



# **Identifying Overburdened Communities Highly Impacted by Air Pollution**

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## **Technical Support Document**

### **Air Quality Program**

Washington State Department of Ecology  
Olympia, Washington

March 2023, Publication 23-02-019

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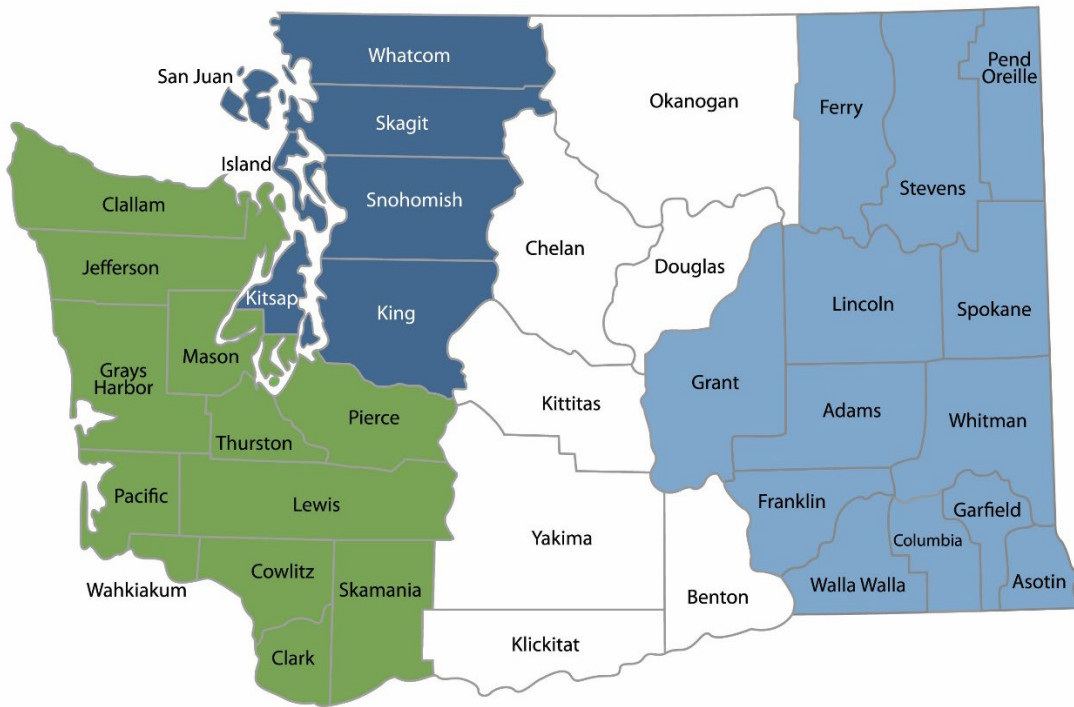
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## Map of Counties Served



**Southwest Region**  
360-407-6300

**Northwest Region**  
206-594-0000

**Central Region**  
509-575-2490

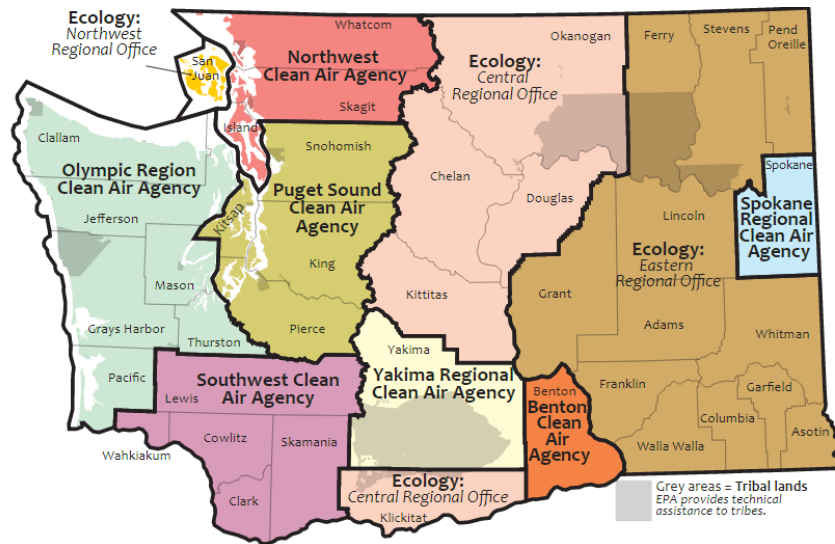
**Eastern Region**  
509-329-3400

Region	Counties served	Mailing Address	Phone
<b>Southwest</b>	Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, Wahkiakum	P.O. Box 47775 Olympia, WA 98504	360-407-6300
<b>Northwest</b>	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	P.O. Box 330316 Shoreline, WA 98133	206-594-0000
<b>Central</b>	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 West Alder Street Union Gap, WA 98903	509-575-2490
<b>Eastern</b>	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 North Monroe Spokane, WA 99205	509-329-3400
<b>Headquarters</b>	Statewide	P.O. Box 46700 Olympia, WA 98504	360-407-6000

# Washington Local Clean Air Agencies

Ecology works in partnership with EPA, local clean air agencies, and Tribes in Washington to make sure we all have clean, healthy air to breathe.<sup>2</sup> Local clean air agencies manage most of the air quality regulation in Washington, within their respective jurisdictions. Tribal governments protect air quality within their Tribal reservations, with technical assistance from EPA. Ecology is the primary air regulator in all other areas.

## Map of Counties Served



- **Benton Clean Air Agency** — Benton County
- **Ecology Central Regional Office** — Chelan, Douglas, Kittitas, Klickitat, Okanogan counties
- **Ecology Eastern Regional Office** — Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Stevens, Walla Walla, Whitman counties
- **Ecology Industrial Section** — Pulp mills, aluminum smelters
- **Ecology Northwest Regional Office** — San Juan County
- **EPA Region 10** — Tribal lands
- **Northwest Clean Air Agency** — Island, Skagit, Whatcom counties
- **Olympic Region Clean Air Agency** — Clallam, Grays Harbor, Jefferson, Mason, Pacific, Thurston counties
- **Puget Sound Clean Air Agency** — King, Kitsap, Pierce, Snohomish counties
- **Southwest Clean Air Agency** — Clark, Cowlitz, Lewis, Skamania, Wahkiakum counties
- **Spokane Regional Clean Air Agency** — Spokane County
- **Yakima Regional Clean Air Agency** — Yakima County

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<sup>2</sup> <https://ecology.wa.gov/About-us/Accountability-transparency/Partnerships-committees/Clean-air-agencies>

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DEPARTMENT OF  
**ECOLOGY**  
State of Washington

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# Purpose of This Document

This document describes the technical information used to identify overburdened communities highly impacted by air pollution. Ecology provides this information for full transparency of our process, rationale, and sources of data. More information is available on our website.<sup>3</sup>

Table 1. Acronyms used in this document

<b>Acronym</b>	<b>Meaning</b>
ACS	American Community Survey
AQI	Air Quality Index
CASAC	Clean Air Scientific Advisory Committee
CCA	Climate Commitment Act
CDC	Center for Disease Control
CEJST	Climate and Economic Justice Screening Tool
CO	Carbon monoxide
COPD	Chronic Obstructive Pulmonary Disease
DOH	Washington State Department of Health
EHD Map	Washington Environmental Health Disparities Map
NAAQS	National Ambient Air Quality Standards
NEI	National Emissions Inventory
NO <sub>2</sub>	Nitrogen dioxide
O <sub>3</sub>	Ozone
Pb	Lead
PM <sub>2.5</sub>	Particulate matter smaller than 2.5 micrometers in diameter
PM <sub>10</sub>	Particulate matter smaller than 10 micrometers in diameter
SO <sub>2</sub>	Sulfur dioxide
VOCs	Volatile organic compounds
WSIPP	Washington State Institute for Public Policy
WTN	Washington Tracking Network

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<sup>3</sup> <https://ecology.wa.gov/Air-Climate/Climate-Commitment-Act/Overburdened-communities>

# Introduction

## What is the Improving Air Quality in Overburdened Communities Initiative?

The “Improving Air Quality in Overburdened Communities Initiative” is a new effort to reduce air pollution in Washington communities highly impacted by air pollution. While the Climate Commitment Act<sup>4</sup> (CCA) focuses on greenhouse gas emissions, Section 3 of the CCA also requires Ecology to reduce another category of air pollution, called criteria air pollutants,<sup>5</sup> in overburdened communities highly impacted by air pollution. This law requires us to:

- Identify which Washington communities are overburdened by air pollution and significant sources of this pollution.
- Expand and improve Washington’s air quality monitoring network to gather more data about the criteria air pollutants that affect these communities.
- Develop strategies to reduce criteria air pollutants in these overburdened communities.
- Conduct periodic analysis to make sure reduction goals for criteria air pollution are being met.

