Technical Support Document:

Chapter 10
Intended Round 4 Area Designations for the 2010 1-Hour SO_2 Primary National Ambient Air Quality Standard for Washington

1. Summary

Pursuant to section 107(d) of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA, we, or us) must designate areas as either "nonattainment," "attainment," or "unclassifiable" for the 2010 1-hour sulfur dioxide (SO_2) primary national ambient air quality standard (NAAQS) (2010 SO_2 NAAQS). The CAA defines a nonattainment area as an area that does not meet the NAAQS or that contributes to a nearby area that does not meet the NAAQS. An attainment area is defined by the CAA as any area that meets the NAAQS and does not contribute to a nearby area that does not meet the NAAQS. Unclassifiable areas are defined by the CAA as those that cannot be classified on the basis of available information as meeting or not meeting the NAAQS. See CAA section 107(d)(1)(A)(i)-(iii).

In this action, EPA defines a nonattainment area as an area that, based on available information including (but not limited to) monitoring data and/or appropriate modeling analyses, EPA has determined either: (1) does not meet the 2010 SO_2 NAAQS, or (2) contributes to ambient air quality in a nearby area that does not meet the NAAQS. An attainment/unclassifiable area is defined as an area that, based on available information including (but not limited to) appropriate monitoring data and/or modeling analyses, EPA has determined meets the NAAQS and does not likely contribute to ambient air quality in a nearby area that does not meet the NAAQS. An unclassifiable area is defined as an area for which the available information does not allow EPA to determine whether the area meets the definition of a nonattainment area or the definition of an attainment/unclassifiable area.

In previous final actions, EPA has issued designations for the 2010 SO_2 NAAQS for most areas of the country.[1] As mentioned, EPA is under a deadline of December 31, 2020, to designate the areas addressed in this TSD as required by the U.S. District Court for the Northern District of California. We are referring to the set of designations being finalized by the deadline of December 31, 2020, as "Round 4" or the final round of the designations process for the 2010 SO_2 NAAQS. After these Round 4 designations are completed, there will be no remaining undesignated areas for the 2010 SO_2 NAAQS.

This technical support document (TSD) addresses designations for all remaining undesignated areas in Washington for the 2010 SO_2 NAAQS. Areas with monitored violations of the NAAQS

[1] Most areas of the U.S. were previously designated in actions published on August 5, 2013 (78 FR 47191), July 12, 2016 (81 FR 45039), December 13, 2016 (81 FR 89870), January 9, 2018 (83 FR 1098) and April 5, 2018 (83 FR 14597). EPA is not reopening these previous designation actions in this current Round 4 of designations under the 2010 SO_2 NAAQS, except where specifically discussed.

are explicitly evaluated in this TSD. Undesignated areas in Washington without monitored violations are referenced in this TSD for completeness but are covered in more detail in Chapter 2.

EPA is under a December 31, 2020, deadline to designate all remaining undesignated areas as required by the U.S. District Court for the Northern District of California.[2] This deadline is the final of three deadlines established by the court for EPA to complete area designations for the 2010 SO_2 NAAQS. The remaining undesignated areas are: 1) those areas which, under the court order, did not meet the criteria that required designation in Round 2 and also were not required to be designated in Round 3 due to installation and operation of a new SO_2 monitoring network by January 2017 in the area meeting EPA's specifications referenced in EPA's SO_2 Data Requirements Rule (DRR)[3], and 2) those areas which EPA has not otherwise previously designated for the 2010 SO_2 NAAQS. EPA previously issued guidance on how to appropriately and sufficiently monitor ambient air quality in the "SO_2 NAAQS Designations Source-Oriented Monitoring Technical Assistance Document" (SO_2 NAAQS Designations Monitoring TAD).[4]

Washington submitted its first recommendation regarding designations for the 2010 1-hour SO_2 NAAQS on June 2, 2011, to designate the whole state as unclassifiable. The state submitted a formal recommendation for Round 4 designations on June 15, 2020, for Douglas and Chelan Counties, however, the state did not update its June 2, 2011, recommendation Whatcom County. Though the state did not provide an updated formal recommendation for Whatcom County, the Washington State Department of Ecology (Ecology) in collaboration with Northwest Clean Air Agency (NWCAA) submitted a technical report and modeling analysis on June 12, 2020, to address more recent air quality monitoring data for monitors that were installed pursuant to the DRR.

Table 1 identifies EPA's intended Round 4 designations and the areas in Washington to which they would apply. It also lists Washington's current recommendations. EPA intends to designate these areas by December 31, 2020, through an assessment and characterization of air quality based primarily on ambient monitoring data, including data from existing and new EPA-approved monitors that have collected data from January 2017 forward, pursuant to the DRR; however, other available evidence and supporting information, such as air dispersion modeling in certain situations, may also be considered.[5]

[2] *Sierra Club v. McCarthy*, No. 3-13-cv-3953 (SI) (N.D. Cal. Mar. 2, 2015).
[3] *See* 80 FR 51052 (August 21, 2015), codified at 40 CFR part 51 subpart BB.
[4] https://www.epa.gov/sites/production/files/2016-04/documents/so2monitoringtad.pdf
[5] Detailed SO_2 monitor information may be found in either the 2016 or 2017 ambient monitoring network plans, or associated addenda.

Table 1: Summary of EPA's Intended Designations and the Designation Recommendations by Washington

Area/County	Washington's Recommended Area Definition	Washington's Recommended Designation	EPA's Intended Area Definition	EPA's Intended Designation
Whatcom County	Entire State	Unclassifiable	Area bounded by lines connecting the following UTM Coordinates (zone 10): Northwest Corner: 519671 5412272, Northeast Corner: 524091 5412261, Southwest Corner: 519671 5409010. Southeast Corner: 524111 5409044	Nonattainment
Remaining portion of Whatcom County	Entire State	Unclassifiable	Remaining portion of Whatcom County	Attainment/ Unclassifiable
Douglas/Chelan County*	Douglas County Chelan County	Attainment/ Unclassifiable	Same as State's Recommendation	Attainment/ Unclassifiable

* EPA addresses this area in Chapter 2 with all other areas which EPA intends to designate "attainment/unclassifiable" or "unclassifiable."

Areas that EPA previously designated in Round 1 (*see* 78 FR 47191), Round 2 (*see* 81 FR 45039 and 81 FR 89870), and Round 3 (*see* 83 FR 1098 and 83 FR 14597) are not affected by the designations in Round 4 unless otherwise noted.

2. General Approach and Schedule

An updated designations guidance document was issued by EPA through a September 5, 2019, memorandum from Peter Tsirigotis, Director, U.S. EPA, Office of Air Quality Planning and Standards, to Regional Air Division Directors, U.S. EPA Regions 1-10.[6] To better reflect the Round 4 designations process, this memorandum supplements, where necessary, prior designations guidance documents on area designations for the 2010 primary SO_2 NAAQS issued

[6] https://www.epa.gov/sites/production/files/2019-09/documents/round_4_so2_designations_memo_09-05-2019_final.pdf

on March 24, 2011, March 20, 2015, and July 22, 2016. This memorandum identifies factors that EPA intends to evaluate in determining whether areas are in violation of the 2010 SO_2 NAAQS. The document also contains the factors that EPA intends to evaluate in determining the boundaries for all remaining areas in the country. These factors include: 1) air quality characterization via ambient monitoring and/or dispersion modeling results; 2) emissions-related data; 3) meteorology; 4) geography and topography; and 5) jurisdictional boundaries.

In EPA's September 2019 memorandum, we note that Round 4 area designations will be based primarily on ambient monitoring data, including data from existing and new EPA-approved monitors that have collected data at least from January 2017 forward, pursuant to the DRR. In addition, EPA may evaluate air dispersion modeling submitted by state air agencies for two specific circumstances. First, states may submit air dispersion modeling to support the geographic extent of a nonattainment boundary. Second, states may submit air dispersion modeling to demonstrate that new federally enforceable SO_2 emissions limits provide for attainment of the NAAQS and represent a more accurate characterization of current air quality at the time of designation than does monitoring of past air quality.

This TSD is organized such that there is a section for each area in Washington for which air quality monitoring data indicate a violation of the 2010 SO_2 NAAQS. When modeling information is available, it is evaluated in the context of that section. EPA does not plan to revise this intended designations TSD after consideration of state and public comment on our intended designation. A separate final TSD will be prepared as necessary to document how we have addressed such comments in the final designations.

The following are definitions of important terms used in this document:

1) 2010 SO_2 NAAQS – The primary NAAQS for SO_2 promulgated in 2010. This NAAQS is 75 ppb, based on the 3-year average of the 99^{th} percentile of the annual distribution of daily maximum 1-hour average concentrations. See 40 CFR 50.17.
2) Design Value - a statistic computed according to the data handling procedures of the NAAQS (in 40 CFR part 50 Appendix T) that, by comparison to the level of the NAAQS, indicates whether the area is violating the 2010 SO_2 NAAQS.
3) Intended designated nonattainment area –an area that, based on available information including (but not limited to) monitoring data and/or appropriate modeling analyses, EPA intends to determine either: (1) does not meet the 2010 SO_2 NAAQS, or (2) contributes to ambient air quality in a nearby area that does not meet the NAAQS.
4) Intended designated attainment/unclassifiable area – an area that, based on available information including (but not limited to) appropriate monitoring data and/or appropriate modeling analyses, EPA intends to determine meets the 2010 SO_2 NAAQS and does not likely contribute to ambient air quality in a nearby area that does not meet the NAAQS.
5) Intended designated unclassifiable area – an area for which the available information does not allow EPA to determine whether the area meets the definition of a nonattainment area or the definition of an attainment/unclassifiable area.
6) Modeled violation – a modeled design value impact above the 2010 SO_2 NAAQS demonstrated by air dispersion modeling.
7) Recommended attainment area – an area that a state, territory, or tribe has recommended that EPA designate as attainment.

8) Recommended nonattainment area – an area that a state, territory, or tribe has recommended that EPA designate as nonattainment.
9) Recommended unclassifiable area – an area that a state, territory, or tribe has recommended that EPA designate as unclassifiable.
10) Recommended attainment/unclassifiable (or unclassifiable/attainment) area – an area that a state, territory, or tribe has recommended that EPA designate as attainment/unclassifiable (or unclassifiable/attainment).
11) Violating monitor – an ambient air monitor meeting 40 CFR parts 50, 53, and 58 requirements whose valid design value exceeds 75 ppb, based on data analysis conducted in accordance with Appendix T of 40 CFR part 50.
12) We, our, and us – these refer to EPA.

3. Technical Analysis for the Whatcom County Area

3.1. Introduction

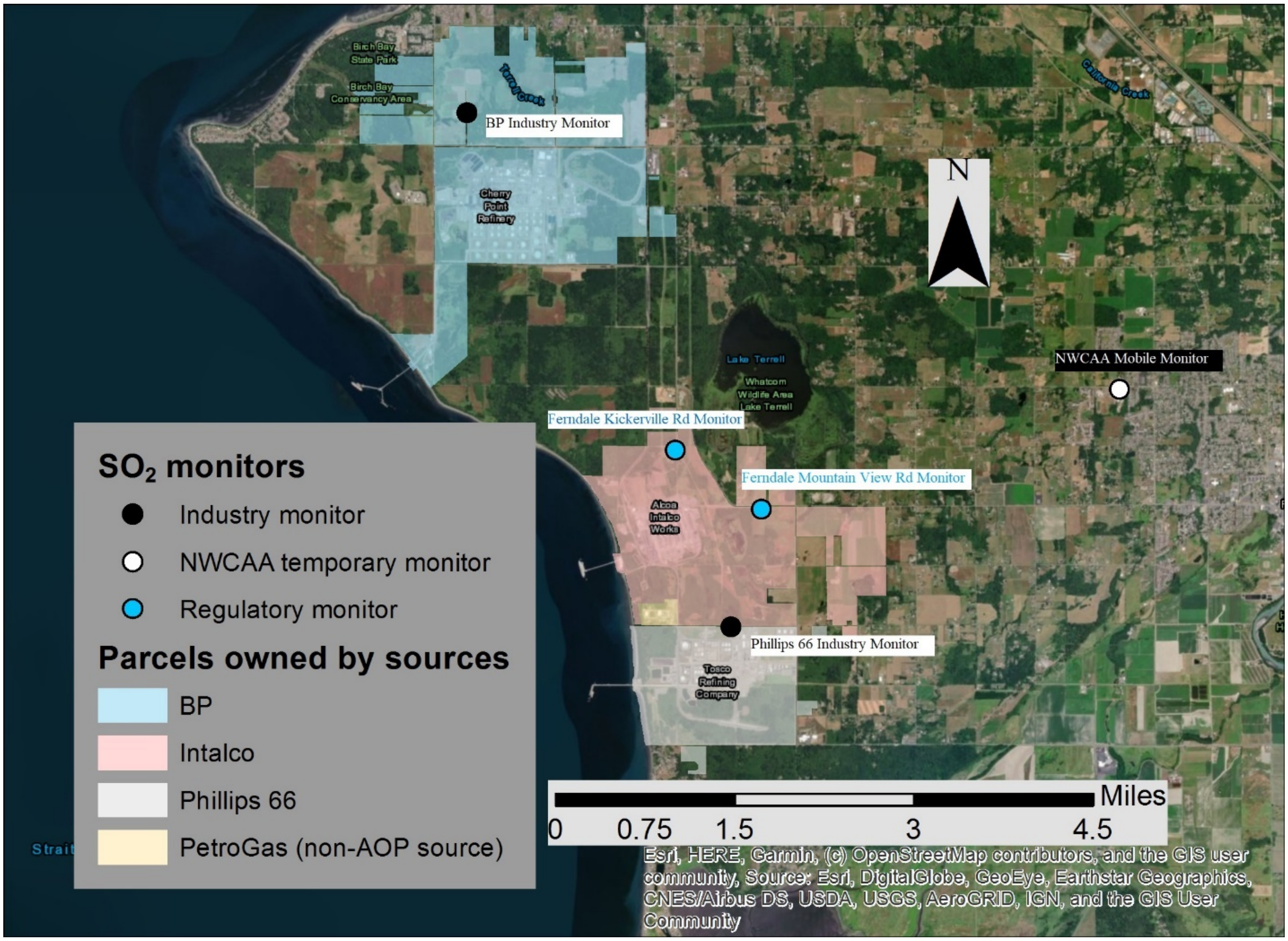
EPA must designate the Whatcom County area by December 31, 2020, because the area has not been previously designated, and Washington identified an existing SO_2 monitor and installed and began operating a new EPA-approved monitor pursuant to the DRR. This section presents all the available air quality information for the portion of Whatcom County that includes the following SO_2 source around which the DRR required the state to characterize air quality:

- The Alcoa Intalco Aluminum LLC (Intalco) facility emits 2,000 tons or more of SO_2 annually. Specifically, Intalco emitted 4,794 tons of SO_2 in 2014. This source meets the DRR criteria and thus is on the SO_2 DRR Source list, and Washington has chosen to characterize it via monitoring.

As seen in Figure 1 below, the Intalco facility is located in the Cherry Point Industrial Area (Cherry Point) in Whatcom County, Washington. Cherry Point is bordered to the north, east, and south by rural lands, and by water to the west. The closest cities to Cherry Point are Blaine, which is about 16 kilometers to the north, and Ferndale, which is about 6.5 kilometers to the east. There are three major industrial facilities in the Cherry Point area, which include the BP Cherry Point refinery (BP), the Phillips 66 refinery (Phillips 66), and the Intalco aluminum smelter. The Petrogas West (Petrogas) facility is adjacent to Intalco and shares the same dock with Intalco, however, Petrogas is not an Air Operating Permit (AOP) source as it only burns natural gas and other low-sulfur fuels resulting in low levels of SO_2 emissions. Since 2016, Petrogas has only emitted a maximum of 2.8 tons per year of SO_2.

Following EPA guidance, Ecology selected two monitor locations to characterize the air quality around BP, Intalco, and Phillips 66. The Ferndale-Kickerville Road monitor is located north of the Intalco facility, and the Ferndale-Mountain View Road monitor is located east of the Intalco facility, near the public Mountain View road. The monitoring sites are shown below on the map in Figure 1.

Figure 1: Map of the Cherry Point Area Addressing Intalco, BP, and Phillips 66



In its June 2, 2011, recommendation letter, Washington recommended that the entire state, including Whatcom County, be designated as unclassifiable for the 2010 SO_2 NAAQS. Washington, however, provided EPA with this recommendation prior to the installation and operation of EPA-approved monitors and before the state had monitoring data for the 2017-2019 period. As stated above, Washington has not submitted a designation recommendation for Whatcom County since 2011. Based on violating monitoring data from the Ferndale Mountain View Road monitor from 2017-2019, EPA does not agree with Washington's 2011 designation recommendation, and intends to designate a portion of Whatcom County as nonattainment for the 2010 SO_2 NAAQS. Our intended boundaries are described below.

3.2. Air Quality Monitoring Data for the Whatcom County Area

EPA considered design values for air quality monitors in the Whatcom County area by assessing the most recent 3 consecutive years (i.e., 2017-2019) of quality-assured, certified ambient air quality data in EPA Air Quality System (AQS) using data from Federal Reference Method and Federal Equivalent Method monitors that are sited and operated in accordance with 40 CFR parts

50 and 58.[7] Procedures for using monitored air quality data to determine whether a violation has occurred are given in 40 CFR part 50 Appendix T, as revised in the 2010 SO_2 NAAQS rulemaking. The 2010 1-hour SO_2 NAAQS is met when the design value is 75 ppb or less. Whenever several monitors are located in an area, the design value for the area is determined by the monitor with the highest valid design value. The presence of one or more violating monitors (i.e., monitors with design values greater than 75 ppb) in a geographic area forms the basis for designating that area as nonattainment. The remaining factors, described in the next section, are then used as the technical basis for determining the spatial extent of the designated nonattainment area surrounding the violating monitor. Table 2 contains the 2017-2019 design values for the area of analysis.

Table 2: 2010 SO_2 NAAQS Design Values for the Cherry Point Area

AQS Site ID	Monitor Location	2017 99th Percentile (ppb)	2018 99th Percentile (ppb)	2019 99th Percentile (ppb)	2017-2019 Design Value (ppb)
53-073-0013	Ferndale, WA- Ferndale Kickerville Rd (48.855274, -122.704700)	70.0	73.7	69.6	**71**
53-073-0017	Ferndale, WA- Ferndale-Mountain View Rd (48.848065, -122.688888)	113.6	101.3	104.5	**106**

Table 2 summarizes the annual 99th percentiles of daily maximum 1-hour average concentrations and the 3-year design values. Both monitors have recorded exceedances of the 1-hour SO_2 NAAQS of 75 ppb. However, only the Ferndale-Mountain View monitor has recorded a design value above 75 ppb. The design value of 106 ppb at the Ferndale-Mountain View monitor violates the 2010 1-hour SO_2 NAAQS. Therefore, a portion of the area must be designated nonattainment because of the violating monitor.

