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ECOLOGY
State of Washington

Washington State Implementation Plan Revision

Interstate Transport of Sulfur Dioxide and Ozone

Addressing requirements for the 2010 1-hour SO_2 and 2015 8-hour O_3 National Ambient Air Quality Standards

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Addressing requirements for the 2010 1-hour SO_2 and 2015 8-hour O_3 National Ambient Air Quality Standards

Air Quality Program
Washington State Department of Ecology
Olympia, Washington

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Table of Contents

Page

List of Figures and Tables ii
Figures ii
Tables ii
Acknowledgements iii
Executive Summary iv
Introduction 1
Difference between Public Comment Draft and Final Draft 1
Interstate Transport of Ozone 2
Background 2
Washington's Approach 3
Transport Assessment 4
Interstate Transport of SO_2 5
Background 5
Transport Assessment 7
Summary of Methodology 7
Washington's Impact on SO_2 Nonattainment and Maintenance Areas 7
Monitoring Data and Design Values in Other States 7
Emissions Inventory 8
Emissions-to-Distance (Q/D) Analysis 9
Appendix A. EPA Ozone Transport Modeling 15
Appendix B. Large SO_2 Sources in Washington 17
Appendix C. Public Involvement 18
Public Comments, Outreach, and Outreach Material 18
Notices of Proposed SIP Revision 19
Legal Notices 21
Public Involvement Calendar 22
Notices of Cancellation of Public Hearing 23

List of Figures and Tables

Figures

Figure 1. Map of significant SO_2 point sources in WA (>40 tons annually) and 50 km buffer inside WA border 10

Figure 2. Map of Washington sources within a 50 km radius of the Multnomah County receptor 11

Figure 3. Map showing Q/D ratios for sources emitting >40 tons annually 13

Tables

Table 1. Largest 2018 and 2023 Contribution from Washington to Downwind 8-Hour Ozone Nonattainment and Maintenance Receptors (ppb) 4

Table 2. Washington's SO_2 Standards 6

Table 3. SO_2 Design Values at Idaho receptors 8

Table 4. SO_2 Design Values for the Multnomah County receptor 8

Table 5. Washington State SO_2 2014 Emissions Inventory of anthropogenic sources 9

Table 6. Emission-to-source (Q/D) results for point sources with >1 values 12

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Executive Summary

The federal Clean Air Act requires Washington to ensure that neither its sources nor any other type of emissions activity contribute significantly to areas with high levels of air pollution in other states. These requirements are often referred as the "good neighbor" provisions of the Clean Air Act. Their objective is to ensure that downwind states are protected from harmful emissions originating in upwind states.

In 2010, EPA strengthened the primary National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO_2). Five years later, they updated the primary standards for ozone (O_3). The revised standards triggered the requirement for Washington to assess air pollution contributions to areas with SO_2 and O_3 concerns. In this submittal, Ecology demonstrates that Washington sources do not contribute significantly to nonattainment or interfere with maintenance of the 2010 1-hour SO_2 or 2015 8-hour O_3 NAAQS in any other state.

Ecology reviewed existing ambient monitoring data, emissions inventories, topography and meteorology features, technical support documents, and the latest design values to establish potential "red flags" indicative of a significant SO_2 transport to neighboring states. EPA provided modeling and analysis for O_3 transport, which shows that Washington sources do not significantly contribute to O_3 nonattainment or maintenance to other states. Furthermore, EPA's analysis puts the state well under its threshold for further consideration. Finally, there are no nonattainment or maintenance areas for either NAAQS in Washington's neighboring states.

Introduction

Ecology submits this State Implementation Plan (SIP) revision to address the requirements of the Clean Air Act (CAA) with regard to the 2010 1-hour sulfur dioxide (SO_2) and 2015 8-hour ozone (O_3) National Ambient Air Quality Standard (NAAQS). The bulk of this revision addresses Section 110(a)(2)(D)(i) - I, commonly referred to as "Prongs I and II." This part of the CAA requires that states create adequate provisions to prohibit any source or other type of anthropogenic emissions activity within the state from emitting any air pollutant in amounts that will contribute significantly to nonattainment or interfere with maintenance of the 2010 SO_2 and 2015 O_3 NAAQS in other states.

The requirements to control interstate transport of pollutants are called the "good neighbor" provisions of the CAA. The intent of the provisions is to protect residents in downwind states from air pollution originating in upwind states. The Washington SIP, codified in 40 CFR 52 Subpart WW, prohibits any source or type of air emissions within the state from significantly contributing to nonattainment or interfering with maintenance in another state.

This document describes the analysis developed by Ecology in support of this SIP revision. Ecology concludes that Washington sources do not contribute to nonattainment, or interfere with maintenance, in any other state with respect to the 2010 1-hour SO_2 and 2015 8-hour O_3 NAAQS.

Difference between Public Comment Draft and Final Draft

Ecology made the following changes to the public comment draft version of this document:

- Added this section
- Completed Appendix C after the conclusion of the public comment period
- Added Appendix D: SIP Adoption Order
- Corrected non-substantive errors (formatting, grammar, spelling, etc.)

Interstate Transport of Ozone

Background

Ground level ozone is the primary component of smog. Ozone that occurs naturally in the upper portions of the earth's atmosphere, often referred to as "good ozone," forms a layer that protects life on earth from intense ultraviolet radiation. Ozone that forms at ground level is harmful to breathe, and damages sensitive vegetation and ecosystems.

Ground level ozone forms when emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) "cook" in the sun making it mainly a summertime pollutant. The major sources of human-made NO_x and VOCs are:

- Motor vehicle exhaust
- Emissions from industrial facilities
- Electric utilities
- Gasoline vapors
- Chemical solvents

Air can transport ozone pollution over hundreds of miles, affecting both urban and rural areas.

Breathing air containing high levels of ozone can reduce lung function and increase respiratory symptoms, thereby aggravating asthma or other respiratory conditions. Ozone exposure also has been associated with increases in:

- Respiratory infections
- Asthma attacks
- Doctor visits
- Emergency department visits
- Hospital admissions for individuals with respiratory disease

Ozone exposure may also contribute to premature death, especially in people with heart and lung disease.

Scientific evidence shows that repeated exposure to ozone damages sensitive vegetation and trees, including those in forests and parks. This leads to reduced growth and productivity, increased susceptibility to disease and pests, and damaged foliage.

