

Tri-Cities to Wallula Community 2025 Environmental Justice Report



Publication Information

This report is available on the Department of Ecology's website at <https://apps.ecology.wa.gov/publications/summarypages/2502037.html>

Contact Information

Air Quality Program

P.O. Box 47600

Olympia, WA 98504-7600

Phone: 360-407-6800

Website: [Washington State Department of Ecology](https://www.ecology.wa.gov/)

ADA Accessibility

The Department of Ecology is committed to providing people with disabilities access to our information and services by meeting or exceeding the requirements of state and federal laws.

To request an ADA accommodation, email aqoutreach@ecy.wa.gov, call 360-407-6800, or call Ecology through the Washington Telecommunication Relay for services including text telephone (TTY) at 711 or through your preferred relay service provider. Visit [Ecology.wa.gov/ADA](https://ecology.wa.gov/ADA) for more accessibility information.

Executive Summary

The Tri-Cities to Wallula Community Report provides community information, demographic data, greenhouse gas emissions data, and information about criteria air pollutant levels (CAPs) and their health impacts. This document provides information about air quality and health impacts to those who live, work, and play in the Tri-Cities to Wallula community.

For more information about the background and methodology of this document, please visit the *2025 Environmental Justice Report: Overburdened Communities Highly Impacted by Air Pollution* (2025 EJ Report).



Community Overview

The Tri-Cities to Wallula community was identified as overburdened and highly impacted by air pollution because it met the statewide screening criteria based on the Washington Environmental Health Disparities map¹ ranking and experiences elevated levels of ozone (O₃), coarse particulate matter (PM₁₀), and cumulative criteria air pollution driven by levels of O₃, PM₁₀, fine particulate matter (PM_{2.5}), and nitrogen dioxide (NO₂). Community identification is described in more detail in the [Overburdened Communities Highly Impacted by Air Pollution StoryMap](#).

Land Area: 173 sq. mi

Population: 114,203

County: Benton, Franklin, Walla Walla

Municipal Government: Pasco, Kennewick, Richland City Councils

Ecology Region: Eastern

Local Clean Air Authority: Benton Clean Air Agency, ECY Eastern Region Office

Local Health Jurisdiction: Benton-Franklin Health District, Walla Walla County
Department of Community Health

Primary languages spoken: English, Spanish

Primary pollutant of concern: Ozone, short-term PM_{2.5}, PM₁₀



Geographic characteristics

The Tri-Cities to Wallula community is in Southeast Washington along the Columbia and Snake Rivers and includes parts of Franklin, Walla Walla, and Benton Counties. The Tri-Cities is the third-largest metropolitan area in Washington and is surrounded by rural, primarily agricultural land. The community that is identified as overburdened and highly impacted by air pollution encompasses parts of each of the Tri-Cities (Richland, Pasco, and Kennewick), as well as a large rural area to the south and east that covers the unincorporated communities of Finley and Highland in Benton County and Burbank and Wallula in Walla Walla County. Some of the hills in

¹ Washington Environmental Health Disparities map <https://doh.wa.gov/data-and-statistical-reports/washington-tracking-network-wtn/washington-environmental-health-disparities-map>

the area, which include Horse Heaven Hills, Candy Mountain and Badger Mountain, create a bowl effect that traps air in the Tri-Cities region. Freeways within the community boundaries are I-82, I-182, US-12, US-395, and SR-240.

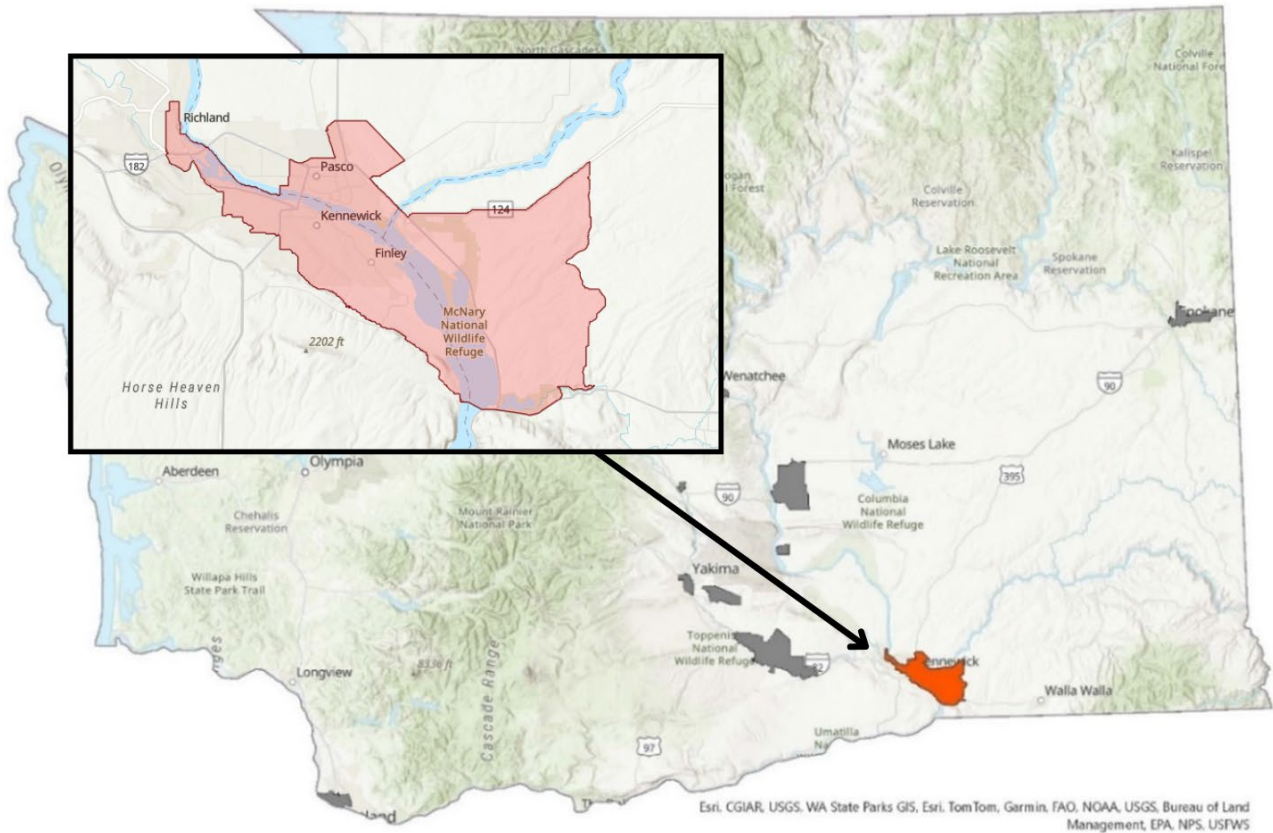


Figure 1. Map of the 16 overburdened communities highly impacted by air pollution in Washington state (gray), with Tri-Cities to Wallula highlighted (red).

Socioeconomic characteristics

Tri-Cities and the surrounding region have a large Hispanic population, with Pasco having the highest concentration as the largest majority-Hispanic city in the Pacific Northwest. More than two-fifths of households in this community speak a language other than English at home. Nearly 3 in 10 residents are children. A large share of the workforce, nearly one-fifth, is employed in natural resources, construction, and maintenance occupations.^{2,3} The Hanford

² American Community Survey Data <https://www.census.gov/programs-surveys/acs/data.html>

³ WA Office of Financial Management, Estimates of April 1 population by age, sex, race and Hispanic origin <https://ofm.wa.gov/data-research/population-demographics/forecasts-projections/age-sex-race-and-hispanic-origin/information/>

nuclear facility and projects dedicated to its management and cleanup are a major source of employment for this region.

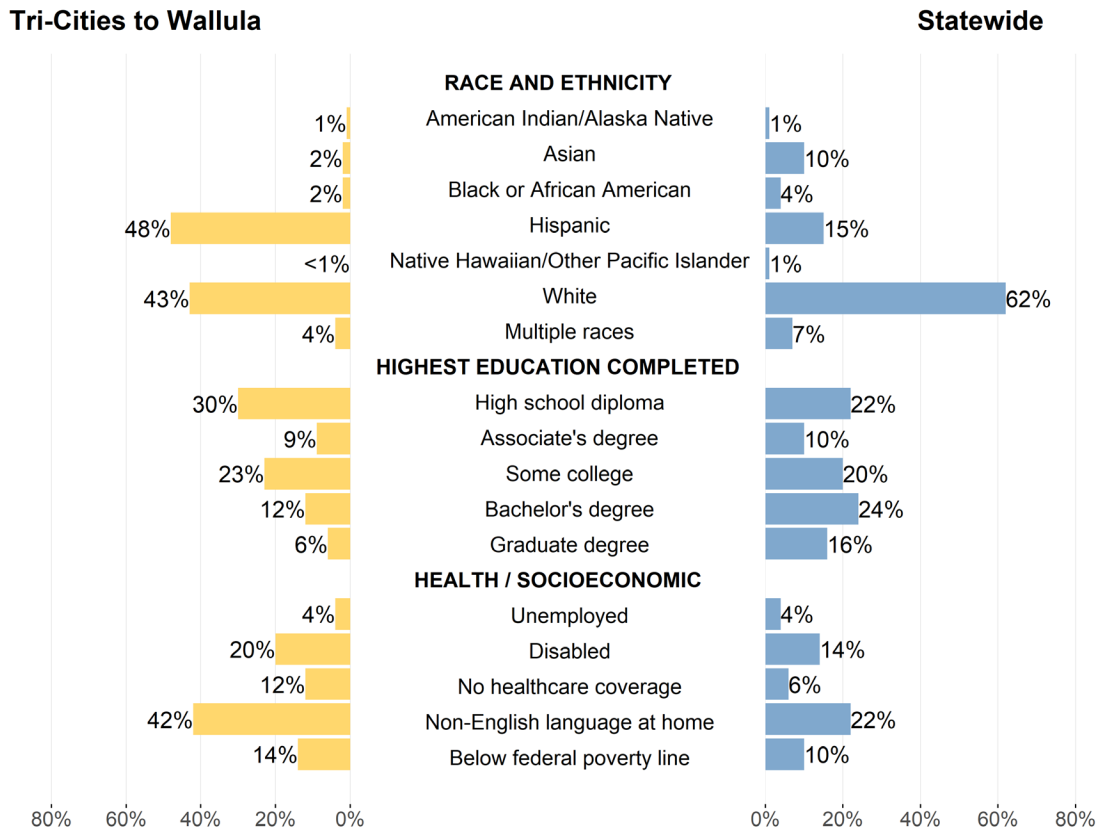


Figure 2. Sociodemographic characteristics of the Tri-Cities to Wallula community compared to statewide percentages, based on Washington State's 2024 estimated population of 8,035,700.⁴

Health characteristics

According to 2022 CDC health survey data,⁵ Tri-Cities to Wallula has elevated prevalences of chronic health conditions among individuals aged 18 years and older relative to the statewide population, including asthma (12.3% vs. 11.4%), cardiovascular disease (6.3% vs. 5.7%), COPD (6.9% vs. 5.7%), diabetes (11.7% vs. 9.6%), and stroke (3.6% vs. 3.1%). These prevalences are

⁴ WA Office of Financial Management, Nov 2024 Data Tables, Population by age and sex https://ofm.wa.gov/wp-content/uploads/sites/default/files/public/dataresearch/pop/stfc/stfc_2024.xlsx

⁵ U.S. Centers for Disease Control and Prevention, PLACES Data Portal <https://www.cdc.gov/places/tools/data-portal.html>

not necessarily attributable to air pollution. Community and statewide prevalences that have overlapping 95% confidence intervals, as shown in Figure 3, might not be statistically significant.