3.3. Air Quality Modeling Analysis for the Whatcom County Area Addressing Intalco

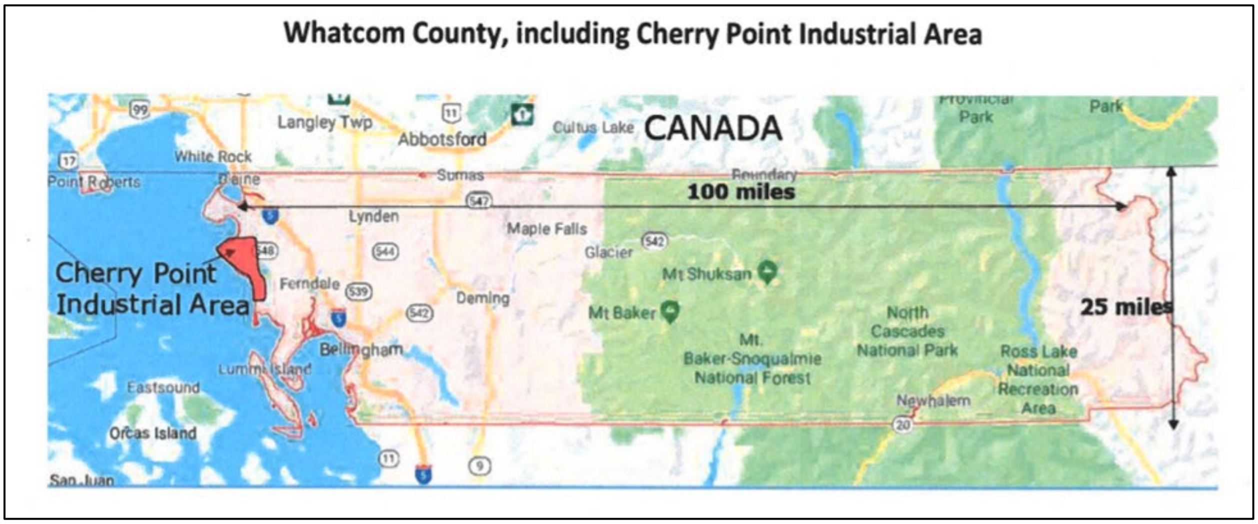
In its June 12, 2020, technical report, Ecology provided an air quality modeling analysis for the area surrounding Intalco, which EPA is using to determine a nonattainment area boundary. The assessment and characterization were performed using air dispersion modeling software, i.e., AERMOD, and by analyzing actual emissions. After review of Ecology's assessment, supporting documentation, and all available data, EPA does not agree with the state's June 2, 2011,

[7] SO_2 air quality data are available from EPA's website at https://www.epa.gov/outdoor-air-quality-data. SO_2 air quality design values are available at https://www.epa.gov/air-trends/air-quality-design-values.

recommendation of designating the area unclassifiable and intends to designate the area as nonattainment. Our reasoning for this conclusion is explained in a later section of this TSD, after all the available information is presented.

The area that Ecology assessed through air quality modeling is located in western Whatcom County, Washington, west of Ferndale, south of Blaine, and northwest of Bellingham. Whatcom County is located at the northwest corner of the state of Washington along the border with Canada. The area modeled includes a portion of the Salish Sea and Island County. Figure 2 illustrates the dimensions of Whatcom County and the location of the Cherry Point Industrial Area within Whatcom County that contains Intalco and other sources.

Figure 2: Map of Whatcom County and location of the Cherry Point Industrial Area



Included in Figure 1 are other nearby emitters of SO_2 in the area. These include the BP and Phillips 66 oil refineries. The BP refinery is located about 3.5 kilometers north-northwest of Intalco and the Phillips 66 refinery is just south of Intalco, sharing a property line. The center of the Phillips 66 facility is about 1 mile south-southeast of the center of the Intalco facility.

The discussion and analysis that follows below will reference the "SO_2 NAAQS Designations Modeling Technical Assistance Document" (Modeling TAD) and the factors for evaluation contained in EPA's September 5, 2019, guidance, July 22, 2016, guidance and March 20, 2015, guidance, as appropriate.[8]

3.3.1. Modeling Analysis Provided by Ecology

Ecology's air quality technical report, submitted to EPA on June 12, 2020, titled "Analysis of Sulfur Dioxide Monitoring Data in Whatcom County," provided an analysis of modeling for the area in Appendix G[9]. The modeling was originally developed to provide technical evidence to support a recommendation for a nonattainment boundary in Whatcom County. The state did not

[8] https://www.epa.gov/sites/production/files/2016-04/documents/so2modelingtad.pdf.

[9] The modeling was conducted by Intalco's consultant AECOM upon request from Ecology. Ecology supervised the development of a modeling protocol with the cooperation of Intalco and AECOM.

ultimately provide a nonattainment boundary or designation recommendation, but Ecology provided the modeling analysis to EPA to assist with EPA's determination of the boundary.

3.3.1.1.Model Selection and Modeling Components

EPA's Modeling TAD notes that for area designations under the 2010 SO_2 NAAQS, the AERMOD modeling system should be used, unless use of an alternative model can be justified. The AERMOD modeling system contains the following components:

- AERMOD: the dispersion model
- AERMAP: the terrain processor for AERMOD
- AERMET: the meteorological data processor for AERMOD
- BPIPPRM: the building input processor
- AERMINUTE: a pre-processor to AERMET incorporating 1-minute automated surface observation system (ASOS) wind data
- AERSURFACE: the surface characteristics processor for AERMET
- AERSCREEN: a screening version of AERMOD

The submitted modeling was conducted using AERMOD version 19191, the most recent version at the time the modeling was submitted to EPA. A discussion of Ecology's approach to the individual components is provided in the corresponding discussion that follows, as appropriate.

3.3.1.2. Modeling Parameter: Rural or Urban Dispersion

For any dispersion modeling exercise, the determination of whether a source area is "urban" or "rural" is important in determining the boundary layer characteristics that affect the model's prediction of downwind concentrations. For SO_2 modeling, the urban/rural determination is also important because AERMOD invokes a 4-hour half-life for urban SO_2 sources. Section 6.3 of the Modeling TAD details the procedures used to determine if a source area is urban or rural based on land use or population density.

For the purpose of performing the modeling for the area of analysis, Ecology determined that it was most appropriate to run the model in urban mode. However, a land use analysis of the TAD-recommended 3-mile area surrounding the facility demonstrates the area is rural because less than 50% of the land use is classified as urban. Although the region surrounding the Intalco facility is rural, Ecology determined the use of urban dispersion coefficients was justified due to the localized heat island effect caused by fugitive heat from the facility.

Special circumstances may warrant use of urban coefficients in areas with low population, as specified in Appendix W, when fugitive heat from industrial activity and site characteristics are potent enough to locally alter the structure of the atmospheric surface layer. In such circumstances, Appendix W recommends the selection of an appropriate equivalent population to apply to AERMOD's population density procedure to determine the urban dispersion coefficients.

The Intalco industrial site is about a kilometer wide, covered by a dense network of elongated buildings and industrial equipment, which provides urban-like surface roughness despite its location in a rural area. An aluminum smelter also produces a large amount of fugitive heat, forming a localized heat island that can modify the local structure of the atmospheric boundary layer.

Appendix G of Ecology's air quality technical report contains a summary of the development of the urban-rural temperature difference equations developed by Oke (1982), originally used to develop AERMOD's population-based urban coefficient system. Oke's work describes the empirical relationships between the population of an urban area and the flux of fugitive heat to the atmosphere.

In the modeling assessment, Oke's relationships were used to estimate an equivalent urban population using satellite-derived urban-rural temperature differences between the Intalco facility and surrounding rural area. Appendix G of Ecology's air quality technical report provides a set of nine measurements of surface temperature taken by the Landsat 8 Thermal Infrared (TIR) satellite from 2015-2018. These images are used to derive the temperature difference between the facility and surrounding rural areas. The average temperature difference is 13.9 °K (minimum of 8.8 °K, maximum of 17.1 °K). These images provide sufficient evidence that the fugitive heat flux from the facility is significant. An equivalent population of 2 million was selected to be used in AERMOD's urban coefficient settings, corresponding to an urban-rural temperature difference of 12 °K. A lower value was selected to be conservative (i.e., overestimating concentrations and extent of violations or underestimating the rate of dispersion) in the application of the urban settings.

Due to the measured temperature differences, the large footprint of the facility (about a kilometer wide), and the enhanced surface roughness due to the network of elongated structures, EPA agrees with the use of urban dispersion parameters for the Intalco facility.

Ecology's modeling demonstrated air pollutant impacts of concern (where concentrations exceed the standard) did not extend far from the Intalco fenceline. Therefore, plumes from nearby sources contributing to exceedances would also be affected by the same urban-like turbulence as the plumes from the Intalco facility. Also, the satellite-derived temperature maps showed similar significant temperature gradients between the nearby oil refineries and surrounding rural area. EPA agrees the urban setting was also appropriate for the nearby sources. If impacts of concern were to reach areas some distance (>1 km) from the facility, additional critique and analysis would be necessary to evaluate the use of urban dispersion coefficients for Intalco and the nearby sources.

3.3.1.3.Modeling Parameter: Area of Analysis (Receptor Grid)

The Modeling TAD recommends that the first step towards characterization of air quality in the area around a source or group of sources is to determine the extent of the area of analysis and the spacing of the receptor grid. Considerations presented in the Modeling TAD include but are not limited to: the location of the SO_2 emission sources or facilities considered for modeling; the extent of significant concentration gradients due to the influence of nearby sources; and sufficient receptor coverage and density to adequately capture and resolve the model predicted maximum SO_2 concentrations.

The source of SO_2 emissions subject to the DRR in this area is described in the introduction to this section. For the Whatcom County area, Ecology included in its analysis two other emitters of SO_2 within 20 km of Intalco. Ecology determined that this was the appropriate distance to adequately characterize air quality through modeling to include the potential extent of any SO_2 NAAQS exceedances in the area of analysis and any potential impact on SO_2 air quality from other sources in nearby areas. In addition to Intalco, the other emitters of SO_2 included in the area of analysis are BP and Phillips 66. No other sources beyond 20 km were determined by Ecology to have the potential to cause significant concentration gradients within the area of analysis.

The grid receptor spacing for the area of analysis chosen by the state is as follows:

- 25 meters spacing along the ambient air boundary (Intalco fenceline),
- 100 m spacing out to 2,000 m from the Intalco facility,
- 300 m spacing between 2,000 m and 4,500 m from the facility,
- 600 m spacing between 4,500 m from facility out to 10,000 m, and
- 1,000 m spacing beyond 10,000

Several refined grids at 100 m spacing were placed over higher terrain features of interest including Haynie Hill to the northeast, Orcas and Lummi islands, and the area south of Bellingham encompassing Larrabee State Park. This was done because Ecology was concerned elevated plumes may impact distant high terrain features and possibly result in localized concentration hotspots (the modeling results demonstrated this not to be the case; all elevated concentrations and violations were only at or adjacent to the Intalco fenceline).

Several discrete receptors were also placed at the locations of SO_2 monitors near the facility. Also, a refined grid of 50 m spacing was applied at a hotspot region located at the northeast corner of the Intalco facility fenceline.

The receptor network contained 23,681 receptors, and the network covered western Whatcom County and a portion of northern Island County from Larrabee State Park in the south, north to the Canadian border and from Lynden and Bellingham in the east, west to Orcas Island. The grid covered the entirety of Ferndale, Blaine, Lummi Nation, and Birch Bay communities and extended to higher terrain features of concern including Haynie Hill to the northeast of Intalco, Lummi Peak on Lummi Island, and Mt. Constitution on Orcas Island.

Figures 3 and 4, selected from Appendix G of Ecology's air quality technical report, show the area of analysis surrounding Intalco, as well as the receptor grid for the area of analysis. Figure 5 provides a closer look at the refined receptor grid surrounding Intalco' s fenceline.

Consistent with the Modeling TAD, Ecology placed receptors for the purposes of this analysis in locations that would be considered ambient air relative to Intalco, the source of focus. The purpose of including nearby sources in the model was to ascertain the contribution from the nearby sources to violations of the NAAQS primarily caused by Intalco. Receptors were not included inside Intalco's fenceline in the model. An assessment of nearby facility impacts within Intalco's fenceline was inferred by EPA using modeled impacts along the fenceline and the concentration gradients, described in Section 3.3.1.10 below. After review of the modeling results, meteorology, and facility SO_2 emissions, EPA believes the nearby sources themselves would not cause or contribute to violations of the 1-hour SO_2 NAAQS within the Intalco fenceline.

Figure 3: Area of Analysis for the Whatcom County Area ***(image is from Appendix G of Ecology's Air Quality Technical Report)***

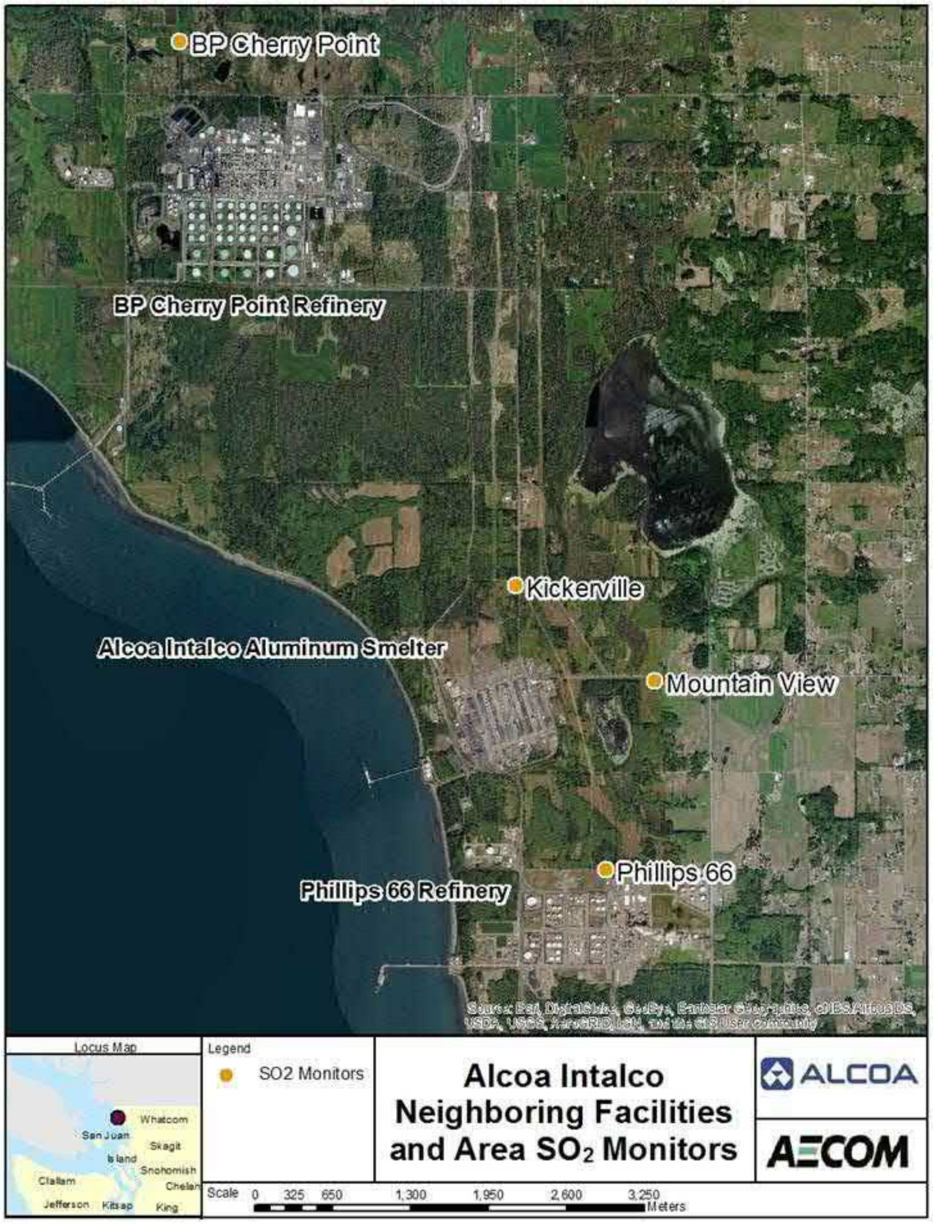


Figure 4: Complete Receptor Grid for the Whatcom County Area ***(the additional dense receptor grids are notable, located over distant high-terrain features; image is from Appendix G of Ecology's Air Quality Technical Report)***