Environmental justice is at the center of this initiative. We are intentionally designing this work to be continuous to incorporate lessons learned, and changes in demographic and air quality data. We will continue to work with Tribes, communities, environmental justice and community-based organizations, the state Environmental Justice Council, and others to refine our process every six years.

## What are criteria air pollutants?

Criteria air pollutants are six common air pollutants that EPA has designated as causing harm to people’s health and the environment. The federal Clean Air Act requires EPA to set National Ambient Air Quality Standards (NAAQS; Appendix A) for criteria air pollutants.<sup>6</sup> Ecology, local clean air agencies, and Tribes monitor these pollutants across Washington, and take action to control and reduce pollution. These six criteria air pollutants are:

- Carbon monoxide (CO)
- Lead (Pb)
- Ozone (O<sub>3</sub>)
- Nitrogen dioxide (NO<sub>2</sub>)
- Particulate matter:
  - Fine particulate matter (PM<sub>2.5</sub>)
  - Coarse particulate matter (PM<sub>10</sub>)

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<sup>4</sup> Engrossed second substitute senate bill 5126, chapter 316, laws of 2021

<sup>5</sup> <https://ecology.wa.gov/Air-Climate/Air-quality/Air-quality-targets/Air-quality-standards#criteria>

<sup>6</sup> <https://www.epa.gov/criteria-air-pollutants>



- Sulfur dioxide (SO<sub>2</sub>)

## What are overburdened communities highly impacted by air pollution?

All communities experience air pollution. However, Ecology recognizes that some communities are affected more than others. This disparity could be due to the level of air pollution exposure, the vulnerability of the population to health impacts related to that exposure, the ability of the community to mitigate its effects, or any combination of these factors. Section 3 of the CCA addresses these inequities, requiring Ecology to identify “overburdened communities highly impacted by air pollution”<sup>7</sup> and to take steps to reduce the disparities in criteria air pollution impacts that these communities face.

The CCA defines “Overburdened Communities” as:<sup>8</sup>

“a geographic area where vulnerable populations face combined, multiple environmental harms and health impacts or risks due to exposure to environmental pollutants or contaminants through multiple pathways, which may result in significant disparate adverse health outcomes or effects.”

The intent section of the law also states:<sup>9</sup>

“Under the program, the legislature intends to identify overburdened communities where the highest concentrations of criteria pollutants occur, determine the sources of those emissions and pollutants, and pursue significant reductions of emissions and pollutants in those communities.”

This means that for the purposes of this work, “overburdened communities highly impacted by air pollution” that Ecology is tasked with identifying, evaluating, and protecting under RCW 70A.65.020 are considered a subset of all overburdened communities – specifically those that experience the highest **concentrations** of air pollution. The rest of Section 3<sup>10</sup> directs Ecology to conduct environmental justice reviews of air quality and health impacts in these communities and to develop strategies to reduce criteria pollution.

## How did Ecology develop a process to identify overburdened communities highly impacted by air pollution?

To identify these overburdened communities, we started with public engagement in early 2022 to hear about people’s experiences with air pollution across the state and researched how

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<sup>7</sup> RCW 70A.65.020(1)

<sup>8</sup> RCW 70A.65.010(54); See appendix B for full definition of “overburdened communities” as well as all CCA language pertaining to this initiative

<sup>9</sup> RCW 70A.65.005(7)

<sup>10</sup> RCW 70A.65.020

criteria air pollution impacts communities across Washington. Next, we looked for data and resources that were available to represent these real-world issues. Then we studied existing approaches and environmental justice tools to identify overburdened or underserved communities, to see where we could apply principles or lessons learned into how we put data together to identify communities.

## Public Engagement

To help guide this process, we held two rounds of public engagement. The first public engagement period was from January 2022 to March 2022. It consisted of Tribal listening sessions, eight public and community group listening sessions, as well as a survey, and a comment map. We also consulted with the Washington State Department of Health and local clean air agencies. For more information about the public input from the first public comment period, and how we used it, see our June 2022 focus sheet.<sup>11</sup>

Using that initial input, we created a draft process to identify communities and held a second public comment period from September 2022 to November 2022. This consisted of Tribal meetings, seven public comment meetings, meetings with community groups across Washington, and comments submitted by e-comments, voicemail, e-mail, and regular mail. All comments and feedback were reviewed and considered. A summary and response to comments can be found in the Concise Explanatory Statement.<sup>12</sup>

Ecology greatly values all the time and energy that people have dedicated into engaging with us on this initiative. These comments, particularly those regarding air pollution concerns and ideas for addressing air pollution, will continue to inform future work for this initiative. That includes strategies for improving air quality in overburdened communities highly impacted by air pollution.

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<sup>11</sup> <https://apps.ecology.wa.gov/publications/SummaryPages/2202025.html>

<sup>12</sup> <https://ecology.wa.gov/Air-Climate/Climate-Commitment-Act/Overburdened-communities>

# Improving Air Quality in Overburdened Communities Initiative

## 2022 timeline



Figure 1. 2022 timeline for identifying overburdened communities highly impacted by air pollution

## Process development and considerations

In developing the process to identify overburdened communities highly impacted by air pollution, we had to balance many considerations. For example:

- Focusing on communities with well-documented air pollution impacts with identifying areas with less information where more work is needed to verify pollution impacts;
- Recognizing people’s experiences and concerns with air pollution with what can be addressed through the limited scope of this initiative. For example, many people are concerned about odors and air toxics in their community, both of which are outside the scope of the CCA; and
- Determining the distinction between overburdened vs. burdened, or highly impacted vs. impacted by air pollution.

There is not one comprehensive approach able to address these often-competing considerations. We did our best to identify communities that fit the definition of overburdened communities in the CCA, address people’s needs and concerns related to criteria air pollution, and stay within the scope of work outlined for this initiative in RCW 70A.65.020.

We developed community indicators to be consistent with the definition of overburdened communities described in the CCA, in the context of Section 3. The community indicators characterize where “vulnerable populations face combined, multiple environmental harms.”<sup>13</sup> Additionally, the CCA directs us to monitor and reduce criteria air pollution in overburdened communities in Section 3. The air pollution indicator then “identif[ies] overburdened communities where the highest concentrations of criteria pollutants occur.”<sup>14</sup> We have also evaluated several other air pollution indicators to address specific concerns around proximity to sources of pollution, health impacts, and additional vulnerability factors (Appendix C). However,

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<sup>13</sup> RCW 70A.65.010(54)

<sup>14</sup> RCW 70A.65.005(7)

we agree with many commenters on this work that it is better not to limit or prioritize communities based on these indicators. They will still be used to help to shape future work in identified communities.

Aside from identifying indicators, we also considered the different ways these indicators can be combined to accurately identify communities. Many environmental justice tools combine different environmental indicators into a single rank or index. Others, like the Climate and Economic Justice Screening Tool (CEJST),<sup>15</sup> use thresholds for each indicator and require that a combination of indicator thresholds be met to be considered disadvantaged or overburdened. We decided to use thresholds for our indicators because it allowed us to use and combine different types and scales of data. As stated in the CEJST technical documentation,

“Given the available datasets, however, it was determined that a thresholds approach would better enable the tool to identify disadvantaged communities in rural and urban areas...The thresholds approach addressed concerns that certain areas of the nation and territories would be penalized in an index simply because they had less available data.”

Furthermore, the thresholds approach allowed us to combine different existing environmental justice mapping tools and datasets to identify where vulnerable and overburdened communities overlap with elevated levels of air pollution.

Unlike CEJST or the EHD map, which are tools and can be used for a variety of purposes, we are developing a process that is informed by, or in some cases uses those tools, but is intended to identify communities for this specific initiative. We used the indicator data that is available statewide first as a screening step to identify general areas for further consideration. Using data available statewide avoids leaving out areas that have less data availability or less spatially detailed data. However, Ecology is tasked with identifying specific communities overburdened by air pollution, which requires further refinement. The Washington State Institute for Public Policy (WSIPP) conducted a technical review of the EHD map<sup>16</sup> where they concluded:

“As the documentation for most of these [EJ mapping] tools stated, these tools are best used as a **starting point** for identifying and assessing cumulative impact...to fully evaluate the impact of environmental changes or government action, more local research would be needed to overcome and incorporate more granular information that these tools are missing.”

Applying localized data, in addition to the statewide indicators, will help us ensure we are identifying overburdened communities more accurately. That is why after the statewide indicators are applied, we used additional local and regional data, where available and applicable, to inform the identification of boundaries for overburdened communities.