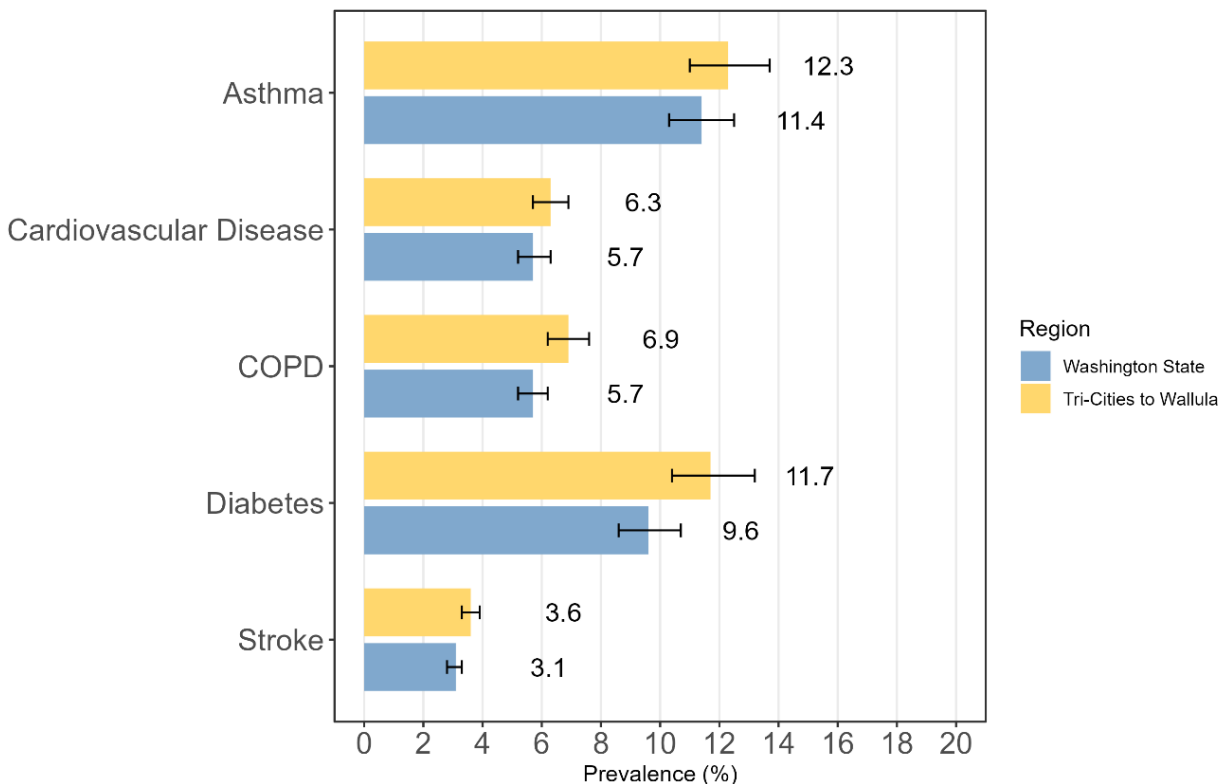


Figure 3. Prevalence of chronic health conditions among people ages 18 years and older in Tri-Cities to Wallula census tracts compared with Washington State.

Data come from CDC PLACES, 2024 release, which uses 2022 survey data.⁵ Yellow and blue bars indicate the estimated prevalence of each condition. Black lines indicate the 95% confidence interval.

Air Monitoring

Ecology’s Central Regional Office (CRO) and Benton Clean Air Agency (BCAA) monitor PM_{2.5}, PM₁₀, and O₃ in the Tri-Cities to Wallula community (Figure 4; Table 1). In May 2024, the Finley-S Finley Rd PM_{2.5} sensor (SensWA) was installed using Climate Commitment Act funding, and partial-year data from this site is included in this report. The Kennewick-Steptoe St ozone (O₃) monitor is outside the community boundary; however, because O₃ is a regional pollutant,

Ecology considers the concentrations measured there to be representative of O₃ within the Tri-Cities to Wallula community (Figure 4). No other criteria air pollutants are currently monitored in this community.

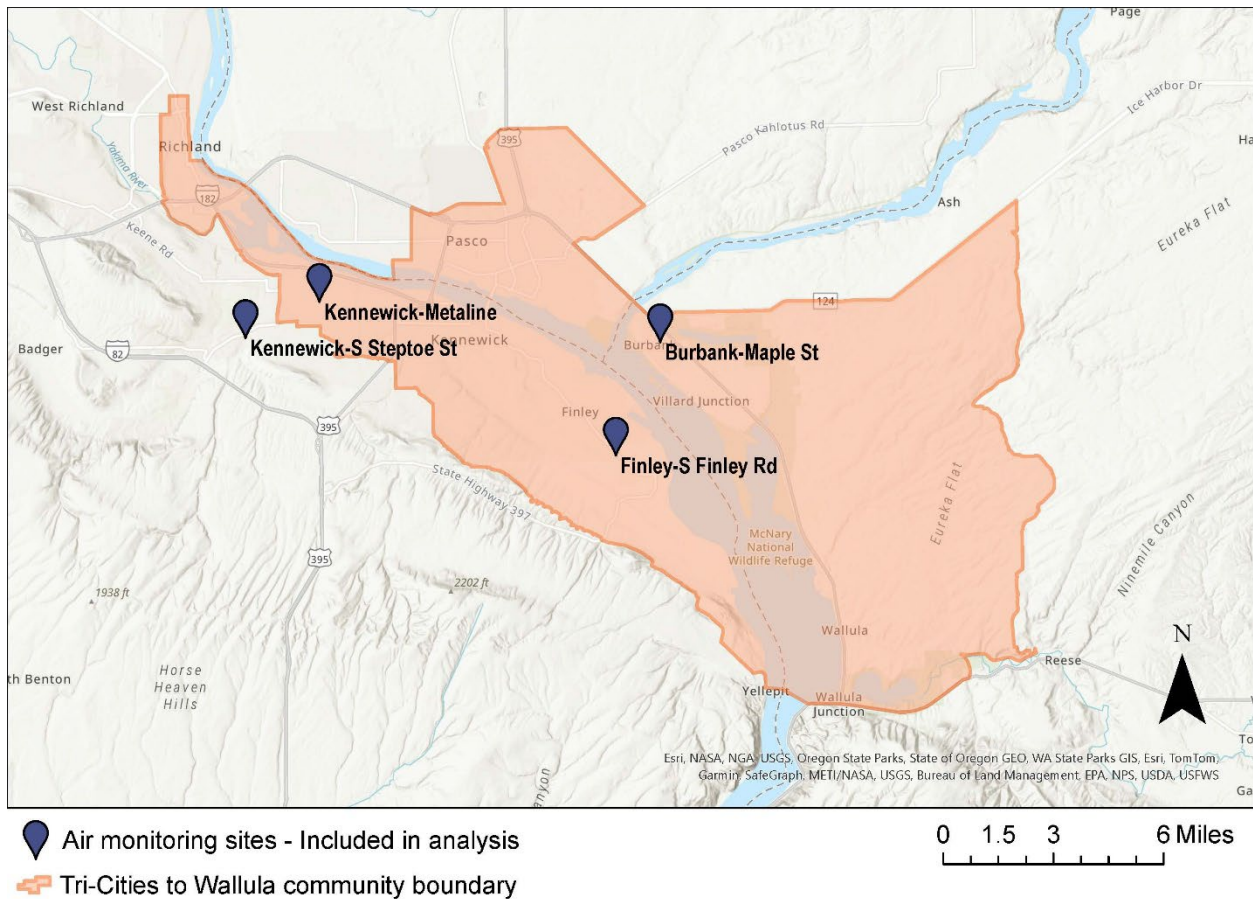


Figure 4. Map of Tri-Cities to Wallula air monitoring sites.

Table 1. Tri-Cities to Wallula criteria air pollutant monitors.

Monitoring Site	Type	Site Owner	Pollutants Monitored
Kennewick-Metaline	Non-regulatory	BCAA	PM _{2.5}
Kennewick-Metaline	Regulatory	BCAA	PM ₁₀
Kennewick-S Steptoe St	Regulatory	BCAA	O ₃
Finley-S Finley Rd	SensWA ¹	Ecology-CRO	PM _{2.5}

Monitoring Site	Type	Site Owner	Pollutants Monitored
Burbank-Maple St	Non-regulatory	Ecology-ERO	PM _{2.5}
Burbank-Maple St	Regulatory	Ecology-ERO	PM ₁₀

¹ Installed as part of Climate Commitment Act implementation

Criteria Air Pollution

This report summarizes criteria air pollution (CAPs) concentrations in the Tri-Cities to Wallula community from 2022 through 2024. CAPs concentrations for PM_{2.5}, PM₁₀, and O₃ are reported using data from the Washington State Air Monitoring Network and calculated according to the Environmental Protection Agency’s (EPA) methodology. More information about the methods can be found in the methods section of the 2025 EJ Report.

In addition to analyzing monitored criteria air pollution concentrations, we calculated the number of days per year residents of the Tri-Cities to Wallula community experienced unhealthy air quality, according to EPA’s Air Quality Index (AQI). The AQI is a six-category color-coded scale used to communicate daily air quality levels to the public. Days when an AQI above 100 are considered “unhealthy for sensitive groups” or worse.

Between 2022-2024, the Tri-Cities to Wallula community experienced an annual average of 2.3 days with unhealthy air quality (Figure 5). In comparison, between 2020-2022, the annual average was 8.3 days. Most unhealthy air quality days were primarily caused by wildfire smoke.