On December 28, 2015, EPA revised the primary (health-based) and secondary (ecosystem and welfare-based) ozone standards to 0.070 parts per million (ppm). EPA determined that the previous 2008 standard of 0.075 ppm was not adequate to protect public health, based on an

extensive body of scientific evidence on the health effects of ozone and the recommendation of EPA's independent Clean Air Scientific Advisory Committee.[1]

EPA and states have historically focused efforts to address ozone transport on reductions of NO_x. Between 1990 and 2016, concentrations of ground-level ozone (8-hour) declined 17 percent nationwide and 8 percent in the Northwest.[2] In the Eastern U.S., EPA continues to implement measures to reduce ozone interstate transport through implementation of the 2016 Cross-State Air Pollution Rule (CSAPR), which effectively replaced the 2003 NO_x Budget Trading Program[3] and 2005 Clean Air Interstate Rule (CAIR).[4] There is no comparable program for western states.

Washington's Approach

In December 2016, EPA released its "Air Quality Modeling Technical Support Document for the 2015 Ozone NAAQS Preliminary Interstate Transport Assessment" (Ozone Transport TSD).[5] In the "Ozone Transport TSD," EPA details photochemical air quality modeling it performed to project ozone concentrations at air quality monitoring sites to the year 2023. EPA then estimated state-by-state contributions to those 2023 concentrations.

EPA applies the CSAPR approach in the "Ozone Transport TSD" for identifying nonattainment and maintenance receptors and for identifying upwind states that contribute to these receptors based on the screening threshold (1 percent of the NAAQS). The "Ozone Transport TSD" states that based on the modeling results a state could demonstrate either that its contribution is below the screening threshold, or that it could evaluate the scope of its transport obligation and identify measures to achieve any needed emissions reductions.

Ecology reviewed EPA's modeling of ozone interstate transport for Washington. It indicates that most western states contribute less than 1 percent to downwind nonattainment or maintenance receptors. EPA's "Ozone Transport TSD" estimated Washington's 2023 contribution to be significantly less than the screening threshold of 0.70 ppb (Table 1). Following the CSAPR approach, the memo confirms that contributions below the screening threshold do not need further evaluation for actions to address transport.

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[1] Clean Air Scientific Advisory Committee Recommendations Concerning the Final Rule for the National Ambient Air Quality Standards for Ozone, 2008
[2] https://www.epa.gov/air-trends/ozone-trends
[3] https://www.epa.gov/airmarkets/nox-budget-trading-program
[4] https://archive.epa.gov/airmarkets/programs/cair/web/html/index.html
[5] Air Quality Modeling TSD for the 2015 Ozone NAAQS Preliminary Interstate Transport Assessment

Table 1. Largest 2018 and 2023 Contribution from Washington to Downwind 8-Hour Ozone Nonattainment and Maintenance Receptors (ppb)

Receptor Type	2018 Contribution[6]	2023 Contribution
Nonattainment	0.21	**0.15**
Maintenance	0.13	**0.11**

In accordance with EPA's approach in CSAPR and the 2015 "Good Neighbor" Memo, and based on the "Ozone Transport TSD" findings, Ecology asserts that Washington sources do not contribute significantly to nonattainment areas or interfere with maintenance of the 2015 ozone NAAQS.

Transport Assessment

In lieu of creating an original, parallel ozone transport assessment, Ecology submits data from EPA's "Ozone Transport TSD" to meet ozone transport SIP requirements. Appendix A contains tables from the "Ozone Transport TSD," which detail Washington sources' contribution to nonattainment and maintenance receptors. The complete "Ozone Transport TSD" is available on EPA's website at https://www.epa.gov/airmarkets/air-quality-modeling-technical-support-document-2015-ozone-naaqs-preliminary-interstate.

[6] 2018 concentrations were released in the 2008 NAAQS Ozone Transport TSD

Interstate Transport of SO_2

Background

Sulfur dioxide is one of the gaseous forms of sulfur oxide (SO_x) compounds emitted into the atmosphere from both human and natural activities. It is a precursor for particulate matter air pollution and acid rain.

When sulfur dioxide oxidizes in the atmosphere, it forms sulfuric acid (H_2SO_4). This can condense onto existing particles or form new particles, specifically fine particulate matter with smaller than 2.5 micrometers ($PM_{2.5}$) in diameter. This is known as "dry deposition" and occurs more often in dry conditions. When sulfur dioxide reacts with water in the atmosphere, the resulting H_2SO_4 contributes to the formation of acid rain. This process is known as "wet deposition" and occurs more often in moist conditions.

Oxidation and deposition in the atmosphere depend largely on local environmental conditions. The overall lifetime of SO_2 in the atmosphere ranges from one to four days.[7] Immediately near the source, SO_2 oxidation is extremely low because higher concentrations of other pollutants deplete available oxidizing agents. However, downwind from the source, the plume dilutes quickly and oxidation increases. Farther downwind, SO_2 converts to particles ($PM_{2.5}$). Thus, SO_2 concentrations and impacts peak near the source.

In the U.S., fossil fuel combustion by electrical utilities and industry is responsible for about 84 percent of anthropogenic SO_2 emissions.[8] Although the largest source category in the state, Washington's point source electrical and industrial combustion emissions made up only about 48 percent of statewide anthropogenic emissions in 2014.[9] The significant difference between Washington and the U.S. is largely due to the state's robust hydropower supply and expansive in-port and shipping activities. In 29 Washington counties, including King, Pierce, Snohomish, Spokane*, and Clark* Counties, marine and on-road mobile SO_2 emissions are greater than point source emissions.

Natural sources of SO_2 include wildfires, volcanos, and geothermal activities. In 2014, wildfires were responsible for about 22 percent of SO_2 emissions in Washington.[9] Photochemical reactions in the atmosphere also produce SO_2 from sulfur-containing compounds like dimethyl sulfide (C_2H_6S), emitted by marine organisms.

Public health studies link both short- and long-term exposure to SO_2 to an array of adverse respiratory effects. Short-term exposure is generally associated with asthmatics, including bronchoconstriction and increased asthma symptoms.[10] Health impacts from long-term exposure to SO_2 pollution are more closely associated with those seen from Particulate Matter (PM), as dry deposition occurs. Consequently, EPA and state agencies have regulated SO_2 as a criteria pollutant since they established the first SO_2 NAAQS in 1971. The original 24-hour standard

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[7] EPA's "Integrated Science-Assessment for Sulfur Oxides – Health Criteria," September 2008, Section 2.2
[8] EPA's 2014 "National Summary of Sulfur Dioxide Emissions," updated 2/10/2017
[9] Washington State Department of Ecology, preliminary 2014 statewide sulfur dioxide emissions data
* Border counties
[10] EPA's "Integrated Science-Assessment for Sulfur Oxides – Health Criteria," September 2008, Section 3.1

was 0.14 parts per million (ppm), not to be exceeded more than one time per year, and the annual standard was 0.03 ppm.