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<sup>15</sup> <https://screeningtool.geoplatform.gov/en/>

<sup>16</sup> [https://www.wsipp.wa.gov/ReportFile/1751/Wsipp\\_Technical-Review-of-the-Washington-State-Environmental-Health-Disparities-Map\\_Report.pdf](https://www.wsipp.wa.gov/ReportFile/1751/Wsipp_Technical-Review-of-the-Washington-State-Environmental-Health-Disparities-Map_Report.pdf)

## Reevaluation

This is a continuous process. We expect both the air quality that communities experience and the availability of data related to environmental justice to change with time. As data is updated and new information is gathered through continued engagement with stakeholders, communities, and Tribes, we may identify new overburdened communities highly impacted by air pollution in the future. This data and new information may include updates in environmental justice screening tools, new air monitoring data (including monitoring efforts taken separately from this initiative), air pollution model results, and lessons learned from the Healthy Environment for All (HEAL) Act and other efforts to identify overburdened communities. We also may need to adjust the boundaries of identified communities from time to time. We are committed to reevaluating these communities regularly every six years to gauge changes in air quality. Importantly, we do not intend to remove an overburdened classification from identified communities unless air quality targets are met (or there is express direction from a Tribal Nation to do so regarding Tribal lands).

## Overview of the Process to Identify Communities

To be considered an overburdened community highly impacted by air pollution, an area must meet the following conditions, based on data available statewide (Figure 1):

- **Community indicators:** Either have a 9 or 10 ranking on the Washington Environmental Health Disparities (EHD) map, be in the 90th percentile<sup>17</sup> or higher of census block groups for the EJScreen Demographic Index, or be Tribal land; and
- **Air pollution indicator:** Have an elevated level of one or multiple criteria air pollutants.

After these statewide indicators are applied, more specific, regional data is then applied to the screened areas to refine the boundaries of the overburdened communities (see “Community Boundaries” section below).

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<sup>17</sup> Percentiles reflect the distribution of a variable and run from the 0th percentile, meaning the lowest score on a given scale, to the 100th percentile, meaning the highest score on a given scale. For example, if an area is in the 95th percentile for demographic index, which means it has a demographic index higher than 95% of all areas measured.

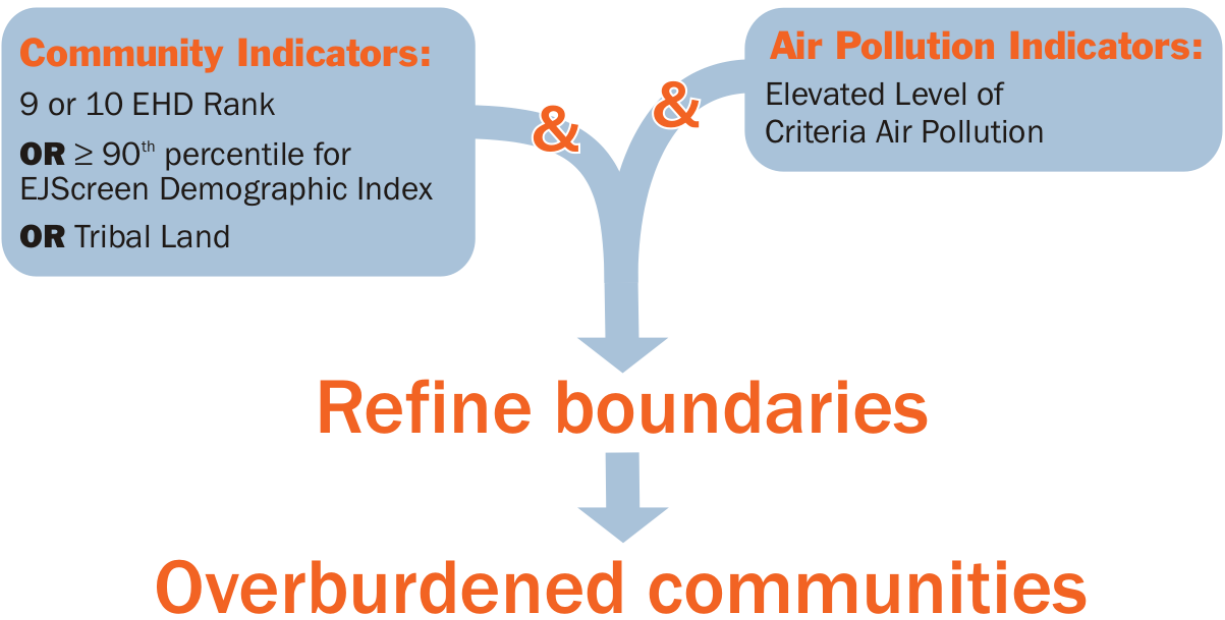


Figure 2. Flowchart of the process to identify overburdened communities highly impacted by air pollution.

## Statewide Indicators

This section provides a technical breakdown of each of the indicators we used for identifying overburdened communities highly impacted by air pollution across the state. Included for each indicator is a short description, rationale for its use, the method for how the data were collected and put together, important caveats to consider when using these data, and data source(s).

### Community Indicators

Community indicators represent the population characteristics or overall environmental health disparity of a community. They are used to identify which communities are overburdened or vulnerable, regardless of air pollution impact.

### Environmental Health Disparities Map rank

**Description:** The EHD Map is an interactive mapping tool that compares communities across Washington for environmental health disparities. The following indicators are included in the EHD map (version 2.0):

- Environmental exposures – diesel PM emissions; ozone concentration; PM<sub>2.5</sub> concentration; proximity to heavy traffic roadways; toxic release from facilities (RSEI model)
- Environmental effects – lead risk from housing; proximity to hazardous waste treatment, storage, and disposal facilities (TSDFs); proximity to National Priorities List

sites (Superfund sites); proximity to Risk Management Plan (RMP) facilities; wastewater discharge

- Sensitive populations – death from cardiovascular disease; low birth weight
- Socioeconomic factors – limited English; no high school diploma; poverty; race – people of color; transportation expense; unaffordable housing; unemployed)

**Threshold:** Rank 9 or 10 (≥80th percentile)

**Rationale:** The definition of “overburdened communities” in the CCA includes but is not limited to “highly impacted communities,”<sup>18</sup> as defined in RCW 19.405.020. These are communities designated by the Department of Health (DOH) for the Clean Energy Transformation Act (CETA) that are highly impacted by climate change and fossil fuel pollution. They must be based, in part on a cumulative impact analysis, i.e., the EHD Map. An EHD Map rank of 9 or 10 is designated as the threshold for this indicator to be consistent with the DOH designation of highly impacted communities.

The WSIPP technical review of the EHD map highlighted the tool’s strengths and limitations. It found that the EHD map and other EJ mapping tools “provide insight into some of the environmental harms present in a community and how well-equipped a community is to overcome those challenges.” The EHD Map version 2.0 Technical Report<sup>19</sup> also states:

“The [EHD] map highlights pollution burden and vulnerabilities to inform state environmental policy, budgeting priorities and regulation enforcement to reduce health inequities across communities. We urge state and local decision-makers, in particular, to use this tool in tandem with direct community engagement to shape environmental policies and priorities...”

We followed that guidance to use the EHD map in conjunction with community engagement to develop this process to identify overburdened communities for this initiative.

Method: The overall EHD rank is calculated with the following equation:

$$\frac{(\text{Average Environmental Exposures Percentile} + 0.5 \times \text{Average Environmental Effects Percentile})}{2} \times \frac{(\text{Average Sensitive Populations Percentile} + \text{Average Socioeconomic Factors Percentile})}{2} = \text{Overall EHD Risk}$$

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<sup>18</sup> <https://doh.wa.gov/data-statistical-reports/washington-tracking-network-wtn/climate-projections/clean-energy-transformation-act/ceta-utility-instructions>

<sup>19</sup> <https://deohs.washington.edu/sites/default/files/2022-08/311-011-EHD-Map-Tech-Report.pdf>

For a full explanation of methods, limitations, and caveats, see UW’s Environmental and Occupational Health Sciences’ [Washington Environmental Health Disparities](#) Map Project.<sup>20</sup>

**Data source:** [WA Environmental Health Disparities Map](#), Version 2.0, DOH

## EJScreen Demographic Index

**Description:** An average of the percent of low-income populations and people of color, used in EPA’s EJScreen mapping tool, calculated at the census block group level.

**Threshold:** ≥90th percentile

**Rationale:** The CCA defines “vulnerable populations” as “population groups that are more likely to be at a higher risk for poor health outcomes in response to environmental harms” including racial or ethnic minorities and low-income populations. Both race/ethnicity and poverty are included as indicators in the EHD map. However, they are included separately in this indicator to account for communities that may experience greater vulnerability to criteria air pollution based on socioeconomic factors, but are not highly impacted by other types of pollution or environmental exposures that may result in an EHD ranking less than 9 or 10. This includes more rural communities that experience elevated levels of criteria air pollution, but face less exposure to the different types of pollution that are predominately in urban areas.

The EJScreen Technical Document<sup>21</sup> states that demographics such as race/ethnicity and income “are correlated with health status and these other susceptibility factors, making them useful screening-level indicators of potential susceptibility at the local level.” The demographic index is combined with environmental indicators of exposure to form an EJ Index for each environmental exposure. We are following EJScreen’s example of combining demographic data related to susceptibility with state-specific air pollution indicators to screen for areas where vulnerable populations are highly impacted by air pollution.

