What Stinks?

Industrial air pollution in north Portland and what can be done about it

In 2024, when the Environmental Protection Agency (EPA) began an initiative to reduce urban air pollution, it designated N/NW Portland as one of 27 communities nationwide that were "overburdened" with industrial pollution. This is not surprising considering the unusual concentration of industrial smokestacks in North Portland on both sides of the Willamette River. Half of the ten most dangerous Portland air polluters are located in N/NW Portland, including the largest fossil fuel storage site in the state, the Critical Energy Infrastructure (CEI) Hub. Almost 500 tanks at the Hub process and store various liquid fuels to be transported. This means that N. Portlanders have high levels of exposure to the most common and dangerous air pollutants, like particulate matter, nitrogen oxide, sulfur dioxide, carbon monoxide, ozone, and volatile organic compounds (VOCs).

The exact consequences for this toxic exposure to N. Portland residents are unknown. We know that adult asthma rates are higher in N. Portland than in communities with less exposure to industrial pollution. Life expectancy at birth is also lower in N. Portland compared to some other Portland neighborhoods. Many factors contribute to these poor health outcomes: poverty, racism, low levels of education, substandard housing stock, urban heat islands, and poor access to healthy food and outdoor recreation all play a role. Bad air is only one factor.

The EPA seeks to reduce the burden of air pollution in N. Portland with their "fence line" project to monitor VOC emissions at the CEI Hub. Five VOCs are being sampled: benzene, xylene, toluene, hexane, and ethylbenzene at the fence lines or boundaries of nine CEI Hub installations. Hundreds of pollutants are emitted at the Hub. The EPA chose VOCs because the Clean Air Act mandates regulation of industrial emissions of VOCs, they are emitted as part of normal operations at the Hub, and they can be toxic at very low levels.

More than 1,200 different VOCs exist. Benzene is the most well-studied. The toxicity from benzene is primarily in the blood and immune system. It causes various blood cancers, like leukemia or lymphoma, and is a very potent carcinogen. Most VOCs have adverse effects on the brain and nervous system, liver, lungs, and kidneys as well as detrimental developmental effects in babies and children. Very few studies, however, have looked at large populations exposed to VOCS over time. Importantly, one large population study published in 2024 showed for every measurable rise of benzene in the air there was a higher death rate from all causes.

We know about the health effects from VOCs primarily from two kinds of research. One is occupational research—the study of people who are exposed to relatively high levels of VOCs on the job over long periods of time. The second kind of study is experimental animal studies—laboratory animals are intentionally exposed to varying levels of VOCs to determine the health effects.

The EPA fence line project, however, will not tell us anything about the level of risk to the surrounding community from VOC emissions at the Hub. It is designed to detect and eliminate excess emissions. The EPA is measuring the levels of the five VOCs, looking for spikes that indicate improper leaks. Emissions above a certain level will trigger further investigation. These so-called "fugitive" leaks can result from improper maintenance of the tanks, defective tanks, aging tanks, or pipelines that are cracked or corroded. The most common source of fugitive emissions in the fossil fuel industry is pipelines. The EPA is also conducting inspections of the tanks and pipelines, as prior inspections have revealed problems with tank management and maintenance.

But, it's important to note that the vast majority of VOC exposure to the general population is not from industrial sources. By far, the most VOC exposure is from cigarette smoke. The second most common source is vehicle fuel and exhaust. While pumping gas at a gas station, for example, you are exposed to VOCs. The other sources of exposure are household products that emit VOCs, like paint, glue, carpet cleaner, nail polish, and various adhesives people use for hobbies.