During the 1980s and 90s, EPA published several addendum documents and requested comments on the addition of a new 1-hour primary (health-based) standard. In 1994, EPA's proposal included new findings on short-term SO_2 exposure in asthmatics. EPA proposed to retain the 24-hour and annual standard, but requested comments on alternatives that reduced health risks posed by exposure to high 5-minute peaks of SO_2. EPA concluded that exposure of asthmatics to those levels was rare and, as result, the 24-hour and annual standards remained unchanged in 1996.

In 1998, the American Lung Association sued EPA because the agency had not established a 5-minute SO_2 standard. The D.C. Circuit Court found that EPA did not adequately explain its decision and remanded the matter back to EPA for further explanation. Finally, after negotiations between EPA and the American Lung Association, EPA requested that states voluntarily submit 5-minute peak SO_2 concentrations. This data helped inform the 2008 review of the SO_2 NAAQS.

In 2010, EPA revised the primary SO_2 NAAQS concluding that the existing 24-hour and annual standards were inadequate to protect public health from short-term SO_2 exposures. At that time, EPA established a new 1-hour standard at a level of 75 ppb, based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations. In the same ruling, EPA established a secondary 3-hour standard not to exceed 0.5 SO_2 ppm more than once per year.[11] This SIP, however, only addresses EPA's 2010 primary 1-hour SO_2 NAAQS. In 2013, Washington adopted federal SO_2 standards, which sunset previous state SO_2 standards.[12]

Table 2. Washington's SO_2 Standards[13]

Avg. Time	Level	Remarks
Annual	0.02 ppmv	Not to be exceeded more than once per calendar year
24-hour	0.14 ppmv	Not to be exceeded more than once per calendar year
3-hour	0.5 ppmv	Not to be exceeded more than once per calendar year
1-hour	75 ppbv (0.075 ppmv)	Annual 99th percentile of the daily maximum one-hour average must not exceed 75 ppb

[11] According to EPA, primary NAAQS focus on protecting public health, while secondary NAAQS protect public welfare, including protecting against decreased visibility and damage to animals, crops, vegetation, and buildings.
[12] WAC 173-476-130
[13] WAC 173-476-900

Transport Assessment

Summary of Methodology

To identify areas of SO_2 concern in other states, Ecology reviewed EPA's 2015 design values and area designations for the 2010 SO_2 NAAQS.[14] Washington's neighboring states, Oregon and Idaho, have no nonattainment or maintenance areas as of November 2017 and we do not anticipate any new nonattainment area designations in the near future. The closest nonattainment and maintenance areas are 1,500 km and 800 km away, respectively. Due to the large distance to the nonattainment and maintenance receptors, Ecology determines Washington sources do not contribute or interfere with air quality in those two areas.

To assess potential for transport of Washington SO_2 emissions, Ecology first reviewed Washington's preliminary 2014 statewide emissions inventory to determine relevant source categories. Next, Ecology performed an emissions-to-distance (Q/D) analysis to prioritize sources in terms of potential impact to the closest receptor in a neighboring state. Ecology also performed spatial analysis of sites meeting certain distance criteria from state borders and out-of-state SO_2 receptors. Finally, Ecology spoke with staff from both Oregon Department of Environmental Quality and Idaho Department of Environmental Quality, and neither indicated that Washington sources significantly affect receptors in their respective states.

Washington's Impact on SO_2 Nonattainment and Maintenance Areas

At about 1,500 km away, Miami, Arizona is the closest 1-hour SO_2 nonattainment area to a significant SO_2 source (greater than 40 tons annual emissions) in Washington. Because of this vast distance and the quickly oxidizing nature of SO_2, Ecology concludes that Washington sources do not significantly affect the Miami, Arizona nonattainment area.[15]

As of Ecology's most recent statewide SO_2 inventory (2014), the closest SO_2 maintenance area to Washington sources is the Yellowstone County SO_2 Maintenance Area (YCMA) near Billings, Montana, at about 800 km away.[16] On page 2 of Montana's 2010 YCMA Technical Support Document, the state determined that the SO_2 exceedances resulted from a specific industrial source within the state.[17] Therefore, Ecology concludes that Washington sources are not responsible for a significant contribution to the levels of SO_2 in the YCMA.

Monitoring Data and Design Values in Other States

In Idaho, SO_2 receptors are located in the southern area near the border with Wyoming and Nevada (Table 2). The Bannock County receptor site came within 50 percent of the 1-hour SO_2 NAAQS in 2015, but Ecology assesses Washington sources do not contribute to SO_2 in that area. This determination is based on the quickly oxidizing nature of SO_2 and the receptor's distance (over 600 km) from Washington sources.

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[14] EPA 2015 Air Quality Design Values data – updated 7/29/2016

[15] For more information, see the 2017 Miami, AZ SO_2 SIP Revision.

[16] EPA has reversed its finding of nonattainment in this since the Corette coal-fired power plant in Billings closed in March 2015 – Associated Press, May 2016

[17] Montana Technical Support Document for the 2010 1-hour SO_2 NAAQS, May 27, 2011

The closest significant source of SO_2 to the Idaho border (Boise Paper in Wallula) was about 150 km away from the Washington/Idaho border. We demonstrate below that it does not impact Idaho SO_2 attainment (Q/D = 1.85). Finally, the two Washington sources closest to Idaho's receptors both emit less than two tons of SO_2 annually. Based on distance, Q/D analysis, and emission levels, we conclude that these sites do not affect Idaho's SO_2 attainment.

Table 3. SO_2 Design Values at Idaho receptors[18]

CBSA	Site	Average	2012	2013	2014	2015	2016
Ada County, Idaho	160010010	1-hour	6 ppb	11 ppb	5 ppb	3 ppb	4 ppb
Bannock County, Idaho	160050004	1-hour	73 ppb	40 ppb	38 ppb	45 ppb	33 ppb
Caribou County, Idaho	160290031	1-hour	35 ppb	31 ppb	23 ppb	23 pm	32 ppb

The Multnomah County receptor is the only site measuring SO_2 in Oregon (Table 4). It is located in the Creston-Kenilworth Neighborhood of Southeast Portland. The receptor is currently attaining the 1-hour SO_2 standard. There are four Washington SO_2 sources within a 50-km radius of the site, three of which are relatively small and emit less than 10 tons SO_2 annually in 2014. The fourth source in the area emitted 17 tons in 2014 (Figure 2).[19]

Table 4. SO_2 Design Values for the Multnomah County receptor[20]

CBSA	Site	Average	2012	2013	2014	2015	2016
Portland-Vancouver-Beaverton, OR-WA	410510080	1-hour	10 ppb	5 ppb	3 ppb	4 ppb	3 ppb

Emissions Inventory

Ecology's most recent emissions inventory was for the year 2014. As of the date of this SIP, Ecology has not published the 2014 emissions inventory (EI) and the data is preliminary. Table 4 lists anthropogenic source categories used in the 2014 EI. As mentioned earlier, the main source categories are point sources and commercial marine vessels, which together account for about 85 percent of the total emissions of SO_2.

