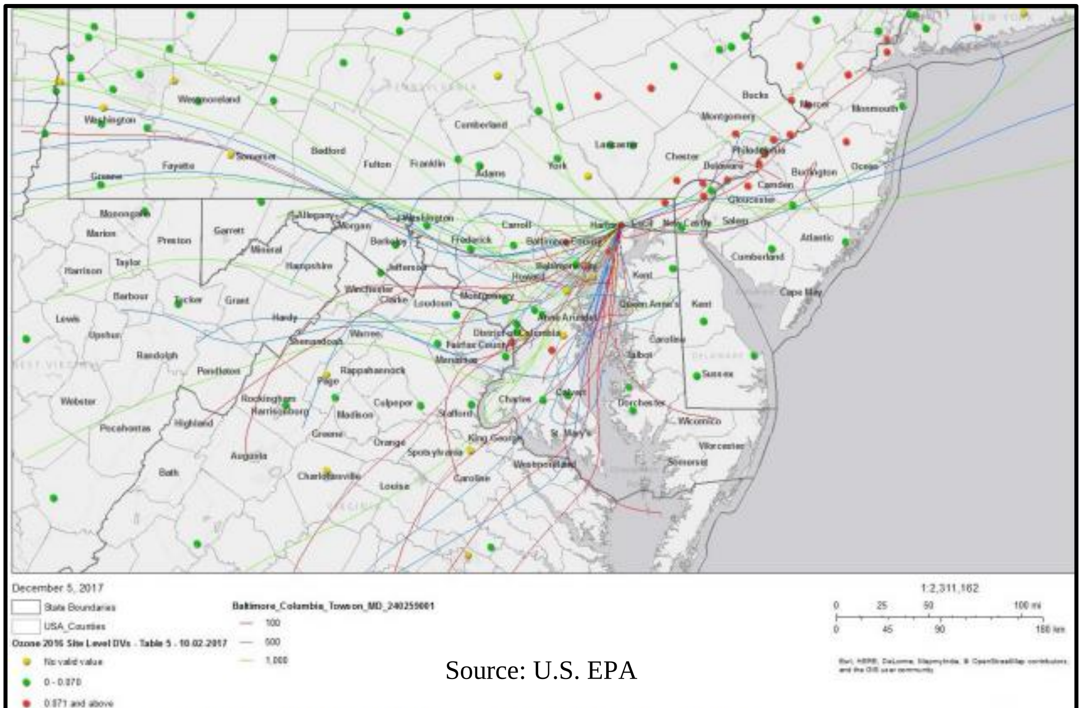
Figure F-18: HYSPLIT Back Trajectories for Monitor 24-025-1001 Harford County, MD
(in the Baltimore, MD Non-Attainment Area)



Source: U.S. EPA

[a] Trajectories are based on HYSPLIT runs for the 2014-2016 design value period.

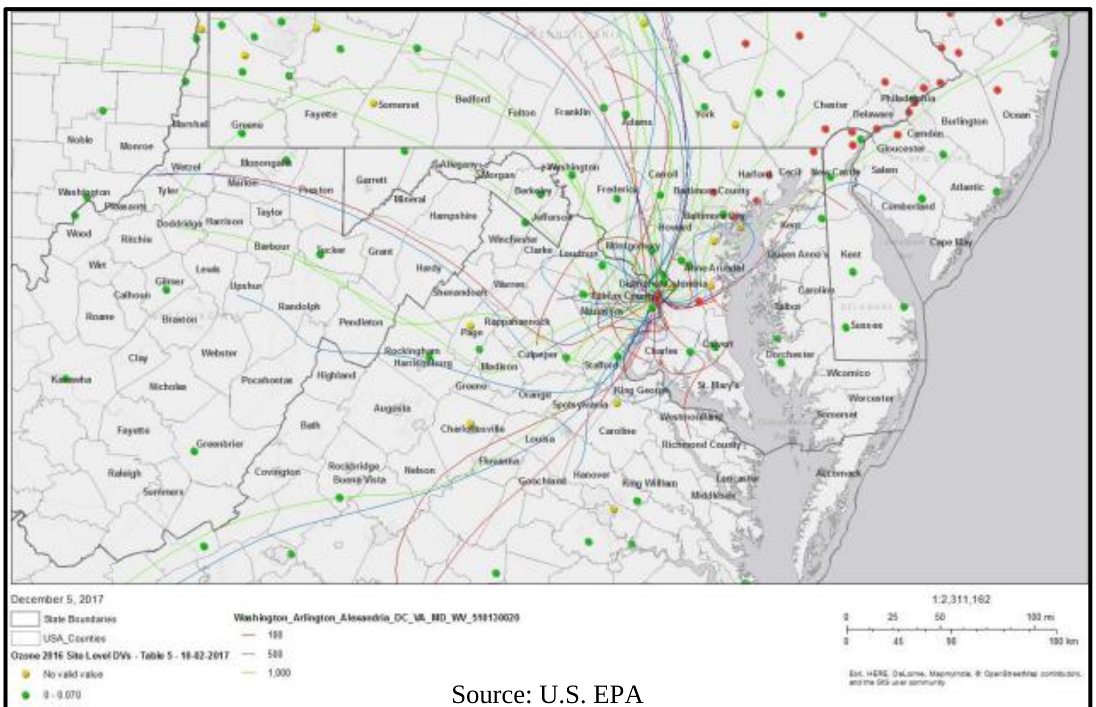
Figure F-19: HYSPLIT Back Trajectories for Monitor 24-025-9001 Harford County, MD
(in the Baltimore, MD Non-Attainment Area)



Source: U.S. EPA

[a] Trajectories are based on HYSPLIT runs for the 2014-2016 design value period.

