



UNFILTERED DIESEL VEHICLES

Who Is Causing Portland's Diesel Particulate Problem?

4/9/2024

In December 2023, Cascadia Action obtained records of all diesel vehicles in Oregon from Oregon Department of Transportation (ODOT) and Oregon Driver & Motor Vehicle Services (DMV). This report is the only publicly available analysis of this data.

The State of California reports that diesel particulate is "responsible for about 70% of California's estimated known cancer risk attributable to toxic air contaminants." DEQ reported in 2015 that diesel exhaust causes lung and bladder cancer, certain heart attacks and other blood clotting diseases, coronary artery disease, malignant childhood brain tumors, decreased cognitive functioning, increased incidence of Lou Gehrig's disease, acute bronchitis, and asthma. A study by Bishop et al. found diesel particulate causes dementia and Alzheimer's disease.

Multnomah ranks among the worst 1% of counties nationwide for diesel particulate exposure according to 2019 EPA AirToxScreen released December 2022. By 2023, virtually every diesel vehicle in California had a filter that removed 90% of particulate before it went airborne. About 35% of industrial diesel trucks in Portland are currently unfiltered but cause ten times as much dangerous airborne particulate as filtered trucks. The 2019 Oregon Diesel Bill HB2007 allows Oregon diesel vehicles to continue to drive unfiltered until 2029 and beyond.



Unfiltered commercial short-haul diesel trucks

The EPA 2019 AirToxScreen calculated that 52% of diesel particulate in Multnomah County is caused by industrial AKA “heavy duty” diesel trucks. EPA reported in 2013 that the vast majority of this industrial diesel particulate is caused by commercial short-haul trucks making in-city deliveries.

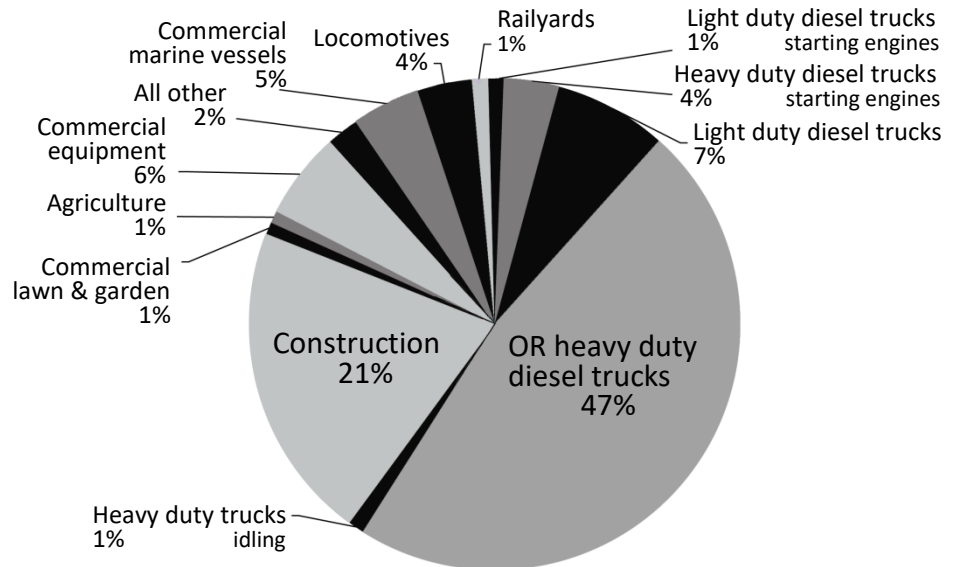
Oregon diesel vehicle records

Cascadia Action information requests to ODOT and DMV resulted 414,148 records with unique vehicle identification numbers being sent to us in December 2023. These included all on-road diesel vehicles registered in Oregon. These spreadsheets update similar datasets we received from these agencies in 2017, 2018, and 2020. ODOT records include all commercial diesel on-road vehicles registered in Oregon that weighs over 26,000 pounds. DMV diesel records include all government and personal diesel vehicles and commercial trucks weighing less than 26,000 pounds. For personal vehicles, owner names addresses were redacted. No Oregon agency collects records for off-road vehicles such as excavators, bulldozers, backhoes, road graders, and portable generators.