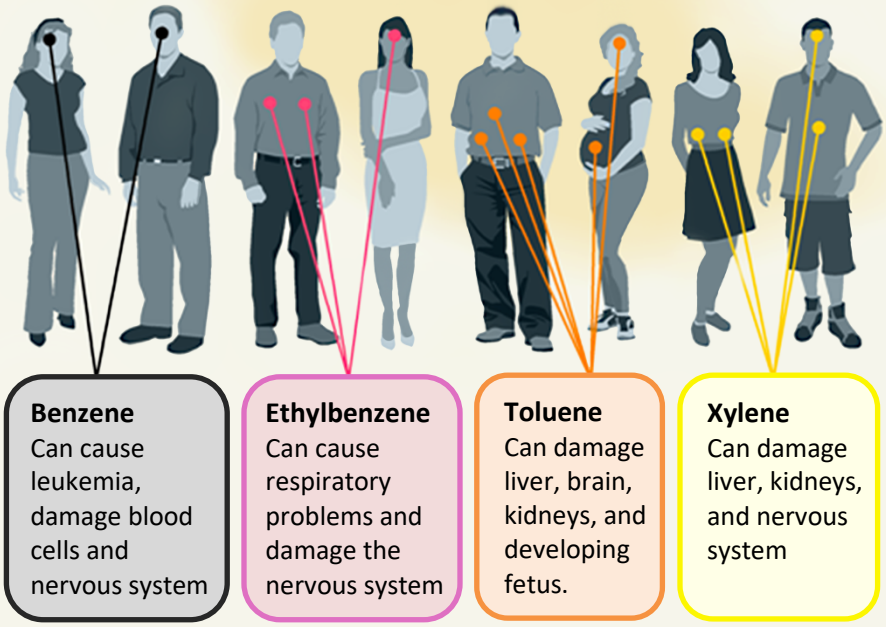
It's known that the more you are exposed to VOCs the more risk you have for adverse health outcomes. So, limiting industrial sources of VOCs is a benefit for the community. Fixing leaks benefits the community by also preventing the emissions of hundreds of other toxins emitted along with the five VOCs.

Many agencies have determined so called "safe levels of exposure" to VOCs but note that these levels are not derived from large population studies. They are extrapolated, using various methods, from occupational and animal studies. That accounts for some differences in the safe levels of exposure that have been reported by various agencies.

The European Union (EU) and the World Health Organization (WHO) have safe levels; the EPA have their own safe levels; the California EPA and Health Canada have their levels. They don't always agree. The WHO, for example, states that benzene is unsafe at any level of exposure. Partly for this reason, Cleaner Air Oregon (CAO), the department of DEQ that considers human health effects from industrial air pollution, undertook a comprehensive evaluation of the literature to determine what Oregon's safe levels of exposure should be, not just for VOCs, but for hundreds of other pollutants.

As part of their evaluation, VOC exposure was looked at for both acute exposure (minutes to

Health effects of airborne tank farm chemicals



All four chemicals irritate the eyes, nose, throat, and skin to varying degrees. Headaches, dizziness, lightheadedness, nausea, and vomiting are also universal reactions to these chemicals.

Sources: National Institute for Occupational Safety and Health (NIOSH); Agency for Toxic Substances and Disease Registry (ATSDR); California's Office of Environmental Health Hazard Assessment (OEHHA); health experts Celeste Monforton and Wilma Subra.

Paul Horn/ Inside Climate News

hours) and chronic exposure (low level exposure for months or years.) Cancer and non-cancer outcomes were separately considered. Safe levels for cancer are defined as less than one chance in a million in getting cancer over a lifetime, a very low rate and more strict than some agencies choose. For non- cancer, it's the level below which a year or more of exposure results in no adverse outcomes. The CAO level for chronic exposure to benzene for cancer outcomes is 0.13 micrograms per cubic meter. This is the equivalent of a third of a grain of salt in a boxcar. Anything above that level of benzene results in an increased risk of blood cancer. The other VOCs being monitored (hexane, toluene, xylene, and ethylbenzene) are generally not as potent as benzene in terms of carcinogenic effects.

One important limitation with safe levels is that they don't take into account multiple exposures. Everyone in an urban area is exposed to multiple pollutants. For example, both xylene and toluene are neurotoxic. You could measure levels in your home for a year and decide, "Yeah, I'm below threshold for each one." But this would ignore the increased risk of their combined effect. Or, when toxins are absorbed onto particulates in the air and people inhale them, they can be carried deep into the lungs where they are better absorbed. There are extremely complex interactions of these pollutants, so we have to take the official safe levels with a grain of salt.