Figure F-20: HYSPLIT Back Trajectories for Monitor 51-013-0020 Arlington County, VA
(in the Washington, DC Non-Attainment Area)



Source: U.S. EPA

[a] Trajectories are based on HYSPLIT runs for the 2014-2016 design value period.

Appendix G: Trajectory Analyses, 2008 Ozone NAAQS as found in EPA's Air Quality Modeling Technical Support Document for the CSAPR Update, August 2016

Appendix E of the *Air Quality Modeling Technical Support Document for the Cross-State Air Pollution Update Rule* states the following:

> *For the back trajectory, EPA used a technique involving independent meteorological inputs to examine the general plausibility of these linkages. Using the HYSPLIT (HYbrid Single-Particle Lagrangian Integrated Trajectory) model along with observation-based meteorological wind fields, EPA created air flow back trajectories for each of the 19 non-attainment or maintenance-only receptors on days with a measured exceedance in 2011 and on exceedance days in several other recent high ozone years (i.e., 2005, 2007, 2010, and 2012). One focus of this analysis was on trajectories for exceedance days occurring in 2011, since this was the year of meteorology that was used for air quality modeling to support this rule. The trajectories during the four additional years were compared to the transport patterns in 2011 to examine whether common transport patterns are present.*
>
> *Air-parcel trajectories were calculated based on meteorological fields obtained from the Eta Data Assimilation System (EDAS). EDAS is an intermittent data assimilation system that uses successive three-hour model forecasts to generate gridded meteorological fields that reflect observations. The three-hour analysis updates allow for the assimilation of high-frequency observations, such as wind profiler data, Next Generation Weather Radar (NEXRAD) data, and aircraft-measured meteorological data. In this manner, the forecast wind fields are aligned to measured wind data.*
>
> *For this analysis, site-specific backward air-parcel trajectories were calculated with the HYSPLIT model from heights at 250-m, 500-m, 750-m, 1000-m, and 1500 m above ground level on days with measured exceedances at the given receptor site. The trajectories were initialized at multiple elevations aloft in order to consider the effects of vertical variations in wind flows on transport patterns. Trajectories were tracked backward in time for 96 hours (i.e., 4 days) for each of several time periods (i.e., initialization times) on each day an exceedance was monitored. Back trajectories were initialized at 0800, 1200, and 1500 local Standard Time (LST). The morning initialization time roughly corresponds to the time when the morning boundary layer is rising and pollutants that were transported aloft overnight begin to mix down to the surface. The afternoon initialization times roughly span the time of the day with highest ozone concentrations.*
>
> *Once the trajectories were created, they were converted to geographic files that can be read by programs such as Google Earth or ArcGIS. These files enable the characterization of the geographic location of each trajectory for every hour that was run. The point locations along the trajectory paths were used to create line densities that correlate to the number of times a trajectory passed through a geographic area. These line densities provide a general sense of the frequency at which an air parcel passed over given areas*.

For further information regarding EPA's analysis, see Appendix E of the *Air Quality Modeling Technical Support Document for the Cross-State Air Pollution Update Rule*, August 2016, which has been listed in the references Section of this document.

Figure G-1 to G-8 in the following pages contain EPA's trajectory analysis results for sites in the OTR that have been identified as 'non-attainment' or 'maintenance'. In each figure's title, the site is specified, along with the states identified as significantly contributing to the monitor. Maine was not identified as contributing significantly to any of these events.

Figure G-1: Upwind States Linked to Fairfield Co., CT Site 090019003: IN, MD, MI, NJ, NY, OH, PA, VA, and WV