Our analysis of these records considers vehicles from 2007 and earlier to be unfiltered. Retrofits allow diesel filters to be installed on older engines, but are rare. Grants, tax credits, and incentives for retrofits have mitigated only a small number of Oregon vehicles. DEQ sent us their retrofit program data: DEQ and Metro retrofitted, repowered, or replaced only 755 diesel vehicles in Oregon between 2002 and 2015 at the relatively high cost of \$28.5 million.

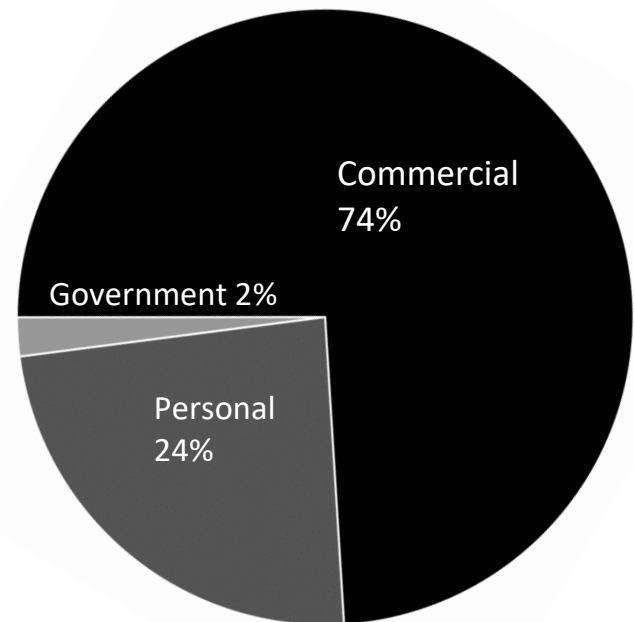
Diesel particulate sources for Multnomah County

2019 EPA AirToxScreen released December 2022



The graph above by Portland Clean Air used EPA data available here: www.epa.gov/AirToxScreen/2019-airtoxscreen-assessment-results#state. From the dropdown menu, download the Oregon file. Multnomah ambient concentrations for diesel particulate were copied from Access and graphed in Excel. Sources less than 1% were omitted.

Portland-area sources of on-road diesel emissions



The graph above by Portland Clean Air used 2017 and 2018 ODOT and DMV on-road diesel vehicle data online at: portlandcleanair.org/files/pcadata.html

Largest on-road unfiltered diesel vehicle fleets licensed in Oregon

Truck fleet owner	Unfiltered diesel vehicles	Truck fleet owner	Unfiltered diesel vehicles
1. ODOT	847	11. CalPortland	206
2. Trimet	788	12. Beaverton School District	194
3. USF Reddaway	774	13. Oregon Dept of Forestry	186
4. BNSF Railway	460	14. Haney Truck Line	182
5. Shred It	382	15. City of Portland	174
6. Wilson Construction	290	16. Oak Harbor Freight Line	169
7. Simplot Grower Solutions	270	17. Sierra Mountain Express	164
8. Knife River	263	18. BakerCorp	158
9. Cascade Drilling	256	19. Pacific Power	157
10. Roofline	206	20. N Clackamas School District #12	145

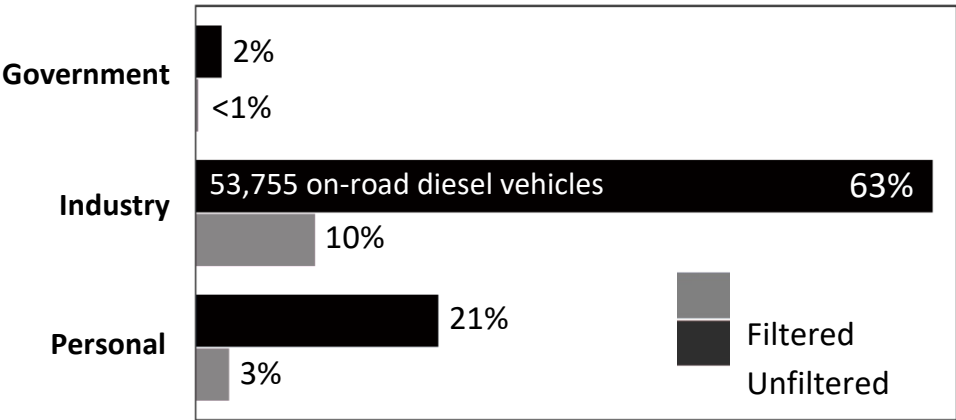
For a complete ranking of Portland-area unfiltered truck fleets go to: portlandcleanair.org/dieseltrucks