For early applications of EJScreen, EPA identified >80th percentile as the starting point for screening geographic areas based on their indexes.<sup>22</sup> Since we are not using EJScreen in isolation, but instead are using it to supplement the EHD map and Tribal lands to identify communities that are more vulnerable to air pollution, the threshold of >90th percentile was selected. That also prioritizes overburdened communities as defined in the CCA by either Tribal status or cumulative impacts, based on state-specific data.

**Method:** The demographic index calculated using the following equation:

$$\frac{(\% \text{ people of color} + \% \text{ low income})}{2} = \textit{Demographic Index}$$

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<sup>20</sup> <https://deohs.washington.edu/washington-environmental-health-disparities-map-project>

<sup>21</sup> [https://www.epa.gov/sites/default/files/2021-04/documents/ejscreen\\_technical\\_document.pdf](https://www.epa.gov/sites/default/files/2021-04/documents/ejscreen_technical_document.pdf)

<sup>22</sup> [EJScreen Technical Documentation](#), Appendix H



We selected the “compare by state” data option to ensure that the percentiles reflect Washington, rather than U.S. demographics.

For more information about the methods, limitations, and caveats, see the EJScreen Technical Documentation.<sup>23</sup>

**Data source:** [EJScreen Version 2.1](#), EPA

## Tribal land

**Description:** Tribal lands in Washington, including:

- Reservation land – federally-recognized Tribal reservation lands
- Disputed land – lands designated as being part of a reservation, but title is disputed by other parties
- Off-reservation Tribal land – lands outside of a reservation acquired by or held in trust for Tribal use

Government-to-government consultation with Tribal governments is ongoing. We are continuing to invite government-to-government consultation with all Tribal Nations and organizations affiliated with Washington Tribes on the areas included in “Tribal land” at any time. Tribal land is not limited to those listed. We look forward to input from Tribal Nations. For more information, see the “Tribal Consultation” section below.

**Rationale:** The definition of “overburdened communities” in the CCA includes, but is not limited to:<sup>24</sup>

- Communities located in census tracts that are fully or partially on “Indian country” as defined in 18 U.S.C. Sec. 1151; and
- Populations, including Native Americans or immigrant populations, who may be exposed to environmental contaminants and pollutants outside of the geographic area in which they reside based on the population’s use of traditional or cultural foods and practices, such as the use of resources, access to which is protected under treaty rights in ceded areas, when those exposures in conjunction with other exposures may result in disproportionately greater risks, including risks of certain cancers or other adverse health effects and outcomes.

We started with Ecology’s Tribal Land Map to identify where these communities are. However, we will continue to work with Tribes to determine what is Tribal land, and which areas Tribes want to see prioritized for air quality monitoring and criteria air pollutant reductions.

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<sup>23</sup> <https://www.epa.gov/ejscreen/technical-documentation-ejscreen>

<sup>24</sup> RCW 70A.65.010(54)(a)

Data source: [Tribal Lands of Washington](#), Ecology

## Air Pollution Indicator

Section 3 of the CCA directs Ecology to focus specifically on criteria air pollution in overburdened communities for monitoring, air quality targets, and pollution reduction strategies. The air pollution indicator is intended to identify which communities are highly impacted by these six pollutants. Focusing on overburdened communities that have an elevated level of criteria air pollution allows us to identify which overburdened communities will most likely benefit from pollution reduction strategies through this initiative.

Several additional air quality indicators related to exposure, health impacts, and vulnerability to air pollution were initially proposed as part of the process to identify overburdened communities highly impacted by air pollution. These indicators were originally included to reflect topics of concern that we heard during our initial listening sessions held in Winter 2022. However, Ecology has considered and agrees with public feedback that these indicators should not be used to limit which communities are identified as overburdened by air pollution. Rather, they will be used to inform future work on improving air quality in the identified communities (see Appendix C for more information).

### Elevated level of criteria air pollution

**Description:** Areas with an elevated level of one or more criteria pollutants or the highest cumulative level of criteria pollutants, based on a combination of monitoring, modeling, and emissions data. These thresholds are for community identification purposes only and do not reflect any new air quality standards set by Ecology. For this indicator, the following thresholds are considered elevated levels of criteria air pollution:

Table 2. Criteria pollutant thresholds

Pollutant	Threshold	Rationale
PM <sub>2.5</sub>	PM <sub>2.5</sub> 24-hour design value > 20.4 ug/m <sup>3</sup>	Ecology's healthy air goal (used to identify <a href="#">areas of concern for PM<sub>2.5</sub></a> )
	PM <sub>2.5</sub> annual design value > 8 ug/m <sup>3</sup>	Lower end of <a href="#">Clean Air Scientific Advisory Committee (CASAC)</a> recommendation for the PM <sub>2.5</sub> NAAQS reconsideration
PM <sub>10</sub>	At least one recent exceedance of the federal 24-hour PM <sub>10</sub> standard of 150 ug/m <sup>3</sup> not attributable to natural events such as wildfires or high-wind dust events	Lower exceedance frequency than <a href="#">NAAQS</a> (not to be exceeded more than once per year on average over 3 years)
O <sub>3</sub>	O <sub>3</sub> 8-hour design value > 65 ppb	Lower end of <a href="#">EPA's proposal for most recent O<sub>3</sub> NAAQS revision</a>

NO <sub>2</sub>	NO <sub>2</sub> 1-hour design value > 54 ppb	Lower end of moderate <a href="#">Air Quality Index</a> (AQI) range
CO	CO 8-hour design value > 4.5 ppm	Lower end of moderate <a href="#">AQI</a> range
SO <sub>2</sub>	SO <sub>2</sub> 1-hour design value > 36 ppm	Lower end of moderate <a href="#">AQI</a> range
Lead	Proximity to any lead source emitting more than 0.5 ton per year	Lowest threshold for EPA’s monitoring network design criteria for lead monitoring, <a href="#">40 CFR Part 58</a> , Appendix D
Cumulative	98th percentile or above for the AQI sum of all statewide interpolated criteria pollutants combined (PM <sub>2.5</sub> 24-hour, O <sub>3</sub> , NO <sub>2</sub> , SO <sub>2</sub> , CO)	Cumulative impact from criteria air pollution

**Rationale:** The only area of Washington that currently does not meet the National Ambient Air Quality Standards is a small portion of Whatcom County that previously violated the 1-hour SO<sub>2</sub> NAAQS due solely to SO<sub>2</sub> emissions from a now-closed aluminum smelter. The rest of Washington meets the NAAQS (Appendix A), or is in “attainment,” for all criteria air pollutants.<sup>25</sup> Thus, to identify which communities are highly impacted by criteria air pollution, we looked at pollution levels lower than the NAAQS. We opted not to use percentiles to compare communities for pollution level, as some criteria pollutants have a much greater relative health impact within Washington than others. Rather, we are using evidence-based thresholds that are lower concentrations than the national standards, reflect what is elevated for Washington, and are sufficiently protective of human health to account for uncertainty in the data.

Under the federal Clean Air Act, criteria air pollutants are regulated individually. There is currently no standard method to account for the cumulative level of criteria air pollution. However, we developed and included a measure of cumulative criteria air pollution to identify communities highly impacted by air pollution in response to concerns about the impact of lower levels of multiple pollutants on communities.

**Method:** PM<sub>2.5</sub>, O<sub>3</sub>, NO<sub>2</sub>, SO<sub>2</sub>, CO: Monitoring data come from Ecology’s air monitoring network. The network’s 70+ locations (about 100 air pollution monitors) operate 24/7 year-round, except for some seasonal monitors for ozone, to provide near-real time data on ambient criteria pollutant concentrations. Modeled data are from the Air Information Report for Public Awareness and Community Tracking (AIRPACT) model,<sup>26</sup> managed by the Washington State University Laboratory for Environmental Research. AIRPACT is a computerized system for predicting air quality for the immediate future of one to three days for Washington, Oregon, and Idaho, and parts of surrounding states and Canada. AIRPACT predicts air quality by

<sup>25</sup> [https://www3.epa.gov/airquality/greenbook/anayo\\_wa.html](https://www3.epa.gov/airquality/greenbook/anayo_wa.html)

<sup>26</sup> <http://www.lar.wsu.edu/airpact/index.html>

calculating the chemistry and physics of air pollutants as determined by pollutant emissions within the context of the background, natural air chemistry, and predicted meteorology. Emissions data includes land use, traffic volumes, industrial emissions, and natural emissions. Adjustments are made for time of day, temperature, and solar (UV) light intensity. The model also accounts for variations in terrain and land cover. Air pollutant concentrations are calculated for each hour.