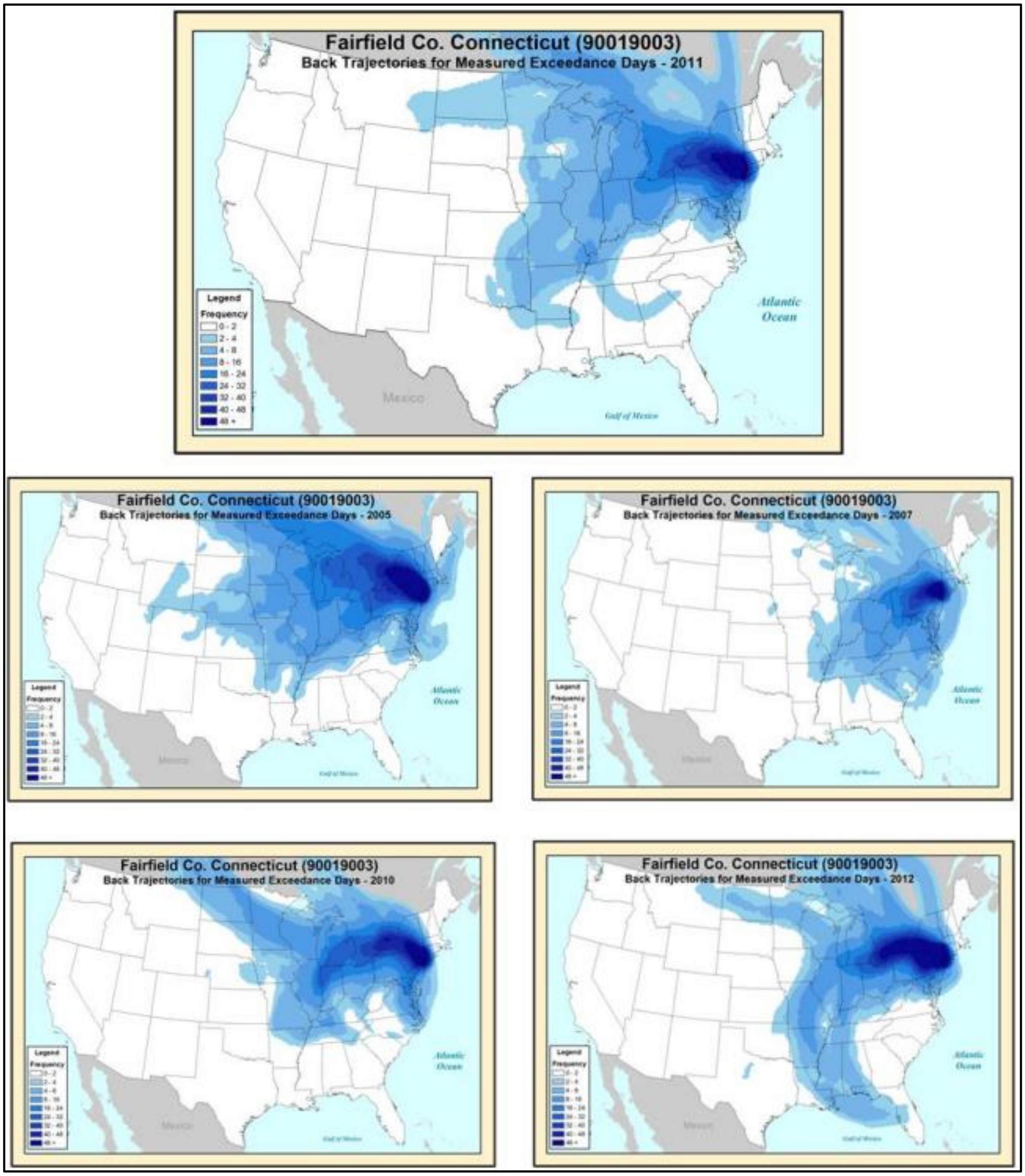


Figure G-2: Upwind States Linked to Fairfield Co., CT Site 090013007: IN, MD, MI, NJ, NY, OH, PA, VA, and WV