Industrial diesel fleets contribute approximately 73% of Portland on-road diesel particulate

According to DEQ, only 6% of Oregon’s on-road vehicles are diesel fueled, yet they emit 60 - 70% of all on-road particulate emissions. While all 1975 and newer diesel powered passenger cars and most light-duty trucks must pass a DEQ emissions test every two years, heavy-duty diesel vehicles are exempted.

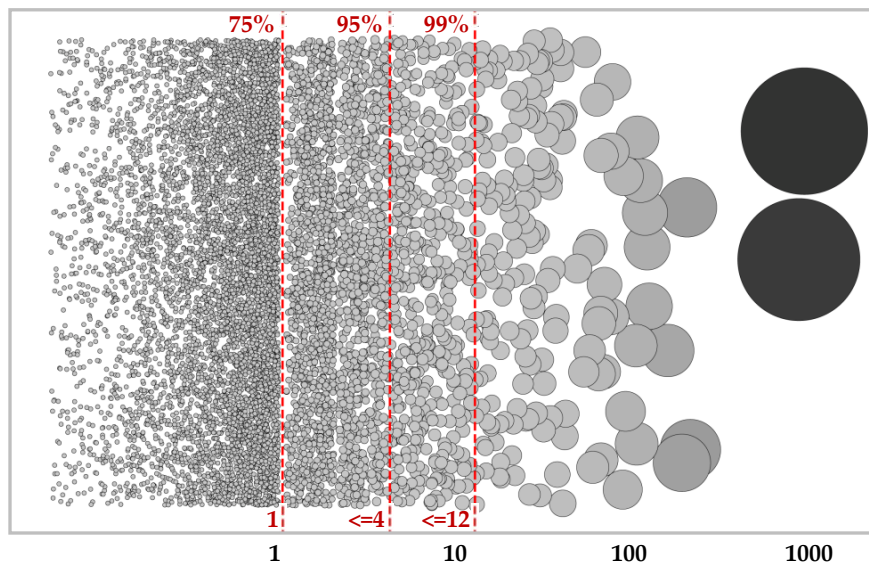
The graph below shows that because unfiltered diesel vehicles emit ten times as much particulate compared with filtered diesel, they cause most of the air pollution problem. Trimet uses "R99" renewable diesel made from vegetable oil, which emits half as much diesel particulate as petroleum diesel. Net carbon dioxide emissions for R99 are typically 70% lower than petroleum diesel.