For each pollutant, modeled and monitored concentration data from July 2014 through June 2017 were used to interpolate criteria pollutant design values<sup>27</sup> at 4 km x 4 km grid cell resolution across Washington. For a more in-depth explanation of the methods, caveats, and limitations of the interpolation for each individual pollutant, see NW-AIRQUEST Regional Background Design Values, 2014-2017.<sup>28</sup>

PM<sub>10</sub>: Due to the absence of reliable modeled or interpolated PM<sub>10</sub> concentrations, we used monitoring data from sites in Washington's Air Monitoring Network.

Lead: We used the most recent state air emissions inventory and the most recent national emissions inventory (NEI) to identify sources that emit greater than 0.5 tons of lead per year.

Cumulative (AQI Sum): EPA's Air Quality Index (AQI)<sup>29</sup> is a unitless index that can be used as a yardstick to relate pollution concentration for each individual criteria pollutant to health. We added the AQI of the pollutants for which we had statewide data (PM<sub>2.5</sub>, O<sub>3</sub>, NO<sub>2</sub>, SO<sub>2</sub>, CO) to determine which communities may experience compounding impacts from multiple pollutants, even if they are lower than the threshold for each individual pollutant.

**Data sources:** [NW-AIRQUEST Regional Background Design Values, 2014-2017](#) (hosted on Idaho Department of Environmental Quality's Website); [Washington's Air Monitoring Network](#), Ecology; [AIRPACT](#), Washington State University; [Air Emissions Inventory](#), Ecology; [National Emissions Inventory](#), EPA

## Community Boundaries

After statewide indicators were applied to screen for areas overburdened by air pollution, Ecology looked at additional factors, including regional and local-level data, to refine the boundaries of the overburdened communities highly impacted by air pollution.

The purpose of the boundaries is to determine where to place additional monitors and report on pollution and subsequent health impacts. These boundaries are not designed to indicate the sources of pollution. Future actions to reduce pollution in identified communities will be developed in future processes which will include public outreach and input.

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<sup>27</sup> A design value is a statistic that describes the air quality status of a given location relative to the level of the National Ambient Air Quality Standards (NAAQS).

<sup>28</sup> <https://idahodeq.maps.arcgis.com/apps/MapSeries/index.html?appid=0c8a006e11fe4ec5939804b873098dfe>

<sup>29</sup> <https://ecology.wa.gov/Research-Data/Monitoring-assessment/Air-Quality-Index>

Since air pollution is not limited by boundaries like census tracts or city limits, but rather by airsheds,<sup>30</sup> we attempted to identify community boundaries highly impacted by air pollution by where we expect to see elevated levels of criteria air pollution overlap with vulnerable populations in overburdened communities. Areas identified as overburdened and highly impacted by air pollution based on the statewide data were sometimes “checkerboarded” or non-contiguous. We generally erred on the side of including areas with less vulnerable populations that did not meet the community indicator thresholds to create a continuous community that is similarly impacted by air pollution. We recognize that these communities likely include multiple smaller communities, neighborhoods, and towns. There was not one formulaic way in which boundaries were determined, as each area has its own considerations and information resources available. More information on each community is available in the Community Summary Report.

For most communities, we used 2020 census block groups as boundary lines. Census block groups are one of the smallest, consistently available geographic units. Using census block groups also helps us to both understand community demographics and easily compare against environmental justice screening tools that compare areas by census block group or census tract. The exceptions are in some rural areas where census block groups are very large and do not easily capture identified communities, as well as Tribal communities. In addition to pollution maps, for rural areas we generally considered factors like land use, locations of towns and places where communities gather, and other local information to identify boundaries. We are continuing to consult with Tribal Nations before finalizing any boundaries for communities on Tribal land.

These boundaries were determined based on the data available, public and stakeholder input received, and other factors described below. Ecology recognizes that these boundaries may not reflect everyone’s area of concern within each community. Our intent is that as this initiative progresses, the benefits are not limited to the areas within these boundaries. They are intended to be a starting point for the work of this initiative, including focused monitoring and reporting in 2023 and future strategies for pollution reduction. However, air quality improvements within these communities are likely to benefit adjacent areas outside the boundaries as well. Additionally, boundaries may be updated and modified during the periodic reevaluation process described above.

## Factors to Identify Community Boundaries

### Environmental justice mapping tools

**Description:** In addition to the EHD map and EJScreen (described above), we used other environmental justice mapping tools like the Climate and Economic Justice Screening Tool (CEJST) and the Environmental Justice Index (EJI) to inform community boundaries.

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<sup>30</sup> An airshed is a geographical area that, because of factors like topography, meteorology, and/or climate, is affected by the same air mass and experiences similar concentrations of air pollution.

**Rationale:** Each tool evaluates environmental burdens and health disparities in different ways, which leads to different outcomes of which communities are ranked as most overburdened, disadvantaged, etc.

CEJST and EJI are used to refine boundaries and were not included as community indicators for two main reasons:

- EJI and CEJST version 1.0 were not yet published at the time indicators were drafted before the public comment period.
- They are federal tools with no option for comparison at the state level only.

**Data sources:** [WA Environmental Health Disparities Map](#), Version 2.0, Washington State Department of Health; [EJScreen Version 2.0](#), EPA; [Climate and Economic Justice Screening Tool, Version 1.0](#), The Council on Environmental Quality; [Environmental Justice Index 2022](#), Agency for Toxic Substances and Disease Registry

## Existing community boundaries

**Description:** Geographic boundaries used to distinguish communities (i.e., city limits, neighborhoods, census designated places, etc.)

**Rationale:** Many people identify their community by geography, such as the town or the neighborhood(s) in which they live, work, and play. Where applicable, we can use these existing geographic boundaries to inform the boundaries of the identified overburdened communities. Also, in rural areas, towns are usually where people gather to work, learn, play, and access community resources.

Because of the overlap of air pollution impacts and sources between adjacent areas, several of the identified communities likely include multiple smaller communities, neighborhoods, and towns.

**Data sources:** Varies, see Community Summary Report

## Historic redlining

**Description:** “Redlining” refers the discriminatory mortgage appraisal practice used by the federal government in metropolitan areas in the 1930s. Lines were drawn around Black and immigrant-populated areas and shown as risky sites for mortgages. Maps also reflected environmental hazards, such as the presence of industrial sites.

**Rationale:** Studies have shown that neighborhoods that were historically subjected to redlining tend to have higher levels of present-day air pollution.<sup>31</sup>

**Data source:** [Mapping Inequality](#) (data only available for Seattle, Tacoma, and Spokane), University of Richmond

## Land use

**Description:** The National Land Cover Database (NLCD) provides nationwide data on land cover and land cover change at a 30-meter resolution with sixteen different classes, including four levels of developed land, two types of cultivated land, as well as other types of natural lands and water.

**Rationale:** For rural areas with large census block groups, land use was used to help determine where people are more likely to live, work, and gather. For example, low to heavy intensity developed land usually indicates the presence of roads and towns or other population centers. Land types like shrublands, grasslands, and forests are likely to be unpopulated.

**Data source:** National Land Cover Database, 2019, [Multi-Resolution Land Characteristics Consortium](#)

## Locations of sensitive receptors

**Description:** Locations where occupants are more susceptible to the adverse effects of exposure to air pollution, including:

- [K-12 schools](#)
- [Childcare facilities](#)
- [Hospitals and health clinics](#)
- Long-term care facilities (e.g., [residential care](#), [nursing homes](#), etc.)
- [Migrant worker housing](#)
- [Prisons, jails, and detention centers](#)

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<sup>31</sup> Haley M. Lane, Rachel Morello-Frosch, Julian D. Marshall, and Joshua S. Apte, Historical Redlining Is Associated with Present-Day Air Pollution Disparities in U.S. Cities. *Environmental Science & Technology Letters*, **2022**, 9 (4), 345-350, DOI: [10.1021/acs.estlett.1c01012](https://doi.org/10.1021/acs.estlett.1c01012)

**Rationale:** People 18 and younger or older than 65, people with health conditions, and outdoor workers are considered sensitive groups with increased risk from exposure to particle pollution.<sup>32</sup> Incarcerated populations also have limited ability to mitigate their risk to air pollution. Places where these populations live, work, learn, or otherwise congregate are considered “sensitive receptors.”

**Data sources:** Varies, but most datasets can be found on the [Washington Geospatial Open Data Portal](#) or [DOH’s GIS Page](#)

## Local and regional data

**Description:** Many studies or additional data on pollution, health, or environmental justice are available at the local or regional scale that can further refine the statewide draft indicator data. This includes pollution studies, health impact assessments, survey data, and more. Sources of regional data include academic studies, community groups, or local clean air agencies.

**Rationale:** As stated in the WSIPP EHD Map Technical Review, state EJ tools are a starting point. To fully evaluate environmental disparities, particularly in rural areas, more local research would be needed to overcome and incorporate more granular information that these tools are missing.