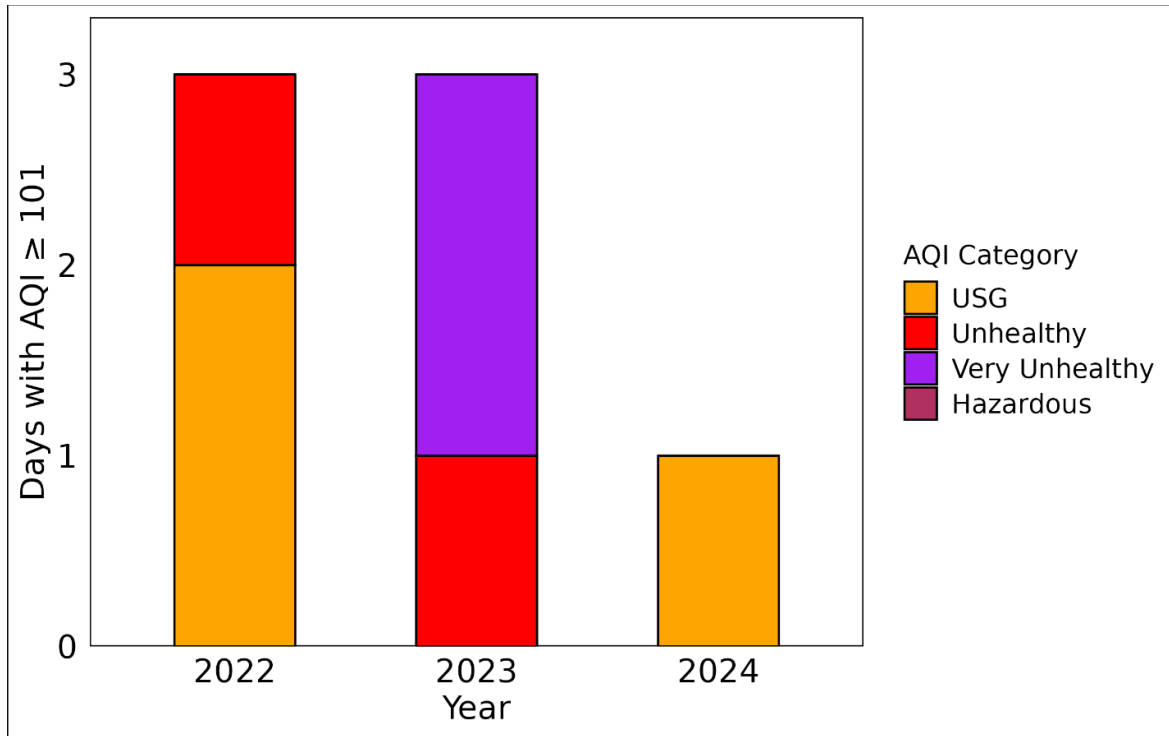


Figure 5. Number of days 2022-2024 with unhealthy air quality. Includes days impacted by wildfire smoke.

Table 2 includes 24-hour PM_{2.5} (98th percentile) summary statistics. PM_{2.5} concentrations are measured over 24-hour periods in micrograms per cubic meter (µg/m³). The EPA establishes national ambient air quality standards (NAAQS), which define the maximum allowable levels (thresholds) for each criteria pollutant. The NAAQS threshold for 24-hour PM_{2.5} (98th percentile) is 35 µg/m³. The design value for 24-hour PM_{2.5} (98th percentile) is a statistic that describes the air quality of a location relative to the NAAQS over a three-year period and is used to describe short-term fine particulate exposure.

From 2022 to 2024, the 24-hour PM_{2.5} (98th percentile) concentrations ranged from 15.0 to 20.0 µg/m³. The Burbank-Maple St monitor was established prior to 2007; however, data was only available for 2023 and 2024. We included partial-year data from the Finley-S Finley Rd monitor, as it was installed in May 2024. The Kennewick-Metaline 2024 design value remained below the NAAQS threshold and concentrations from the other two sites also remained below the NAAQS. The numbers in brackets in Table 2 exclude wildfire-impacted days when the 24-hour average PM_{2.5} concentrations exceeded 35.4 µg/m³. Excluding wildfire smoke days reduced daily PM_{2.5} concentrations by approximately 7% at the Kennewick-Metaline monitor.

Table 2. 24-hour PM_{2.5} (98th percentile) summary statistics (2024) and 2024 design values (2022-2024). Units are in µg/m³. Brackets [] exclude wildfire days when 24-hour average PM_{2.5} concentration exceeded 35.4 µg/m³. 24-hour PM_{2.5} (98th percentile) NAAQS is 35 µg/m³.

Monitoring Site	2022 24-hour 98th Percentile	2023 24-hour 98th Percentile	2024 24-hour 98th Percentile	2024 Design Value
Kennewick- Metaline	17.1 [15.9]	16.1 [14.8]	15.5 [15.5]	16 [15]
Burbank- Maple St	DNC	<i>15.0</i> [14.7]	19.8 [19.8]	*
Finley-S Finley Rd	DNC	DNC	<i>20.0</i> [20.0]	*

Italics indicate incomplete annual data, DNC = data not collected, NAAQS = national ambient air quality standards, PM = particulate matter, µg/m³ = micrograms per cubic meter, * = incomplete data for 3-year design value



Figure 6. **24-hour PM_{2.5} (98th percentile) summary statistics, 2022-2024.** Annual summary statistics calculated with and without days elevated from wildfire smoke. Dark blue bar includes three complete years of data, 2022-2024; light blue bars include average of available data from 2024. Dashed line is the federal limit (NAAQS) for 24-hr PM_{2.5}.

Table 3 includes annual mean PM_{2.5} concentrations between 2022 to 2024 and 2024 design values. The annual PM_{2.5} design value is a three-year average of annual mean PM_{2.5} concentrations used to describe long-term exposure. Annual mean PM_{2.5} concentrations from two of the three PM_{2.5} monitoring sites in this community only have partial data. Annual mean PM_{2.5} concentrations remained below the federal standard from 2022-2024 at the Kennewick-Metaline site (Table 3). There were noticeable impacts from wildfire smoke each year. Excluding days impacted by wildfire smoke reduced annual concentrations from 5-25%.

Table 3. Annual mean PM_{2.5} concentrations and 2024 design values, 2022–2024. Units are in µg/m³. Brackets [] exclude wildfire days when the average PM_{2.5} concentration exceeded 15.0 µg/m³. Annual PM_{2.5} NAAQS is 9.0 µg/m³.

Monitoring Site	2022	2023	2024	2024 Design Value
Kennewick-Metaline	5.55 [4.89]	6.57 [5.25]	4.43 [4.28]	5.5 [4.8]
Burbank-Maple St	DNC	5.62 [5.29]	5.23 [5.06]	*
Finley-S Finley Rd	DNC	DNC	5.94 [5.72]	*

Italics indicate incomplete annual data, DNC = data not collected, NAAQS = national ambient air quality standards, PM = particulate matter, µg/m³ = micrograms per cubic meter, * = incomplete data for 3-year design value.

For PM₁₀, 24-hour concentrations should not exceed 150 µg/m³ more than once per year on average over a three-year period. The O₃ design values are a three-year average of the annual 4th-highest daily maximum 8-hour concentration at a monitor site. From 2022-2024, O₃ concentrations remained below the NAAQS. In 2023, there were three days that exceeded the PM₁₀ standard at the Burbank-Maple St and Kennewick-Metaline monitors (Table 4), due to wildfire smoke and windblown dust. Both monitoring sites’ 2024 design values met the NAAQS levels averaging one day per year.

Table 4. Annual number of exceedances (PM₁₀); 4th highest daily maximum 8-hour average (O₃); and 2024 design values, 2022-2024.

Monitoring Site	Pollutant	2022	2023	2024	2024 Design Value	NAAQS Level	Form
Kennewick-S Steptoe St	O ₃	0.067	0.067	0.064	0.066	0.070 (ppm)	Annual 4 th highest daily maximum 8-hour concentration, averaged over 3 years

Monitoring Site	Pollutant	2022	2023	2024	2024 Design Value	NAAQS Level	Form
Burbank-Maple St	PM ₁₀	0	3	0	1	1 (µg/m ³)	# of annual exceedances >150 µg/m ³ , averaged over 3 years
Kennewick-Metaline	PM ₁₀	0	3	0	1	1 (µg/m ³)	# of annual exceedances >150 µg/m ³ , averaged over 3 years

µg/m³ = micrograms per cubic meter, ppm = parts per million

Health Impacts of Criteria Air Pollution

We estimated the number and rate of deaths and morbidities associated with PM_{2.5} and O₃ concentrations by age range and using health effect estimates from peer-reviewed studies (Appendix B, Table 2 in the 2025 EJ Report). All estimates are rounded to the nearest whole number. We present ranges of deaths or morbidities where multiple studies assessed that health outcome.

PM_{2.5}

We estimated 26 deaths by any cause (29 deaths per 100,000 population, Table B1) related to yearly PM_{2.5} exposure. Among older adults, which is a smaller portion of the population, we estimated 17 total deaths (102 deaths per 100,000 population) each year associated with yearly PM_{2.5} exposure (Table B2).

Among different racial and ethnic groups (Figure 7), we estimated most PM_{2.5} related deaths by any cause per year to be among non-Hispanic White people (15 deaths among 18–84-year-olds). However, when accounting for the ages of people in each racial and ethnic group⁶, the

⁶ Age-adjusted mortality rates represent the mortality rate if the age distribution in that race category matched the age distribution of the total Washington State population. This allows for better comparability given that different race groups can have different age distributions and the risk of death is higher in older age groups. We see higher age-adjusted rates for race categories other than the non-Hispanic White group given that these groups are generally younger in overburdened communities compared to the statewide age distribution; when we standardize these groups to the state age distribution (which has a higher proportion of older people) the estimated mortality rates are higher. More information about our age-adjustment methods can be found in the 2025 EJ Report.

annual age-adjusted mortality rate was highest among Hispanic people (57 deaths per 100,000 population) and non-Hispanic Black people (39 deaths per 100,000 population).

Figure 7 is based on the study by Pope et al. (2019),⁷ where AIAN refers to American Indian and Alaska Native; NH to non-Hispanic; and NHOPI to Native Hawaiian and Other Pacific Islander. The bars indicate the 95% confidence interval (CI) for each rate.