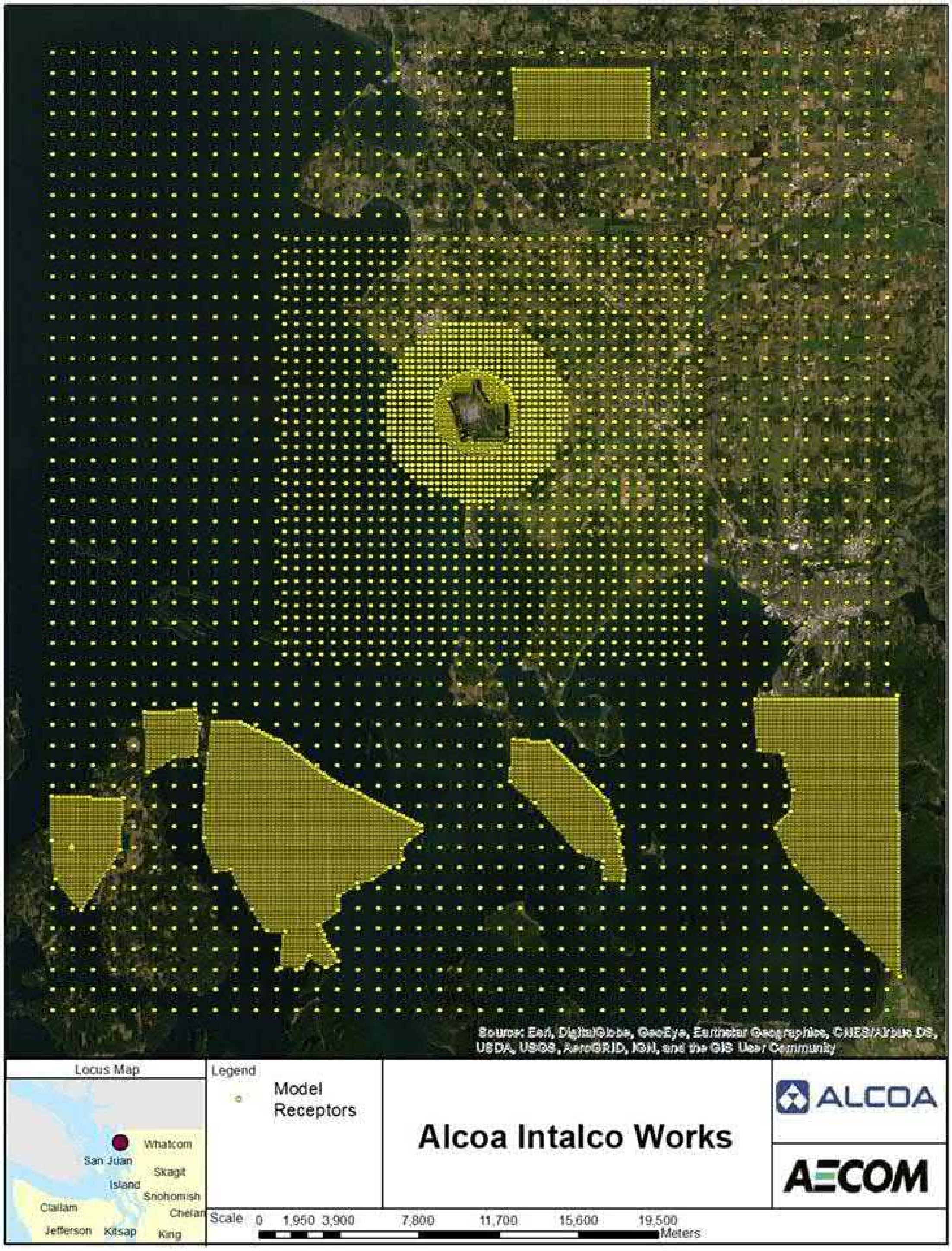
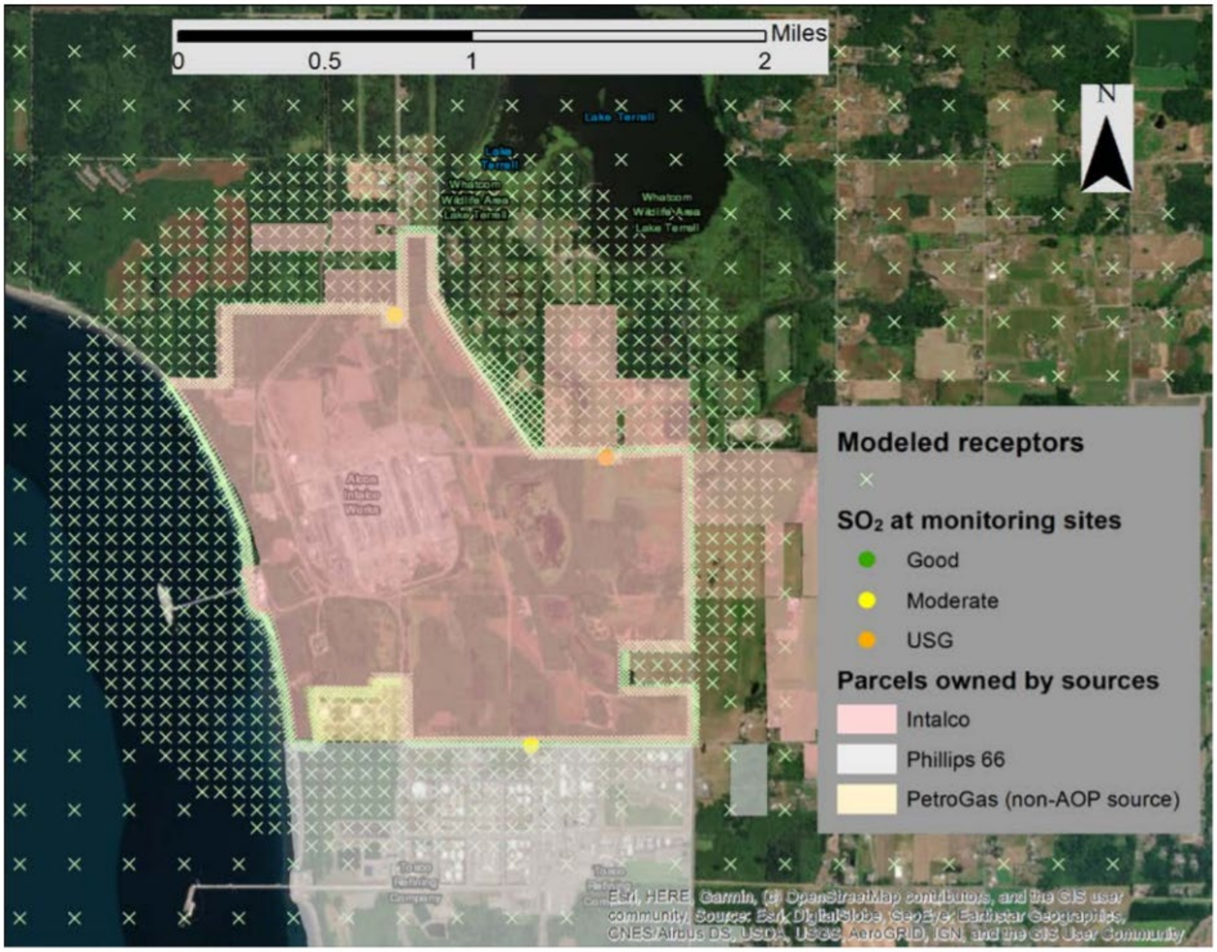


Figure 5: Receptor Grid at Intalco Fenceline (SO_2 monitor locations, shaded by air quality index corresponding to 2017-2019 design concentration)



EPA concludes that the receptor grid is adequate for the assessment of the geographic extent of the 2010 SO_2 NAAQS violations in the Intalco area and for establishing a nonattainment boundary. The density of the modeling grid is adequate for determining the maximum ambient concentrations of SO_2. Refined receptor grids were added to areas of interest such as the regions of elevated concentration along the Intalco fenceline and including distant high terrain features such as Haynie Hill (north of Intalco), Lummi Peak (south of Intalco), the Chuckanut Mountains (southeast of Intalco), and Mt. Constitution (southwest of Intalco). The modeling confirmed no distant concentration hotspots on distant elevated terrain. Grid resolution was found to be adequate at the location along the fenceline and over local communities such as Ferndale, Birch Bay, and the Lummi Nation to address the magnitude and gradient of SO_2 concentrations in these areas.

3.3.1.4.Modeling Parameter: Source Characterization

Section 6 of the Modeling TAD offers recommendations on source characterization including source types, use of accurate stack parameters, inclusion of building dimensions for building downwash (if warranted), and the use of actual stack heights with actual emissions.

All of Intalco's SO_2 source units and facility buildings were explicitly included in the modeling. All of Intalco's stacks were modeled using actual stack heights and actual emissions. All facility buildings were included to account for the effect of building wakes and downwash on the plumes from the source units. Also, as discussed later in the TSD, BP and Phillips 66 source units that emit SO_2 were all explicitly modeled as nearby sources. Building downwash effects were accounted for, for all of the source units at the nearby sources. No other sources of SO_2 were modeled because it was determined more distant sources would not cause a concentration gradient in the vicinity of the area of nonattainment and were properly represented in the background concentration.

Ecology characterized these sources within the area of analysis in accordance with the best practices outlined in the Modeling TAD. Specifically, Ecology used actual stack heights in conjunction with actual emissions. Ecology also adequately characterized the source's building layout and location, as well as the stack parameters, e.g., exit temperature, exit velocity, location, and diameter. Where appropriate, the AERMOD component BPIPPRM was used to assist in addressing building downwash.

Preliminary modeling tests during the development of the modeling protocol, using default AERMOD settings and site characterization methods, found concentrations at the two nearby monitor locations (Kickerville Road state SO_2 monitor, Mountain View Road state SO_2 monitor, and the Phillips 66 industrial SO_2 monitor) that were much higher than measured. Intalco's consultant AECOM identified several likely causes for the overpredicted concentrations and worked with Ecology to develop solutions to improve accuracy.

Several refined site characterizations were adopted to more accurately simulate plume behavior in AERMOD. First, use of urban dispersion coefficients, as described in Section 3.3.1.2, was found to partially alleviate over-prediction by accounting for the additional mechanical and heat-driven turbulent flux in the area of the facility. Second, excessively low plume height was identified as a probable factor in the over-prediction of concentrations. AERMOD does not account for additional plume buoyancy from the interaction and superimposition of adjacent hot plumes. The potline dry-scrubber stack array at Intalco consists of rows of numerous adjacent stacks that emit large volumes of exhaust at about 350° K, well above the ambient temperature. When AERMOD models these plumes as individual units, it does not account for the interaction and superimposition of plumes from the adjacent stacks. Collective plume interaction will tend to raise the collective plume height of the individual plumes. To correct this, stack merging was used in the modeling to help AERMOD account for the additional plume rise that results from plume interaction.

There are several groups of point sources at the Intalco facility, consisting mainly of dry-scrubber stacks located in banks adjacent to potline buildings, as shown in Figure 6. Intalco stack parameters are listed in Table 3 to illustrate the distribution of the stack groupings. The majority of SO_2 emissions are from the dry-scrubber stacks, arranged in six banks of 6 to 26 stacks each (listed as the "DS" point sources in Table 3). A small amount of SO_2 is emitted from the bake-oven and holding furnace stacks, listed in Table 3 as "BAKEOVEN" and "CAST" stack groups, respectively. Roofline wet-scrubbers are also placed at building vents along each potline building, but emission from these stacks is relatively low (3% of the total emitted from the dry-scrubbers). The SO_2 emissions from the wet-scrubbers were added to the dry-scrubber stack emission rate since the emission from the wet-scrubbers was low. This approach was considered conservative (i.e. overestimated emissions) and lowered the computational expense of the modeling.

Figure 6: Aerial view of Intalco and stack groups. The six banks of dry-scrubber stacks are labeled (DSxx groups)

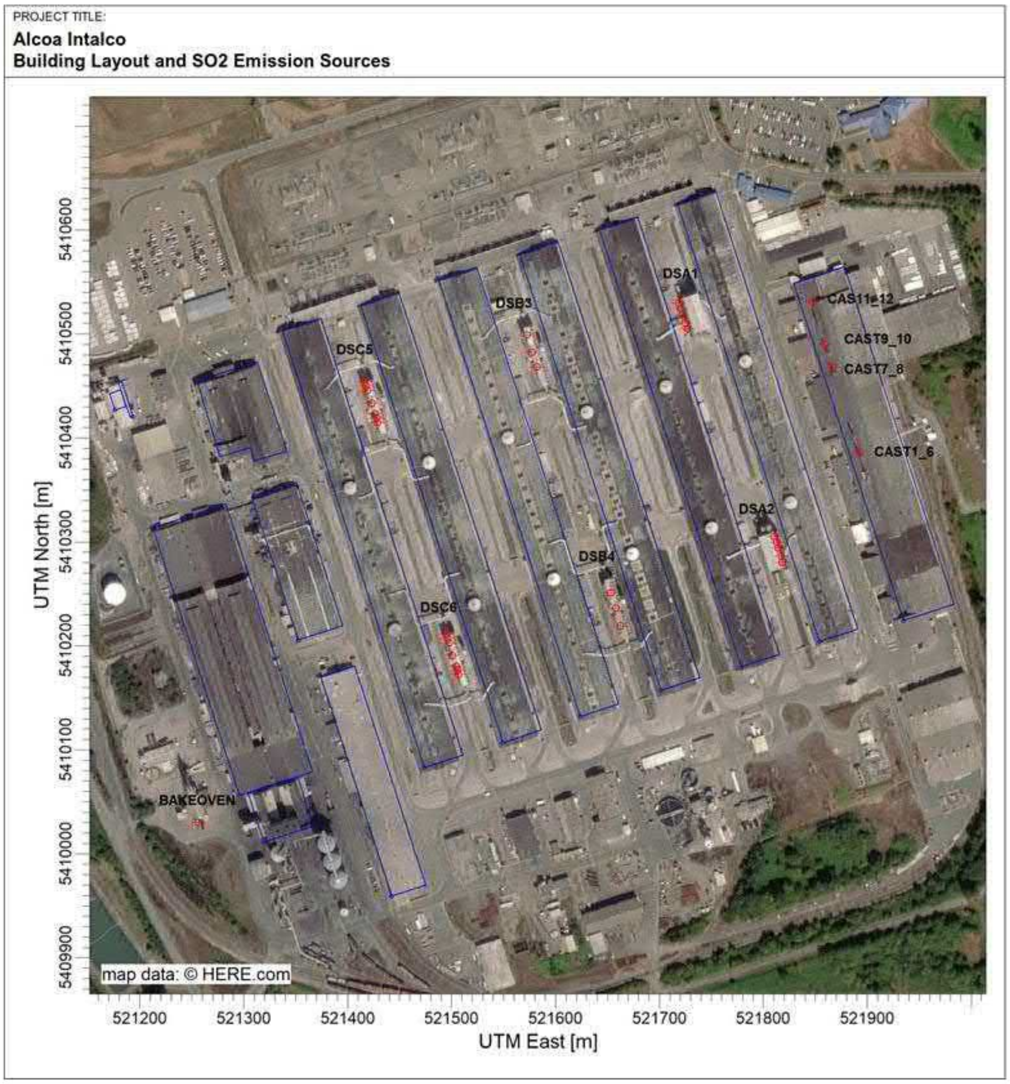


Table 3: Intalco source unit parameters

ID / Center	No. of Stacks	Base Elevation (m)	Release Height (m)	Stack Diameter* (m)	Exit Velocity (m/s)	Exit Temperature (K)	Typical SO_2 Emission Rate (g/s)
DSA1 / Center 1	6	65.4	19.8	1.52	15.53	356.3	22.5
DSA2 / Center 2	6	63.9	19.8	1.52	15.53	356.3	22.5
DSB3 / Center 3	26	62.2	17.9	0.72	8.92	348.0	22.5
DSB4 / Center 4	26	61.4	17.9	0.72	8.92	348.0	0
DSC5 / Center 5	22	59.7	17.9	0.72	9.60	355.0	22.5
DSC6 / Center 6	22	59.0	17.9	0.72	9.60	355.0	22.5
BAKEOVEN / Center 7	1	57.5	25.5	2.13	15.64	341.3	10.2
CAST1_6	6	70.35	26.9	0.79	13.80	532.5	0.007
CAST7_8	2	70.66	23.2	0.79	13.80	532.5	0.003
CAST9_10	2	70.17	18.4	0.79	13.80	532.5	0.003
CAS11_12	2	68.81	23.2	0.79	13.80	532.5	0.003

Stack merging was justified due to the close proximity of the multiple hot plumes from banks of dry-scrubber stacks. The plumes will overlap to a degree and collectively enhance the buoyancy of each other, resulting in additional plume rise. The most important justification for use of stack merging was the improved performance of AERMOD when compared to measurements at the three local SO_2 monitors located on the north, east, and south sides of the Intalco facility. The preliminary test modeling, conducted during development of the modeling protocol, demonstrated AERMOD highly overpredicted concentrations at all three monitor locations when stacks were modeled as individual point sources. The preliminary test modeling showed plume merging and urban source parameterization improved AERMOD performance substantially, when compared to measurements at multiple monitors in the vicinity of Intalco. Therefore, Ecology accepted these site characterization techniques for the modeling submitted as part of the air quality technical report.

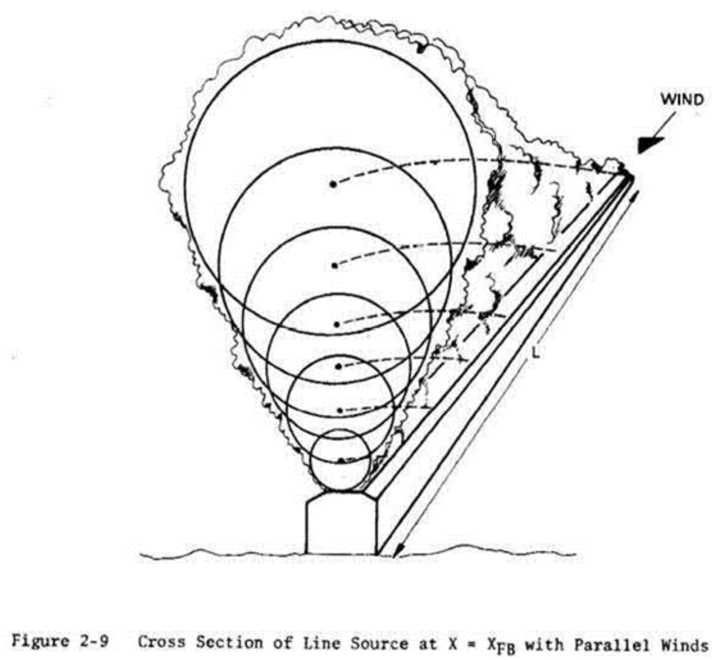
Additional improvement in the performance of the model was found using a unique directionally-dependent stack merging approach. The “partial merging” approach uses a variation of merged stacks for each bank of pot-line stacks, depending on the alignment of the wind vector to the alignment of the stack row. Collective plume buoyancy is more pronounced when the wind vector is tangent to the alignment of a row of stacks because the plumes override and superimpose on each other, as shown in Figure 7.

Documentation of the development of the stack-merging method were included in Appendix G of the air quality technical report. EPA assumes selection of stack merges was likely conducted as a qualitative iterative procedure, where multiple arrangements were tested, and an optimum arrangement selected for final modeling. The documentation provided is sufficient for designations modeling with a key piece being the demonstration of improved AERMOD performance against the multiple monitor datasets. However, for regulatory modeling under Appendix W, additional documentation would likely be necessary and could require EPA approval of an alternative modeling technique.

Various stack merges were conducted depending on wind direction by considering sixteen 22.5° wind sectors. Merging was more aggressive when the wind vector aligned along the axis of each individual bank of stacks. Dry-scrubber banks of stacks were generally merged to a set of 1 or 2 virtual stacks (from groups of 6, 22, and 26 stacks) during the best alignment (south-southeast and north-northwest winds). The minimal merging (when the wind vector is normal to the alignment of a bank of stacks) resulted in merged stacks in groups of 4 to 5 point sources (compared to the actual configuration of 6, 22, and 26 stacks). Partial-merging was simulated in AERMOD using a pre-processed hourly emission file for all wind-direction merged stack scenarios. Stack groupings were assigned to emit SO_2 on hours where the wind direction falls within the applicable sector each grouping was assigned. Inactive stack groups were modeled at a rate of 0 g/s per hour where wind alignment did not support the given stack group.

Most importantly, the partial-merged stack system used for the modeling compared well to measurements at the three local monitors. The modeling report's Appendix E provides a demonstration of the model performance against the measurements at the three monitors. The QQ-plots and resulting modeled design concentrations are shown to compare favorably. The QQ-plots show the model still over-predicts concentrations at all three monitor locations a majority of the time but predicts the magnitude of the upper percentile of concentrations well at all monitors.

Figure 7: Plume overlap and superimposition when wind is tangent to a row of stacks (image borrowed from Figure 2-9 of EPA's BLP model User's Guide)



3.3.1.5.Modeling Parameter: Emissions

EPA's Modeling TAD notes that for the purpose of modeling to characterize air quality for use in designations, the recommended approach is to use the most recent 3 years of actual emissions data and concurrent meteorological data.

EPA believes that continuous emissions monitoring systems (CEMS) data provide acceptable historical emissions information, when they are available. These data are available for many electric generating units. In the absence of CEMS data, EPA's Modeling TAD highly encourages the use of AERMOD's hourly varying emissions keyword HOUREMIS, or through the use of AERMOD's variable emissions factors keyword EMISFACT. When choosing one of these methods, EPA recommends using detailed throughput, operating schedules, and emissions information from the impacted sources.