Local clean air agencies may have additional air quality data available to help identify overburdened communities or they may be doing work to address environmental justice within their own jurisdictions. For example, Puget Sound Clean Air Agency has a process to identify “focus areas,” or geographic locations with degraded air quality, whose residents face economic or historic barriers to participation in clean air decisions and solutions within Puget Sound. The data and insights from local efforts can also be used to help inform overburdened community boundaries within that region.

**Data source:** Varies, see Community Summary Report

## Size

**Description:** Ecology does not intend to have a uniform size for all communities. Some large identified areas were separated into several smaller adjacent overburdened communities, while some identified single isolated block groups were not included.

**Rationale:** Community size was scaled based on the size of the screened areas using statewide indicators and local data or information available. Some large areas were separated into multiple communities, since it was important to make sure that the airshed, pollutants of concern, source categories of pollutants, and types of land use were reasonably consistent within each community identified. Screened areas of single isolated block groups were evaluated using localized data, where available. In cases where localized data indicated that the

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<sup>32</sup> <https://enwiwa.ecology.wa.gov/Documents/WhatIsAQI.pdf>



block group was not highly impacted by air pollution, or where air quality is expected to improve because of actions taken in a nearby overburdened community, the block group was not included.

## Public input

Input from public comment periods informed how we considered and applied the draft factors to determine overburdened community boundaries.

## Tribal consultation

We will consult with Tribal governments before identifying communities on Tribal reservation land, managed under jurisdiction of a federally-recognized Tribal government, and before finalizing boundaries for those communities.

## Next Steps

In 2023, we will begin the process of placing air monitors in identified communities, as well as doing more public outreach to provide information about monitoring. The first biennial report on criteria pollution levels, greenhouse gas emissions, and health impacts in the identified overburdened communities highly impacted by air pollution will be completed and published by the end of 2023.

Section 3 of the CCA also requires Ecology to develop standards and strategies to reduce the criteria air pollution in overburdened communities highly impacted by air pollution. The biennial report on criteria pollution levels, greenhouse gas emissions, and health impacts will be used to inform future decision-making and policy development. Ecology's budget package to develop these standards and strategies was included in the Governor's proposed 2023-2025 biennial budget.<sup>33</sup> Pending legislative appropriation, Ecology proposed rulemaking to develop control technology standards using existing authority under Washington's Clean Air Act.<sup>34</sup> Ecology also proposed a grant program to target non-point sources that contribute to criteria air pollution in the identified overburdened communities highly impacted by air pollution. Depending on legislative appropriation, Ecology would begin rulemaking and developing a community-centered grant program later in 2023.

## Tribal Consultation

We invited government-to-government consultation with all Tribal governments in December 2021 and conducted Tribal meetings in January 2022 and September 2022, prior to each public engagement period. Ecology is reaching out to Tribes we have identified as highly impacted by air pollution for additional government-to-government consultation. We will continue to

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<sup>33</sup> [Gov. Inslee's proposed 2023-25 budgets | Office of Financial Management \(wa.gov\)](#)

<sup>34</sup> [2023-25 Budget - Washington State Department of Ecology](#)

consult with Tribal governments and engage organizations affiliated with Washington Tribes throughout every stage of this initiative.

## More Information

Please visit [our webpage](#) for more information about this initiative, a map of overburdened communities highly impacted by air pollution, information about public input opportunities, as well as translated materials available in Spanish, Chinese, Korean, Vietnamese, and Russian.<sup>35</sup>

For questions about this document, contact Rylie Ellison at [rylie.ellison@ecy.wa.gov](mailto:rylie.ellison@ecy.wa.gov) or 360-790-2567.

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<sup>35</sup> <https://ecology.wa.gov/Air-Climate/Climate-Commitment-Act/Overburdened-communities>

## Appendix A. National Ambient Air Quality Standards<sup>36</sup>

Pollutant	Primary/ Secondary	Averaging Time	Level	Form
<a href="#">Carbon Monoxide (CO)</a>	primary	8 hours	9 ppm	Not to be exceeded more than once per year
		1 hour	35 ppm	
<a href="#">Lead (Pb)</a>	primary and secondary	Rolling 3-month average	0.15 µg/m <sup>3</sup>	Not to be exceeded
<a href="#">Nitrogen Dioxide (NO<sub>2</sub>)</a>	primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	primary and secondary	1 year	53 ppb	Annual mean
<a href="#">Ozone (O<sub>3</sub>)</a>	primary and secondary	8 hours	0.070 ppm	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
<a href="#">Fine Particle Pollution (PM<sub>2.5</sub>)</a>	primary	1 year	12.0 µg/m <sup>3</sup>	annual mean, averaged over 3 years
	secondary	1 year	15.0 µg/m <sup>3</sup>	annual mean, averaged over 3 years
	primary and secondary	24 hours	35 µg/m <sup>3</sup>	98 <sup>th</sup> percentile, averaged over 3 years
<a href="#">Coarse Particle Pollution (PM<sub>10</sub>)</a>	primary and secondary	24 hours	150 µg/m <sup>3</sup>	Not to be exceeded more than once per year on average over 3 years

<sup>36</sup> <https://www.epa.gov/criteria-air-pollutants/naaqs-table>

<b>Pollutant</b>	<b>Primary/ Secondary</b>	<b>Averaging Time</b>	<b>Level</b>	<b>Form</b>
<a href="#">Sulfur Dioxide (SO<sub>2</sub>)</a>	primary	1 hour	75 ppb	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
	secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

## Appendix B. Climate Commitment Act Code

RCW 70A.65.005(7) is the portion of the Climate Commitment Act that establishes legislative intent for the law regarding environmental justice:

(7) Under the program, the legislature intends to identify overburdened communities where the highest concentrations of criteria pollutants occur, determine the sources of those emissions and pollutants, and pursue significant reductions of emissions and pollutants in those communities. The legislature further intends for the department of ecology to conduct environmental justice assessments to ensure that funds and programs created under this chapter provide direct and meaningful benefits to vulnerable populations and overburdened communities. Additionally, the legislature intends to prevent job loss and provide protective measures if workers are adversely impacted by the transition to a clean energy economy through transition and assistance programs, worker-support projects, and workforce development and other activities designed to grow and expand the clean manufacturing sector in communities across Washington state. The legislature further intends to empower the environmental justice council established under RCW 70A.02.110 to provide recommendations for the development and implementation of the program, the distribution of funds, and the establishment of programs, activities, and projects to achieve environmental justice and environmental health goals. The legislature further intends for the department of ecology to create and adopt community engagement plans and Tribal consultation frameworks in the administration of the program to ensure equitable practices for meaningful community and federally recognized Tribal involvement. Finally, the legislature intends to establish this program to contribute to a healthy environment for all of Washington’s communities.

This focus of this initiative is on overburdened communities highly impacted by criteria air pollution, as directed by RCW 70A.65.020(1). For the purposes of the Climate Commitment Act, overburdened communities are defined in RCW 70A.65.010(54):

(54) “Overburdened community” means a geographic area where vulnerable populations face combined, multiple environmental harms and health impacts or risks due to exposure to environmental pollutants or contaminants through multiple pathways, which may result in significant disparate adverse health outcomes or effects.

(a) “Overburdened community” includes, but is not limited to:

(i) Highly impacted communities as defined in RCW 19.405.020;

(ii) Communities located in census tracts that are fully or partially on “Indian country” as defined in 18 U.S.C. Sec. 1151; and

(iii) Populations, including Native Americans or immigrant populations, who may be exposed to environmental contaminants and pollutants outside of the geographic area

in which they reside based on the populations' use of traditional or cultural foods and practices, such as the use of resources, access to which is protected under treaty rights in ceded areas, when those exposures in conjunction with other exposures may result in disproportionately greater risks, including risks of certain cancers or other adverse health effects and outcomes.

(b) Overburdened communities identified by the department may include the same communities as those identified by the department through its process for identifying overburdened communities under RCW 70A.02.010.

RCW 70A.65.020, titled "Environmental Justice Review" is the portion of the Climate Commitment Act that directs the formation and implementation of this initiative:

(1) To ensure that the program created in RCW 70A.65.060 through 70A.65.210 achieves reductions in criteria pollutants as well as greenhouse gas emissions in overburdened communities highly impacted by air pollution, the department must:

(a) Identify overburdened communities, which may be accomplished through the department's process to identify overburdened communities under chapter 70A.02 RCW;

(b) Deploy an air monitoring network in overburdened communities to collect sufficient air quality data for the 2023 review and subsequent reviews of criteria pollutant reductions conducted under subsection (2) of this section; and

(c)(i) Within the identified overburdened communities, analyze and determine which sources are the greatest contributors of criteria pollutants and develop a high priority list of significant emitters.

(ii) Prior to listing any entity as a high priority emitter, the department must notify that entity and share the data used to rank that entity as a high priority emitter, and provide a period of not less than 60 days for the covered entity to submit more recent data or other information relevant to the designation of that entity as a high priority emitter.