Portland on-road diesel air pollution: mostly from industry trucks



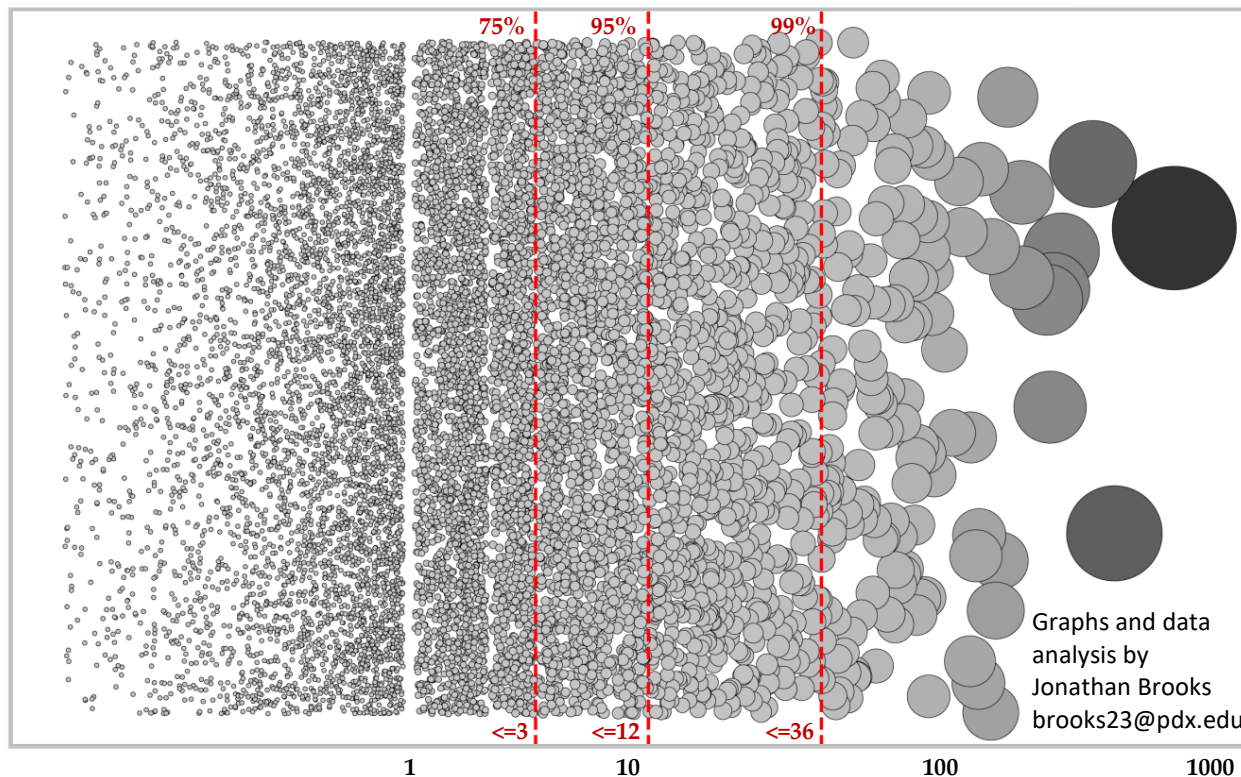
All government and industry unfiltered diesel fleets in Oregon

Dec. 2023 DMV data: All government trucks, industry trucks under 26,000 pounds



These two graphs use circles to depict all unfiltered diesel fleets in Oregon. We scaled these circles in proportion to the number of unfiltered vehicles in each fleet. These include 19,196 unfiltered diesel fleets from DMV data and 15,151 unfiltered diesel fleets reported by ODOT. Over 3/4 of Oregon's unfiltered diesel vehicles are in a fleet with three or fewer unfiltered vehicles. The largest 20 unfiltered diesel fleets produce over 12% of all on-road diesel particulate in the Portland area.

Dec. 2023 ODOT data: Industry trucks over 26,000 pounds



Graphs and data analysis by
Jonathan Brooks
brooks23@pdx.edu

Solutions to reduce diesel particulate

"R99" renewable diesel reduces diesel particulate emissions by 50% according to Cadrazco et al. Other commercially available renewable diesel blends reduce particulate emissions 28% - 50%. In California, renewable diesel is priced closely to petroleum diesel, according to Star Oil. Price depends on the value of CO2 credits for lower-carbon fuels. In Oregon, renewable diesel has consistently cost \$.05 to \$.80 a gallon more than

petroleum diesel. Again, this depends on associated CO2 abatement and what these carbon credits are trading for. Oregon-based Titan Freight Systems President Keith Wilson reported that switching to renewable diesel has led to a "\$0.015 per-mile savings by eliminating exhaust system replacement parts and downtime from clogged diesel particulate filters...The company has also reduced oil costs by 75%... on account of fewer contaminants entering the crankcase."

The largest single driver of climate change in Oregon is transportation, which is about 35% of total human-caused climate change emissions according to DEQ. Renewable diesel has 70% lower net carbon dioxide emissions than diesel "after factoring in the [carbon dioxide] emissions associated with processing, transportation, and distribution" according to Cummins.