As previously noted, Ecology reviewed Intalco and two other nearby sources of SO_2. Ecology chose to model these facilities using actual emissions. The facilities in Ecology's modeling analysis and their associated annual actual SO_2 emissions between 2017 and 2019 are summarized below.

For Intalco, Ecology identified the annual actual SO_2 emissions between 2017 and 2019 in the air quality technical report and summarized in Table 4 below. This information was used to determine actual emission rates for Intalco source units in the modeling. Annual emissions for Intalco were provided in the form of unit-specific monthly totals. The CEMs records, emission factors, and temporally variable production rates were used to determine the representative monthly-average actual emission rate for each SO_2 emitting source unit. A grams-per-second emission rate was determined for each source unit based on the monthly emission record, assuming the emission rate was constant through the given month. The execution of the model used the AERMOD option "EMISFACT," to assign the monthly grams-per-second emission rates assuming continuous operations throughout the month. For Intalco, a direction-dependent stack merging technique was applied that retained the cumulative volume, stack velocity, and emission rate of each group of stacks merged.

Table 4: Actual SO_2 Emissions Between 2017 – 2019 from Facilities in the Whatcom County Area

Facility Name	SO_2 Emissions (tpy)		
	2017	2018	2019
Alcoa Intalco Aluminum Smelter	3,987	4,103	4,249
BP Cherry Point Refinery	828	726	622
Phillips 66 Refinery	38	43	31
Total Emissions from All Modeled Facilities in the State's Area of Analysis	4,853	4,872	4,902

For BP and Phillips 66, the emissions data were also obtained from each respective facility's unit-specific monthly totals. A mixture of CEMs, emission factors, and temporally variable production rates were used to determine the representative monthly-average actual emission rate for each SO_2 emitting source unit. The execution of the model used the AERMOD option "EMISFACT," to assign the monthly grams-per-second emission rate for each stack, assuming continuous operations throughout the month.

EPA reviewed the emissions calculations and modeling inputs and confirmed the grams-per-second emission rates used for each stack correctly corresponded to the reported monthly emissions. Review of merged stack emissions also confirmed calculated grams-per-second emissions rates were correctly used in the model. EPA believes the use of a representative monthly average emissions rate is suitable for determining the geographic extent of the 2010 SO_2 NAAQS violations around Intalco and establishing a nonattainment boundary.

3.3.1.6.Modeling Parameter: Meteorology and Surface Characteristics

As noted in the Modeling TAD, the most recent 3 years of meteorological data (concurrent with the most recent 3 years of emissions data, for sources modeled with actual emissions) should be used in designations efforts. The selection of data should be based on spatial and climatological (temporal) representativeness. The representativeness of the data is determined based on: 1) the proximity of the meteorological monitoring site to the area under consideration, 2) the complexity of terrain, 3) the exposure of the meteorological site, and 4) the period of time during which data are collected. Sources of meteorological data include National Weather Service (NWS) stations, site-specific or onsite data, and other sources such as universities, Federal Aviation Administration (FAA), and military stations.

For the area of analysis for the Whatcom County area, Ecology selected the surface meteorology from a site-specific PSD-quality meteorological monitor co-located at the Mountain View SO_2 monitoring station located at 48.848° N, 122.689° W, on the eastern edge of the Intalco fenceline, about 1.2 km east of the center of the facility. Coincident upper air observations were selected from Quillayute airport (KUIL), located about 180 km southwest of Whatcom County. The 2017-2019 meteorological dataset at the Mountain View monitor was not 100% complete, so the nearest most-representative National Weather Service (NWS) Automated Surface Observing System (ASOS) station was selected for substitution. The Bellingham Airport (KBLI) ASOS station dataset was selected, located about 12 km southeast of the Mountain View monitor. The KBLI dataset was also used to provide representative cloud cover, assuming little variance in regional cloud cover between the Cherry Point Industrial Area and Bellingham airport sites.

The KBLI meteorological tower is located near the airport tarmac runway in similar terrain and local land-use as the Mountain View monitor. Both monitors are located a few kilometers inland from the Salish Sea (KBLI is adjacent to Bellingham Bay, Intalco is adjacent to the Strait of Georgia). The wind climate at both locations is similar, affected by prevailing south-southeast winds a majority of the year, light north-northeast winds during warm summer periods, west-northwest winds in autumn/winter/spring post-frontal periods, and northeast modified arctic outflow winds during the winter.

The Mountain View meteorological monitor was built and operated by the Washington State Department of Ecology, reportedly in accordance with the standards for PSD quality specified in EPA's meteorological monitoring guidance.[10] Ecology has provided documentation of the quality control procedures used for its regulatory monitors, included as Appendix F of Ecology's air quality technical report. Ecology ensures the dataset is certified as PSD quality, but no details

[10] https://www.epa.gov/sites/production/files/2016-04/documents/so2monitoringtad.pdf and https://www3.epa.gov/ttn/scram/guidance/met/mmgrma.pdf

regarding a station quality assurance performance plan, instrumentation used, audit history and findings, or station history were provided in Appendix F to confirm.

The station consists of a single 10-meter tower supporting a R.M. Young model 85004 heated sonic anemometer to measure wind speed and direction at 10 meters height above the surface. No information was provided on the thermometer – it is assumed temperature readings were provided by the instrument coupled with the sonic anemometer.

Ecology used AERSURFACE version 13016 using land-use data at the locations of the Mountain View monitor and KBLI meteorological tower (the missing-data substitution dataset) to estimate the surface characteristics of the area of analysis. Ecology estimated values for 12 spatial sectors out to 1 km at a monthly temporal resolution for dry, wet, and average conditions for each month depending on the 2017-2019 monthly precipitation compared to a 30-year monthly record at a local climatological station. Ecology also estimated values for albedo (the fraction of solar energy reflected from the earth back into space), the Bowen ratio (the method generally used to calculate heat lost or heat gained in a substance), and the surface roughness (sometimes referred to as "Zo" and is related to the height of obstacles to the wind flow, which is an important factor in determining the magnitude of mechanical turbulence and the stability of the boundary layer).

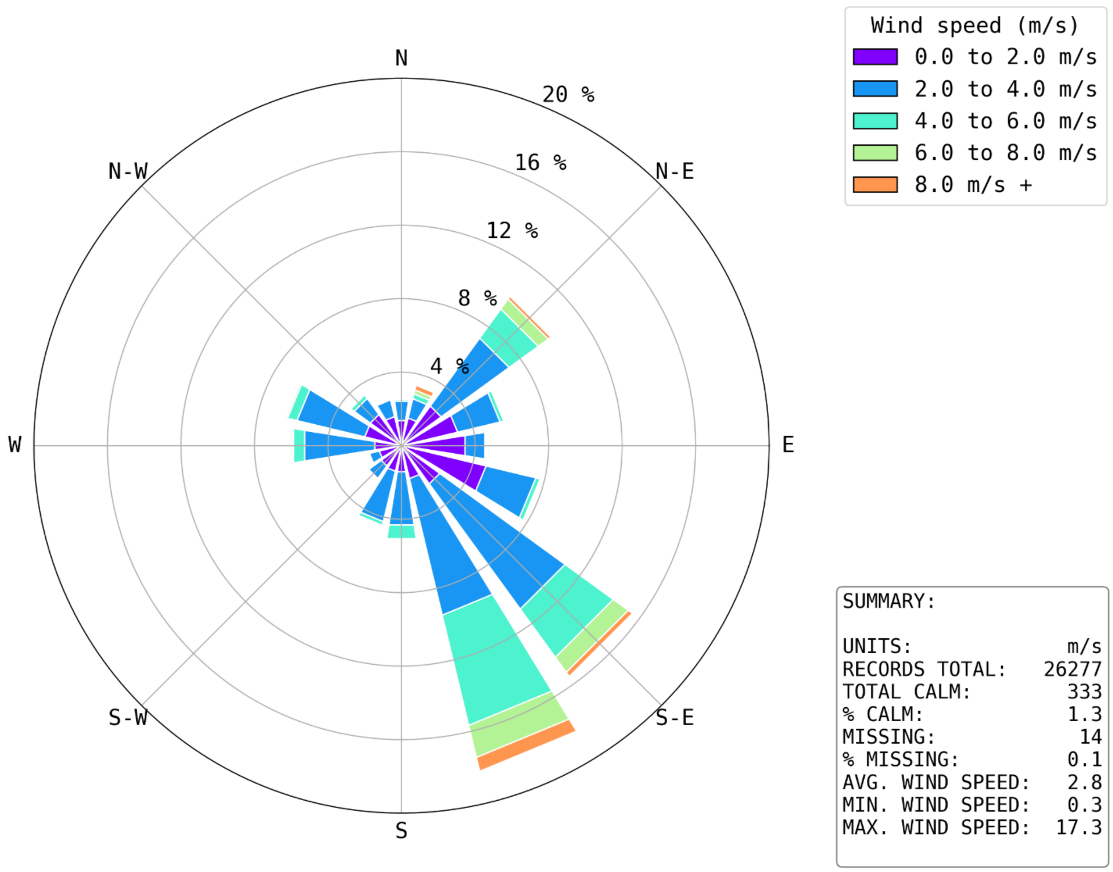
In Figure 8 below, generated by EPA, the location of the Mountain View meteorological monitor and KBLI NWS station is shown relative to the area of analysis.

Figure 8: Area of Analysis and the NWS station in the Whatcom County Area *(generated using Google Earth, from Google, LLC)*

EPA developed a surface wind rose for 2017-2019 using the combined Mountain View / KBLI meteorological dataset developed with AERMET (majority of hours measured at the Mountain View monitor, except for 880 missing hours in 2019 with KBLI substitution). In Figure 9, the frequency and magnitude of wind speed and direction are defined in terms of from where the wind is blowing. The predominant wind blows from the southeast and south-southeast roughly 40% of the hours of the year. These winds are common all seasons of the year and generally correspond to the influence of passing fronts and associated mid-latitude cyclones. Also, a mode of west-northwest wind occurs roughly 15% of the hours of the year, generally occuring in the autumn and winter after cold frontal passage. A mode of northeasterly wind occurs roughly 10% of the hours of the year, caused mainly from the outflow of continental air through the Fraser gap. Typically, the northeast winds are the result of cold modified arctic outflow that occur in the winter.

The pattern of maximum concentrations predicted by AERMOD generally agree with what would be expected, given the wind climate shown by the wind-rose. A region of violating receptors occurs at the northwest fenceline, downwind of the facility during the predominant southeast winds. The region of maximum impact, at the west-northwest region of the facility fenceline, does not correspond with frequent wind conditions. Instead, these maxima occur during rare southwest winds (winds blowing from the 205° wind vector). Though rare, southwest winds that align perpendicularly with the elongated pot-line buildings result in plume downwash in the wake of the buildings. The result is a region of local high concentration along the fenceline. A similar region of high concentration occurs on the west side of the facility, likely due to downwash that occurs due to perpendicular east-northeast winds.

Figure 9: Whatcom County, Washington (KBLI) Cumulative Annual Wind Rose for Years 2017 – 2019 (from the Mountain View meteorological dataset)



Meteorological data from the above site-specific and NWS surface stations and upper air NWS station were used in generating AERMOD-ready files with the AERMET processor. The output meteorological data created by the AERMET processor is suitable for being applied with AERMOD input files for AERMOD modeling runs. Ecology followed the methodology and settings adopted in the modeling protocol. The AERMET User's Guide and Appendix W were generally adhered to in the processing of the raw meteorological data into an AERMOD-ready format and used AERSURFACE to best represent surface characteristics.

Hourly surface meteorological data records are read by AERMET and include all the necessary elements for data processing. The site-specific dataset used a minimum threshold of 0.25 meters per second to coincide with the configuration of the sonic anemometer. The instrument is rated for accurate measurement of wind speed at 0.25 m/s and above. In setting these thresholds, no wind speeds lower than these values would be used, respectively, for determining concentrations.

EPA is confident the meteorological dataset used for the assessment is representative of the area and is adequate for determining facility impacts during the 2017-2019 period. Under Appendix W, only a single year of site-specific meteorology is required for regulatory assessments and the current dataset consists of three years of site-specific measurements (note, however, modeling for determination of a nonattainment boundary is not a regulatory assessment under Appendix

W, as discussed in the Modeling TAD. Instead, Appendix W is referred to for best-practices purposes, where applicable). Ecology provided documentation in the air quality technical report proclaiming the dataset is certified as PSD quality and therefore, highly reliable. However, the audit record and documentation to confirm this was not provided in Ecology's submitted report. The meteorological dataset is also collected at the same location as the violating SO_2 monitor itself, along the fenceline of the Intalco facility, so it is sited well to provide a representative record of conditions at the site. EPA has no reason to doubt Ecology's PSD-quality certification of its own monitors, but it would have been ideal if more documentation was provided to support the certification. Despite this lack of documentation, the modeling submitted by Ecology is still sufficient for the purposes of informing EPA's intended nonattainment boundary.

3.3.1.7.Modeling Parameter: Geography, Topography, and Terrain
The terrain in the area of analysis is best described as generally flat with some areas of elevated terrain. The Intalco facility and nearby oil refineries are located adjacent to the Salish Sea. The Cherry Point Industrial Area shoreline is characterized by short steep bluffs that rise from the shoreline to a flat plateau where the industrial facilities are located. Local isolated regions of high terrain are present several kilometers downwind of the facility in various directions. To account for these terrain changes, the AERMAP terrain program within AERMOD was used to specify terrain elevations for all the receptors. The source of the elevation data incorporated into the model is from the 30-meter Shutter Radar Topography Mission data (SRTM).

EPA was initially concerned with the use of SRTM data because it may be biased high in spots due to elevations provided at the top of obstacles, including trees and buildings, instead of ground level elevation. After spot-checks of the receptor grid, with a particular focus in the regions of high SO_2 concentration and terrain features of interest, EPA concluded the SRTM data was sufficient for the purposes of this assessment. The elevations provided by AERMAP appeared to be approximately the same as elevations from other digital elevation maps. The most noticeable differences were in regions of tree cover and found to likely result in a more conservative modeling analysis (i.e. overestimated concentrations) by providing receptor heights biased slightly high, closer to the plume heights from Intalco stacks.

The majority of receptors were modeled with a "flagpole" height of 1.4 meters above the ground. Several additional discrete receptors are located along the facility fenceline and at the SO_2 monitor locations. These additional discrete receptors were assigned no flagpole height (concentrations calculated at ground level). The discrepancy in receptor height was likely unintentional, but ultimately determined to be a non-issue by Ecology for the purposes of this modeling. EPA's modeling guidance and Appendix W states use of flagpole receptors, to calculate concentration at average breathing height, is unnecessary but not prohibited. Ideally, it is best practice to use the same receptor height above the ground for all receptors.

3.3.1.8.Modeling Parameter: Background Concentrations of SO_2
The Modeling TAD offers two mechanisms for characterizing background concentrations of SO_2 that are ultimately added to the modeled design values: 1) a "tier 1" approach, based on a monitored design value, or 2) a temporally varying "tier 2" approach, based on the 99^{th} percentile monitored concentrations by hour of day and season or month. For this area of analysis, Ecology selected the tier 1 approach using a regional monitor unaffected by the sources in the Cherry

Point industrial area. Two candidate ambient air monitors were identified to represent regional SO_2: monitors located in Custer, WA (about 10 km northeast of Intalco) and Anacortes, WA (about 40 km south of Intalco). Ecology found the Custer monitor was impacted by SO_2 emissions from a wastewater treatment plant to its immediate south. Therefore, Ecology expressed a preference for the Anacortes monitor (AQS ID 53- 057-0011). The Anacortes design value for 2017-2019 was calculated as 3 ppb (7.86 µg/m3). The background concentration for this area of analysis was determined by the state to be 7.86 $\mu g/m^3$, equivalent to 3 ppb when expressed in 3 significant figures, and that value was incorporated into the final AERMOD results

EPA finds the selected monitor and background concentration to be representative and appropriate. Although the selected monitor is distant from the area of concern, the alternative nearer monitors are exposed to local sources of SO_2 and therefore, do not provide a representative regional background value. The Anacortes monitor is located in a region of similar terrain and climate as Intalco, adjacent to the waters of the Puget Sound. The monitor is located in a generally rural area (center of a small town) but adjacent to large industrial facilities (Marsh Point oil refineries) but not impacted by any localized significant source of SO_2 emission. EPA agrees with Ecology's assessment that the Anacortes monitor dataset was the best available option for determination of a representative regional background concentration.

3.3.1.9. Summary of Modeling Inputs and Results

The AERMOD modeling input parameters for the Whatcom County area of analysis are summarized below in Table 5.

Table 5: Summary of AERMOD Modeling Input Parameters for the Area of Analysis for the Whatcom County Area

Input Parameter	Value
AERMOD Version	19191
Dispersion Characteristics	Urban, with use of ADJ_U*
Modeled Sources	3
Modeled Stacks	154*
Modeled Structures	221
Modeled Fencelines	1
Total receptors	23,681
Emissions Type	Actual
Emissions Years	2017-2019
Meteorology Years	2017-2019
Site-specific station for surface meteorology	Mountain View monitor operated by the Washington State Dept. Ecology. Turbulence (sigma theta) dataset not used in the modeling. Temperature difference dataset not collected.
NWS Station for Surface Meteorology (substitution dataset)	KBLI (Bellingham Airport NWS ASOS). Cloud cover from this station used for all hours.
NWS Station Upper Air Meteorology	KUIL (Quillayute, WA upper-air station)
Areas selected for Calculating Surface Characteristics	Surface characteristics calculated separately for both the Mountain View site-specific station and KBLI NWS ASOS station, centered at location of each station.
Methodology for Calculating Background SO_2 Concentration	AQS Site #53-057-0011, Anacortes, WA monitor, Tier 1 design value, 2017-2019 period
Calculated Background SO_2 Concentration	3 ppb (7.86 μg/m^3)

** Direction-dependent stack merging used for Intalco dry-scrubber stacks, so actual number of stacks modeled varied per hour.*

The results presented below in Table 6 and Figure 10 show the geographic extent of the predicted modeled violations based on the input parameters.

Table 6: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentration Averaged Over Three Years for the Area of Analysis for the Whatcom County Area

Averaging Period	Data Period	Receptor Location UTM Zone 10		99th percentile daily maximum 1-hour SO_2 Concentration ($\mu g/m^3$)	
		UTM	UTM	Modeled concentration (including background)	NAAQS Level
99th Percentile 1-Hour Average	2017-2019	5410637.9 N (zone 10)	522431.85 W (zone 10)	543 µg/m3	196.4*

*Equivalent to the 2010 SO_2 NAAQS of 75 ppb using a 2.619 $\mu g/m^3$ conversion factor

Figure 10 was included as part of Ecology's modeling report and demonstrates high concentrations that violate the NAAQS occur near to the facility along the fenceline. Figure 11, developed by EPA, indicates that the predicted modeled violations occur along the facility fenceline on the west, north, and east sides of the facility. Ecology's receptor grid is also shown in the figure.