(2)(a) Beginning in 2023, and every two years thereafter, the department must conduct a review to determine levels of criteria pollutants, as well as greenhouse gas emissions, in the overburdened communities identified under subsection (1) of this section. This review must also include an evaluation of initial and subsequent health impacts related to criteria pollution in overburdened communities. The department may conduct this evaluation jointly with the department of health.

(b) Once this review determines the levels of criteria pollutants in an identified overburdened community, then the department, in consultation with local air pollution control authorities, must:

(i) Establish air quality targets to achieve air quality consistent with whichever is more protective for human health:

(A) National ambient air quality standards established by the United States environmental protection agency; or

(B) The air quality experienced in neighboring communities that are not identified as overburdened;

(ii) Identify the stationary and mobile sources that are the greatest contributors of those emissions that are either increasing or not decreasing;

(iii) Achieve the reduction targets through adoption of emission control strategies or other methods;

(iv) Adopt, along with local air pollution control authorities, stricter air quality standards, emission standards, or emissions limitations on criteria pollutants, consistent with the authority of the department provided under RCW 70A.15.3000, and may consider alternative mitigation actions that would reduce criteria pollution by similar amounts; and

(v) After adoption of the stricter air quality standards, emission standards, or emissions limitations on criteria pollutants under (b)(iv) of this subsection, issue an enforceable order or the local air authority must issue an enforceable order, as authorized under RCW 70A.15.1100, as necessary to comply with the stricter standards or limitations and the requirements of this section. The department or local air authority must initiate the process, including provision of notice to all relevant affected permittees or registered sources and to the public, to adopt and implement an enforceable order required under this subsection within six months of the adoption of standards or limitations under (b)(iv) of this subsection.

(c) Actions imposed under this section may not impose requirements on a permitted stationary source that are disproportionate to the permitted stationary source's contribution to air pollution compared to other permitted stationary sources and other sources of criteria pollutants in the overburdened community.

(3) An eligible facility sited after July 25, 2021, that receives allowances under RCW 70A.65.110 must mitigate increases in particulate matter in overburdened communities due to its emissions.

(4)(a) The department must create and adopt a supplement to the department's community engagement plan developed pursuant to chapter 70A.02 RCW. The supplement must describe how the department will engage with overburdened communities and vulnerable populations in:

(i) Identifying emitters in overburdened communities; and

(ii) Monitoring and evaluating criteria pollutant emissions in those areas.

(b) The community engagement plan must include methods for outreach and communication with those who face barriers, language or otherwise, to participation.



## Appendix C. Indicators Not Included

To identify communities highly impacted by air pollution, we originally proposed eight additional air pollution indicators related to air pollution emissions sources, health impacts, or vulnerability. These were intended to reflect specific concerns we heard during our initial public listening sessions, such as living near agriculture or having high rates of asthma. In some cases, we were not able to find data and develop indicators that reflect important air pollution impacts that we heard in the initial engagement period (see “Indicators Under Exploration” below). That includes vulnerable populations like outdoor workers and unhoused people, as well as health impacts like general wellness and quality of life.

We agree with many commenters that it is better not to limit or prioritize communities based on these data. However, we also did not identify communities based solely on any of these data because they do not directly reflect the relative levels or impact of criteria air pollution in communities. The exception is wildfire smoke impact, which is outside of Ecology’s regulatory authority for this initiative.

Nevertheless, this information is still valuable for recognizing different types of air pollution impacts and will still be used to help guide policy and evaluation of air quality improvements in the identified communities highly impacted by air pollution. Maps of these indicators will continue to remain available on our [StoryMap](#)<sup>37</sup> for public information.

### Emissions over distance from stationary sources

**Description:** Emissions quantity divided by distance from airports, railyards, and major stationary sources of criteria air pollution. Major sources are as designated in the Air Operating Permit program.<sup>38</sup> Each of the six pollutants were mapped individually and overlaid: PM<sub>2.5</sub>, SO<sub>2</sub>, CO, Pb, nitrogen oxides (NO<sub>x</sub>), or volatile organic compounds (VOCs). VOCs are not considered criteria pollutants; however, they are precursors to the formation of O<sub>3</sub>, which is a criteria pollutant. This indicator represents which areas are near one or multiple stationary sources of criteria pollutants and criteria pollutant precursors.

**Method:** We used the AIRPACT 1.33 km gridded domain, major source emissions from the 2019 point-source [stationary] emissions database, airport emissions from the 2017 NEI, and railyard emissions from the 2017 NEI. We created individual layers for each pollutant by: (1) calculating the distance of each source to each grid-cell and used a minimum distance of 1 km for calculations; (2) dividing the emissions for each pollutant by the distance to each grid-cell; and (3) adding the emissions/distance from all sources (by pollutant) for each grid-cell.

**Caveats:** The 99th percentile for each pollutant was originally selected for this indicator because it is made up of a combination of six separate map layers for each of the six pollutants

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<sup>37</sup> <https://arcg.is/15nC0m>

<sup>38</sup> For attainment areas, a major source is any stationary source that has the actual or potential to emit ≥100 tons per year for any criteria air pollutant.

included. The combined map of the six pollutants with the higher threshold for each had roughly the same weight as the other indicators with a 95th percentile threshold.

PM<sub>10</sub> is not included here because >80% of PM<sub>10</sub> emissions are included in the PM<sub>2.5</sub> emissions data.

**Data source:** [Air Emissions Inventory](#), Ecology, 2019; [National Emissions Inventory](#), EPA, 2017; [AIRPACT](#) grid-cells (1.33 km), University of Washington Weather Research and Forecasting (WRF) Model/Washington State University

**Discussion:** Proximity to sources of pollution do not necessarily align with ambient concentrations of pollution. Factors like wind direction, weather, and topography play a large role in which communities have persistent levels of elevated pollution, regardless of emissions. Furthermore, our existing indicator of elevated levels of criteria air pollution expressly accounts for stationary source emissions and the other factors that influence which areas are likely to be impacted by that pollution.

## Proximity to agriculture

**Description:** Average of distance to land designated for cultivating crops and distance to dairies adjusted for range of mature animals

**Method:** We calculated separate scores for agricultural intensity and proximity to dairies. For agricultural intensity, each 1.33 km grid cell was assigned a score for the percent of agricultural land in a 15 km buffer, normalized to a scale of 0-1. Agricultural land was identified using the Washington State Department of Agriculture's [2017 Agricultural Land Use Dataset](#).<sup>39</sup> For proximity to dairies, each 1.33 km grid cell was assigned a score for the total number of mature cattle at dairies within a 15 km buffer, normalized to a scale of 0-1. Dairy locations and number of mature cattle were extracted from a [2017 WSDA Dairy Map](#).<sup>40</sup> In accordance with RCW 42.56.610 and RCW 90.64.190, animal counts were generalized to the ranges listed in WAC 16-06-210. Each dairy was assigned the midpoint of its corresponding range. The final proximity to agriculture score was calculated as the mean of the normalized agricultural intensity score and proximity to dairies score.

**Caveats:** The methods for quantifying agricultural intensity do not distinguish among different crop types, which may pose different environmental impacts to people living nearby. Furthermore, other types of animal feeding operations (aside from dairies) are currently not included, but may be added in the future depending on data availability.

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<sup>39</sup> <https://agr.wa.gov/departments/land-and-water/natural-resources/agricultural-land-use>

<sup>40</sup> [https://geo.wa.gov/datasets/26add7da921d4aa68ccb50ce191c6182\\_0/about](https://geo.wa.gov/datasets/26add7da921d4aa68ccb50ce191c6182_0/about)

**Data source:** [Agricultural Land Use Map](#), WSDA, 2017; [WA Dairy Map](#), WSDA, 2017; [AIRPACT](#) grid-cells (1.33 km), University of Washington Weather Research and Forecasting (WRF) Model/ Washington State University

**Discussion:** Agriculture is a significant source of dust (particulate matter), as well as NH<sub>3</sub> and VOCs, which are criteria pollutant precursors. However, proximity to sources of pollution do not necessarily align with ambient concentrations of pollution. Factors like wind direction, weather, and topography play a large role in which communities have persistent levels of elevated pollution, regardless of emissions. Furthermore, our existing indicator of elevated levels of criteria air pollution expressly accounts for food/agriculture emissions and the other factors that influence which areas are likely to be impacted by that pollution.

## Wildfire smoke exposure

**Description:** The average number of days a census tract was impacted by heavy wildfire smoke over a 7-year period.

**Method:** The number of wildfire smoke-impacted days by census tract were mapped for June-September, 2015-2021. These months cover the typical wildfire smoke season in Washington. 2015 was the start date to capture the major wildfire smoke seasons in the past decade.

Daily smoke plume data from National Oceanic and Atmospheric Administration's (NOAA) Office of Satellite and Product Operations which provides the daily Hazard Mapping System (HMS) Fire and Smoke product. The number of wildfire smoke-impacted days was calculated by census tract by counting the number of days the smoke polygons classified as "heavy" intersected with each census tract centroid. The number of days were then added by census tract and the annual average calculated over the 7-year period and binned 5 categories.