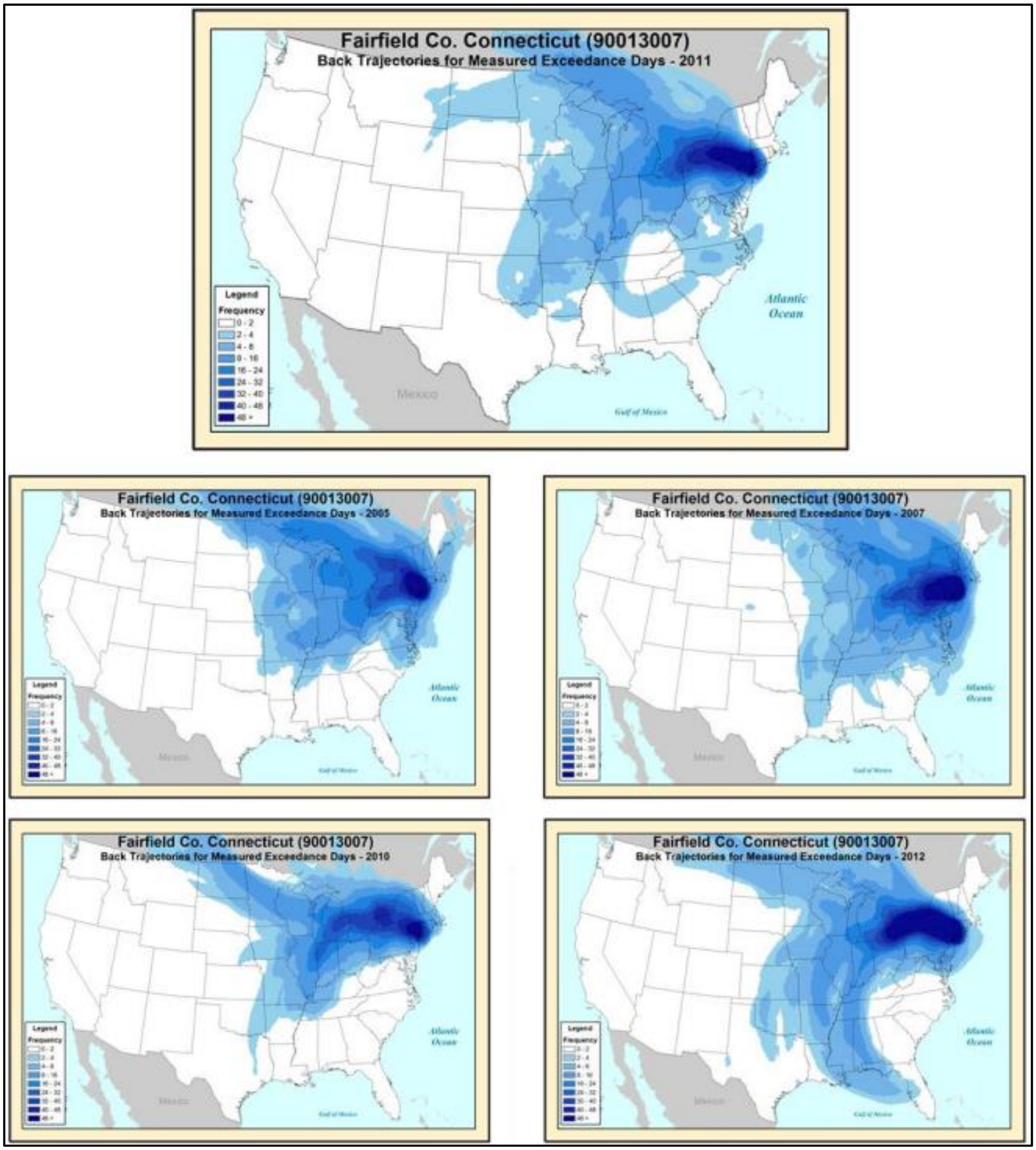


Figure G-3: Upwind States Linked to Fairfield Co., CT Site 090010017: MD, NJ, NY, OH, PA, VA, and WV

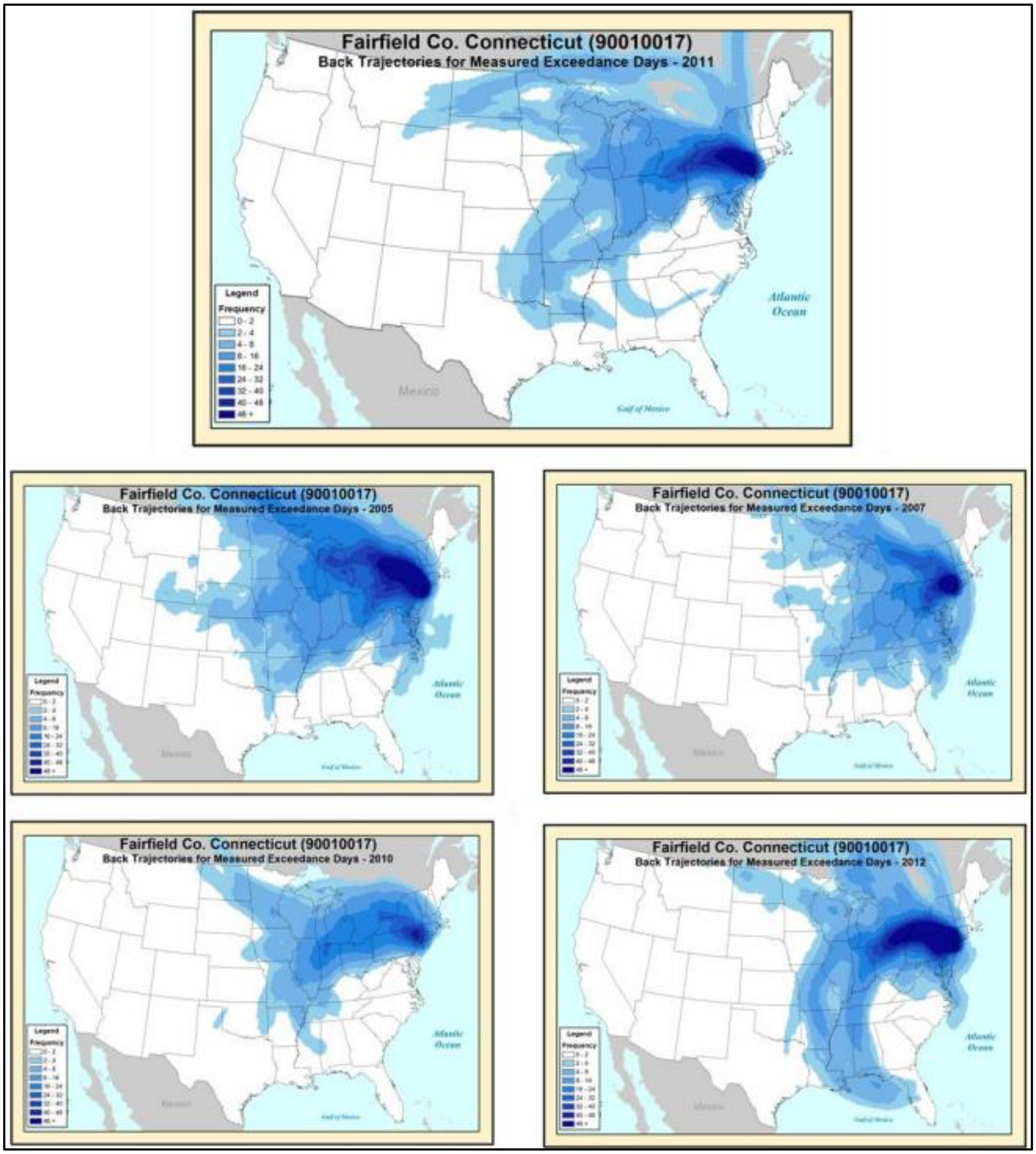


Figure G-4: Upwind States Linked to New Haven Co., CT Site 090099002: MD, NJ, NY, OH, PA, and VA