[18] Data obtained from EPA's Outdoor Air Quality Database for Idaho (7/5/2017)
[19] Per 40 CFR Part 51, Appendix W, 50 km is used as a distance threshold for this analysis
[20] Data obtained from EPA's Outdoor Air Quality Database for Oregon (7/5/2017)

Table 5. Washington State SO_2 2014 Emissions Inventory of anthropogenic sources[21]

Category	2014 SO_2 (short tons)
Point Sources	**14,510**
Commercial marine vessels	**11,316**
Silvicultural burning	1,177
Industrial, Commercial, Institutional combustion	1,095
On-road mobile	591
Residential fuel use: natural gas, oil, LPG	574
Aircraft: military, commercial, general aviation	383
Woodstoves, fireplaces, inserts	272
Residential outdoor burning: yard waste, trash	263
Agricultural burning	185
Non-road mobile except locomotives	87
Locomotives	10
Recreational boats	6

*Major sources are in **bold.**

Emissions-to-Distance (Q/D) Analysis

The Q/D analysis is a commonly used first-level screening technique to estimate potential for impact on visibility in Class I areas under the Regional Haze Rule[22] and in Prevention of Significant Deterioration (PSD) permitting modeling.[23]

The Federal Land Managers Air Quality Related Values Workgroup (FLAG) considers a Q/D maximum value of 10 for sources not contributing to visibility impairment. PSD modeling suggests a threshold value of 20. For the purposes of this assessment, Ecology considered sources with Q/D ratios less than 20 that were more than 50 km away from the state borders or Multnomah County receptor to have no impact on neighboring SO_2 receptors.[24]

[21] Washington State Department of Ecology, preliminary 2014 statewide sulfur dioxide emissions data
[22] See Federal Land Managers Air Quality Related Values Workgroup (FLAG), Phase I Report, section 3.2, 2010 and 70 FR 39104 "Regional Haze Regulations and Guidelines for Best Available Retrofit Technology (BART) Determinations", July 6, 2005
[23] See "Screening Threshold Method for PSD Modeling", North Carolina AQS, September 12, 1985
[24] 40 CFR Part 51, Appendix W; Ecology chose the 10 ton threshold for sources close to the border to capture a greater number of sources than would have with the standard Title V Permit emission threshold of 100 tons-per-year.

Point Sources

In order to estimate potential impact of significant sources on the Multnomah County receptor, Ecology reviewed all the point sources in the state and selected those emitting above 40 tons as significant. This is in accordance with the PSD regulations.[25] Figure 1 shows a map of all the sources above 40 tons. A list of these sources is included in Table B-1 of this document's Appendix B.

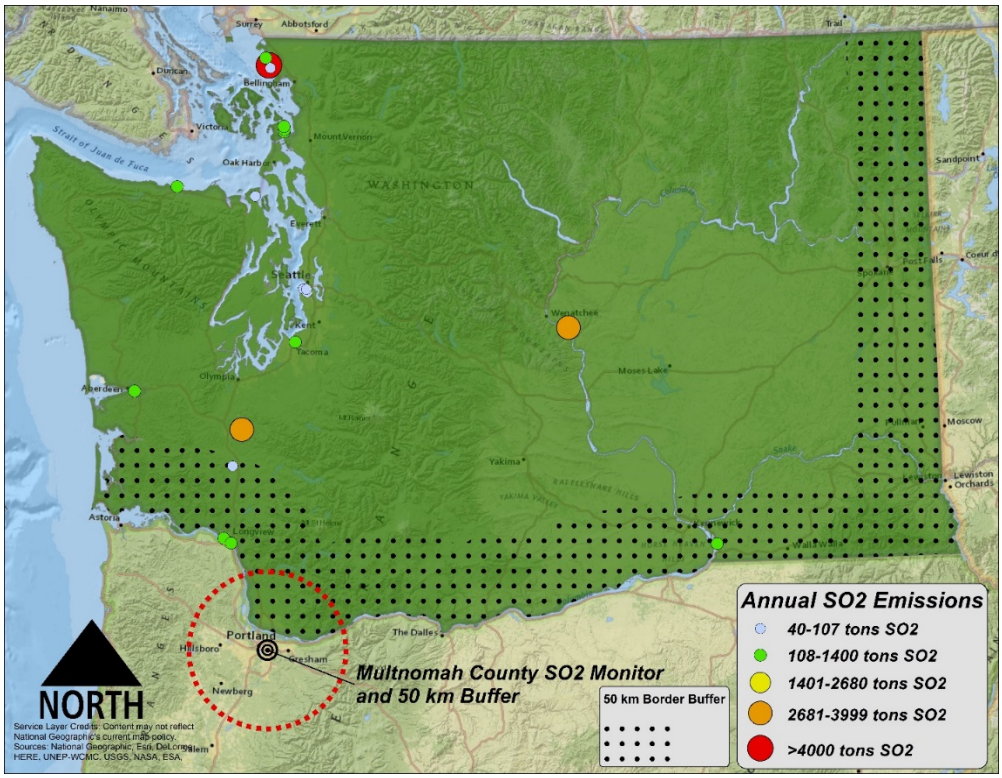

Figure 1. Map of significant SO_2 point sources in WA (>40 tons annually) and 50 km buffer inside WA border

Subsequently, we examined the sources that emitted greater than 10 tons and were within 50 km distance from the Multnomah County receptor (Figure 2). We identified sources using Ecology's most recent statewide SO_2 emissions inventory, measured distances using Google Earth, and built spatial models using ArcGIS. Distance-to-border measurements are from the source's stacks to the closest point of the Washington/Oregon border.[26] Distance-to-receptor measurements are from the source's stacks to the center of the receptor near SE 57th Avenue and SE Lafayette Street in Portland.

[25] 40 CFR 52.21(b)(23)(i)

[26] For most sources, the closest point to the Oregon/Washington border was near the unincorporated community of Skamokawa on the Columbia River.