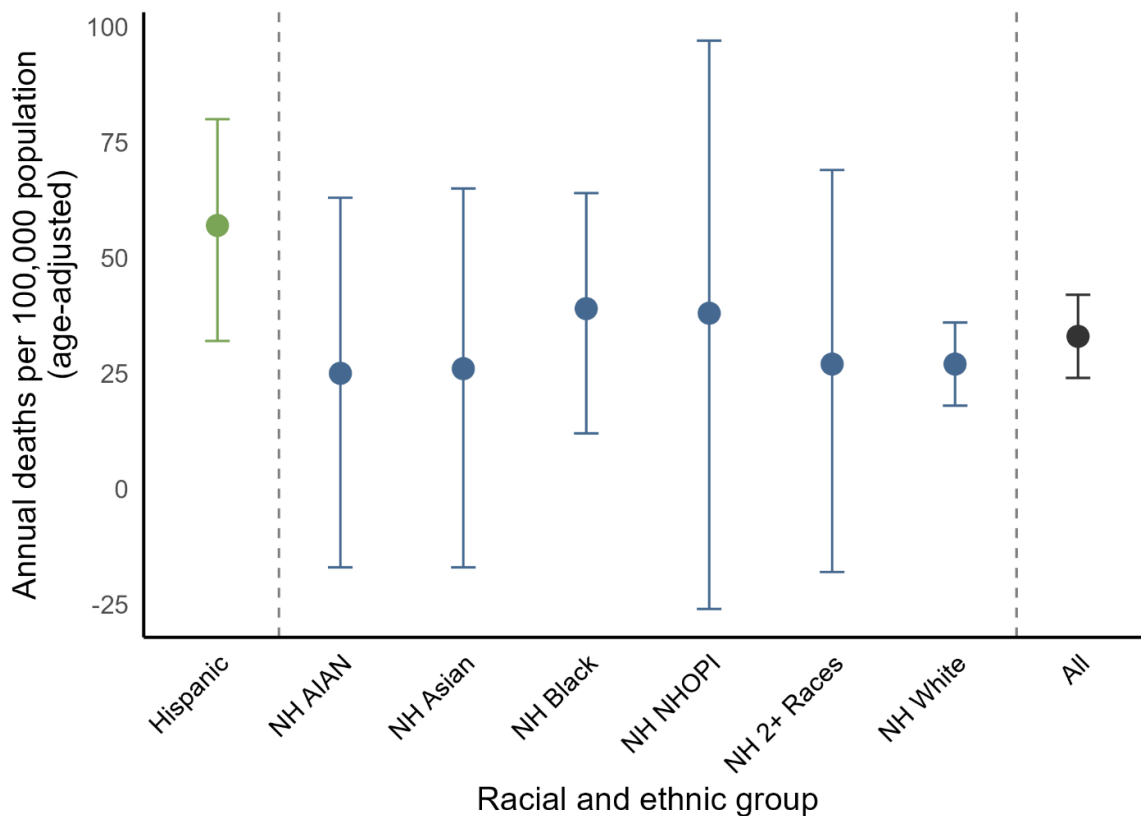


Figure 7. Age-adjusted annual death rates by any cause associated with annual PM_{2.5} exposure among ages 18-84 by race and ethnicity group in Tri-Cities to Wallula.

When assessing specific causes of death related to yearly PM_{2.5} concentrations (Table B3), we estimated 9 deaths due to cardiovascular disease (10 deaths per 100,000 population), 10 to 16

⁷ Pope, C.A., 3rd, Lefler, J.S., Ezzati, M., Higbee, J.D., Marshall, J.D., Kim, S.Y., Bechle, M., Gilliat, K.S., Vernon, S.E., Robinson, A.L., & Burnett, R.T. (2019). Mortality Risk and Fine Particulate Air Pollution in a Large, Representative Cohort of U.S. Adults. *Environmental Health Perspectives*, 127(7), 77007.

deaths due to non-fatal ischemic heart disease (14 to 23 deaths per 100,000 population), and 1 to 2 deaths per year due to lung cancer (2 deaths per 100,000 population) among adults.

Regarding non-fatal health outcomes (Table B3), we estimated that 11 hospital admissions (13 visits per 100,000 population) for acute myocardial infarction were associated with yearly PM_{2.5} concentrations among adults. Additionally, 7 lung cancer diagnoses (10 diagnoses per 100,000 population) per year were associated with annual PM_{2.5} exposure among all people.

Daily PM_{2.5} exposure (Table B4) was associated with 1 death by any cause (<1 per 100,000 population) among all people and 2 deaths by any cause (9 per 100,000 population) among older adults ages 65 to 99. For non-fatal conditions, daily PM_{2.5} was associated with 2 acute non-fatal myocardial infarction admissions (2 to 3 per 100,000 population) among all adults ages 65 to 99, 4 respiratory admissions (21 per 100,000 population) among older adults ages 65 to 99, 4 asthma hospital admissions (3 per 100,000 population) among people ages 0 to 64 years. Additionally, 24 to 45 asthma-related emergency department (ED) visits (19 to 36 per 100,000 population) among all people and 28 asthma-related ED visits (79 per 100,000 population) among youths ages 0 to 17 years were associated with daily PM_{2.5} exposure.

Ozone

We estimated that O₃ exposure during the warm season (Table B5) was associated with 13 seasonal deaths by any cause among older adults ages 65 to 99 (74 deaths per 100,000 population). Daily O₃ exposure was associated with 4 deaths by any cause (3 per 100,000 population), 127 asthma-related ED visits (100 per 100,000 population) among all people, and 49 respiratory hospital admissions (291 per 100,000 population) among older adults ages 65–99.

Greenhouse Gas Emissions

Greenhouse gas emissions data for the Tri-Cities to Wallula overburdened community highly impacted by air pollution include: 1) Emissions from greenhouse gas reporting entities per RCW 70A.65⁸ and WAC 173-441,⁹ -446;¹⁰ and 2) Mobile source emissions.¹¹

We did not collect information or model greenhouse gas emissions from other sources at this time. The greenhouse gas information provided in this report aligns with the Climate

⁸ Greenhouse Gas Emissions – Cap-and-Invest Program <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65>

⁹ Reporting of Emissions of Greenhouse Gases <https://app.leg.wa.gov/WAC/default.aspx?cite=173-441>

¹⁰ Climate Commitment Act – Program Rule <https://app.leg.wa.gov/WAC/default.aspx?cite=173-446>

¹¹ Environmental Justice Review <https://app.leg.wa.gov/RCW/default.aspx?cite=70A.65.020>

Commitment Act's (CCA) requirements. For further information on methods and statewide results, refer to the 2025 EJ Report.

Facilities

Washington State requires certain businesses that emit more than 10,000 metric tons of carbon dioxide equivalents (MT CO₂e) to report to the Washington Greenhouse Gas Reporting Program.¹² Businesses that emit over 25,000 MT CO₂e are also subject to the Cap-and-Invest Program (covered sources). Each reporting facility is required to follow a compliance plan.

In the Tri-Cities to Wallula community, seven facilities (Figure 7; Table 4) within and near the community boundary reported their emissions in 2023, compared to nine in 2022. The total reported emissions from these facilities was 1,104,535 MT CO₂e in 2022 and 697,423 MT CO₂e in 2023, a 36.8% year-to-year decrease. Two facilities reported biogenic carbon (biogenic CO₂)¹³ emissions, which are expected to be partially recaptured as part of the natural carbon cycle. For reporting purposes, biogenic CO₂ is subtracted from total metric tons of CO₂e, even though it has the same atmospheric warming effect as non-biogenic CO₂. Excluding biogenic CO₂, total emissions were 719,301 MT CO₂e in 2022 and 468,799 MT CO₂e in 2023, a 34.8% year-to-year decrease. Since 2020, total reported greenhouse gas emissions from facilities within or near OBCs have decreased by 20.3%, and by 6.3% after subtracting biogenic CO₂ emissions.¹⁴ Some year-to-year fluctuations in emissions from individual facilities are expected.

The Tri-Cities to Wallula encompasses a large amount of agricultural land. Fuels (such as gas, diesel, biodiesel, and propane) used for farming or to transport unprocessed agricultural goods are currently exempt from the CCA. Concentrated animal feeding operations (CAFOs) and dairy farms are not required to report emissions to the greenhouse gas reporting program but can do so on a voluntary basis.

Reeser's Fine Foods voluntarily reported their emissions in 2022, which was their first and only year. Nutrien U.S. in Kennewick and Packaging Corporation of America in Wallula reported significantly less emissions as of 2023 (Table 4), however emissions still vary from year-to-year.

¹² Mandatory greenhouse gas reports <https://ecology.wa.gov/air-climate/reducing-greenhouse-gas-emissions/tracking-greenhouse-gases/mandatory-greenhouse-gas-reports>

¹³ Biogenic carbon refers to greenhouse gases released from the combustion, decomposition, or processing of materials derived from biological sources – such as wood, paper, biomass fuels, agriculture residues, food waste, or biogas. Under the Washington Greenhouse Gas Reporting Program, these emissions are reported separately from fossil-derived emissions because they result from carbon that circulates within the short-term natural carbon cycle rather than long-term carbon stores. Biogenic CO₂ acts the same way in the atmosphere as non-biogenic CO₂. Anthropogenic processes that include these emissions reduce a facility's environmental impact.

¹⁴ Improving Air Quality in Overburdened Communities Highly Impacted by Air Pollution 2023 Report <https://apps.ecology.wa.gov/publications/SummaryPages/2302115.html>

Packaging Corporation of America in Wallula slowed down production at the pulp and paper mill in 2023 to address economic conditions. In 2026, they will permanently close a paper machine and kraft pulping operations at its containerboard mill, but another paper machine and recycled pulping facilities will still operate.¹⁵ The closure will result in reductions of greenhouse gases and criteria air pollutants emitted by the facility.