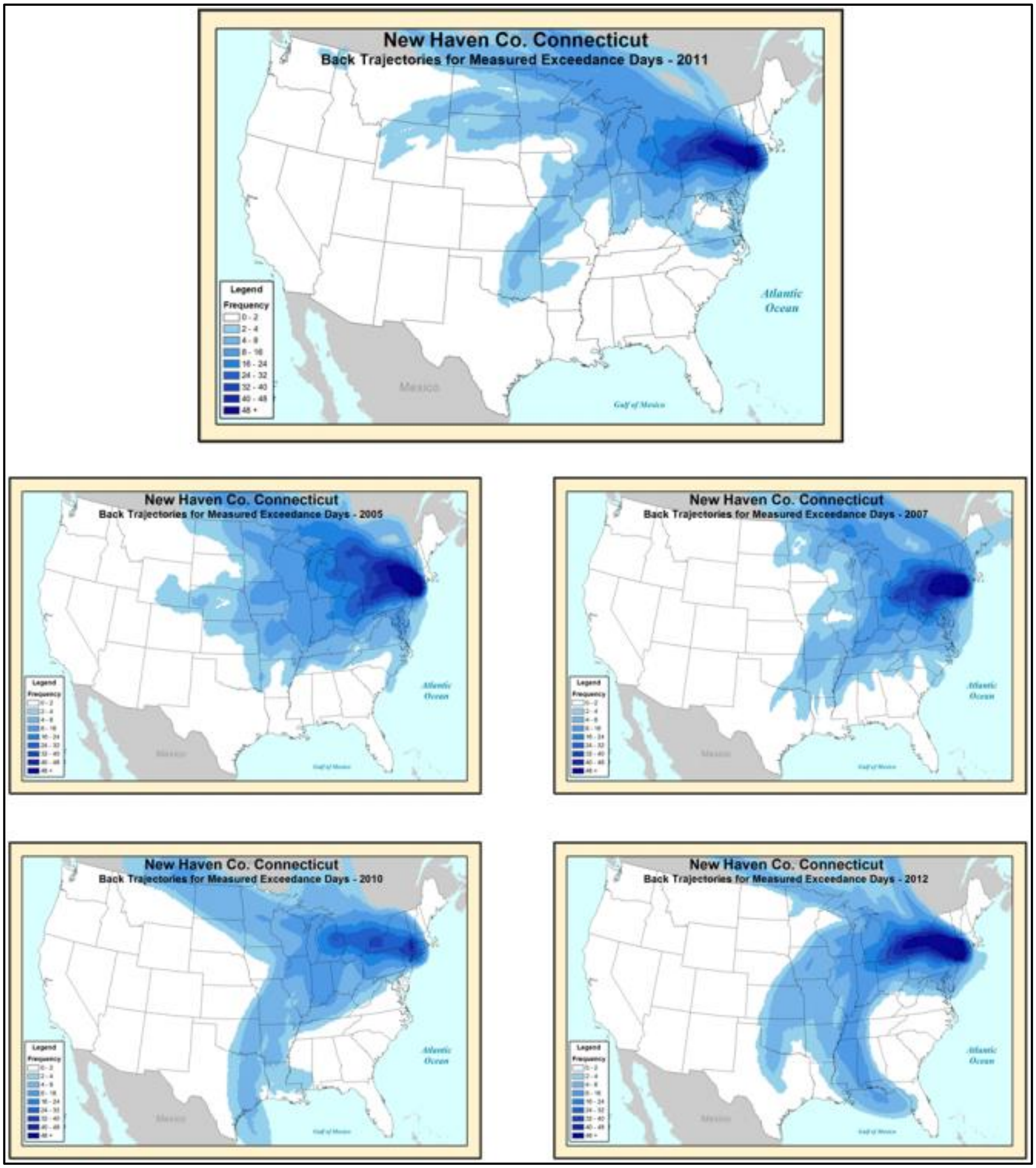


Figure G-5: Upwind States Linked to Richmond Co., NY Site 360850067: IN, KY, MD, NJ, OH, PA, VA, and W