Figure 10: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Whatcom County Area

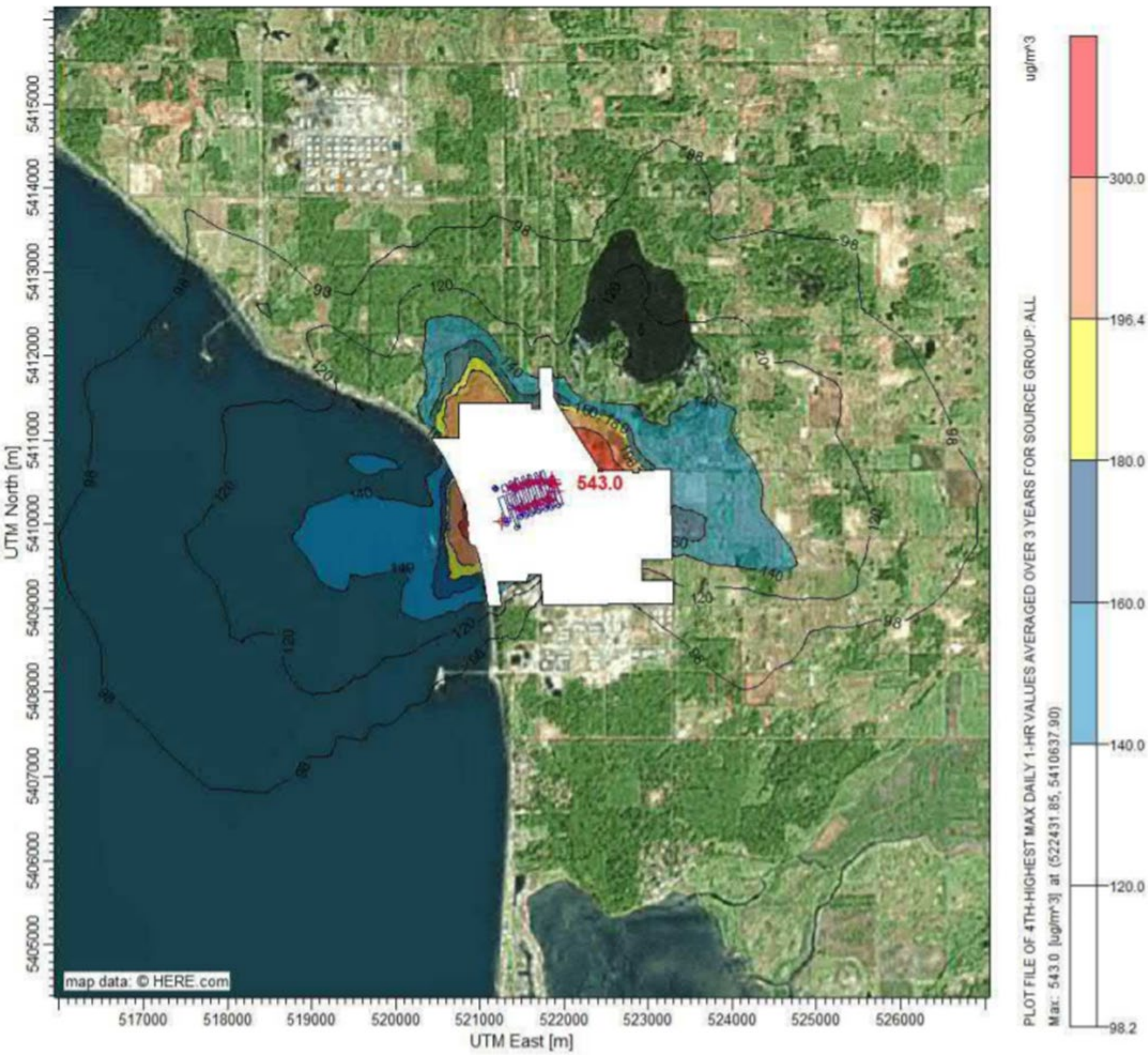
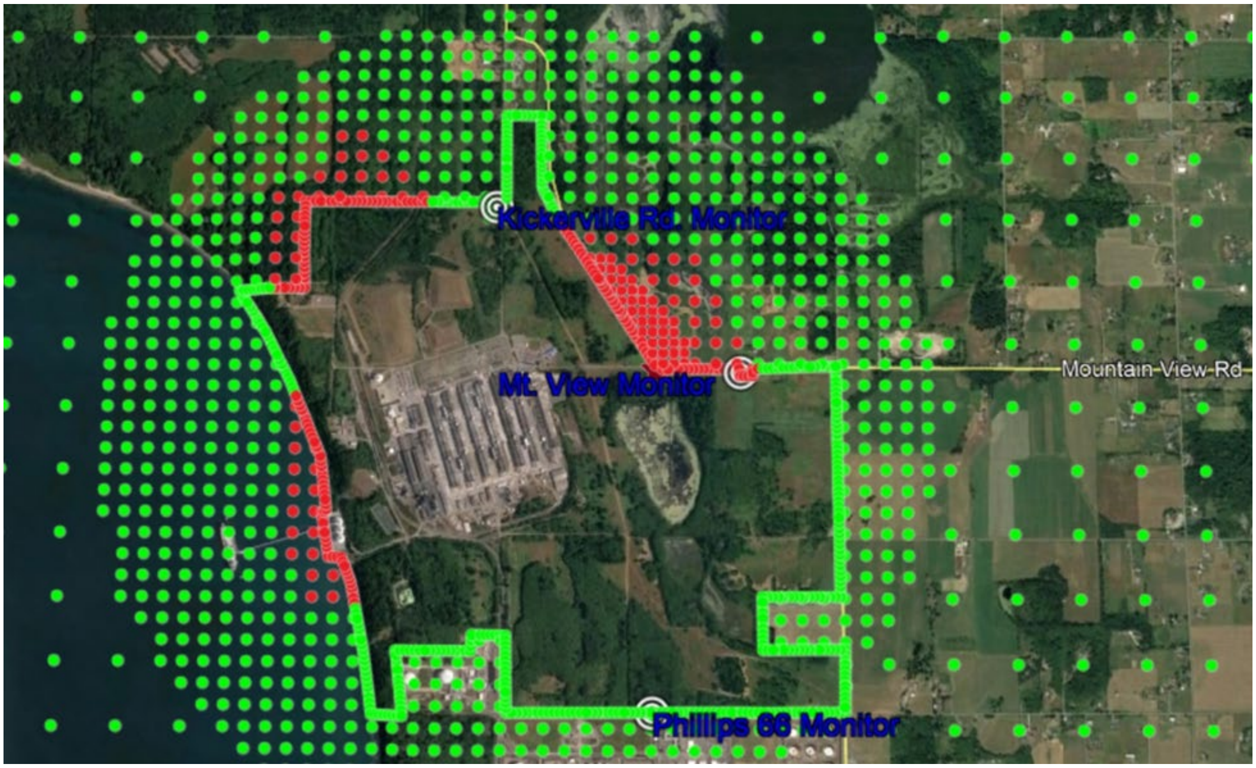


Figure 11: Predicted 99th Percentile Daily Maximum 1-Hour SO_2 Concentrations Averaged Over Three Years for the Area of Analysis for the Whatcom County Area that exceed the NAAQS (red: violates, green: does not violate) *(developed using Google Earth from Google, LLC)*



The modeling submitted by Ecology indicates that the 1-hour SO_2 NAAQS is violated at the receptor with the highest modeled concentration. The modeling results also include the area in which a NAAQS violation was modeled, information that is relevant to the selection of the boundaries of the area that will be designated. The violations occur generally along the west, north, and east fencelines of the facility and extend a small distance from the fenceline. All modeled violations are within one-half kilometer from the facility fenceline. The highest concentrations, exceeding 500 $\mu g/m^3$, occur on the northeast fenceline. Some violations occur on and near the west fenceline, at receptors located over the waters of the Salish Sea. No violations are found to occur on the south fenceline, the property border shared with Phillips 66 and Petrogas.

3.3.1.10. EPA's Assessment of the Modeling Information Provided by Ecology

Given that the state did not provide a recommendation for the boundary, EPA conducted an extensive review of the submitted modeling to provide sufficient evidence to support the determination of a nonattainment boundary. The nonattainment boundary must contain all of the area where the NAAQS are not attained and all of the areas that contribute to the violations. Therefore, the two key goals of EPA's assessment are to determine:

a) The reliability of the model results in determining the extent of the area of violation, and
b) The contribution of emissions from sources in two nearby areas (BP Cherry Point and Phillips 66 oil refineries).

EPA has determined that the modeling assessment is reliable for determining the extent of the area of violation of the 1-hour SO_2 NAAQS. In summary, based on the review of the modeling protocol, modeling report, the air quality technical report, and modeling files, we have concluded the following:

1) The modeling was generally conducted in accordance with the SO_2 modeling TAD.
2) The meteorology is adequate, based on a 3-year state-certified PSD-quality site-specific dataset collected adjacent to Intalco property. Missing data were properly substituted using measurements from a local representative NWS ASOS station (KBLI).
3) Land-use and terrain processing was adequate and in line with guidance and Appendix W. The surface roughness, albedo, and Bowen ratios used are physically reasonable for each sector.
4) The receptor grid had adequate resolution and covered all of the areas where maximum concentrations and local elevated concentrations could perceivably occur.
5) AERMOD settings and configuration were generally in line with guidance.
6) The determination that "urban" dispersion coefficients were appropriate was based on EPA guidance and sound evidence using high-resolution satellite temperature maps of the area. The facility is sufficiently wide (> 1 km) and urban-rural temperature differences are great enough to support the conclusion the local boundary layer is sufficiently disturbed such that urban coefficients would provide more accurate AERMOD results.
7) The stack merging site technique is novel and appropriate to support EPA's intended nonattainment boundary, based on the verification demonstration; use of the technique was necessary to account for additional plume rise and results were shown to verify against measured design values at monitors on the north, east, and south sides of the facility. QQ-plots demonstrated the AERMOD results were similar in magnitude and slightly higher (conservative) than measured values. EPA still expresses concern regarding the lack of a demonstrated objective procedure to determine merging therefore future regulatory use of this method for NSR or SIP demonstration purposes may require alternative model technique approval and analysis for compliance with EPA's regulations restricting the use of dispersion techniques. Further discussion is needed between Ecology and EPA prior to the state using the stack merging site technique in any SIP modeling.
8) Modeled design concentrations were found to closely match those observed at local SO_2 monitors during the 2017-2019 time period, as shown in Table 7.

Table 7: Modeled design concentrations (99th percentile daily 1-hour maxes, 3-year averages where applicable) compared to measurements at the monitor locations

Monitor Site	Modeled Design Conc. (µg/m^3)	Monitor Design Conc. (µg/m^3)	Period
Mountain View	252	278	2017-2019
Kickerville	179	186	2017-2019

Given our assessment of the modeling, there is high confidence in the extent of the results of the modeling including the area of modeled violations. The modeled area of violation does not extend far from the Intalco facility fenceline. The region of violation on the west and east sides of the facility are most likely due to plume downwash in the wake of the elongated pot-line buildings during wind directions that align perpendicular to the buildings. The downwash results in isolated areas of elevated concentration near to the facility during these wind conditions. A group of receptors in the area of the northwest fenceline are also in violation, downwind of Intalco during predominant south-southeast winds. The modeling showed no significant hot-spots or violations on high terrain far downwind of the facility. The gradient of concentration near the areas of violation is steep, quickly dropping with distance from the Intalco fenceline.

EPA evaluated the potential for contribution of emissions from facilities in nearby areas to the violations through an examination of the nearby facility impacts at all modeled violating receptors. Under the CAA, EPA has not applied a "significance" threshold in determining whether a nearby source's or area's emissions contribute to pollution concentrations that do not meet a NAAQS, nor has EPA adopted any bright line emissions mass, rate or percentage of contribution thresholds for making these determinations. Moreover, EPA has not limited its determinations of contribution to situations where corrective measures at sources in the nearby area will address the problem or help achieve attainment in the violating area, or to where a nearby violating area's nonattainment problem wouldn't still persist in the absence of source emissions from the possibly contributing area. *See, Catawba County v. EPA*, 571 F.3d 39 (D.C. Cir. 2009). However, if the emissions from a potentially contributing source or area are shown to not exacerbate a nonattainment problem, EPA may determine that such a potential contribution is not sufficient to deem that area nonattainment.

The nearby BP Cherry Point and Phillips 66 Ferndale refinery emissions impacts were analyzed separately. However, note the results provided in the modeling output files reported a single source group for all refinery emissions. Therefore, the potentially contributing nearby source was estimated based on the wind direction during the hours of concern. It is possible the potentially contributing source was mis-identified or both sources' emissions occurred at hours of concern where wind directions were very light. During these hours, AERMOD's meandering plume module accounts for a portion of impact due to variable wind direction, regardless of the wind direction specified. Since no violations occurred along the south fenceline of Intalco, EPA assumed impacts at violating receptors that occurred during wind directions from 270° to 360° could be due to BP emissions. All other impacts at violating receptors, during wind directions from 1° to 270°, were attributed to Phillips 66 emissions.

Ecology identified 268 receptors in the modeling domain with 1-hour SO_2 NAAQS violations. EPA's review of the information for these receptors indicates that Intalco emissions are the primary cause of the violations at all 268 receptors because the maximum design concentration of 543 $\mu g/m^3$ is at a receptor located at the northeast corner of the Intalco fenceline (refer to Figure 10) and Intalco contributes 535 $\mu g/m^3$ of the emissions (background concentration was 7.86 $\mu g/m^3$). About 0.01 $\mu g/m^3$ of the concentration impact is due to refinery emissions at the maximum receptor (from Phillips 66 emissions in this case). The top 20 violating concentrations are listed in Table 8 (refer to Appendix A for a table containing concentrations for all of the 268 violating receptors). Based on our review of these concentrations, Phillips 66 and BP emissions account for a negligible portion of the impact at 0.01 $\mu g/m^3$ in each case. In addition, the refinery emissions do not exacerbate the highest violations; if the refinery portion was removed from each of the top twenty design concentrations, the design concentrations at each violating receptor would not differ (when rounded appropriately).

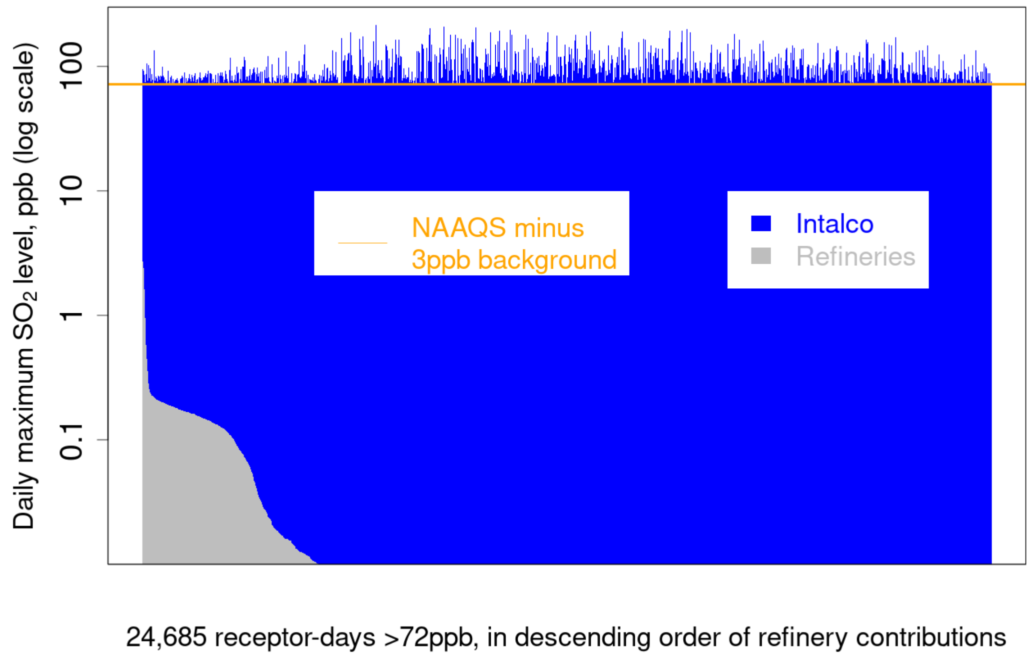
Table 8: Top 20 modeled violating receptors.

Violating Receptor Rank	UTM east (m)	UTM north (m)	SO_2 3-yr avg. design conc. ($\mu g/m^3$)*	Intalco portion ($\mu g/m^3$)	Refinery portion ($\mu g/m^3$)
1	522431.9	5410637.9	543.01	535.14	0.01
2	522255.9	5410904.9	524.68	516.81	0.01
3	522283	5410863.9	522.73	514.86	0.01
4	522269.5	5410884.4	521.28	513.41	0.01
5	522455.9	5410638.2	519.07	511.20	0.01
6	522257	5410917	519.00	511.13	0.01
7	522337.1	5410781.7	515.76	507.89	0.01
8	522242.4	5410925.5	515.22	507.35	0.01
9	522323.6	5410802.2	509.81	501.94	0.01
10	522364.2	5410740.6	509.42	501.55	0.01
11	522418.3	5410658.4	508.44	500.57	0.01
12	522296.5	5410843.3	506.58	498.71	0.01
13	522479.9	5410638.4	500.56	492.68	0.01
14	522310.1	5410822.8	500.30	492.43	0.01
15	522350.7	5410761.2	496.39	488.52	0.01
16	522404.8	5410679	495.58	487.70	0.01
17	522357	5410767	495.27	487.40	0.01
18	522307	5410867	492.37	484.50	0.01
19	522228.9	5410946	487.33	479.46	0.01
20	522504	5410638.7	485.27	477.40	0.01

*Design concentration is the 3-year average of the 99th percentile of daily maximum 1-hour SO_2 concentration at each receptor. Background concentration of 7.86 μg/m3 included.

Ecology conducted an extensive analysis of the concentrations at violating receptors to examine possible contributions of refinery emissions to the violations. Figure 12, which was presented in Ecology's air quality technical report, demonstrates the relatively small portion of concentration impacts attributable to refinery emissions at all receptors with daily maximum values exceeding the 2010 1-hour SO_2 NAAQS threshold. EPA evaluated Ecology's analysis and the modeling results to ascertain any possible contributions of BP or Phillips 66 refinery emissions to the modeled violations. Our review is summarized below.