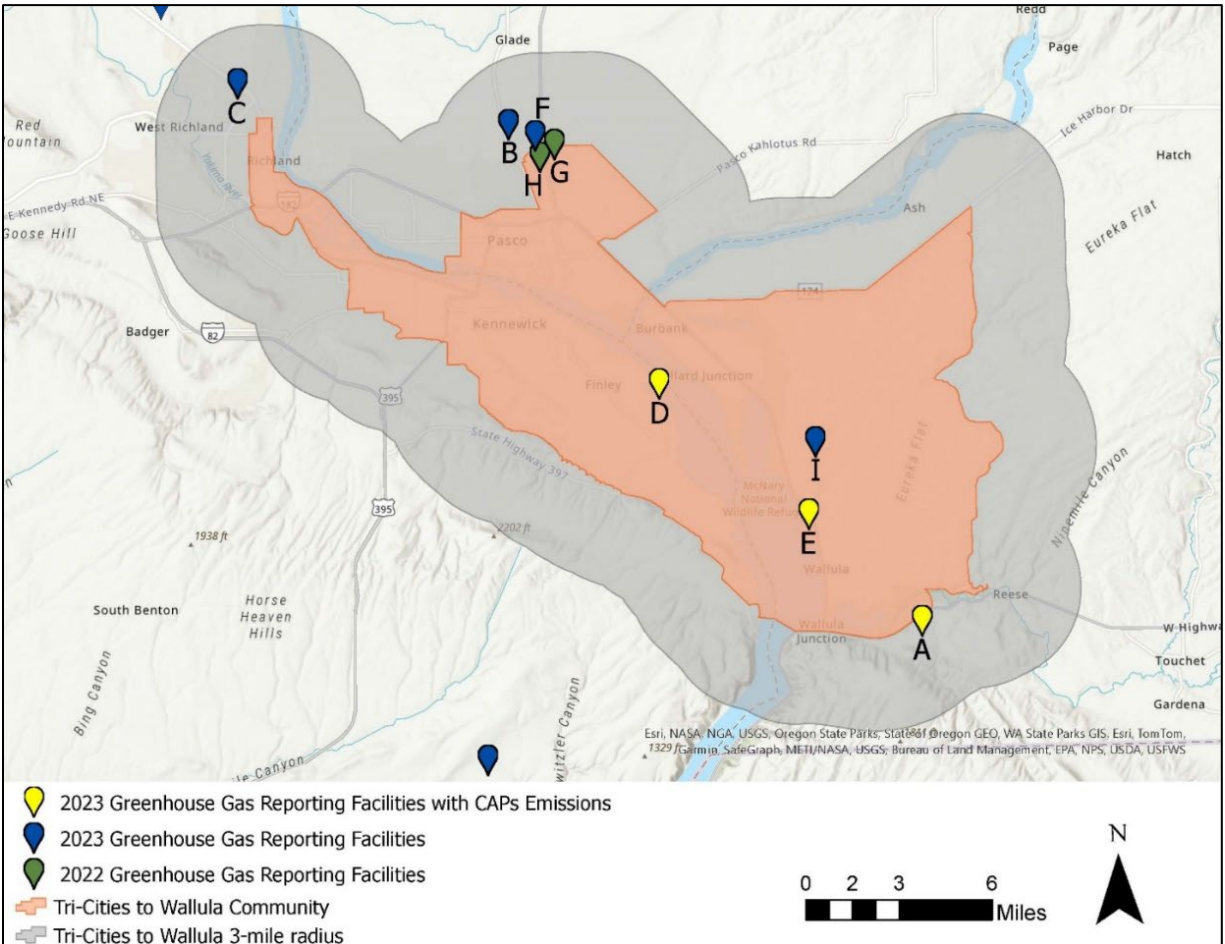


Figure 8. Reporting facilities as of 2023 that are in or near the Tri-Cities to Wallula community boundary. Facility letters correspond with Table 4.

The emissions in Table 4 are in MT CO₂e. Each greenhouse gas uses a conversion factor known as its Global Warming Potential (GWP), in this case AR4 GWP¹⁶, to convert emissions into CO₂e.

¹⁵ Pyzyk, Katie. (2025, Dec 4). *PCA to shut down machines in Washington, affecting 200 jobs. Packing Dive.* <https://www.packingdive.com/news/packaging-corporation-shut-down-machines-wallula-washington-200-layoffs/807013/>

¹⁶ Reporting of Emissions of Greenhouse Gases <https://app.leg.wa.gov/WAC/default.aspx?cite=173-441>

A GWP describes how much heat a greenhouse gas traps in the atmosphere relative to carbon dioxide over a specific time horizon (20, 100, or 500 years). AR4 GWPs are published in the 2007 Intergovernmental Panel on Climate Change (IPCC).¹⁷ The Greenhouse Gas Reporting Program uses AR4 GWPs mainly for regulatory stability, consistency, and alignment with other federal programs.

Table 5. Facility emissions in or nearby¹⁸ the Tri-Cities to Wallula community. Biogenic CO₂ is in brackets [].

	Facility Name/City	Facility Sector	Within Community Boundary	CCA-Covered Facility ¹⁹	Source of CAPs ²⁰	2022 Emissions (MTCO ₂ e)	2023 Emissions (MTCO ₂ e)
A	Gas Transmission Northwest Compressor Station 8 - Wallula	Natural Gas Systems	Nearby	Yes	Yes	127,135 [0]	133,440 [0]
B	Lamb Weston - Pasco	Food Production	Nearby	Yes	No	39,066 [0]	35,750 [0]
C	Lamb Weston - Richland	Food Production	Nearby	Yes	No	92,506 [10,970]	84,081 [9,355]
D	Nutrien US - Kennewick	Chemicals	Yes	Yes	Yes	142,911 [0]	13,400 [0]
E	Packaging Corporation of America - Wallula	Pulp and Paper	Yes	Yes	Yes	586,148 [374,264]	318,762 [219,269]

¹⁷ Intergovernmental Panel on Climate Change <https://www.ipcc.ch/>

¹⁸ “Nearby” refers to facilities within a three-mile radius of the community boundary that were included in this analysis.

¹⁹ Large emitters of greenhouse gases, specifically those emitting 25,000 or more MT CO₂e annually in Washington State that are part of the Cap-and-Invest program established by the Climate Commitment Act.

²⁰ Major sources of criteria air pollutants are designated in the Air Operating Permit program. A major source is any stationary source that has the actual or potential to emit ≥100 tons per year for any air pollutant. Many sources emit far below the threshold. More information can be found at <https://ecology.wa.gov/regulations-permits/permits-certifications/air-quality-permits/air-operating-permit>

	Facility Name/City	Facility Sector	Within Community Boundary	CCA-Covered Facility¹⁹	Source of CAPs²⁰	2022 Emissions (MTCO₂e)	2023 Emissions (MTCO₂e)
F	Pasco Processing - Pasco	Food Production	Yes	No	No	16,718 [0]	11,545 [0]
G	Reser's Fine Foods-Capitol Plant - Pasco	Food Production	Yes	No	No	2,481 [0]	
H	Reser's Fine Foods-Industrial Way Plant - Pasco	Food Production	Yes	No	No	2,974 [0]	
I	Tyson Fresh Meats - Wallula	Food Production	Yes	Yes	No	94,596 [0]	100,445 [0]

Washington has local natural gas distribution companies and utilities that import electricity who report emissions on a statewide basis. These statewide emissions are not disaggregated at the community level.

Cascade Natural Gas Corporation's pipeline distribution system runs through the community. They are excluded from this analysis because they report greenhouse gas emissions on a statewide basis for pipeline leaks, such as methane. Pipeline corporations combust natural gas at compressor stations throughout the state, which allow natural gas to flow through community to community. This facility is a CCA-covered entity, but not a major source of CAP emissions. Statewide emissions were 25,017 MT CO₂e in 2022 and 27,198 MT CO₂e in 2023.

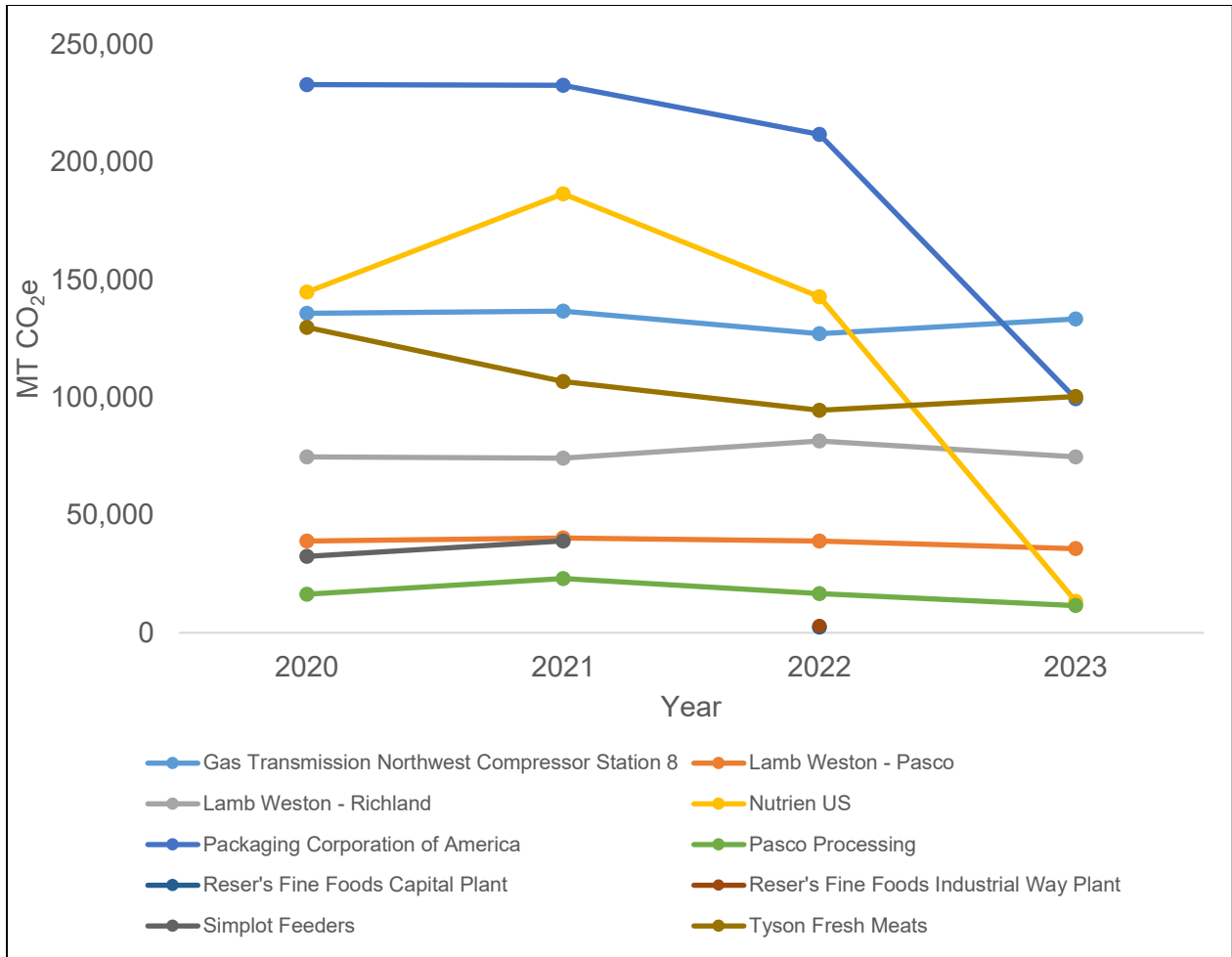


Figure 9. Greenhouse gas reporting facilities and their emissions from 2020-2023, excluding biogenic CO₂.