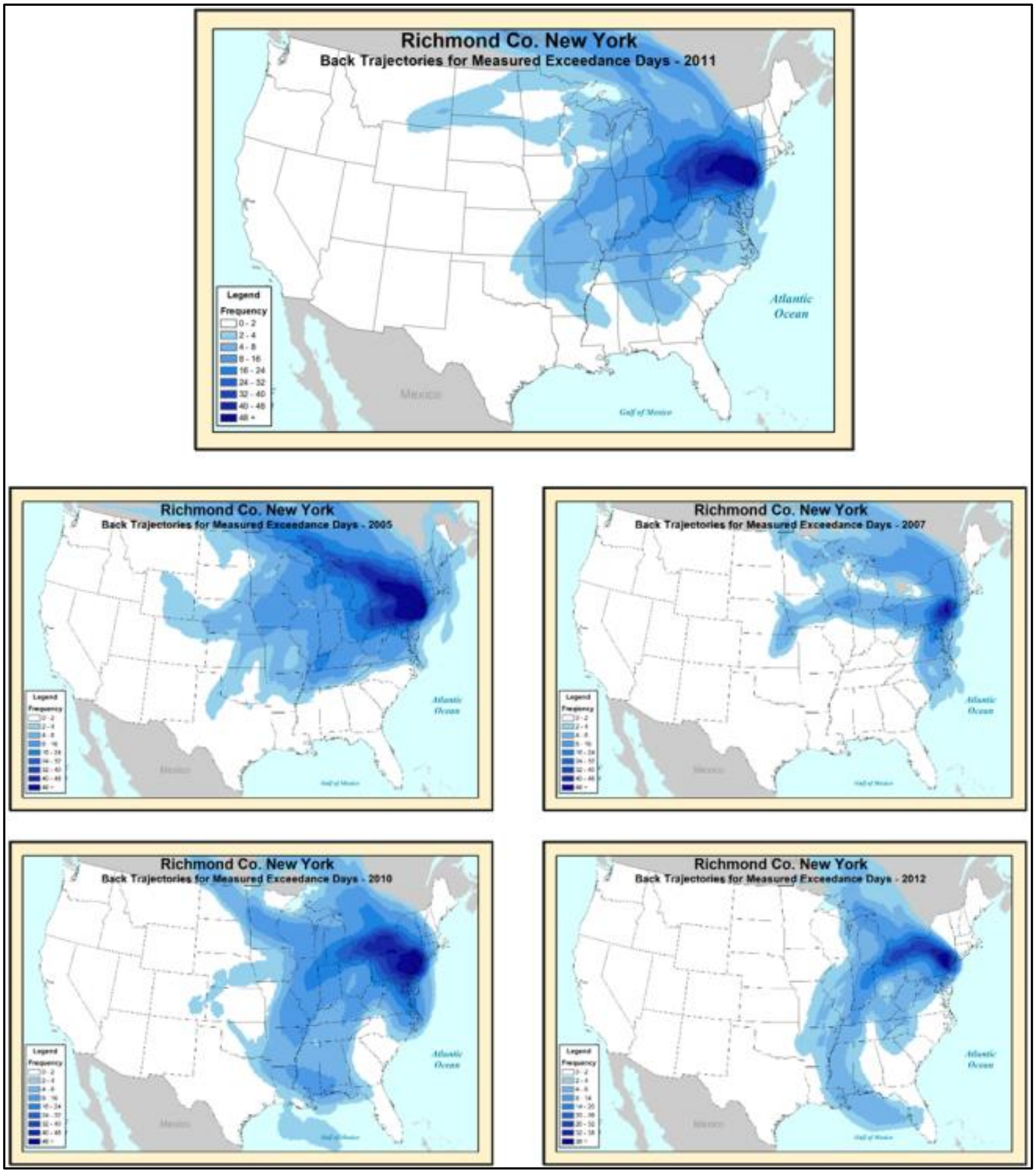


Figure G-6: Upwind States Linked to Suffolk Co., NY Site 36030002: IL, IN, MD, MI, NJ, OH, PA, VA, and WV