The EPA fence line project is important because it could help reduce one source of these toxins in the air in N/NW Portland. But, if we really want to know how much risk the community faces from VOC emissions, we need to measure the specific levels of VOCs in the community. Fence line measurements at the Hub might be very high, but how much actually drifts into the community depends on the weather, the geography, the wind, and the unique characteristics of the particular pollutant. Plus, the CEI Hub is only one source of VOCs. That's why mobile monitoring, like Portland Clean Air (PCA) is doing, is potentially of more value.

PCA has identified the Ion Science Tiger XT as the ideal monitor for VOCs at the CEI Hub and surrounding communities. The resolution on this device is as low as 1 part per billion (ppb) which is three micrograms per cubic meter. The accuracy is ±5% or ±one digit after calibration during ideal temperature and humidity. This monitor can also report individual benzene samples. It is an optimal mobile device for neighborhood airborne VOC concentrations coming from the CEI Hub, and also the Albina Yard, the Linnton tanks, and the Rivergate industrial area.

This device can log months of data at a time. PCA's custom AirMap software can automatically GIS map the mobile monitoring results and graph the collected data. This can be used to identify hot spots of increased pollution, the time of day that emissions peak, and proximity to polluting industries. This data could more accurately assess actual community risk and suggest how best to reduce it.

Ion Science Tiger XT reports either total VOC or just benzene individually. Summa canisters can report accurate levels of each individual airborne VOC for $200 per sample. Deployment of Summa canisters should include an anemometer such the Kestral (costing $179 – $359) with a weather vane attachment (costing $39 – 79). Most areas of Portland have access to Mesowest anemometer data but Linnton does not. A portable anemometer has the added benefit of screening desirable spots for location of stationery Summa canisters that are verified to be upwind of the CEI Hub.

Volunteers are needed for the mobile air quality monitoring project. This is work that can be done at home, reporting atmospheric conditions from online data. For more information, or if you would like to volunteer, or have any questions, please contact Greg Bourget at Portland Clean Air:

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Linnton Neighborhood Association and Portland Clean Air's work deploying Summa canisters is online here:
https://portlandcleanair.org/files/reports/Linnton-CEI-Hub-Report%2003-30-23.pdf

Overview of Fenceline Project:
https://www.epa.gov/or/fenceline-air-monitoring-oregons-critical-energy-infrastructure-hub

EPA Reducing Air Toxics in Overburdened Communities:
https://www.epa.gov/enforcement/national-enforcement-and-compliance-initiative-reducing-air-toxics-overburdened

Industrial Air Polluters Portland:
https://portlandcleanair.org/files/reports/Portland%20Stack%20and%20Diesel%20Booklet%20Color.pdf

Adult Asthma Rates by Census Tract:
https://clfuture.org/atlas-maps/asthma-rates

Life Expectancy at Birth:
https://www.arcgis.com/apps/mapviewer/index.html?webmap=342bca082cc742f38e4d3646c3ac8855

Long-Term Exposure to Low Concentrations of Ambient Benzene and Mortality in a National English Cohort:
https://www.atsjournals.org/doi/10.1164/rccm.202308-1440OC

WHO and Safe Levels of Exposure to Benzene:
https://pub-london.escribemeetings.com/filestream.ashx?DocumentId=30864

Toxicological Profile for Benzene:
https://www.atsdr.cdc.gov/ToxProfiles/tp3.pdf

Toxicological Profile for Ethylbenzene:
https://www.epa.gov/sites/default/files/2016-09/documents/ethylbenzene.pdf

Toxicological Profile for Hexane:
https://www.epa.gov/sites/default/files/2016-09/documents/hexane.pdf
Toxicological Profile for Toluene:
https://www.epa.gov/sites/default/files/2016-09/documents/toluene.pdf

Toxicological Profile for Xylenes:
https://www.epa.gov/sites/default/files/2016-09/documents/xylenes.pdf

DEQ Toxic Air Contaminant Review and Update Rulemaking:
https://www.oregon.gov/deq/aq/cao/pages/toxic-air-contaminant-review.aspx

DEQ Technical Support Document for Cancer potency Factors:
https://oehha.ca.gov/media/downloads/crnr/tsdcancerpotency.pdf