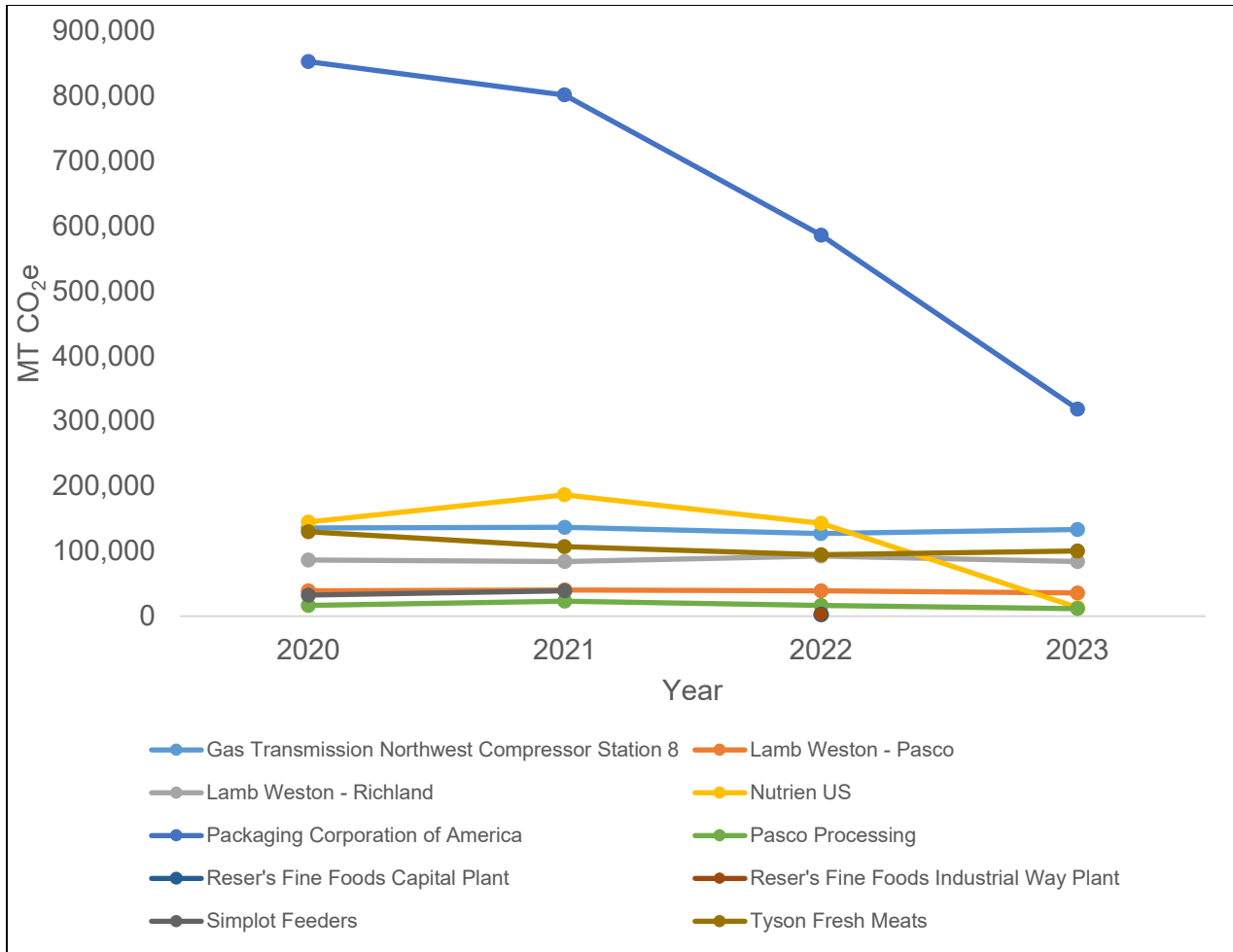


Figure 10. Greenhouse gas reporting facilities and their emissions from 2020-2023, including biogenic CO₂.

Mobile sources

In the Tri-Cities to Wallula community, greenhouse gas emissions from mobile sources increased by 21% from 2020 to 2021 (Table 5), but have decreased by 5.4% between 2019 to 2021.²¹ Mobile sources consist of on-road and non-road emissions. The drop in emissions in

²¹ Improving Air Quality in Overburdened Communities Highly Impacted by Air Pollution 2023 Report <https://apps.ecology.wa.gov/publications/SummaryPages/2302115.html>

2020 was largely due to a decrease in vehicle traffic that was attributed to the COVID-19 pandemic.^{22,23}

Similar to Table 4, the results in Table 5 use AR5 GWPs to convert greenhouse gas emissions into CO₂e. In 2013-2014, the IPCC published AR5 GWPs and AR6 GWPs in 2021-2022. The Washington Greenhouse Gas Emissions Inventory²⁴ uses AR5 GWPs in mobile source emission estimates, as the inventory models for greenhouse gas accounting are revised as science improves.

Table 6. Greenhouse gas emissions from mobile sources per capita from 2020-2021.

Population	2020 Emissions (MT CO₂e)	2020 Per Capita MT CO₂e	2021 Emissions (MT CO₂e)	2021 Per Capita MT CO₂e
112,708	535,744	4.7	648,092	5.7

²² Washington State Greenhouse Gas Emissions Inventory: 1990-2021. Jan 2025

<https://apps.ecology.wa.gov/publications/SummaryPages/2414077.html>

²³ Reducing Greenhouse Gas Emissions from the Transportation Sector through Climate Planning. Dec 2024

<https://www.epa.gov/system/files/documents/2024-12/420f24042.pdf>

²⁴ Washington State Greenhouse Gas Emissions Inventory: 1990-2021, Jan 2025

<https://apps.ecology.wa.gov/publications/SummaryPages/2414077.html>

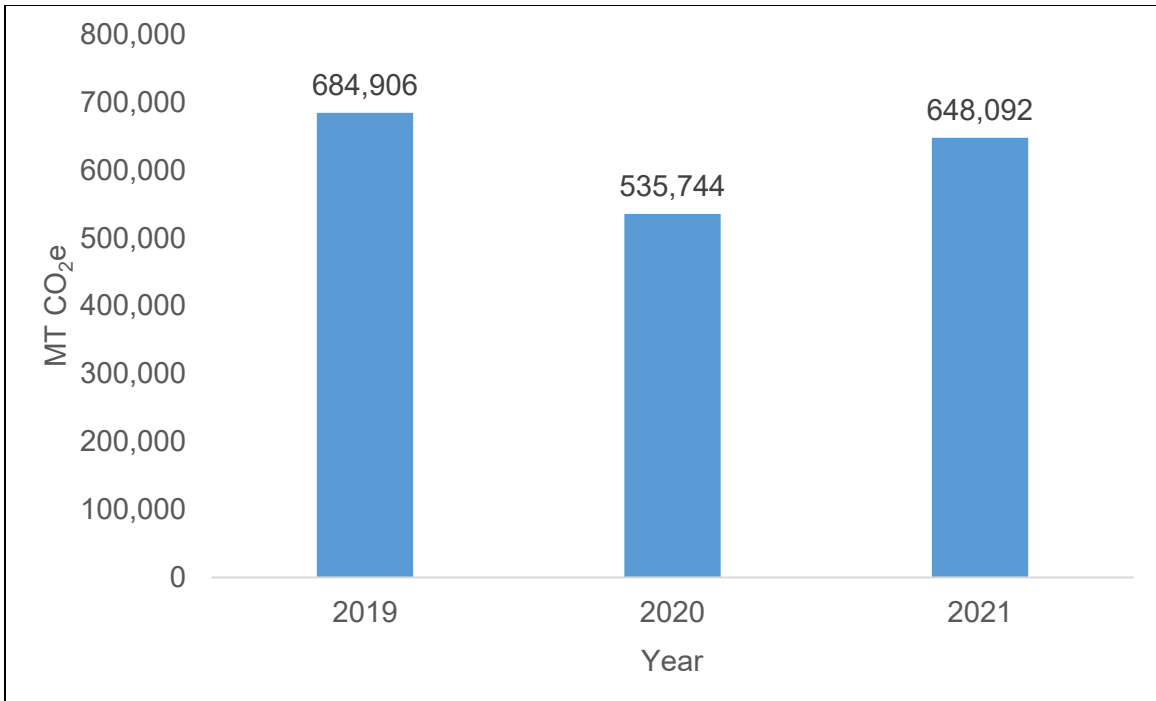


Figure 11. Annual greenhouse gas emissions from mobile sources in the Tri-Cities to Wallula community, 2019-2021.

Community Resources

These resources provide more information about air quality and health in the Tri-Cities to Wallula community:

- [Benton and Franklin Counties 2023-2025 CHA/CHIP 'At A Glance'](#)²⁵
- [Benton and Franklin Counties 2022 Community Health Needs Assessment](#)²⁶
- [Benton and Franklin Counties 2023-2025 Community Health Improvement Plan](#)²⁷
- [Benton-Franklin Health District Data and Reports](#)²⁸

²⁵ https://cdns5-hosted.civiclive.com/UserFiles/Servers/Server_10765972/File/2022%20CHNA%20DATA%20AT%20A%20GLAN%20CE%20updated.pdf

²⁶ https://cdns5-hosted.civiclive.com/UserFiles/Servers/Server_10765972/File/2022%20CHNA%20Full%20Document%2011-2-2022.pdf

²⁷ https://cdns5-hosted.civiclive.com/UserFiles/Servers/Server_10765972/File/2023%20CHIP.pdf

²⁸ https://www.bfhd.wa.gov/data_reports

- [Benton-Franklin Health District Community Health Assessment and Improvement Plan information page](#)²⁹
- [Walla Walla County Community Health Improvement information](#)³⁰
- [Walla Walla County 2019-2023 Community Health Improvement Plan](#)³¹
- [Walla Walla County Department of Community Health 2023 Community Health Needs Assessment](#)³²
- [Providence St. Mary Hospital 2024 Community Health Needs Assessment \(Walla Walla County\)](#)³³
- [Benton-Franklin Trends - Health indicators](#)³⁴
- [Walla Walla Trends - Health indicators](#)³⁵
- [Zero-emission and electric vehicles mapping tool | WSDOT](#)³⁶
- [Home | Washington Climate Action](#)³⁷

²⁹ https://www.bfhd.wa.gov/data_reports/community_health_assessment_improvement_plan

³⁰ https://www.wvcowa.gov/bmrchp/chna_and_chip.php

³¹ [https://cms7files.revize.com/wallawallacounty/document_center/Health/Assessment/CHIP%20Process%20Draft%20Document%20updated%20\(002\).pdf](https://cms7files.revize.com/wallawallacounty/document_center/Health/Assessment/CHIP%20Process%20Draft%20Document%20updated%20(002).pdf)

³² https://cms7files.revize.com/wallawallacounty/WWCDCH%20CHNA%20Final%20Digital%20Version_8-30-23.pdf

³³ <https://www.providence.org/-/media/project/psjh/providence/social/files/about/community-benefit/reports/2024-chna-providence-stmary-medical-center.pdf?rev=bd55993e33d6442ab47cfed97f2dcc62&hash=7B9C9FF2FDAA7C8853B1063064AFB0BA>

³⁴ <https://bentonfranklintrends.org/category.cfm?id=6>

³⁵ <https://wallawallatrends.org/category.cfm?id=4>

³⁶ <https://wsdot.wa.gov/business-wsdot/grants/zero-emission-vehicle-grants/zero-emission-and-electric-vehicles-mapping-tool>