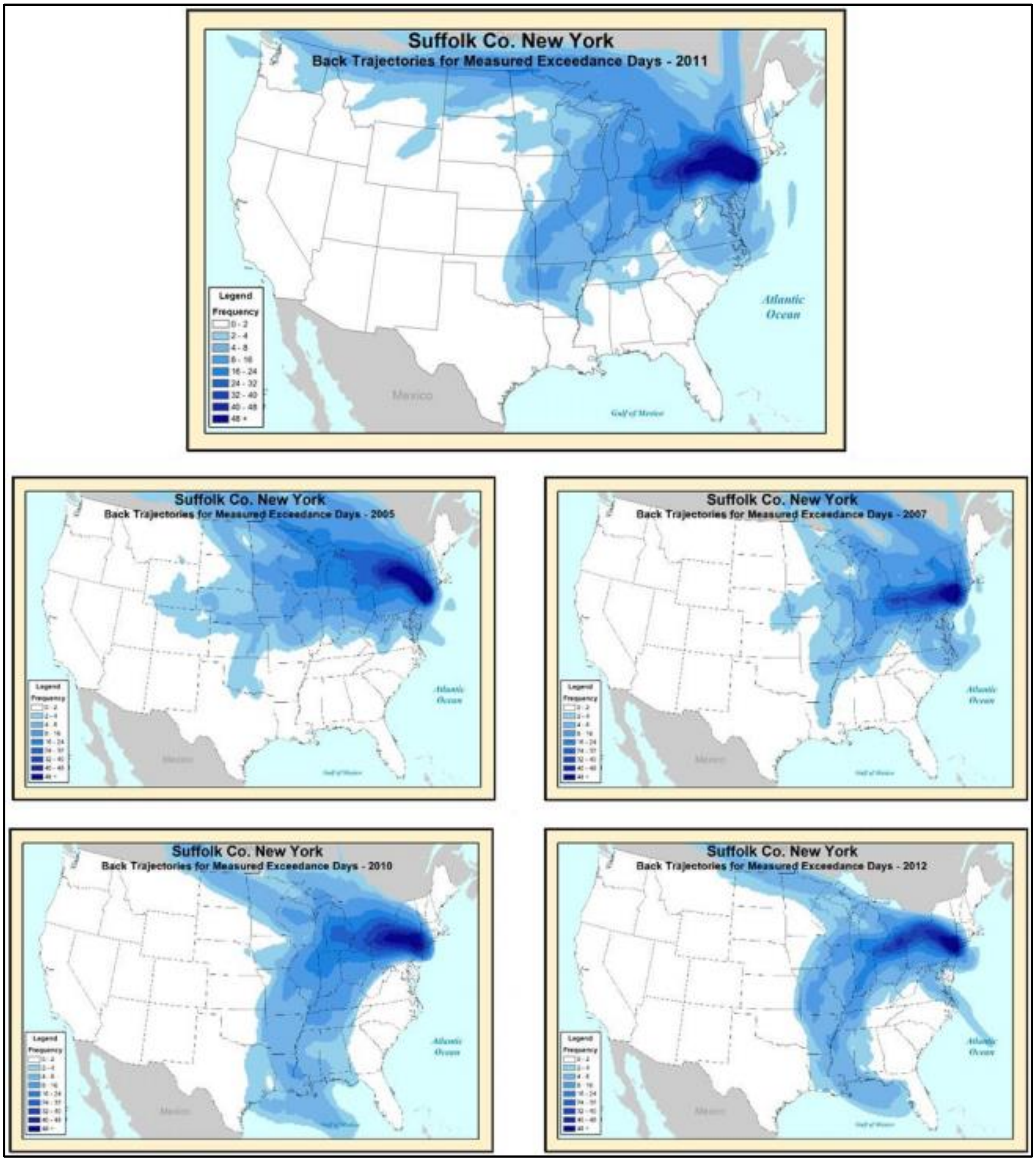


Figure G-7: Upwind States Linked to Philadelphia Co., PA Site 421010024: DE, IL, IN, KY, MD, NJ, OH, TN, TX, VA, and WV

