Cancer Risk from Diesel Particulate Matter for Multnomah and Washington Counties, Oregon

Summary

According to the Environmental Protection Agency (EPA) 2011 National Air Toxics Assessment (NATA) data, which was released in December 2015, Multnomah County ranked 32nd worst for Diesel Particulate Matter (DPM) concentrations out of 3,279 Counties nationwide. Table 1 below summarizes the reported average, and highest, DPM concentrations estimated in both Multnomah and Washington counties and the associated excess cancer risk calculated using a cancer risk value derived from the California Office of Environmental Health Hazard Assessment (OEHHA) – see Methods.

County		DPM conc. [ug/m^3]	Excess Cancer Risk (per million)
Multnomah	Avg.	0.8	270
	High	1.8	600
Washington	Avg	0.4	135
	High	0.8	270

Table 1: DPM concentrations from 2011 NATA, with excess cancer risk determined using the California OEHHA Inhalation Unit Risk (IUR) for DPM – see Methods.

This is significant because the EPA 2011 NATA data, which excluded excess cancer risk from DPM as EPA has not yet established a cancer risk benchmark for DPM, indicated a cancer risk in Multnomah county no higher than 75-100 per million for all other airborne carcinogens combined, and no higher than 50-75 per million in Washington county. A comparison of these analyses reveals that the reported DPM concentrations would lead to ~three to six times more cancer risk than all other airborne carcinogens combined in Multnomah County, and ~two to four times more cancer risk in Washington County. Here's a link to an EPA explanation of why excess cancer risk from DPM isn't calculated for NATA.

https://www.epa.gov/national-air-toxics-assessment/nata-frequent-questions#mobile4

Introduction

Diesel combustion exhaust contains the following known or suspected carcinogens: acetaldehyde, acrolein, aniline, arsenic, benzene, biphenyl, 1,3-butadiene, cadmium, 1,8-dinitropyrene, formaldehyde, naphthalene, nickel, 3-nitrobenzanthrone, benzo(a)pyrene, styrene. The NATA data includes most of these toxic air pollutants in the cancer risk analysis; however, DPM is excluded from this analysis as it is treated as a separate pollutant from the other constituents of diesel combustion exhaust, and further because while Oregon, Washington, and California account for excess cancer risk from DPM, the EPA does not yet have an inhalation cancer risk value established.

According to California Air Resources Board (CARB), the effects from DPM on cancer risk are five times worse than the effect of the other exhaust constituents combined. CARB has provided a breakdown of the cancer risks of known carcinogens here:

https://oehha.ca.gov/media/downloads/crnr/appendixa.pdf
and here:
https://oehha.ca.gov/chemicals/diesel-exhaust-particulate

This is in line with CARB's estimate that "about 70 percent of the cancer risk that the average Californian faces from breathing toxic air pollutants stems from diesel exhaust particles.":

http://oehha.ca.gov/public_info/facts/dieselfacts.html

Methods

Excess cancer risk is calculated using a health benchmark, or exposure concentration (ug/m^3), established by different authorities. In this report, the California OEHHA Inhalation Unit Risk (IUR) was used to derive the cancer risk benchmark for DPM. (see Equations 1-2 below). This benchmark is based on chronic, long-term exposure to DPM across 70 years.

$$\textbf{Eq. 1: } \text{DPM Benchmark}(\text{ug/m}^3) = \text{Target Risk(per million)} \,/\text{IUR}(\text{ug/m}^3)^{-1}$$

$$\textbf{Eq. 2: } \text{DPM}_{\text{cancer}} = 1 \times 10^{-6}/3.0 \times 10^{-4} = 0.003\ (\text{ug/m}^3)$$

California's DPM health benchmark for cancer is 0.003 μg/m^3. For comparison, the same benchmark for DPM used by the Oregon Department of Environmental Quality (DEQ) is 0.1 μg/m^3.

Excess Cancer Risk (ECR) per million people was calculated in this report as shown in Equation 3 below:

$$\textbf{Eq. 3: } \text{ECR} = \frac{\text{Reported Conc. (ug/m}^3)}{\text{Benchmark Conc. (ug/m}^3)}$$

DEQ Portland Air Toxics Study (PATS) map of modeled DPM benchmark values was converted into DPM exposure concentrations in μg/m^3 by multiplying the benchmark numbers by 0.03 μg/m^3

We got the DPM DEQ PATS map from:

http://www.oregon.gov/ODOT/TD/TP/docs/OMSC/2013-Oct/PortlandAirToxicsStudy.pdf

National ranking of DPM exposure is reported in 2011 NATA national respiratory risk by tract pollutant at:

http://www.epa.gov/national-air-toxics-assessment/2011-nata-assessment-results

Ranking Counties using that data can be done in Excel. 00000000000 under tract means County. Sort first for Tract and second for Diesel PM. This ranks diesel concentrations first by the 3279 Counties, Boroughs, and Parishes with a tract of 00000000000. Multnomah ranked 32nd worst for diesel PM concentrations out of 3279 Counties.