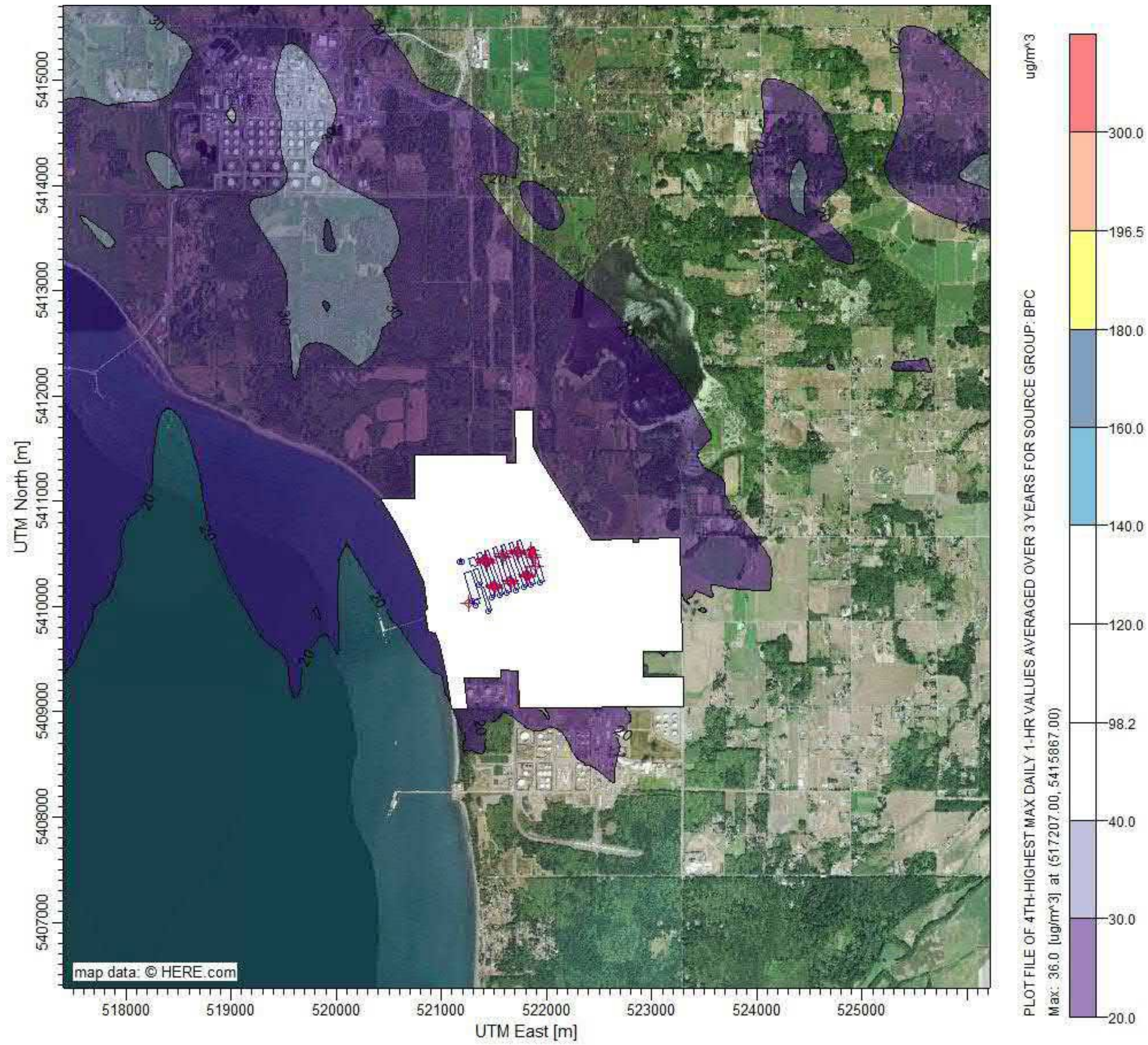
Figure 12: Distribution of Intalco and Refinery emission contributions to all daily maximum 1-hour concentrations >72 ppb at all receptors (not necessarily violating receptors, though all violating receptors are included).



Assessment of BP emissions' possible contribution to violations

BP Cherry Point emissions 3-year average of 99th percentile of maximum daily 1-hour concentrations are shown in Figure 12. A maximum concentration of 36 µg/m^3 occurs northwest of BP. A local region of concentration exceeds 30 µg/m^3 just northwest of Intalco. Note that these are not contributions of BP emissions to periods of violation at violating receptors. These maximum concentrations from BP emissions alone do not occur at violating receptors during periods of violation. The modeling demonstrates BP emissions do not cause a violation of the 1-hour SO_2 NAAQS themselves at any receptor (when only BP emissions and no other facility emissions are considered). Though receptors were not placed within the Intalco fenceline, it can be inferred through examination of the concentration gradient and terrain profile that it is highly unlikely that BP impacts were higher within the fenceline than observed outside the fenceline.

Figure 13: Isopleths of 2017-2019 modeled design concentration of BP Cherry Point emissions only (reflects all periods, not just periods of violation).



EPA's review did not find BP emissions to have a discernible contribution to the hours used to determine the design concentrations (99th percentile and above) at all 268 violating receptors at and around the Intalco fenceline. In no case do emissions from BP result in any contribution to the design concentration (4th high values – see Appendix A) nor the 1st, 2nd, and 3rd high values at any of the violating receptors at the maximum daily hours used to determine the 3-year average concentrations. BP emissions do not exacerbate nonattainment in any way. There is no direct impact from BP emissions during periods of violation at violating monitors, because wind directions at all hours that determine the 3-year average concentrations were not between 270° and 360°, which is the conceivable range at which BP emissions could advect towards any violating receptor. Therefore, EPA has determined that if BP SO_2 emissions were completely eliminated there would be no decrease in the design concentrations at any of the violating receptors and there would be no change in the area of violation.

Assessment of Phillips 66 emissions possible contribution to violations

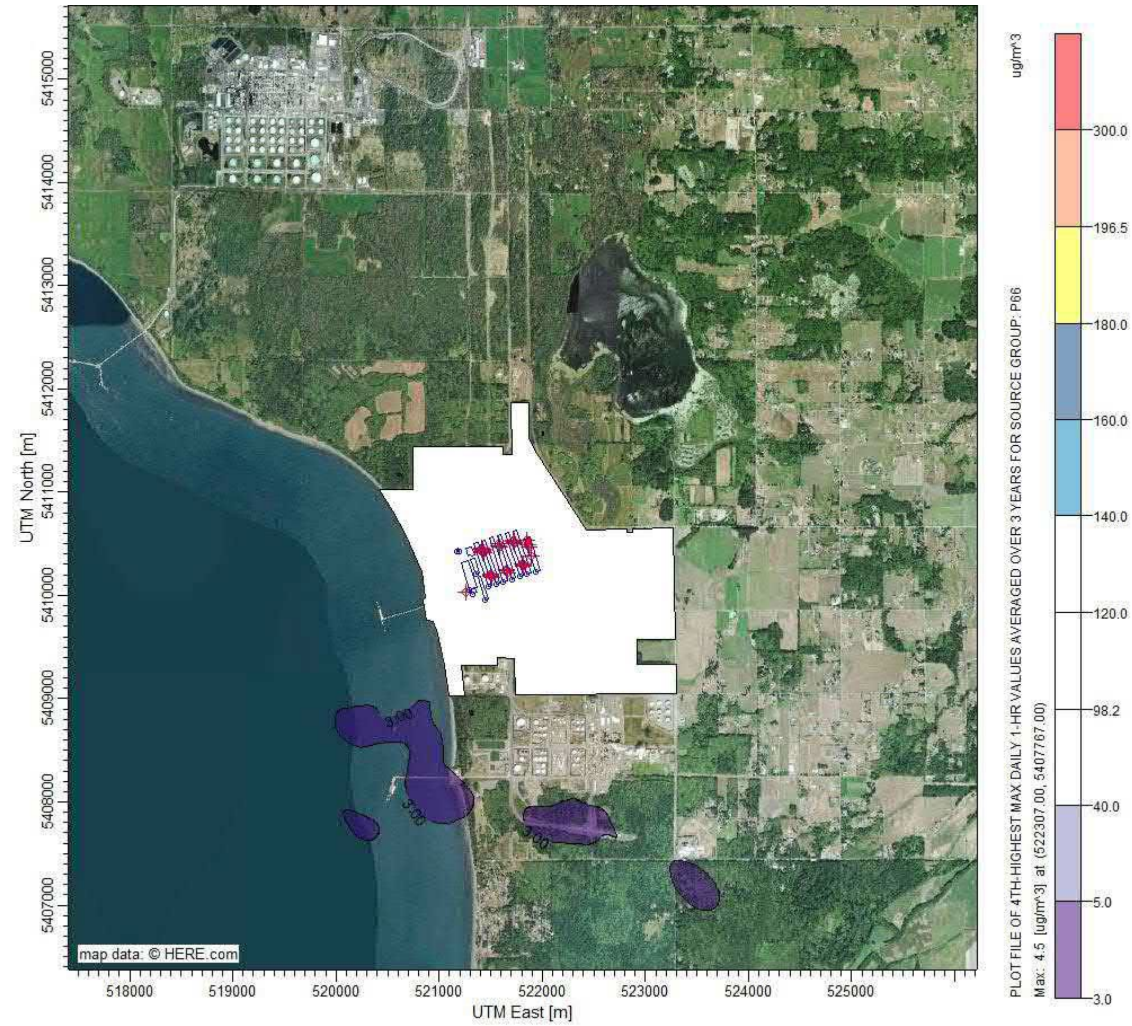
The Phillips 66 emissions 3-year average of 99^{th} percentile of maximum daily 1-hour concentrations are shown in Figure 13. A maximum of 4.5 $\mu g/m^3$, from Phillips 66 emissions alone, occurs south of Phillips 66. An area of concentration exceeding 3.0 $\mu g/m^3$ occurs west of Phillips 66, nearer to the Intalco fenceline. These maximum concentrations did not contribute to any violations and occurred only at non-violating receptors.

Receptors were not included within the Intalco fenceline in Ecology's modeling, so Phillips 66 possible contribution to violations within the fenceline cannot be directly assessed with the information provided. Though receptors were not placed within the Intalco fenceline, it can be inferred through examination of the concentration gradient and terrain profile that it is highly unlikely that Phillips impacts were higher within the fenceline than modeled outside the fenceline.

EPA examined the potential contribution of Phillips 66 emissions to the modeled 268 violating receptor design concentrations. The top twenty receptors, ranked by portion of the design concentration attributable to Intalco, are provided in Table 9 below. The table lists the total design concentration at each receptor, the portion of the concentration attributable to Intalco and Phillips 66 emissions, and the rank of the receptor (from 1 to 268, with rank 1 having the highest of the violating design concentrations of 543 $\mu g/m^3$ and rank 268 the lowest violating design concentration of 196.9 $\mu g/m^3$).

Of the 268 violating receptors, more than 1.0 µg/m3 was attributable to Phillips 66 emissions at only four of the receptors (only 1.5% of the violating receptors). The greatest average portion, 3.15 µg/m3 (1.2% of 268.1 µg/m3), is at a receptor at the northeast corner of the Intalco fenceline, shown in Figure 14 (the "average contribution" is the 3-year average of the refinery contribution from the 2017, 2018, and 2019 99th percentile maximum daily 1-hour concentrations at a receptor).

Figure 14: Isopleths of modeled design concentration 2017-2019 for Phillips 66 emissions only



EPA further analyzed the data and determined if the portion of the design concentration attributable to Phillips 66 emissions is removed from all of the 268 receptors, all receptors are still in violation of the NAAQS, due overwhelmingly to Intalco emissions. The area with the greatest portion of the design concentration attributable to Phillips 66's low levels of emissions, shown in Figure 14, would still be well within the area of nonattainment, determined from Intalco emission impacts, if Phillips 66 had no SO_2 emissions at all rather than the low emissions that already have nearly no discernible impact.

Table 10 provides the list of the bottom ten design concentrations (rank 258 through 268) at modeled violating receptors. The portion of the design concentration attributable to emissions from Phillips 66 ranges from 0.01 $\mu g/m^3$ to 0.43 $\mu g/m^3$. If the Phillips 66 portion is removed from all receptors, there is no receptor with a design concentration that would change from nonattainment to attainment, and the low levels of emissions from Phillips 66 do not sufficiently exacerbate the area of nonattainment modeled to include it in the nonattainment area.

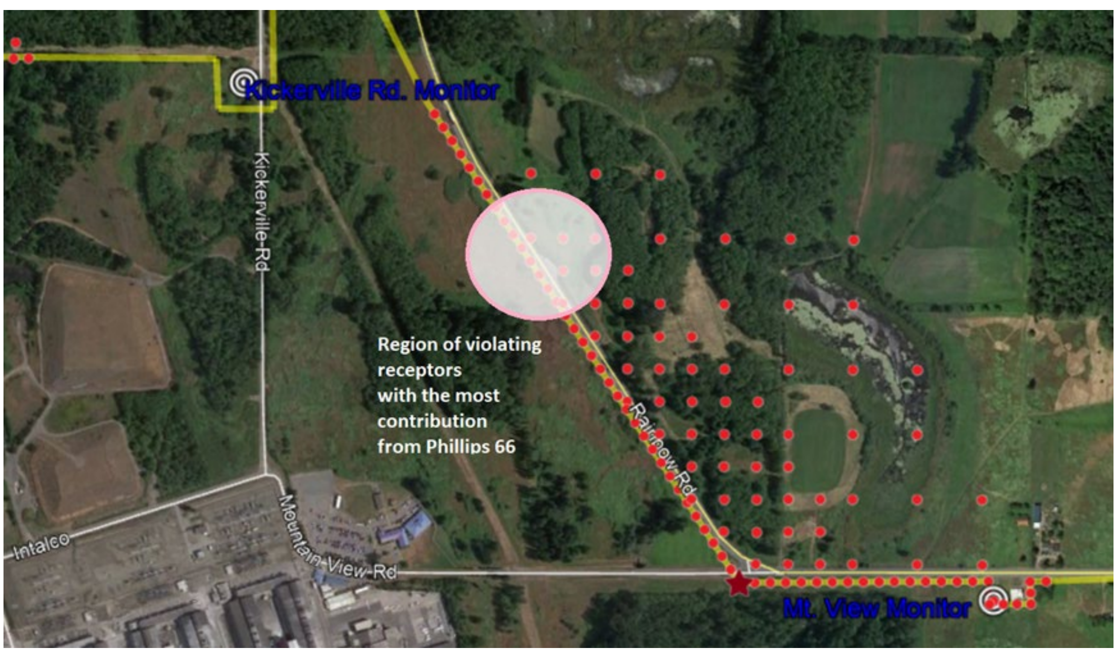
Table 9: Top twenty Phillips 66 contributions to design concentration at modeled violating receptors

Violating Receptor Rank	UTM east (m)	UTM north (m)	3-yr avg. design conc. (µg/m^3)*	Intalco (µg/m^3)	Refinery (µg/m^3)	Average wind direction (degrees)	Attributed Refinery (µg/m^3)
128	522039.4	5411234	268.06	257.04	3.15	206	P66
124	522057	5411217	273.50	263.34	2.30	208	P66
122	522052.9	5411213	277.28	267.26	2.16	209	P66
169	521998.8	5411295	232.44	222.45	2.13	206	P66
182	520889.4	5411444	228.59	220.26	0.47	148	P66
234	521007	5411667	210.21	201.89	0.46	155	P66
156	521084	5411443	235.26	226.94	0.46	154	P66
153	521132.7	5411443	235.93	227.61	0.45	155	P66
204	521107	5411567	221.79	213.48	0.45	157	P66
167	520986.7	5411444	232.98	224.68	0.44	151	P66
198	520816.4	5411444	224.20	215.90	0.44	146	P66
187	520865.1	5411444	226.77	218.48	0.43	146	P66
138	522025.9	5411254	255.98	247.69	0.43	209	P66
173	520962.4	5411444	230.82	222.53	0.43	151	P66
193	520840.7	5411444	225.25	216.96	0.43	146	P66
194	521230	5411443	225.07	216.78	0.43	156	P66
202	520807	5411467	222.40	214.11	0.43	146	P66
172	521205.6	5411443	230.98	222.70	0.43	156	P66
164	521035.3	5411444	233.43	225.15	0.42	152	P66
191	521207	5411467	225.68	217.40	0.42	156	P66
181	520907	5411467	229.15	220.86	0.42	150	P66

Table 10: Bottom ten design concentrations at modeled violating receptors

Violating Receptor Rank	UTM east (m)	UTM north (m)	3-yr avg. design conc. (µg/m³)*	Intalco (µg/m³)	Refinery (µg/m³)	Average wind direction (degrees)	Attributed Refinery (µg/m³)
258	521327.3	5411443	200.23	191.95	0.42	158	P66
259	520607	5411467	199.01	190.82	0.33	139	P66
260	521010.7	5409536	198.68	190.80	0.02	34	P66
261	522904.7	5410643	198.19	190.32	0.01	264	P66
262	520607	5411067	198.18	190.19	0.13	129	P66
263	520708.4	5410514	197.97	190.10	0.00	107	P66
264	520605.6	5411026	197.82	189.83	0.13	129	P66
265	520629	5411026	197.69	189.70	0.14	129	P66
266	522607	5411167	197.33	189.46	0.01	234	P66
267	522807	5410767	197.21	189.34	0.01	252	P66
268	520607	5411167	196.87	188.88	0.12	130	P66

Figure 15: Region of violating receptors with greatest portion of the design concentration attributable to Phillips 66 emissions ***(developed with Google Earth, from Google, LLC)***



Based on this analysis of the data, EPA finds Phillips 66 emissions do not exacerbate the nonattainment problem principally caused by Intalco, and therefore do not exacerbate the violations of the 1-hour SO_2 NAAQS to justify including the refineries within the boundaries of the nonattainment area. The potential for contribution to the design contributions at all violating receptors is extremely small.

Refinery potential contribution to nonattainment conclusion

EPA has determined that the same area and high degree of violation would occur even if the refineries were not present because Intalco emissions overwhelmingly are the cause of violations at all receptors in the domain and must be substantially reduced for the area to attain the NAAQS. Ecology's and EPA's analyses found no cases where BP emissions caused any contribution to a violating modeled receptor. EPA finds Phillips 66 emissions do not exacerbate violations nor exacerbate the nonattainment area found in the modeling. As shown in Appendix A and demonstrated throughout this TSD, modeling at actual emission rates indicate that Intalco emissions are the dominant cause of SO_2 NAAQS violations in the Whatcom County area. Therefore, EPA concludes both the BP and Phillips 66 refineries' emissions and impacts are not sufficient to include them in the Whatcom County SO_2 nonattainment area.

3.4. Emissions and Emissions-Related Data, Meteorology, Geography, and Topography for the Whatcom County Area

In section 3.3.1.1.5 of Ecology's technical report, annual emissions were provided for Intalco, Phillips 66, and BP (2017-2019). EPA reviewed the emissions calculations and modeling inputs and confirmed the grams-per-second emission rates used for each stack correctly corresponded to the reported monthly emissions for each facility. Review of merged stack emissions also confirmed calculated grams-per-second emissions rates were correctly used. In each year, Intalco was the greatest emitter of SO_2.