**Caveats:** The NOAA HMS Smoke Product may miss smoke plumes when heavy cloud cover is present. Analysts update the smoke polygons throughout the daylight hours as new satellite imagery becomes available, thus mitigating the impact of cloud cover interfering with smoke detection. Additionally, satellite imagery does not distinguish between wildfire smoke that is at ground level versus high in the atmosphere. By selecting only smoke polygons that are categorized as "heavy," the smoke is much more likely to be at ground level. However, some degree of misclassification likely exists.

The presence of a smoke plume is not an indicator of the magnitude of smoke impacts at ground level. This layer indicates only the frequency and duration of smoke events, not their intensity.

**Data source:** [Washington Tracking Network](#), DOH, 2015-2021

**Discussion:** Wildfire smoke has increasingly become a dominant source of criteria pollution in Washington. Which communities are most impacted fluctuates from year to year. However, some communities face more persistent exposure to wildfire smoke than others. Wildfire is

outside of Ecology’s regulatory authority for addressing criteria air pollution. Section 3 of the Climate Commitment Act directs Ecology to address pollution using our existing authority under the Clean Air Act, which does not include wildfire emissions.<sup>41</sup> We recognize the importance of having current, local data on wildfire smoke to make important health decisions. Many of our existing monitors are in wildfire-smoke impacted areas. We do our best to deploy additional monitoring resources to communities during wildfire smoke events. We also provide up-to-date information to impacted communities across the state through the [Washington smoke blog](#)<sup>42</sup> and [smoke forecast map](#).<sup>43</sup>

## Asthma prevalence

**Description:** Asthma prevalence among adults age 18 years or over

**Method:** Weighted percentage of people age ≥18 years who answer “yes” to both of the following questions: (1) have you ever been told by a doctor, nurse, or other health professional that you have asthma, and (2) do you still have asthma. The weighted percentage ensures that survey responses match the population characteristics of each census tract.

**Caveats:** Physician-diagnosed asthma is self-reported. It requires a doctor diagnosis of asthma, which may not include all persons with asthma. This measure does not include prevalence of asthma among children (under age 18). It also does not represent asthma severity.

**Data source:** [PLACES: Local Data for Better Health](#), CDC, 2019

**Discussion:** People with asthma are at increased risk of particle pollution-related health effects.<sup>44</sup> Studies have also shown that children exposed to particulate matter are more likely to develop asthma.<sup>45</sup> We were not able to identify a dataset that adequately captures all these impacts, including the severity of asthma or prevalence in children. As part of this initiative, we will be examining health impacts related to criteria air pollution in overburdened communities in our biennial environmental justice review. The first review will be released by the end of 2023.

## COPD prevalence

**Description:** Chronic obstructive pulmonary disease prevalence among adults age 18 years or older

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<sup>41</sup> Wildfires are generally considered “exceptional events,” which EPA defines as “unusual or naturally occurring events that can affect air quality but are not reasonably controllable using techniques that tribal, state or local air agencies may implement in order to attain and maintain the National Ambient Air Quality Standards.”

<sup>42</sup> <https://wasmoke.blogspot.com/>

<sup>43</sup> <https://enwiwa.ecology.wa.gov/home/text/421#Forecast>

<sup>44</sup> <https://www.epa.gov/pmcourse/particle-pollution-and-respiratory-effects>

<sup>45</sup> Keet, C. A., Keller, J. P., & Peng, R. D. (2018). Long-term coarse particulate matter exposure is associated with asthma among children in Medicaid. *American journal of respiratory and critical care medicine*, 197(6), 737-746.

**Method:** Percentage of people age ≥18 years who report ever having been told by a doctor, nurse, or other health professional that they had chronic obstructive pulmonary disease (COPD), emphysema, or chronic bronchitis

**Caveats:** The percentage is based on being diagnosed by a physician and respondent recall of the diagnosis. It might underestimate the true prevalence. This measure also does not represent COPD severity.

**Data source:** [PLACES: Local Data for Better Health](#), CDC, 2019

**Discussion:** People with COPD may be at increased risk of particle pollution-related health effects.<sup>46</sup> We were not able to identify a dataset that adequately captures these impacts, such as COPD hospitalizations. In addition to risk factors associated with air pollution exposure, the main cause of COPD is tobacco smoke.<sup>47</sup> As part of this initiative, we will be examining health impacts related to criteria air pollution in overburdened communities in our biennial environmental justice review. The first review will be released by the end of 2023.

## Life expectancy

**Description:** The number of years a newborn can expect to live if the current age-specific death rate remains constant

**Method:** The Washington State Department of Health collects information about deaths in Washington from death certificates. DOH collects and presents these data in data tables.

**Caveats:** Life expectancy calculations can fluctuate considerably in smaller populations, or populations experiencing low or no deaths for the year(s) being calculated. Because of these issues, the life expectancy at birth calculation for the census tract geographies was suppressed for census tracts with a population (for the 5 years combined) of <5000 or a result with a standard error >2 or a record of <50 deaths for the time period.

**Data source:** [Washington Tracking Network \(WTN\)](#), DOH, 2015-2019

**Discussion:** Air quality is one of many factors that contribute to differences in average life expectancy across geographies. As part of this initiative, we will be examining health impacts related to criteria air pollution in overburdened communities in our biennial environmental justice review. The first review will be released by the end of 2023.

## Age

**Description:** Percent of individuals under age 18 and over age 65, as a fraction of the population

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<sup>46</sup> <https://www.epa.gov/pmcourse/particle-pollution-and-respiratory-effects>

<sup>47</sup> <https://www.cdc.gov/copd/features/copd-symptoms-diagnosis-treatment.html>

**Method:** The number of individuals under the age of 18 and over the age of 65 were added together and divided by the total population in each census tract.

**Data source:** [American Communities Survey \(ACS\)](#), U.S. Census, 2015-2019

**Discussion:** Children and older adults are groups that are particularly vulnerable to the health impacts of criteria air pollution. These populations live in all parts of the state; however, some communities have a higher percentage of these age groups.

## Households with no vehicle

**Description:** Percent of household units with no vehicle.

**Method:** The number of household units that report having no vehicle available divided by the number of households in each census tract

**Caveats:** Households with a vehicle is an indirect measure of vulnerability to air pollution.

**Data source:** [American Communities Survey \(ACS\)](#), U.S. Census, 2015-2019

**Discussion:** Households with no vehicle was used as a proxy for areas where individuals may be more likely to get around by walking, biking, or public transit, and therefore face greater exposure to outdoor air pollution during transit. This indicator is correlated with urban areas where public transportation is more available. It appears to be inversely related to transportation expense, which is considered a socioeconomic burden in the EHD map.

## Indicators under Exploration

Several indicators were not included in the draft indicators due to data limitations. The following indicators are still under exploration and may be developed in the future if the limitations with the data are resolved.

- **Outdoor workers** – People who work primarily outdoors (agricultural workers, construction workers, postal delivery workers, etc.) have higher exposure to outdoor air pollution than people who primarily work indoors. We have not yet been able to identify or produce a dataset that captures the many different types of outdoor workers and where they are located across the state.
- **Homelessness** – Outdoor air pollution disproportionately affects unhoused people. Statewide data on homeless populations is available through the [Point in Time Count](#).<sup>48</sup> However, the data is only available at the county level, which does not provide enough resolution to determine where unhoused populations are located for community identification.

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<sup>48</sup> <https://www.commerce.wa.gov/serving-communities/homelessness/annual-point-time-count/>

- **Healthcare access** – People have unequal access to healthcare across the state. Communities might be at greater risk for pollution-related health effects when access to treatment is limited. We are aware of several available measures related to healthcare resources, accessibility, and insurance rates. However, they are available at different geographic scales and would require more work to develop into an indicator.
- **Indoor exposure to ambient air pollution** – Depending on housing age, quality, ventilation, etc., people face unequal exposure to ambient air pollution inside their homes, schools, workplaces, and other buildings. Several potential measures that could be combined to represent this vulnerability have been identified. However, more work is needed to develop this as an indicator.
- **Childhood asthma** – While prevalence of asthma was included in the draft indicators, childhood asthma was frequently brought up in public comment. We have not been able to identify an adequate dataset where data on childhood asthma is collected and reported consistently across the state.
- **Proximity to CAFOs** – The “proximity to agriculture” indicator includes cultivated crops and dairies, but not other types of concentrated animal feeding operations (CAFOs), such as beef feedlots and poultry farms. These facilities are not uniformly permitted, so we do not yet have a comprehensive source of data on different CAFO types in Washington or their relative sizes.
- **Short term emissions events** – Acute pollution exposure events from fires, accidents, facility start-up/shut-down, etc. can expose nearby populations to hazardous levels of criteria air pollution, as well as other harmful pollutants. We did not find any consistent method of tracking these events, or their emissions, across the state.