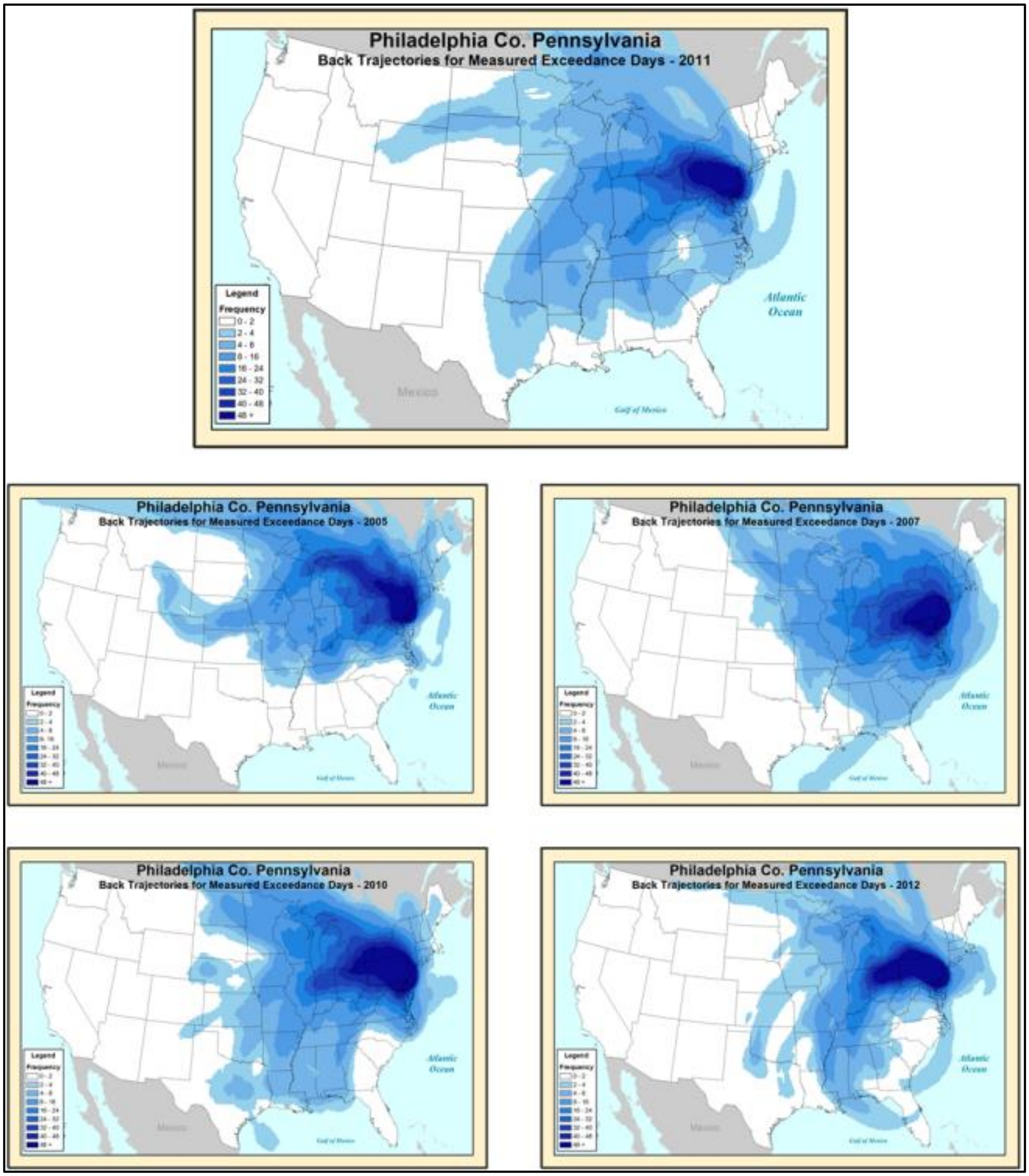
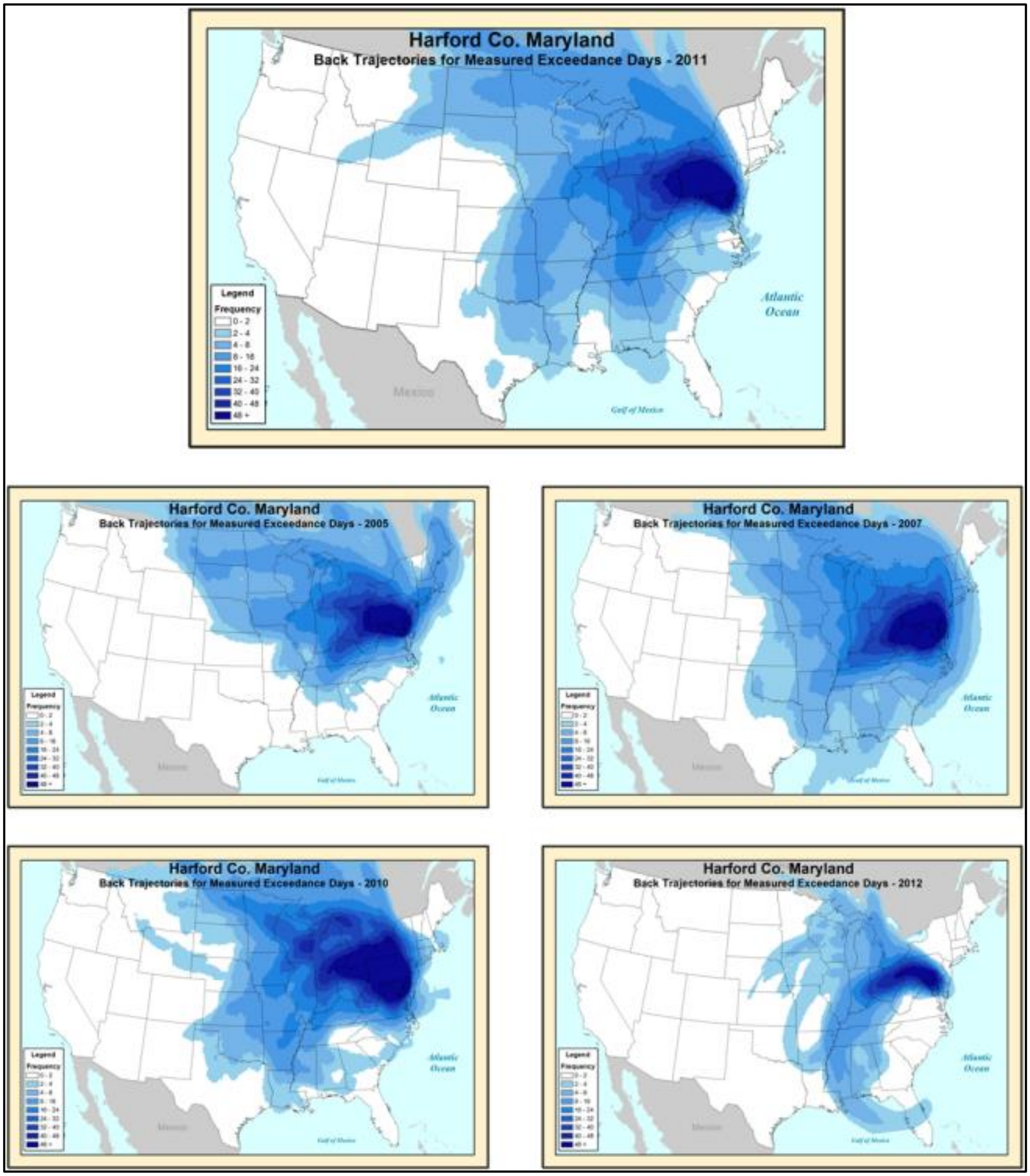


**Figure G-8: Upwind States Linked to Harford Co., MD Site 240251001:
IL, IN, KY, MI, OH, PA, TX, VA, and WV
Washington, D.C. is also linked to this receptor.**



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