In section 3.3.1.1.6 of the technical report, Ecology provided meteorology for the Cherry Point Industrial Area. In Figure 9, EPA developed a surface wind rose for 2017-2019 using the combined Mountain View / KBLI meteorological dataset developed using AERMET (majority of hours measured at the Mountain View monitor, except for 880 missing hours in 2019 with KBLI substitution). The predominant wind blows from the southeast and south-southeast roughly 40% of the hours of the year. These winds are common all seasons of the year and generally correspond to the influence of passing fronts and associated mid-latitude cyclones. Also, a mode of west-northwest wind occurs roughly 15% of the hours of the year, generally occurring in the autumn and winter after cold frontal passage. A mode of northeasterly wind occurs roughly 10% of the hours of the year, caused mainly from the outflow of continental air through the Fraser gap. Typically, the northeast winds are the result of very cold modified arctic outflow that occur in the winter. The pattern of maximum concentrations predicted by AERMOD generally agree with the wind-rose.

As discussed in section 3.3.1.17, the geography and topography were built in the modeling (AERMOD) through the AERMAP terrain program. The terrain in the area of analysis is best described as generally flat with some areas of elevated terrain that is located adjacent to the Salish Sea. The Cherry Point Industrial Area shoreline is characterized by short steep bluffs that rise from the shoreline to a flat plateau where the industrial facilities are located. Local isolated regions of high terrain are present several kilometers downwind of the facility in various directions.

These factors have been incorporated into the air quality modeling efforts and results discussed above. EPA is giving consideration to these factors by considering whether they were properly incorporated and by considering the air quality concentrations predicted by the modeling.

3.5. Jurisdictional Boundaries in the Whatcom County Area

EPA considers existing jurisdictional boundaries for the purposes of providing a clearly defined legal boundary for carrying out the air quality planning and enforcement functions for the area. Our goal is to base designations on clearly defined legal boundaries that align with existing administrative boundaries when reasonable. Existing jurisdictional boundaries used to define a nonattainment area must encompass the area that has been identified as meeting the nonattainment definition.

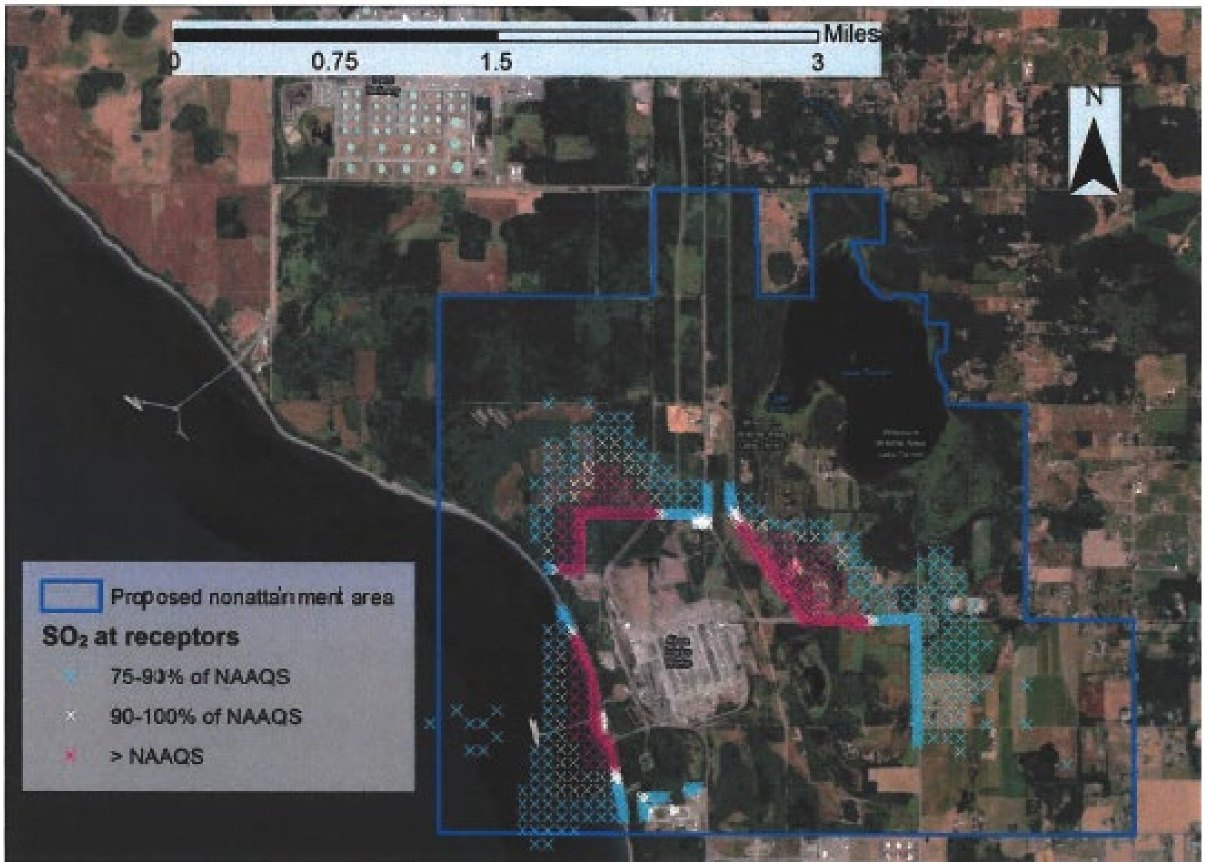
Without a state recommended boundary, EPA considered the use of different jurisdictional boundaries ranging from census tracts to roadways and identifiable property boundaries. However, as violating receptors reached out to the Strait of Georgia west of the Intalco facility, EPA decided to use UTM coordinates with ARCGIS in order to fully capture the area where the NAAQS are not attained and all of the areas that contribute to the violations.

3.6. Other Information Relevant to the Designation of the Whatcom County Area

EPA received additional information relevant to the designation of this area. As noted earlier, NWCAA, the local clean air agency with jurisdiction in Whatcom County, collaborated with Ecology on the technical report submitted to EPA on June 12, 2020. Citing the report, NWCAA advocated for a designation recommendation of nonattainment to EPA in a June 9, 2020 letter. NWCAA suggested that EPA designate a small area surrounding the Intalco facility as nonattainment for the 2010 1-hr SO_2 NAAQS, and that EPA exclude the Phillips 66 and BP facilities from the nonattainment boundary because “it is not possible to conclude that these facilities contribute to nonattainment in any meaningful way.” Because the technical analysis of NWCAA’s recommendation relies on that NWCAA’s collaborative technical report with Ecology, which EPA has already reviewed in detail in this TSD, we will not restate the details of that analysis here. The boundary suggested by NWCAA is provided in Figure 16, below. EPA has elected to create an intended nonattainment boundary for the Whatcom County Area that is similar in size to that suggested by NWCAA, as we are proposing to concur with their view that the boundary should be drawn to encompass the cause of the SO_2 violations, the Intalco facility.

EPA, however, intends to use a simpler intended nonattainment boundary consisting four UTM coordinates instead of the various roadways and property lines suggested by NWCAA.

Figure 16: NWCAA Suggested Boundary for the Whatcom County Nonattainment Area



EPA also received a letter dated February 11, 2020, from Mark DeLaquil of Baker & Hostetler, LLP, Alcoa's legal representative, regarding the 2010 SO_2 NAAQS designation for the Alcoa Intalco area in Whatcom County, Washington. The letter claims that, during the 2017-2019 monitoring period, "there has been only one hour with a 5-minute 200 ppb air quality value monitored at Intalco" and suggests that EPA designate the area unclassifiable.

On May 5, 2020, EPA sent a response letter to Mr. DeLaquil reiterating that the 2010 1-hour SO_2 primary NAAQS was a 1-hour standard based on the 3-year average of the annual 99th percentile of the daily maximum 1-hour average concentrations of SO_2. This design value is determined in accordance with appendix T of 40 CFR part 51 and as measured by a reference method based on appendix A or A-1 of part 51 or by a Federal Reference Method designated in accordance with 40 CFR part 53 (75 FR 35520, June 22, 2010, codified at 40 CFR 50.17). This standard protects against short-term exposures ranging from 5-minutes to 24-hours. During the 2010 SO_2 NAAQS review process, the Clean Air Scientific Advisory Committee stated that EPA's rationale for a 1-hour standard was "convincing" and that "a 1-hour standard is the preferred averaging time" (75

FR 35537).[11] Furthermore, as required by the CAA, EPA conducted a periodic review of the SO_2 NAAQS, and on March 18, 2019, the Agency published a decision to retain the 2010 1-hour primary standard (84 FR 9866). EPA notes that even if the form of the SO_2 standard had been changed in 2019 such that an area without any 5-minute ambient concentrations at or above 200 ppb over a three-year period would be attaining the 2019 standard, EPA would still be required to designate areas for the 2010 SO_2 NAAQS according to the form of the 2010 standard.

The 2017-2019 violating design value at the Alcoa Intalco monitor meets the averaging criteria established in EPA's 2010 SO_2 NAAQS rulemaking. There is no available information indicating that the monitoring data are not reliable. Moreover, any objections to either the level or the form of the 2010 1-hour primary NAAQS are outside the scope of this designations action. Therefore, EPA cannot support an intended unclassifiable designation for the Whatcom County area based on the claims in Mr. DeLaquil's February 11, 2020 letter.

3.7. EPA's Assessment of the Available Information for the Whatcom County Area

A monitor (Ferndale-Mountain View) in the Whatcom County area is violating the NAAQS based on the 2017-2019 design value. Ecology submitted air dispersion modeling to demonstrate the extent of the NAAQS violations, which EPA has used to establish a nonattainment boundary.[12]

In section 3.3.1.10, EPA discussed in detail its determination that the Ecology modeling assessment is reliable for determining the extent of the area of violation of the 1-hour SO_2 NAAQS. The modeling shows that Phillips 66 and BP emissions do not exacerbate the violations caused by Intalco and therefore do not sufficiently contribute to the violations of the 1-hour SO_2 NAAQS to justify including them within the nonattainment area boundary. As a result, the nonattainment boundary was created to capture both the violating receptors and the source of the violations (Intalco) based on modeling, while excluding both the Phillips 66 refinery and the BP refinery due to their lack of sufficient contribution to the modeled violations and exceeding hours. The nonattainment boundary was extended past the Intalco facility's north and east fencelines to include the violating receptors and some additional "buffer" beyond those receptors, given their very close proximity to the Intalco fenceline. The southern fenceline was not separated because no violations were modeled to the south of Intalco, and because that fenceline is shared with the Phillips 66 facility, forming its northern border. EPA determined it was necessary to create the boundary using UTM coordinates with ARCGIS software in order to fully capture all of the violating receptors in the nonattainment area, as violations were modeled in the open water of the Strait of Georgia west of the Intalco facility, making reliance on jurisdictional boundaries alone insufficient.

[11] The 2010 1-hour SO_2 NAAQS and EPA's denial of petitions for reconsideration were challenged and upheld in *National Environmental Development Association's Clean Air Project* v. *EPA,* 686 F.3d 803 (D.C. Cir. 2012).
[12] EPA's assessment of the modeling for the Whatcom County area to inform our intended nonattainment boundary for 2010 SO_2 NAAQS designations does not imply that the modeling is appropriate for other purposes, such as NSR, interstate transport, or SIP demonstrations.

EPA believes that our intended nonattainment area, bounded by lines connecting the UTM coordinates (Zone 10, meters from ARCGIS Pro) as follows: Northwest Corner: 519671 5412272, Northeast Corner: 524091 5412261, Southwest Corner: 519671 5409010, Southeast Corner: 524111 5409044, will have clearly defined legal boundaries, and we intend to find these boundaries to be a suitable basis for defining our intended nonattainment area.

3.8. Summary of EPA's Intended Designation for the Whatcom County Area and the Remaining Portion of Whatcom County

After careful evaluation of Ecology's technical report and modeling analysis, as well as all available relevant information, EPA intends to designate the Intalco area as nonattainment for the 2010 SO_2 NAAQS. Specifically, the area bounded by lines connecting the following UTM Coordinates (zone 10): Northwest Corner: 519671 5412272, Northeast Corner: 524091 5412261, Southwest Corner: 519671 5409010, Southeast Corner: 524111 5409044. Figure 17 shows the boundary of this intended designated area, which we are referring to as the "Whatcom County Area" for the purposes of this designation.

Additionally, EPA intends to designate the remaining portion of Whatcom County as attainment/unclassifiable because there are no violations occurring outside of the intended nonattainment boundary and no sources in the county apart from those explicitly modeled (Intalco, Phillips 66 and BP) emitting greater than 10 tons per year of SO_2. As noted in Section 3.3.1.4., no other sources of SO_2 were modeled because it was determined more distant sources would not cause a concentration gradient in the vicinity of the area of nonattainment and were properly represented in the background concentration. Figure 16 shows the intended attainment/unclassifiable designation boundary for the remaining portion of Whatcom County.

Figure 17: EPA's Intended Nonattainment Area and Attainment/Unclassifiable Area

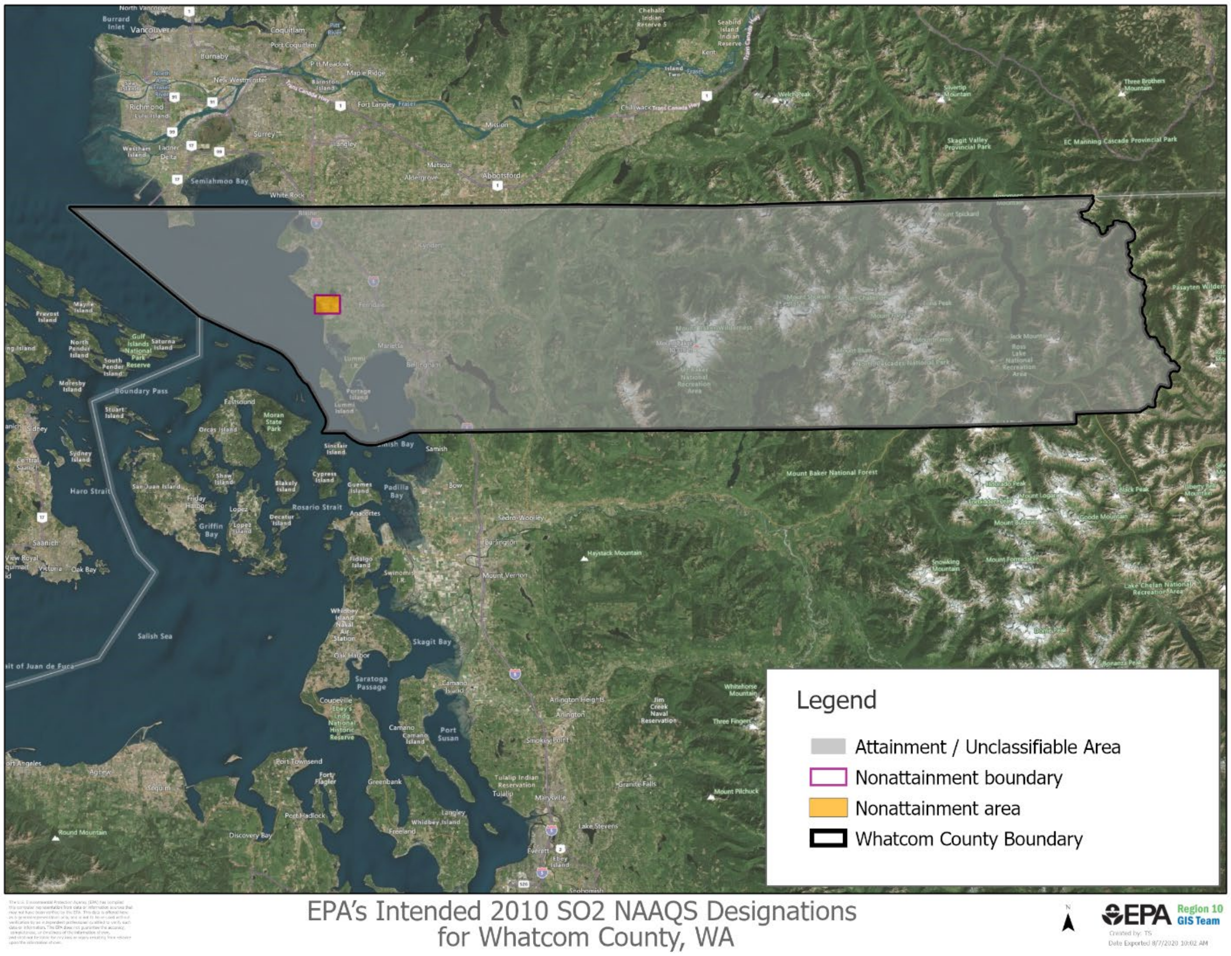
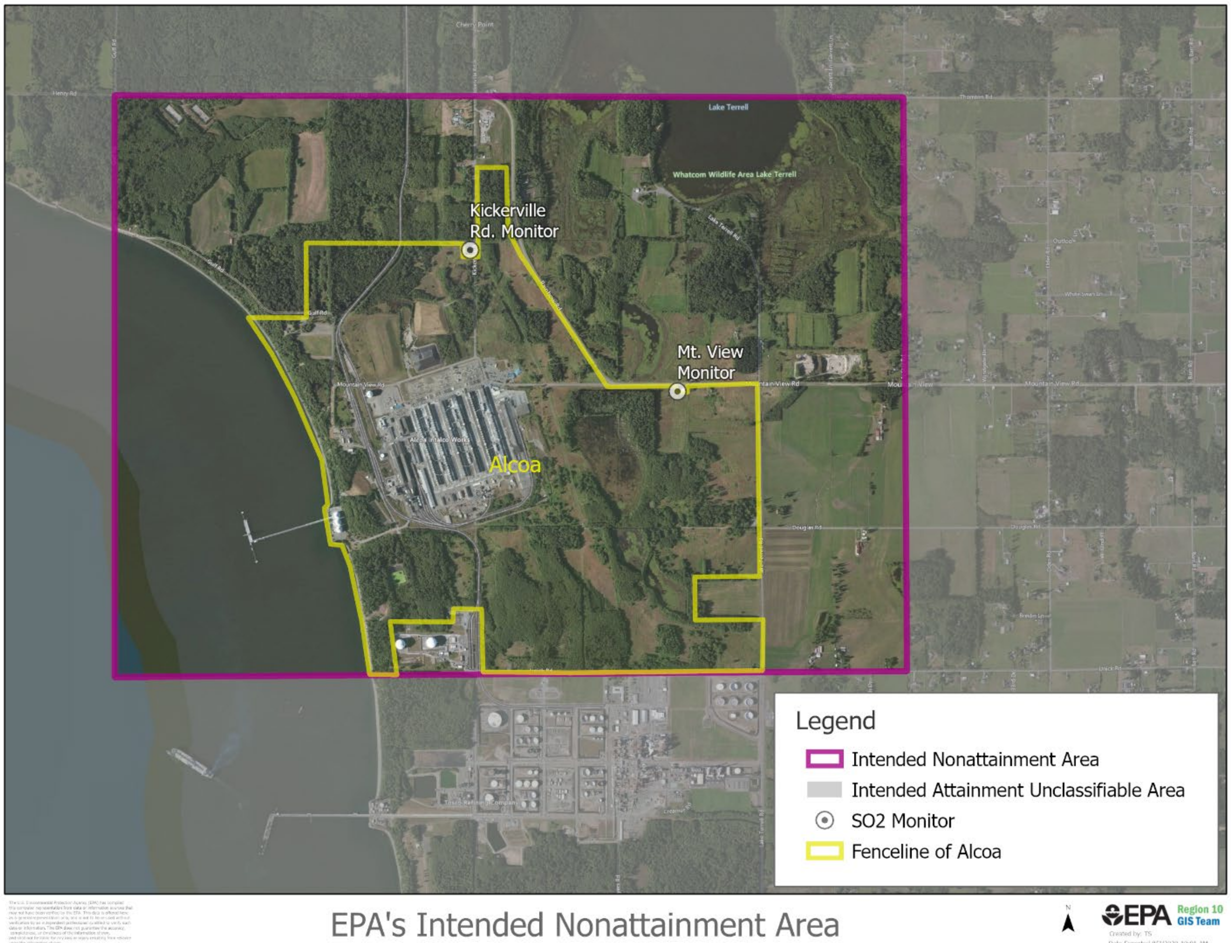