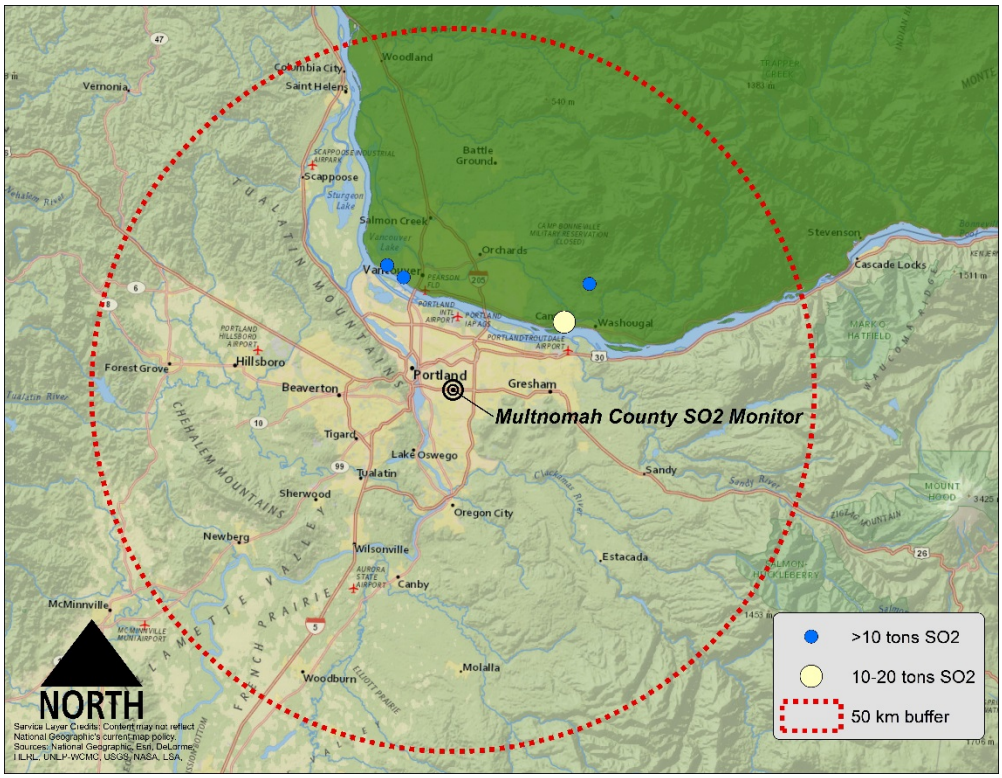

Figure 2. Map of Washington sources within a 50 km radius of the Multnomah County receptor

Ecology's Q/D analysis (Table 6) found nine point source facilities with a Q/D value greater than 1. Of these, the majority of facilities' Q/D values were low (less than 20) or very low (less than 10) with the single exception of the TransAlta Centralia Generation facility (Q/D = 21.5).

Spatial analysis identified three sources with annual emissions greater than 100 tons SO_2 within 50 km of the border and one source within 50 km of the Multnomah County receptor with annual emissions greater than 10 tons SO_2 (Figure 2). No sources with a Q/D value greater than 1 were within 50 km of the Multnomah County receptor (Table 6).

Table 6. Emission-to-source (Q/D) results for point sources with >1 values

Facility	Type	County	Distance to border (km)	Distance to receptor (km)	2014 SO_2 (short tons)	Q/D
TransAlta Centralia Generation LLC	Electricity Generation via Combustion	Lewis	68	141	3037	**21.5**
Alcoa Primary Metals Intalco Works	Primary Aluminum Plant	Whatcom	292	373	4794	**12.9**
Alcoa Primary Metals Wenatchee Works	Primary Aluminum Plant	Chelan	164	281	2935	**10.5**
Weyerhaeuser NR Company	Pulp and Paper Plant	Cowlitz	1	76	440	**5.8**
BP Cherry Point Refinery	Petroleum Refinery	Whatcom	296	377	917	**2.4**
Longview Fibre	Pulp and Paper Plant	Cowlitz	1	72	141	**2.0**
RockTenn Mill Tacoma	Pulp and Paper Plant	Pierce	131	197	261	**1.3**
Cosmo Specialty Fibers	Pulp and Paper Plant	Grays Harbor	75	185	237	**1.3**
Puget Sound Refining Company	Petroleum Refinery	Skagit	255	331	347	**1.0**

The TransAlta Centralia Generation facility was the only source that exceeded the Q/D = 20 ratio threshold.

Despite the facility exceeding our Q/D ratio threshold, recently published SO_2 emissions modeling of the TransAlta facility show limited SO_2 impact outside of the site's immediate area.[27] Furthermore, the facility has limited SO_2 emissions at the facility to less than 1,350 pounds per hour as of December 15, 2016.[28]

Ecology also reviewed 2016 modeling data of the site's SO_2 plume and found that, although the plume's pattern of distribution is generally toward the south, the plume did not reach the Portland area in significant concentration ($\leq$ 0.6 ppb SO_2).[29] Ecology therefore concludes that this facility did not significantly contribute to SO_2 emissions observed at the Multnomah County receptor.

[27] Air Quality Modeling Results: Levels of Sulfur Dioxide in the Ambient Air Around TransAlta Centralia Generation Power Plant, Washington State Department of Ecology, January 2017
[28] SWCAA Regulatory Order to Limit Sulfur Dioxide Emissions (16-3202), December 2016
[29] 2016 AIRPACT-5 Dynamic Map data

As an additional assessment on significant sources of SO_2 within 50 km of the border or 50 km of the Multnomah County receptor, Ecology reviewed 2014 monitoring data from the Multnomah County site, local weather data, and regional emissions modeling.

Monitoring data showed the highest observed 1-hour SO_2 concentration at the site (4.2 ppb) in 2014 occurred on February 10.[30] Using weather conditions at the Portland International Airport as a proxy for the Multnomah County receptor, weather data from February 10, 2014 shows highly variable winds predominately from the south, southeast, and southwest. [31] This suggests that significant transport of SO_2 from Washington sources within 50 km of the Multnomah County receptor on the day of highest 1-hour concentration observation is unlikely.

As an additional measure, Ecology reviewed air quality forecasting data in the Portland area. The data suggest that the majority of emissions detected by the Multnomah site originate within the city limits.[32]