NATA reports Multnomah DPM concentrations in Pollutant Specific Results, scroll down the list for "Diesel PM" at:

http://www.epa.gov/national-air-toxics-assessment/2011-nata-assessment-results

Results

For the 172 census tracts in Multnomah County, the following DPM concentrations (μg/m^3) were reported:

Highest	1.817
Lowest	0.194
Average	0.819

For the 105 census tracts in Washington County, the following DPM concentrations (μg/m^3) were reported:

Highest	0.842
Lowest	0.089
Average	0.490

The excess cancer risks calculated for the average and highest concentrations in these counties is provided above in Table 1.

Discussion

These results are similar to the Clean Air Task Force, a nonprofit concerned with air quality in Boston, who calculated an excess cancer risk of 534 per million due to DPM concentrations in Multnomah County using 2005 NATA data. They also found that excess cancer risk from DPM was almost six times that of all other airborne carcinogens combined. Clean Air Task Force results have been removed from their website.

It is worth noting that DEQ uses 0.1 μg/m^3 as the health benchmark for an excess cancer risk of one in a million for lifetime exposure to DPM, while CARB uses 0.003 μg/m^3. Thus, California calculates excess cancer risk per million by a factor of 33 times higher than Oregon does for the same concentrations.

Also, NATA DPM concentrations for Multnomah County are reported at a range of 0.194 to 1.817 $\mu g/m^3$, while the DEQ PATS study showed concentration range of 0.03 to 0.3 $\mu g/m^3$, far lower than EPA estimates for the same area.

By using Oregon DEQ's DPM cancer health benchmarks of 0.1 $\mu g/m^3$ and PATS diesel PM concentrations, the worst excess cancer risk in Portland is calculated at just three cancers per million.

Compare DEQ's estimate of excess cancer risk of 3 per million to those calculated using the CARB/ NATA-based analysis in this report of 600 per million for the same area of Portland – this is a 200 times difference in estimate.

The NATA average concentrations may be somewhat misleading in regards to the actual DPM concentrations people are exposed to because the NATA model data averages the entire amount of a pollutant emitted in a census tract across that entire tract. In this way, the data may reduce the apparent DPM concentrations experienced by populations located in DPM 'hot spots' such as near highways, rail yards, and other heavily trafficked truck routes. Frequently these 'hot spots' are located in Environmental Justice communities.

We are working to address inaccuracies and disparities in DPM modeled concentrations that leads to conclusions that underestimate DPM risk. Portland Clean Air modeling for DPM using 2014 EPA NATA for DPM concentration by census tract and ODOT 24 hour truck counts found that DPM concentration were up to eight times greater than the highest census tract average when living within three blocks of a highway or truck route. If so, this would increase the excess cancer risk by a factor of 8 as excess cancer risk is linearly calculated to exposure. This means that living near the highway in Portland, where the highest truck counts are observed, would lead to an excess cancer risk as high as 3,200 per million.

Portland Clean Air's modeling of DPM concentration using both 2014 EPA NATA model data, released in 2018, and ODOT 24-hour truck counts for Portland is located here:

http://portlandcleanair.org/files/reports/Portland%20Stack%20and%20Diesel%20Booklet%20Color.pdf

In the Portland area, 3/4 of diesel trucks do not have filters. Commercial trucks cause 81.2% of airborne diesel particulate in Portland according to the EPA National Emissions Inventory. Ten commercial Portland area trucking companies cause more than a fifth of all Portland area diesel truck particulate pollution. California solved the problem of airborne DPM exposure by requiring diesel particulate filters on virtually all diesel vehicles. These filters remove 90% of diesel particulate before it can go airborne.

Portland Clean Air is a nonprofit working with 39 Neighborhood Association boards, six churches and synagogues, five other local organizations, and over 3,000 individual donors to help neighbors directly negotiate with industrial air polluters such as truck fleets.

Portland Clean Air welcomes volunteers and donors to participate. Please email with any questions or visit our website:

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