A diesel particulate filter (DPF) removes 90% of particulate emissions before they go airborne. All new on-road diesel engines in the United States are sold with DPFs already installed. DPFs were required by federal law in all new engines starting in 2007 and implemented in all new vehicles starting in 2008.

For earlier vehicles, a DPF retrofit can provide the same benefit. According to 2019 research by Dr. Rasto Brezny with the Joint Taskforce on Supporting Businesses in Reducing Diesel Emissions of the Oregon Senate Committee on Labor and Business, a DPF retrofit in Oregon costs between \$8,000 and \$30,000.

The more effective and ultimately less expensive solution is for Oregon is to ban all unfiltered diesel vehicles as California has already done.

Works Cited:

- Brezny, Dr. Rasto.** Joint Taskforce on Supporting Businesses in Reducing Diesel Emissions of the Oregon Senate Committee on Labor and Business 2019. Diesel Retrofit Experience for Heavy-Duty Diesel Vehicles. Online at: <https://olis.oregonlegislature.gov/liz/201911/Downloads/CommitteeMeetingDocument/207997>
- Cadrozco, Marlin.** 2020. Characterization of renewable diesel particulate matter gathered from non-premixed and partially premixed flame burners and from a diesel engine. Online at: www.ncbi.nlm.nih.gov/pmc/articles/PMC7080205
- California Air Resources Board.** 2017. Truck and Bus Regulation. Online at: arb.ca.gov/msprog/onrdiesel/onrdiesel.htm
- Cummins.** 2022. Pros and cons of different fuels in your decarbonization journey. Online at: www.cummins.com/news/2022/09/30/pros-and-cons-different-fuels-your-decarbonization-journey?utm_campaign=newsletter&utm_term=%5B2022%20Wrapped%5D%20Alternative%20fuels%20you%20must%20remember&utm_content=PSBU-Marketing-en-Year%20End-email%201-Dec-22-

[Subject%20Line%20A&utm_medium=email&utm_source=Eloqua](#)

- Environmental Protection Agency.** 2022. 2019 AirToxScreen. DieselPm10 under Pollutant Specific Results choose Online at: www.epa.gov/AirToxScreen/2019-airtoxscreen-assessment-results#state
2013. 2011 NEI Portland area diesel particulate by vehicle source. Obtained by email. Online at: portlandcleanair.org/files/data/dieselpm_3counties%20%281%29.xlsx
- Procedure online at: portlandcleanair.org/files/procedures/diesel%20PM%20algorithm.pdf
- Loqa, Doug.** 2024. Python analysis of DMV and ODOT data.
- Oregon Department of Environmental Quality.** 2015. The Concerns about Diesel Engine Exhaust. Online at: oregon.gov/deq/FilterDocs/DieselEffectsReport.pdf
2022. Oregon Greenhouse Gas Sector-Based Inventory Data. Online at: www.oregon.gov/deq/ghgp/Pages/GHG-Inventory.aspx
- Oregon Department of Motor Vehicles.** 2018. 2023. Spreadsheet of all OR diesel trucks under 26,000 lbs. and all OR personal and government trucks. Obtained by information request. Online at: portlandcleanair.org/files/pcadata.html
- Oregon Department of Transportation.** 2016. 2023. spreadsheet of all OR diesel trucks over 26,000 lbs. Obtained by email from information request. Online at: portlandcleanair.org/files/pcadata.html
- Portland Clean Air.** 2019. Diesel Particulate and the Body. 2019. Diesel Bill Analysis — 2019 HB2007. Online at portlandcleanair.org/files/pcapubs.html
2019. Oregon Diesel Bill Passed 06/30/19 Analysis of House Bill 2007 by Portland Clean Air. Online at: portlandcleanair.org/files/reports/PCA_HB2007_report.pdf
- Quimby, Tom.** 2021. Biodiesel, renewable diesel show DPF and engine performance improvements. Online at: <https://www.ccjdigital.com/maintenance/article/15064025/dpf-engine-improvements-with-biodiesel-and-renewable-diesel>
- Star Oil.** 2024. Renewable Diesel Frequently Asked Questions (FAQ) Every Question we have been asked about Renewable Diesel. Online at: <https://www.staroilco.net/every-question-we-have-been-asked-about-renewable-diesel/>
- Trimet.** 2021. The future of cleaner air is now as TriMet buses run on cleaner-burning renewable diesel. Online at: <https://www.masstransitmag.com/bus/vehicles/gas-diesel-cng-lng/press-release/21249099/trimet-the-future-of-cleaner-air-is-now-as-trimet-buses-run-on-cleaner-burning-renewable-diesel>