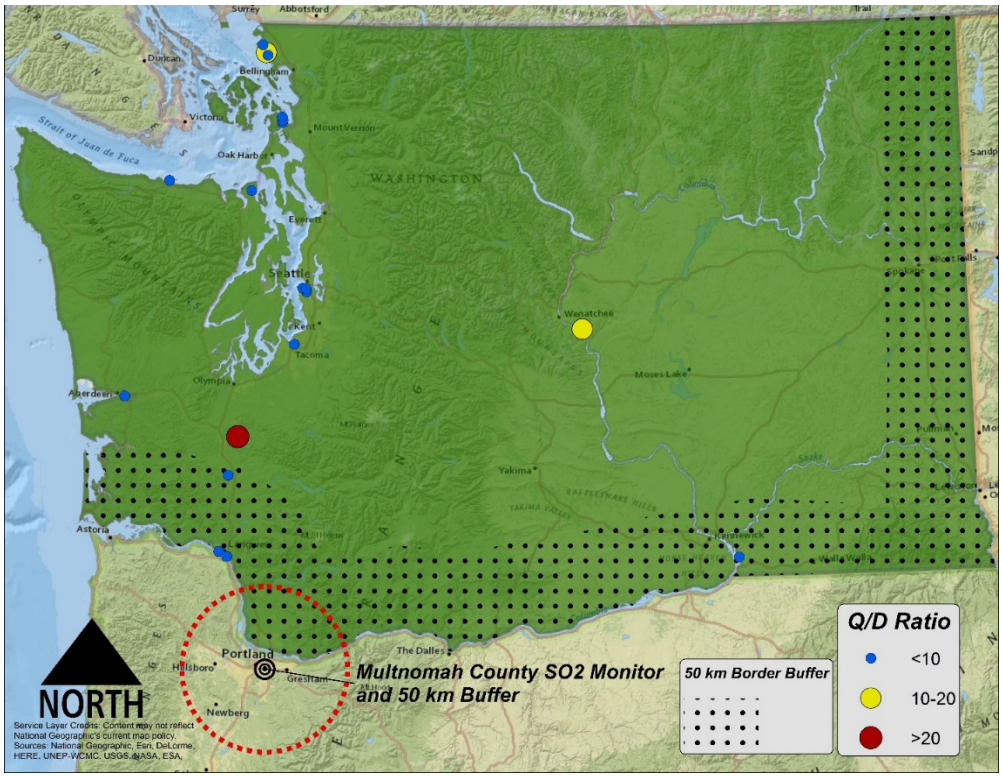

Figure 3. Map showing Q/D ratios for sources emitting >40 tons annually

Finally, data from the Multnomah County receptor show that SO_2 levels have not exceeded 15 percent of the 2010 1-hour SO_2 NAAQS of 75 ppb since at least 2012. While this site is not a

[30] 2014 data accessed via AirNow Tech
[31] University of Washington, Department of Atmospheric Science weather database
[32] Washington State University, AIRPACT-5 Dynamic Map

receptor of concern, it is the only SO_2 receptor within 50 km of the Washington border, which warranted the additional analysis provided above.

Ecology concludes that Washington point sources do not contribute significantly to SO_2 pollution observed at the Multnomah County receptor.

Commercial Marine Vessels

Commercial Marine Vessels (CMVs) emissions and emissions related to port activities are the second largest source of SO_2 in Washington, responsible for roughly 37 percent of SO_2 emissions in 2014.[33]

Although the Ports of Port Angeles, Bellingham, and Seattle are the second, fourth, and sixth largest sources of SO_2 respectively, over 98 percent of all CMV emissions in the state are located in non-border counties at significant distances from monitoring locations in neighboring states.

The Q/D ratios obtained are still within the low (less than 20) and very low (less than 10) range according to the thresholds used as reference in this analysis. Even though the assumptions made to analyze the impact of emissions related to marine activities are approximated and likely to overestimate impact by attributing all the CMV-related SO_2 emissions to one point, the results suggest that these type of sources are not likely to contribute significantly, or interfere with maintenance, in any other state with respect to the 2010 1-hour SO_2 NAAQS.

[33] Washington State Department of Ecology, preliminary 2014 statewide sulfur dioxide emissions data

Appendix A. EPA Ozone Transport Modeling

Table A-1. This table is from EPA's December 2016 Ozone Transport TSD (p. 17). It shows the largest contribution from each state to downwind 8-Hour Ozone Nonattainment Receptors.

Upwind States	Largest Contribution to a Downwind Nonattainment Receptor (ppb)	Upwind States	Largest Contribution to a Downwind Nonattainment Receptor (ppb)
Alabama	0.37	Montana	0.09
Arizona	0.74	Nebraska	0.37
Arkansas	1.16	Nevada	0.62
California	0.19	New Hampshire	0.01
Colorado	0.32	New Jersey	11.73
Connecticut	0.43	New Mexico	0.18
Delaware	0.55	New York	0.19
District of Columbia	0.70	North Carolina	0.43
Florida	0.49	North Dakota	0.15
Georgia	0.38	Ohio	2.38
Idaho	0.07	Oklahoma	2.39
Illinois	14.92	Oregon	0.61
Indiana	7.14	Pennsylvania	9.11
Iowa	0.43	Rhode Island	0.00
Kansas	1.01	South Carolina	0.16
Kentucky	2.15	South Dakota	0.08
Louisiana	2.87	Tennessee	0.52
Maine	0.01	Texas	1.92
Maryland	1.73	Utah	0.24
Massachusetts	0.05	Vermont	0.00
Michigan	1.77	Virginia	5.04
Minnesota	0.43	Washington	0.15
Mississippi	0.56	West Virginia	2.59
Missouri	1.20	Wisconsin	0.47
-	-	Wyoming	0.31

Table A-2. This table is from EPA's December 2016 Ozone Transport TSD (p. 18). It shows the largest contribution from each state to downwind 8-Hour Ozone Maintenance Receptors.

Upwind States	Largest Contribution to a Downwind Maintenance Receptor (ppb)	Upwind States	Largest Contribution to a Downwind Maintenance Receptor (ppb)
Alabama	0.48	Montana	0.11
Arizona	0.52	Nebraska	0.41
Arkansas	2.20	Nevada	0.43
California	2.03	New Hampshire	0.02
Colorado	0.25	New Jersey	8.65
Connecticut	0.36	New Mexico	0.41
Delaware	0.38	New York	15.36
District of Columbia	0.08	North Carolina	0.43
Florida	0.22	North Dakota	0.13
Georgia	0.31	Ohio	3.82
Idaho	0.16	Oklahoma	1.30
Illinois	21.69	Oregon	0.17
Indiana	6.45	Pennsylvania	6.39
Iowa	0.60	Rhode Island	0.02
Kansas	0.64	South Carolina	0.15
Kentucky	1.07	South Dakota	0.06
Louisiana	3.37	Tennessee	0.69
Maine	0.00	Texas	2.49
Maryland	2.20	Utah	1.32
Massachusetts	0.11	Vermont	0.01
Michigan	1.76	Virginia	2.03
Minnesota	0.34	Washington	0.11
Mississippi	0.65	West Virginia	0.92
Missouri	2.98	Wisconsin	1.94
-	-	Wyoming	0.92

Appendix B. Large SO_2 Sources in Washington

Table B-1. Point sources with greater than 40 tons of annual SO_2 emissions in Washington (2014 National Emissions Inventory)