³⁷ <https://climate.wa.gov/>

Appendix A. Criteria Air Pollution

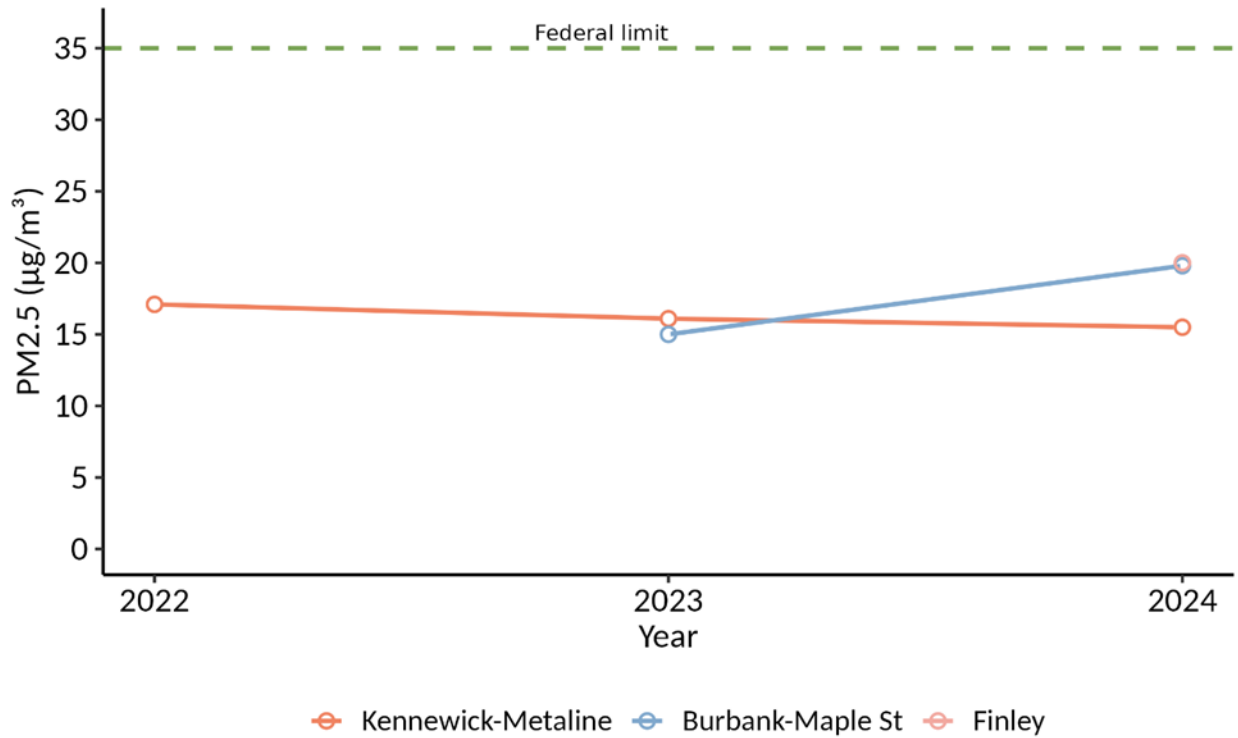


Figure A1. 24-hour PM_{2.5} (98th percentile) concentrations at Tri-Cities to Wallula monitoring sites. Days impacted by wildfire smoke are included. Dashed line is the federal limit (NAAQS) for 24-hr PM_{2.5} (35 µg/m³).

Appendix B. Supplemental Health Impacts Tables

Table B1. Estimated annual deaths by any cause related to yearly PM_{2.5} exposure among 18–84-year-olds in Tri-Cities to Wallula by racial and ethnic group, 2022–2023 (based on effect estimates in study by Pope, et al., 2019⁷).

Racial and Ethnic Group	Population (18-84-year-olds)	Estimated Annual Deaths [95% CI]	Estimated annual deaths per 100,000 population [95% CI]	Estimated age-adjusted annual deaths per 100,000 population [95% CI]
All	89,433	26 [19 to 33]	29 [21 to 37]	33 [24 to 42]
Hispanic	37,695	12 [7 to 17]	31 [18 to 44]	57 [32 to 80]
Non-Hispanic AIAN	609	<1 [range <1]	23 [-15 to 58]	25 [-17 to 63]
Non-Hispanic Asian	1,893	0 [0 to 1]	21 [-14 to 54]	26 [-17 to 65]
Non-Hispanic Black	1,581	0 [0 to 1]	31 [10 to 51]	39 [12 to 64]
Non-Hispanic NHOPI	312	<1 [range <1]	23 [-16 to 59]	38 [-26 to 97]
Non-Hispanic 2+ races	3,110	1 [0 to 2]	20 [-14 to 52]	27 [-18 to 69]
Non-Hispanic White	44,233	15 [9 to 19]	33 [21 to 44]	27 [18 to 36]

AIAN: American Indian and Alaska Native; CI: confidence interval; NHOPI: Native Hawaiian and Other Pacific Islander

Race categories only include people who identify as non-Hispanic to reflect the race categories used in the study by Pope, et al.

Population is the average of the 2022 and 2023 Washington State Office of Financial Management estimates for the census tracts that comprise this overburdened community

The age-adjusted rate indicates the expected rate if the age distribution in this overburdened community matched that of Washington State

Table B2. Estimated annual deaths by any cause related to yearly PM_{2.5} exposure among 65–99-year-olds in Tri-Cities to Wallula by racial and ethnic group, 2022–2023 (based on effect estimates in study by Di, et al., 2017³⁸).

Racial and Ethnic Group	Population (65-99-year-olds)	Estimated Annual Deaths [95% CI]	Estimated annual deaths per 100,000 population [95% CI]	Estimated age-adjusted annual deaths per 100,000 population [95% CI]
All	16,978	17 [17 to 18]	102 [99 to 104]	98 [96 to 101]
Hispanic	2,577	3 [3 to 4]	122 [105 to 138]	133 [115 to 150]
AIAN	256	<1 [range <1]	94 [57 to 128]	96 [59 to 131]
Asian	375	<1 [range <1]	89 [70 to 107]	87 [69 to 105]
Black	301	<1 [0 to 1]	161 [155 to 167]	164 [158 to 170]
NHOPI	44	<1 [range <1]	79 [48 to 108]	115 [71 to 158]
2+ races	1,101	1 [1 to 1]	80 [49 to 109]	89 [55 to 123]
White	14,901	9 [9 to 9]	61 [58 to 63]	59 [56 to 61]

AIAN: American Indian and Alaska Native; CI: confidence interval; NHOPI: Native Hawaiian and Other Pacific Islander

Race categories include people who identify as Hispanic and non-Hispanic to reflect the race categories used in the study by Di, et al.

Population is the average of the 2022 and 2023 Washington State Office of Financial Management estimates for the census tracts that comprise this overburdened community.

The age-adjusted rate indicates the expected rate if the age distribution in this overburdened community matched that of Washington State.

³⁸ Di, Q., Wang Y., Zanobetti, A., Wang, Y., Koutrakis, P., Choirat, C., Dominici, F., Schwartz, J.D. 2017. Air Pollution and Mortality in the Medicare Population. *The New England Journal of Medicine*, 376(26), pp. 2513-2522.

Table B3. Annual mortality and morbidity associated with yearly PM_{2.5} exposure (yearly 24-hour average concentrations) in Tri-Cities to Wallula, 2022-2023. Brackets [] include 95% confidence interval.

Health Outcome	Age Group	Source of Risk Estimate	Population	Estimated Annual Number [95% CI]	Estimated annual rate per 100,000 population [95% CI]
Deaths – Any cause	65 to 99	Di et al., 2017 ³⁹	16,978	17 [17 to 18]	102 [99 to 104]
Deaths – Any cause	18 to 84	Pope et al., 2019 ⁴⁰	89,433	26 [19 to 33]	29 [21 to 37]
Deaths – Cardiovascular disease	18 to 99	Alexeeff et al., 2023 ⁴¹	91,380	9 [3 to 14]	10 [4 to 15]
Deaths – Ischemic heart disease	30 to 99	Jerrett et al., 2017 ⁴²	68,849	10 [8 to 13]	15 [11 to 18]
Deaths – Ischemic heart disease	30 to 99	Krewski et al., 2009 ⁴³	68,849	16 [13 to 18]	23 [18 to 27]
Deaths – Ischemic heart disease	30 to 99	Pope et al., 2019 ⁴⁴	68,849	10 [7 to 12]	14 [10 to 18]

³⁹ Di, Q., Wang Y., Zanobetti, A., Wang, Y., Koutrakis, P., Choirat, C., Dominici, F., Schwartz, J.D. 2017. Air Pollution and Mortality in the Medicare Population. *The New England Journal of Medicine*, 376(26), pp. 2513-2522.

⁴⁰ Pope, C.A., 3rd, Lefler, J.S., Ezzati, M., Higbee, J.D., Marshall, J.D., Kim, S.Y., Bechle, M., Gilliat, K.S., Vernon, S.E., Robinson, A.L., & Burnett, R.T. (2019). Mortality Risk and Fine Particulate Air Pollution in a Large, Representative Cohort of U.S. Adults. *Environmental Health Perspectives*, 127(7), 77007.

⁴¹ Alexeeff SED, K. Van Den Eeden, S. Schwartz, J. Liao, N. S. Sidney, S. Association of Long-term Exposure to Particulate Air Pollution with Cardiovascular Events in California. *JAMA Network Open*. 2023;6(2):e230561.

⁴² Jerrett, 2017. Comparing the Health Effects of Ambient Particulate Matter Estimated Using Ground-Based Versus Remote Sensing Exposure Estimates. *Environmental Health Perspectives*. 2017 Apr;125(4):552-559. doi: 10.1289/EHP575. Epub 2016 Sep 9.

⁴³ Krewski D, Jerrett M, Burnett R, et al. 2009. Extended Follow-Up and Spatial analysis of the American Cancer Society Linking Particulate Air Pollution and Mortality. Health Effects Institute, Cambridge MA

⁴⁴ Pope, C.A., 3rd, Lefler, J.S., Ezzati, M., Higbee, J.D., Marshall, J.D., Kim, S.Y., Bechle, M., Gilliat, K.S., Vernon, S.E., Robinson, A.L., & Burnett, R.T. (2019). Mortality Risk and Fine Particulate Air Pollution in a Large, Representative Cohort of U.S. Adults. *Environmental Health Perspectives*, 127(7), 77007.

Health Outcome	Age Group	Source of Risk Estimate	Population	Estimated Annual Number [95% CI]	Estimated annual rate per 100,000 population [95% CI]
Deaths – Lung Cancer	30 to 99	Krewski, et al., 2009 ⁴⁵	68,849	2 [1 to 3]	2 [1 to 4]
Deaths – Lung Cancer	30 to 99	Turner et al., 2016 ⁴⁶	68,849	1 [0 to 2]	2 [0 to 3]
Hospital Admissions – Acute Non-Fatal Myocardial Infarction	18 to 99	Alexeeff, et al., 2023 ⁴⁷	91,380	11 [6 to 16]	12 [7 to 18]
Lung Cancer Diagnoses	30 to 99	Gharibvand et al., 2016 ⁴⁸	68,849	7 [2 to 11]	10 [3 to 16]

CI: confidence interval. CIs are inversely proportional to population sizes reflecting higher uncertainty when estimating effects with smaller numbers of people. CIs that include 0 indicate that it is plausible that no deaths are associated with PM2.5 in this group in this community. Population is the average of the 2022 and 2023 Washington State Office of Financial Management estimates for the census tracts that comprise this overburdened community. The age-adjusted rate indicates the expected rate if the age distribution in this overburdened community matched that of Washington State. Health outcomes were selected based on the availability of effect estimates for that outcome relevant to the Washington population in the scientific literature. Where multiple effect estimates exist, we listed the model results separately for each. See the 2025 EJ Report for more information.