How this paper was written

Cascadia Action wrote information requests to ODOT and DMV in 2018 asking for all Oregon diesel vehicle records. ODOT was perhaps the most cooperative of the eight agencies that gave us Oregon air pollution data. DMV was migrating its records out of Fortran at that time and told us it would be at least a year before they would fulfill our request. We asked ODOT, Portland environmental groups, and elected officials for help with DMV. DMV quickly relented and apparently hired a Fortran programmer to fulfill our request, including a fee waiver for us.

A volunteer used the statistics program R to calculate and rank the diesel fleet data. Seth Woolley made an Excel spreadsheet loaded with all the ODOT and DMV data that can automatically look up dozens of license plates to see if the truck is filtered or not. We worked with the Brooklyn Neighborhood Association who checked truck license plate numbers entering the Brooklyn Rail Yard. Many of these Oregon license plates weren't in either dataset. We told ODOT who looked them up and found they were out-of-state fleet

owners with Oregon license plates. ODOT had not provided these in 2018 but did include them in our 2020 information request of the same diesel vehicle data.

In December 2023 we again requested the same diesel vehicle data from ODOT and DMV. Both agencies cooperated promptly and a volunteer used Python to analyze the data. From that we discovered that DMV data contains mostly obsolete records -- vehicles that are no longer on the road. We were looking for this problem because we had been working for years with numerous Portland neighborhood association boards writing letters to the largest unfiltered diesel fleets. One complaint letter endorsed by 43 Portland organizations was to XPO Logistics, who at one time owned 7,469 unfiltered diesel trucks in Oregon. XPO responded that these unfiltered trucks no longer operate in Oregon. We found a row header in the DMV data that signified obsolete records. Jonathan Brooks recently used Python and all we had learned so far to produce the graphs and analysis used in this paper.

Acknowledgements

Thanks to ODOT, DMV, and EPA for their cooperation with our records requests and questions

Alexandra Ruhf is our researcher and a board member. She has a Master's degree in Neuroscience from University of Washington and ten years of health care employment experience helping patients with heart and vascular imaging. She currently works at the neuroscience department of Oregon Health Sciences University as a study coordinator. Alexandra's report citing the health effects of diesel particulate is here:
<http://portlandcleanair.org/files/reports/new%20PCA%20diesel%2012.pdf>

Greg Bourget is our executive director and lead researcher. He has a BA in political science from Humboldt State University and has been employed in mass outreach with 18 nonprofit environmental protection organizations since 1991. Greg works to connect 82 participating Portland organizations, staff, and volunteers working with this monitor project. Greg's report on diesel particulate monitoring options is here:
<http://portlandcleanair.org/files/reports/Diesel%20particulate%20monitoring.pdf>

Jonathan Brooks is a data specialist in Python programming language. He is a Portland State University senior majoring in Environmental Science and Management with a minor in Geographic Information Science.

Seth Woolley is our data expert and board member. He has over 20 total years of professional software engineering experience including 14 years with geospatial data analysis systems and six years in digital security auditing. He is currently employed as a senior programmer working on Doppler-radar-collected moisture and airborne particulate data. Seth solves our math and physics needs with software code.

Teodoro (Teddy) Holt is our data analyst and a board member. He has an AS in Natural Science from Sierra College and two years of hands-on chemistry experience at Sierra and Portland Community Colleges. He is working towards a Bachelor's degree in Environmental Science from Portland State University with a minor in Climate Change Science. Teodoro provides data management and analysis, map and graph making, atmospheric forecasting, and procedure writing for our diesel particulate monitoring effort.