Site Name	Facility Type	SO_2 (tons)	County	City
Alcoa Primary Metals Intalco Works	Primary Aluminum Plant	4794	Whatcom	Ferndale
TransAlta Centralia Generation, LLC	Electricity Generation via Combustion	3037	Lewis	Centralia
Alcoa Primary Metals Wenatchee Works	Primary Aluminum Plant	2935	Chelan	Malaga
BP Cherry Point Refinery	Petroleum Refinery	917	Whatcom	Blaine
Weyerhaeuser NR Company	Pulp and Paper Plant	440	Cowlitz	Longview
Puget Sound Refining Company	Petroleum Refinery	347	Skagit	Anacortes
RockTenn Tacoma Mill	Pulp and Paper Plant	261	Pierce	Tacoma
Cosmo Specialty Fibers	Pulp and Paper Plant	237	Grays Harbor	Cosmopolis
Chemtrade	H_2SO_4 Production	215	Skagit	Anacortes
Tesoro Northwest	Petroleum Refinery	191	Skagit	Anacortes
Boise Paper	Pulp and Paper Plant	186	Walla Walla	Wallula
Nippon Paper Industries USA Company, LTD	Pulp and Paper Plant	154	Clallam	Port Angeles
Longview Fibre Paper and Packaging, Inc.	Pulp and Paper Plant	141	Cowlitz	Longview
Ardagh Glass	Glass Bottle Production	106	King	Seattle
Port Townsend Paper	Pulp and Paper Plant	79	Jefferson	Port Townsend
Nucor Steel Seattle, Inc.	Steel Mill	76	King	Seattle
Ash Grove Cement Company	Cement Production	57	King	Seattle
Cardinal FG Winlock	Steel Mill	57	Lewis	Winlock
Phillips 66	Petroleum Refinery	49	Whatcom	Ferndale

Appendix C. Public Involvement

Public Comments, Outreach, and Outreach Material

This appendix documents Ecology's efforts to meet and exceed both federal and state requirements for public involvement during the development of this SIP revision. Ecology conducted public outreach for this SIP in conjunction with Interstate Transport SIP revision related to the 2010 1-hour sulfur dioxide and 2015 8-hour ground level ozone NAAQS.

Ecology held a public comment period from November 8, 2017 through December 21, 2017 and offered to hold a public hearing on December 14, 2017, if requested. Ecology notified the public of the public comment period and hearing on Ecology's website and public involvement calendar, via email, and through a November 7, 2017 public notice in the *Seattle Journal of Commerce*. The public did not submit comment or request that Ecology hold a public hearing.

Notices of Proposed SIP Revision

Notice on Ecology's Website

11/8/2017 Infrastructure, Rules, and Programs SIPs | Washington State Department of Ecology

DEPARTMENT OF ECOLOGY State of Washington

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Infrastructure, Rule, and Program SIPs

Infrastructure SIPs

When EPA establishes a new National Ambient Air Quality Standard (NAAQS) or revises an existing standard, the federal Clean Air Act requires Washington to develop an infrastructure State Implementation Plan (SIP). The infrastructure SIP demonstrates that Washington has the necessary legal authority, regulatory structure, and sufficient resources to implement the standards statewide.

- EPA's list of federally-approved infrastructure SIPs

Infrastructure SIP Title	Status
Interstate transport SIPs for the 2010 sulfur dioxide, 2015 ground-level ozone, and 2012 fine particles National Ambient Air Quality Standards • Draft SIP for Sulfur Dioxide and Ground-Level Ozone Transport • Draft SIP for Fine Particulate Transport	**Public comment period:** November 8, 2017 to December 21, 2017 • Send comments online, to AQComments@ecy.wa.gov. or mail comments to: *Sam Wilson* Air Quality Program Washington State Department of Ecology P.O. Box 47600 Olympia, WA 98501-7600 • Public hearing, *if requested*: Thursday, December 14, 2017 at 6:30 p.m. Ecology Headquarters 300 Desmond Drive SE Lacey, WA 98503 To request a hearing, contact Sam Wilson by December 8, 2017. If the public hearing is cancelled, it will be posted on this page and on Ecology's Public Involvement Calendar. For more information, contact Sam Wilson at 360-407-6837.
Interstate transport of lead, nitrogen dioxide, ozone, and fine particles air pollution • SIP Adoption Order • SIP Submittal Letter • SIP Submittal for Interstate Transport of Lead, Nitrogen Dioxide, and Ground-Level Ozone • SIP Submittal for Interstate Transport of Fine Particulate Matter	Ecology accepted comments from March 9, 2015 through April 10, 2015. EPA proposed to partially approve and partially disapprove the NO_2 and lead portions of the interstate transport SIP. • Federal Register Notice EPA approved the ground-level ozone portion of the interstate transport SIP on December 15, 2015. • Federal Register Notice EPA approved the fine particle portion of the interstate transport SIP on July 30, 2015. • Federal Register Notice

Notice sent through Ecology Listserv

Wilson, Sam (ECY)

From: Ecology's Air Quality Rule and State Implementation Plan Updates <ECY-AQ-RULE-AND-SIP-UPDATES@LISTSERV.WA.GOV> on behalf of ECY RE AQComments <AQComments@ECY.WA.GOV>
Sent: Tuesday, November 07, 2017 10:03 AM
To: ECY-AQ-RULE-AND-SIP-UPDATES@LISTSERV.WA.GOV
Subject: Washington SIP Notice: Comment on Proposed SO2, O3, and PM2.5 Interstate Transport SIPs

Greetings,

The Washington State Department of Ecology is accepting comments on a proposed State Implementation Plan (SIP) related to the transport of air pollutants generated by Washington sources to other states. The SIP addresses transport of sulfur dioxide (SO_2), ozone (O_3), and fine particulate matter ($PM_{2.5}$).

Ecology must submit documentation of how Washington sources affect nonattainment or hinder progress in maintenance areas in neighboring states. Based on our review of the most recent air monitoring data, air modeling data, recent publications, and conversations with neighboring states, Ecology proposes that Washington sources do not significantly contribute to nonattainment or maintenance areas in other states for the 2010 SO_2, 2015 O_3, and 2012 $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS).

Review Proposed SIP Revision:
You may review and comment on the proposed SIP from November 8, 2017 through December 21, 2017. The draft documents are available for review at Ecology's website.

Public Hearing (if requested):

- The public can request a public hearing by contacting Sam Wilson by email at sam.wilson@ecy.wa.gov or by phone at 360-407-6837.
- Requests for public hearing must be received no later than December 8, 2017 at 5 pm PST.
- If requested, a hearing will be held at 6:30 pm PST on December 14, 2017 at Ecology Headquarters, 300 Desmond Drive SE, Lacey, WA 98503.
- If a hearing request is not received, Ecology will announce a cancellation of the December 14 public hearing on its public involvement calendar.

How to comment:

- Visit Ecology's eComment website
- Mail Washington Dept. of Ecology, Sam Wilson, PO Box 47600, Olympia, WA 98504-7600
- Testify or submit written comments at the public hearing (if one is requested).
- If you have questions regarding comment submission, please email Sam Wilson at sam.wilson@ecy.wa.gov.