⁴⁵ Krewski D, Jerrett M, Burnett R, et al. 2009. Extended Follow-Up and Spatial analysis of the American Cancer Society Linking Particulate Air Pollution and Mortality. Health Effects Institute, Cambridge MA

⁴⁶ Turner, M.C., Jerrett, M., Pope, C.A., III, Krewski, D., Gapstur, S.M., Diver, W.R., Beckerman, B.S., Marshall, J.D., Su, J., Crouse, D.L., & Burnett, R.T. (2016). Long-term ozone exposure and mortality in a large prospective study. *American Journal of Respiratory Critical Care Medicine* 193(10): 1134-1142.

⁴⁷ Alexeeff SED, K. Van Den Eeden, S. Schwartz, J. Liao, N. S. Sidney, S. Association of Long-term Exposure to Particulate Air Pollution with Cardiovascular Events in California. *JAMA Network Open*. 2023;6(2):e230561.

⁴⁸ Gharibvand, L., Shavlik, D., Ghamsary, M., Beeson, W.L., Soret, S., Knutsen, R., & Knutsen, S.F. (2016). The association between ambient fine particulate air pollution and lung cancer incidence: results from the AHSMOG-2 study. *Environmental Health Perspectives* 125 (3): 378-384

Table B4. Annual mortality and morbidity associated with daily PM_{2.5} exposure (daily 24-hour average concentrations) in Tri-Cities to Wallula, 2022-2023. Brackets [] include 95% confidence interval.

Health Outcome	Age Group	Source of Risk Estimate	Population	Estimated Annual Number [95% CI]	Estimated annual rate per 100,000 population [95% CI]
Deaths – Any cause	0 to 99	Ito et al., 2013 ⁴⁹	127,364	1 [0 to 1]	<1 [0 to 1]
Deaths – Any cause	65 to 99	Zanobetti et al., 2014 ⁵⁰	16,978	2 [1 to 2]	9 [6 to 12]
Deaths – Cardiovascular disease	0 to 99	Liu et al., 2022 ⁵¹	127,364	1 [0 to 2]	1 [0 to 1]
Deaths – Respiratory	0 to 99	Liu et al., 2022 ⁵²	127,364	1 [0 to 3]	1 [0 to 2]
Hospital Admissions – Acute Non-Fatal Myocardial Infarction	18 to 99	Sullivan et al., 2005 ⁵³	91,380	2 [-3 to 6]	2 [-3 to 7]

⁴⁹ Ito, K., Ross, Z., Zhou, J., Nádas, A., Lippmann, M. and Thurston, G.D., 2013. NPACT Study 3. Time-series analysis of mortality, hospitalizations, and ambient PM_{2.5} and its components. National Particle Component Toxicity (NPACT) Initiative. <https://www.healtheffects.org/publication/national-particle-component-toxicity-npact-initiative-integrated-epidemiologic-and>

⁵⁰ Zanobetti, A., Dominici, F., Wang, Y. and Schwartz, J.D., 2014. A national case-crossover analysis of the short-term effect of PM_{2.5} on hospitalizations and mortality in subjects with diabetes and neurological disorders. *Environmental Health*, 13(1), p.38.

⁵¹ Liu, R.A., Wei, Y., Qiu, X., Kosheleva, A. and Schwartz, J.D., 2022. Short term exposure to air pollution and mortality in the US: a double negative control analysis. *Environmental Health*, 21(1), p.81.

⁵² Liu, R.A., Wei, Y., Qiu, X., Kosheleva, A. and Schwartz, J.D., 2022. Short term exposure to air pollution and mortality in the US: a double negative control analysis. *Environmental Health*, 21(1), p.81.

⁵³ Sullivan, J., L. Sheppard, A. Schreuder, N. Ishikawa, D. Siscovick and J. Kaufman. 2005. Relation between short-term fine-particulate matter exposure and onset of myocardial infarction. *Epidemiology*. Vol. 16 (1): 41-8.

Health Outcome	Age Group	Source of Risk Estimate	Population	Estimated Annual Number [95% CI]	Estimated annual rate per 100,000 population [95% CI]
Hospital Admissions – Acute Non-Fatal Myocardial Infarction	18 to 99	Zanobetti et al., 2009 ⁵⁴	91,380	2 [1 to 3]	3 [1 to 4]
Hospital Admissions – All Respiratory	65 to 99	Zanobetti et al., 2009 ⁵⁵	16,978	11 [6 to 15]	62 [35 to 88]
Hospital Admissions – Asthma	0 to 64	Sheppard et al., 2003 ⁵⁶	110,386	4 [1 to 6]	3 [1 to 5]
ED Visits – Asthma	0 to 99	Mar et al., 2010 ⁵⁷	127,364	45 [11 to 77]	36 [9 to 61]
ED Visits – Asthma	0 to 99	Slaughter, J. C., et al., 2005 ⁵⁸	127,364	24 [-21 to 66]	19 [-16 to 52]

⁵⁴ Zanobetti, A., Franklin, M., Koutrakis, P. and Schwartz, J., 2009. Fine particulate air pollution and its components in association with cause-specific emergency admissions. *Environmental Health*, 8(1), p.58.

⁵⁵ Zanobetti, A., Franklin, M., Koutrakis, P. and Schwartz, J., 2009. Fine particulate air pollution and its components in association with cause-specific emergency admissions. *Environmental Health*, 8(1), p.58.

⁵⁶ Sheppard, L. Ambient Air Pollution and Nonelderly Asthma Hospital Admissions in Seattle, Washington, 1987-1994. In: Revised Analyses of Time-Series Studies of Air Pollution and Health. 2003, Health Effects Institute: Boston, MA. p. 227-230.

⁵⁷ Mar, T. F., J. Q. Koenig and J. Primomo. 2010. Associations between asthma emergency visits and particulate matter sources, including diesel emissions from stationary generators in Tacoma, Washington. *Inhalation Toxicology*. Vol. 22 (6): 445-8.

⁵⁸ Slaughter, J. C., E. Kim, L. Sheppard, J. H. Sullivan, T. V. Larson and C. Claiborn. 2005. Association between particulate matter and emergency room visits, hospital admissions and mortality in Spokane, Washington. *Journal of Exposure Analysis and Environmental Epidemiology*. Vol. 15

Health Outcome	Age Group	Source of Risk Estimate	Population	Estimated Annual Number [95% CI]	Estimated annual rate per 100,000 population [95% CI]
ED Visits – Asthma	0 to 17	Norris, G., et al., 1999 ⁵⁹	35,984	28 [14 to 41]	79 [40 to 114]

ED: emergency department; CI: confidence interval. CIs are inversely proportional to population sizes reflecting higher uncertainty when estimating effects with smaller numbers of people. CIs that include 0 indicate that it is plausible that no deaths are associated with PM2.5 in this group in this community.

Population is the average of the 2022 and 2023 Washington State Office of Financial Management estimates for the census tracts that comprise this overburdened community. The age-adjusted rate indicates the expected rate if the age distribution in this overburdened community matched that of Washington State.

Health outcomes were selected based on the availability of effect estimates for that outcome relevant to the Washington population in the scientific literature. Where multiple effect estimates exist, we listed the model results separately for each. See the 2025 EJ Report for more information.

Table B5. Annual mortality and morbidity associated with seasonal and daily O₃ exposure (seasonal and daily 8-hour maximum concentrations) in Tri-Cities to Wallula, 2022-2023. Brackets [] include 95% confidence interval.

Health Outcome	Age Group	Source of Risk Estimate	Population	Estimated Annual Number [95% CI]	Estimated annual rate per 100,000 population [95% CI]
Deaths – Any cause (Seasonal)	65 to 99	Di, et al. 2017 ⁶⁰	16,978	13 [9 to 16]	74 [51 to 96]

⁵⁹ Norris, G., et al. An association between fine particles and asthma emergency department visits for children in Seattle. *Environmental Health Perspectives*, 1999. 107(6): p. 489-93.

⁶⁰ Di, Q., Wang Y., Zanobetti, A., Wang, Y., Koutrakis, P., Choirat, C., Dominici, F., Schwartz, J.D. 2017. Air Pollution and Mortality in the Medicare Population. *The New England Journal of Medicine*, 376(26), pp. 2513-2522.

Health Outcome	Age Group	Source of Risk Estimate	Population	Estimated Annual Number [95% CI]	Estimated annual rate per 100,000 population [95% CI]
Deaths – Any cause (Daily)	0 to 99	Zanobetti and Schwartz, 2008 ⁶¹	127,364	4 [2 to 5]	3 [2 to 4]
ED Visits – Asthma (Daily)	0 to 99	Mar and Koenig, 2009 ⁶²	127,364	127 [32 to 207]	100 [25 to 163]
Hospital Admissions – All Respiratory (Daily)	65 to 99	Schwartz, 1995 ⁶³	16,978	49 [14 to 81]	291 [85 to 476]

ED: emergency department; CI: confidence interval. CIs are inversely proportional to population sizes reflecting higher uncertainty when estimating effects with smaller numbers of people. CIs that include 0 indicate that it is plausible that no deaths are associated with O3 in this group in this community.

Population is the average of the 2022 and 2023 Washington State Office of Financial Management estimates for the census tracts that comprise this overburdened community. Age-adjusted rate indicates the expected rate if the age distribution in this overburdened community matched that of Washington State.

Health outcomes were selected based on the availability of effect estimates for that outcome relevant to the Washington population in the scientific literature. Where multiple effect estimates exist, we listed the model results separately for each. See the 2025 EJ Report for more information.

⁶¹ Zanobetti, A. and Schwartz, J., 2008. Mortality displacement in the association of ozone with mortality: an analysis of 48 cities in the United States. *American Journal of Respiratory and Critical Care Medicine*, 177(2), pp.184-189.

⁶² Mar, T.F. and Koenig, J.Q. (2009). Relationship between visits to emergency departments for asthma and ozone exposure in greater Seattle, Washington. *Annals of Allergy, Asthma & Immunology*, 103, 474-479.

⁶³ Schwartz, J., 1995. Short term fluctuations in air pollution and hospital admissions of the elderly for respiratory disease. *Thorax*, 50(5), pp.531-538.