Figure 18: EPA's Intended Nonattainment Area



Appendix A: Table of design concentrations at all 268 modeled violating receptors

Violating Receptor Rank	UTM east (m)	UTM north (m)	3-yr avg. design conc. (μg/m^3)*	Intalco (μg/m^3)	Refinery (μg/m^3)	Average wind direction (degrees)	Attributed Refinery (μg/m^3)
1	522431.9	5410638	543.01	535.14	0.01	263	P66
2	522255.9	5410905	524.68	516.81	0.01	234	P66
3	522283	5410864	522.73	514.86	0.01	238	P66
4	522269.5	5410884	521.28	513.41	0.01	235	P66
5	522455.9	5410638	519.07	511.20	0.01	262	P66
6	522257	5410917	519.00	511.13	0.01	233	P66
7	522337.1	5410782	515.76	507.89	0.01	247	P66
8	522242.4	5410925	515.22	507.35	0.01	234	P66
9	522323.6	5410802	509.81	501.94	0.01	231	P66
10	522364.2	5410741	509.42	501.55	0.01	234	P66
11	522418.3	5410658	508.44	500.57	0.01	263	P66
12	522296.5	5410843	506.58	498.71	0.01	236	P66
13	522479.9	5410638	500.56	492.68	0.01	257	P66
14	522310.1	5410823	500.30	492.43	0.01	234	P66
15	522350.7	5410761	496.39	488.52	0.01	236	P66
16	522404.8	5410679	495.58	487.70	0.01	247	P66
17	522357	5410767	495.27	487.40	0.01	236	P66
18	522307	5410867	492.37	484.50	0.01	236	P66
19	522228.9	5410946	487.33	479.46	0.01	234	P66
20	522504	5410639	485.27	477.40	0.01	256	P66
21	522357	5410817	484.95	477.08	0.01	239	P66
22	522377.7	5410720	484.12	476.25	0.01	238	P66
23	522307	5410917	476.61	468.74	0.01	235	P66
24	522391.3	5410700	476.22	468.34	0.01	247	P66
25	522215.3	5410967	472.59	464.73	0.01	230	P66
26	522457	5410667	468.82	460.94	0.01	261	P66
27	522528	5410639	462.00	454.13	0.02	255	P66
28	522257	5410967	452.70	444.83	0.01	232	P66
29	522407	5410717	451.32	443.45	0.01	239	P66
30	522201.8	5410987	448.42	440.54	0.01	229	P66
31	522407	5410817	447.42	439.55	0.01	237	P66
32	522357	5410867	447.28	439.41	0.01	238	P66
33	522407	5410767	446.65	438.78	0.01	235	P66

34	522507	5410667	445.70	437.82	0.01	253	P66
35	522307	5410967	443.31	435.44	0.01	235	P66
36	520862.4	5410000	439.15	431.29	0.00	54	P66
37	522552.1	5410639	439.12	431.25	0.01	263	P66
38	520859.3	5410023	434.55	426.68	0.00	54	P66
39	522357	5410917	434.14	426.27	0.01	238	P66
40	520865.5	5409977	429.96	422.10	0.00	52	P66
41	522188.3	5411008	422.45	414.58	0.01	226	P66
42	522576.1	5410640	417.13	409.26	0.01	264	P66
43	520856.1	5410046	416.21	408.35	0.00	54	P66
44	520855.2	5409967	415.44	407.58	0.00	52	P66
45	522407	5410867	413.66	405.79	0.01	239	P66
46	522457	5410717	413.46	405.59	0.01	247	P66
47	522207	5411017	411.55	403.68	0.01	228	P66
48	522174.7	5411028	411.37	403.46	0.05	222	P66
49	522357	5410967	410.36	402.49	0.01	234	P66
50	522557	5410667	404.51	396.64	0.01	263	P66
51	522257	5411017	403.46	395.59	0.01	229	P66
52	520844.9	5409957	400.89	393.02	0.00	52	P66
53	522457	5410817	399.27	391.41	0.01	241	P66
54	522457	5410767	398.15	390.28	0.01	243	P66
55	522600.1	5410640	392.26	384.39	0.01	264	P66
56	522161.2	5411049	390.91	383.03	0.02	221	P66
57	522407	5410917	387.07	379.20	0.01	235	P66
58	520848.8	5409935	385.13	377.26	0.00	52	P66
59	522307	5411017	384.64	376.75	0.03	226	P66
60	522457	5410867	383.23	375.36	0.01	237	P66
61	522157	5411067	378.00	370.12	0.02	222	P66
62	520853	5410069	377.39	369.53	0.00	54	P66
63	522147.7	5411069	377.08	369.20	0.02	221	P66
64	522357	5411017	372.22	364.35	0.01	234	P66
65	522407	5410967	371.66	363.79	0.01	235	P66
66	522624.2	5410640	370.82	362.95	0.01	264	P66
67	522507	5410717	370.68	362.81	0.01	244	P66
68	522507	5410767	370.10	362.23	0.01	245	P66
69	520807	5409967	369.22	361.35	0.00	53	P66
70	520852.8	5409912	368.89	361.02	0.00	51	P66
71	522207	5411067	367.99	360.08	0.05	222	P66
72	522607	5410667	366.56	358.69	0.01	263	P66
73	522134.1	5411090	361.19	353.30	0.03	222	P66

74	522457	5410917	358.47	350.61	0.01	235	P66
75	520856.7	5409890	356.91	349.05	0.00	49	P66
76	522507	5410817	354.02	346.15	0.01	237	P66
77	522257	5411067	350.05	342.17	0.01	228	P66
78	522507	5410867	348.90	341.03	0.01	232	P66
79	522648.2	5410640	347.54	339.67	0.01	258	P66
80	520840.6	5410160	344.04	336.17	0.00	79	P66
81	522307	5411067	341.71	333.84	0.01	229	P66
82	520843.7	5410137	340.85	332.99	0.01	79	P66
83	522557	5410717	339.85	331.98	0.01	252	P66
84	520860.6	5409867	339.05	331.19	0.00	49	P66
85	520849.9	5410091	336.38	328.51	0.01	58	P66
86	522157	5411117	333.97	326.10	0.02	222	P66
87	522120.6	5411110	333.08	325.20	0.02	220	P66
88	522672.2	5410641	328.80	320.92	0.01	265	P66
89	522207	5411117	327.43	319.54	0.02	222	P66
90	522557	5410767	323.54	315.67	0.01	237	P66
91	522107.1	5411131	319.05	311.17	0.02	216	P66
92	520846.8	5410114	318.04	310.17	0.01	63	P66
93	520864.6	5409845	315.88	308.02	0.00	47	P66
94	520837.5	5410183	315.69	307.82	0.00	86	P66
95	522257	5411117	313.08	305.16	0.06	222	P66
96	522696.3	5410641	312.77	304.90	0.01	264	P66
97	520807	5410167	309.51	301.64	0.01	79	P66
98	520807	5409867	309.30	301.44	0.00	49	P66
99	522507	5410967	309.15	301.29	0.01	232	P66
100	522407	5411067	308.23	300.36	0.01	234	P66
101	520868.5	5409822	301.95	294.08	0.00	44	P66
102	520812.3	5410272	300.97	293.11	0.00	98	P66
103	520821.8	5410250	300.51	292.65	0.00	90	P66
104	522093.5	5411151	298.72	290.78	0.08	215	P66
105	522720.3	5410641	296.29	288.42	0.01	262	P66
106	520802.9	5410294	296.14	288.28	0.00	100	P66
107	520807	5410267	296.09	288.22	0.00	96	P66
108	520807	5410067	294.40	286.53	0.00	57	P66
109	520831.2	5410228	291.22	283.35	0.01	87	P66
110	520834.3	5410206	290.98	283.11	0.00	82	P66
111	520793.4	5410316	289.82	281.96	0.00	99	P66
112	522080	5411172	289.39	281.43	0.10	210	P66
113	522207	5411167	288.68	280.81	0.01	220	P66

114	522707	5410667	287.63	279.76	0.01	262	P66
115	520784	5410338	285.92	278.05	0.00	101	P66
116	522107	5411167	285.44	277.51	0.08	215	P66
117	520872.4	5409800	285.24	277.37	0.00	45	P66
118	522066.5	5411193	283.37	275.32	0.19	210	P66
119	522157	5411167	283.18	275.31	0.02	221	P66
120	522607	5410767	282.68	274.80	0.02	255	P66
121	522744.4	5410641	279.56	271.69	0.01	263	P66
122	522052.9	5411213	277.28	267.26	2.16	209	P66
123	520774.5	5410360	273.83	265.97	0.00	102	P66
124	522057	5411217	273.50	263.34	2.30	208	P66
125	522607	5410867	272.05	264.18	0.01	239	P66
126	520876.4	5409777	271.68	263.82	0.00	44	P66
127	522507	5411067	270.41	262.54	0.01	234	P66
128	522039.4	5411234	268.06	257.04	3.15	206	P66
129	520765.1	5410382	266.71	258.85	0.00	104	P66
130	522307	5411167	264.05	256.12	0.07	222	P66
131	522768.4	5410642	263.15	255.28	0.01	263	P66
132	520923.5	5409752	261.65	253.78	0.01	43	P66
133	520901.9	5409753	261.64	253.77	0.00	43	P66
134	520945	5409750	260.69	252.83	0.00	42	P66
135	520880.3	5409755	260.41	252.55	0.00	43	P66
136	522607	5410967	258.67	250.80	0.01	234	P66
137	522818.1	5410607	256.59	248.72	0.01	264	P66
138	522025.9	5411254	255.98	247.69	0.43	209	P66
139	520707	5409867	255.40	247.54	0.00	53	P66
140	520755.6	5410404	253.65	245.79	0.00	106	P66
141	522824.7	5410612	252.19	244.32	0.01	264	P66
142	522407	5411167	249.35	241.47	0.02	229	P66
143	520952.6	5409730	248.30	240.43	0.01	43	P66
144	522792.4	5410642	248.02	240.15	0.01	262	P66
145	522817.3	5410625	247.26	239.39	0.01	266	P66
146	522012.3	5411275	246.19	237.91	0.42	207	P66
147	520707	5409967	245.26	237.39	0.01	55	P66
148	520807	5409767	243.93	236.07	0.01	45	P66
149	520960.2	5409710	243.89	236.02	0.01	42	P66
150	522839.1	5410607	243.09	235.22	0.01	264	P66
151	520746.2	5410426	242.28	234.42	0.00	107	P66
152	520967.8	5409691	239.85	231.98	0.02	43	P66
153	521132.7	5411443	235.93	227.61	0.45	155	P66

154	521157	5411443	235.47	227.24	0.37	157	P66
155	521108.3	5411443	235.42	227.23	0.33	156	P66
156	521084	5411443	235.26	226.94	0.46	154	P66
157	520707	5410067	235.06	227.19	0.01	65	P66
158	521059.7	5411444	234.92	226.65	0.41	154	P66
159	521181.3	5411443	234.43	226.21	0.35	157	P66
160	522816.5	5410642	234.17	226.30	0.01	264	P66
161	520975.4	5409671	234.17	226.29	0.02	40	P66
162	520707	5410167	234.07	226.20	0.00	80	P66
163	521011	5411444	233.97	225.73	0.38	153	P66
164	521035.3	5411444	233.43	225.15	0.42	152	P66
165	521107	5411467	233.38	225.15	0.36	158	P66
166	520707	5410367	233.35	225.49	0.00	101	P66
167	520986.7	5411444	232.98	224.68	0.44	151	P66
168	520707	5410267	232.51	224.65	0.00	96	P66
169	521998.8	5411295	232.44	222.45	2.13	206	P66
170	520938	5411444	232.31	224.04	0.41	150	P66
171	520736.7	5410448	232.26	224.40	0.00	107	P66
172	521205.6	5411443	230.98	222.70	0.43	156	P66
173	520962.4	5411444	230.82	222.53	0.43	151	P66
174	521007	5411467	230.67	222.41	0.40	152	P66
175	522860.2	5410608	230.43	222.56	0.01	264	P66
176	522607	5411067	230.39	222.52	0.01	234	P66
177	522107	5411267	229.87	222.00	0.01	213	P66
178	522707	5410767	229.80	221.92	0.02	258	P66
179	520913.7	5411444	229.62	221.35	0.41	149	P66
180	522807	5410667	229.43	221.56	0.01	261	P66
181	520907	5411467	229.15	220.86	0.42	150	P66
182	520889.4	5411444	228.59	220.26	0.47	148	P66
183	520983	5409651	228.34	220.47	0.01	41	P66
184	520743.8	5411370	228.07	219.81	0.40	142	P66
185	520744	5411346	227.04	218.84	0.33	142	P66
186	520743.7	5411395	226.86	218.70	0.30	141	P66
187	520865.1	5411444	226.77	218.48	0.43	146	P66
188	520907	5409667	226.66	218.79	0.01	43	P66
189	520744.1	5411321	225.75	217.54	0.35	141	P66
190	520744.2	5411297	225.69	217.58	0.25	140	P66
191	521207	5411467	225.68	217.40	0.42	156	P66
192	520744.4	5411272	225.59	217.50	0.23	139	P66
193	520840.7	5411444	225.25	216.96	0.43	146	P66

194	521230	5411443	225.07	216.78	0.43	156	P66
195	520744.5	5411247	224.69	216.51	0.32	141	P66
196	520792.1	5411444	224.35	216.11	0.38	144	P66
197	520743.6	5411420	224.25	216.10	0.30	141	P66
198	520816.4	5411444	224.20	215.90	0.44	146	P66
199	520767.8	5411444	224.09	215.97	0.26	143	P66
200	520727.3	5410470	223.14	215.27	0.00	106	P66
201	520743.4	5411444	222.47	214.25	0.36	144	P66
202	520807	5411467	222.40	214.11	0.43	146	P66
203	520744.6	5411223	221.94	213.85	0.23	138	P66
204	521107	5411567	221.79	213.48	0.45	157	P66
205	520907	5411567	221.28	213.02	0.40	152	P66
206	520707	5411367	220.80	212.60	0.34	142	P66
207	520744.8	5411198	220.74	212.59	0.29	140	P66
208	520990.6	5409631	220.28	212.41	0.01	38	P66
209	521007	5411567	220.03	211.83	0.34	155	P66
210	521254.3	5411443	220.00	211.81	0.34	160	P66
211	520744.9	5411173	219.01	211.00	0.15	138	P66
212	521985.3	5411316	218.99	210.98	0.15	204	P66
213	522881.3	5410608	218.78	210.91	0.01	264	P66
214	520707	5411467	218.76	210.54	0.36	143	P66
215	520707	5409767	218.13	210.27	0.00	48	P66
216	520807	5411567	216.37	208.09	0.42	149	P66
217	522507	5411167	216.16	208.29	0.01	231	P66
218	520707	5411267	216.08	207.97	0.25	139	P66
219	520807	5409667	216.05	208.18	0.01	42	P66
220	520745.2	5411124	216.01	207.96	0.20	134	P66
221	520745.3	5411100	215.58	207.51	0.21	134	P66
222	520745	5411149	215.49	207.45	0.18	135	P66
223	520707	5410467	215.21	207.35	0.00	106	P66
224	521278.6	5411443	214.33	206.06	0.42	157	P66
225	520745.4	5411075	214.00	205.77	0.37	138	P66
226	520907	5411667	213.80	205.58	0.36	154	P66
227	520995.6	5409607	213.21	205.34	0.01	34	P66
228	522880.8	5410625	211.99	204.12	0.01	263	P66
229	522707	5410867	211.22	203.34	0.02	243	P66
230	520707	5411167	211.09	203.03	0.19	134	P66
231	522307	5411267	211.03	203.14	0.03	219	P66
232	520745.7	5411026	210.93	202.92	0.15	131	P66
233	520745.6	5411050	210.42	202.44	0.12	130	P66

234	521007	5411667	210.21	201.89	0.46	155	P66
235	521107	5411667	210.17	201.92	0.39	158	P66
236	520717.8	5410492	210.13	202.27	0.00	108	P66
237	521302.9	5411443	209.72	201.45	0.41	158	P66
238	521000.6	5409584	209.38	201.50	0.02	37	P66
239	522207	5411267	209.28	201.39	0.02	215	P66
240	520722.3	5411026	209.00	200.98	0.16	131	P66
241	521971.7	5411336	208.79	200.76	0.17	205	P66
242	521207	5411567	208.63	200.37	0.41	161	P66
243	520707	5411067	207.97	199.96	0.15	131	P66
244	520699	5411026	207.90	199.93	0.11	129	P66
245	522880.2	5410642	207.33	199.45	0.01	261	P66
246	520907	5409567	207.14	199.27	0.01	39	P66
247	520675.7	5411026	205.89	197.91	0.12	129	P66
248	520907	5411767	205.07	196.83	0.38	154	P66
249	521307	5411467	203.78	195.51	0.41	158	P66
250	521005.6	5409560	203.20	195.33	0.02	34	P66
251	521007	5411767	202.87	194.66	0.35	160	P66
252	520607	5411267	202.56	194.60	0.10	134	P66
253	520607	5411367	202.30	194.10	0.33	139	P66
254	520807	5409567	202.26	194.40	0.01	44	P66
255	520652.3	5411026	201.74	193.75	0.13	129	P66
256	521958.2	5411357	201.25	193.38	0.01	200	P66
257	522707	5410967	200.58	192.71	0.01	235	P66
258	521327.3	5411443	200.23	191.95	0.42	158	P66
259	520607	5411467	199.01	190.82	0.33	139	P66
260	521010.7	5409536	198.68	190.80	0.02	34	P66
261	522904.7	5410643	198.19	190.32	0.01	264	P66
262	520607	5411067	198.18	190.19	0.13	129	P66
263	520708.4	5410514	197.97	190.10	0.00	107	P66
264	520605.6	5411026	197.82	189.83	0.13	129	P66
265	520629	5411026	197.69	189.70	0.14	129	P66
266	522607	5411167	197.33	189.46	0.01	234	P66
267	522807	5410767	197.21	189.34	0.01	252	P66
268	520607	5411167	196.87	188.88	0.12	130	P66