Contact Us:

- Sam Wilson at (360) 407-6837 or sam.wilson@ecy.wa.gov

1

Legal Notices

***Seattle Daily Journal of Commerce*, November 7, 2017**

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Department of Ecology

NOTICE OF PUBLIC COMMENT PERIOD AND PUBLIC HEARING ON Interstate Transport of SO2, O3, and PM2.5

Ecology is accepting comments on our analysis determining that Washington's air emissions of sulfur dioxide (SO2), ozone (O3), and fine particulate matter (PM2.5) do not affect nonattainment or impair maintenance areas in other states. This analysis is known as an Interstate Transport State Implementation Plan (IT SIP).

You may review and comment on the proposed IT SIPs from November 8, 2017 through December 21, 2017. The public review documents are available for review at: http://www.ecy.wa.gov/programs/air/sips/plans/infrastructure.htm.

The public can request a public hearing by contacting Sam Wilson by email at sam.wilson@ecy.wa.gov or by phone at 360-407-6837. The deadline to request a hearing is December 8, 2017 at 5 pm PST. If Ecology receives a hearing request by the deadline, we will hold it at 6:30 pm on December 14, 2017 at Ecology Headquarters, 300 Desmond Drive SE, Lacey, WA 98503.

If Ecology does not receive a request for public hearing, we will post a cancellation of the December 14 hearing on our public involvement calendar: https://fortress.wa.gov/ecy/publiccalendar/.

To comment on the plan:

- visit http://ac.ecology.commentinput.com/?id=aPsx2
- email AQComments@ecy.wa.gov
- mail:

Sam Wilson
Air Quality Program
Washington State Dept. of Ecology
P.O. Box 47600
Olympia, WA 98504-7600

- testify or submit written comments at the public hearing.

For more information, contact Sam Wilson at (360) 407-6837 or sam.wilson@ecy.wa.gov.

For special accommodations or documents in alternate format or languages, call (360) 407-6800, 711 (relay service), or 877-833-6341 (TTY)

Date of publication in the Seattle Daily Journal of Commerce, November 7, 2017.

11/7(355495)

Phone (206) 622-8272 • Fax (206)-622-8416 • legals@djc.com

Public Involvement Calendar

Notice of Comment Period and Public Hearing

Dec 14 2017 6:30PM **Public Hearing/Webinar - Lacey**
---------- **Revised Interstate Transport State Implementation Plan**

Ecology is accepting comments on our analysis determining that Washington's air emissions of sulfur dioxide, ozone, and fine particles do not affect areas in neighboring states that do not meet or are maintaining to meet a national air quality standard. This analysis is known as an Interstate Transport State Implementation Plan. We will hold a public hearing if one is requested by Dec. 8, 2017. If a public hearing is not requested by then, we will post a cancellation on this calendar and on the web page.

More Information: More Information
Location: Dept of Ecology HQ/Southwest Regional Office
300 Desmond Drive SE
Lacey , WA
Sponsor: Ecology
ECY HQ
Contact: Sam Wilson
(360) 407-6837 / sam.wilson@ecy.wa.gov

Public Comment Period - Nov 8 2017 - Dec 21 2017

Nov 08 2017 **Public Comment Period - Statewide**
Dec 21 2017 **Revised Interstate Transport State Implementation Plan**

Ecology is accepting comments on our analysis determining that Washington's air emissions of sulfur dioxide, ozone, and fine particles do not affect areas in neighboring states that do not meet or are maintaining to meet a national air quality standard. This analysis is known as an Interstate Transport State Implementation Plan. We will hold a public hearing if one is requested by Dec. 8, 2017. If a public hearing is not requested by then, we will post a cancellation on this calendar and on the web page.

More Information: More Information
Location:
Statewide , WA
Sponsor: Ecology
ECY HQ
Contact: Sam Wilson
(360) 407-6837 / sam.wilson@ecy.wa.gov

Public Hearing/Webinar - Dec 14 2017 6:30PM

Notices of Cancellation of Public Hearing

Public Involvement Calendar

Nov 08 2017 Public Comment Period - Statewide
Dec 21 2017 HEARING CANCELLED: Revised Interstate Transport State Implementation Plan

Ecology is accepting comments on our analysis determining that Washington's air emissions of sulfur dioxide, ozone, and fine particles do not affect areas in neighboring states that do not meet or are maintaining to meet a national air quality standard. This analysis is known as an **Interstate** Transport State Implementation Plan. We will hold a public hearing if one is requested by Dec. 8, 2017. If a public hearing is not requested by then, we will post a cancellation on this calendar and on the web page.

More Information: More Information
Location:

Statewide , WA
Sponsor: Ecology
ECY HQ
Contact: Sam Wilson
(360) 407-6837 / sam.wilson@ecy.wa.gov

Public Hearing/Webinar - Dec 14 2017 6:30PM

Dec 14 2017 6:30PM Public Hearing/Webinar - Lacey
---------- HEARING CANCELLED: Revised Interstate Transport State Implementation Plan

Ecology is accepting comments on our analysis determining that Washington's air emissions of sulfur dioxide, ozone, and fine particles do not affect areas in neighboring states that do not meet or are maintaining to meet a national air quality standard. This analysis is known as an Interstate Transport State Implementation Plan. We will hold a public hearing if one is requested by Dec. 8, 2017. If a public hearing is not requested by then, we will post a cancellation on this calendar and on the web page.

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Public Comment Period - Nov 8 2017 - Dec 21 2017

Notice on Ecology's Website

Infrastructure, Rule, and Program SIPs

Infrastructure SIPs

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Infrastructure SIP for the 2010 Nitrogen Dioxide, 2008 Ozone, and 1997, 2006, and 2012 Fine Particulate Matter National Ambient Air Quality Standards • SIP Submittal • News Release - 07/25/2014	EPA partially approved part of the SIP submittal on 1/14/15. • Federal Register Notice EPA proposed to partially approve another part of the SIP submittal on 10/17/14 in a separate action. • Federal Register Notice
Infrastructure SIP Certification for the 2008 Lead National Ambient Air Quality Standards • SIP Submittal • FAQ • 2012 Airport Lead Study: Auburn Municipal Airport and Harvey Field	EPA partially approved this SIP on 7/23/14. • Federal Register Notice
Infrastructure SIP Certification for the 1997 8-Hour Ozone National Ambient Air Quality Standards • SIP submittal	EPA partially approved this SIP on 5/24/12. • Federal Register Notice
Interstate Transport SIP State Implementation Plan for 1997 8-Hour Ozone and PM2.5 National Ambient Air Quality Standards	EPA approved this SIP on 8/27/07. • Federal Register Notice