

Story map link: <https://arcg.is/Oi0LGv>

Petroleum Refineries and Public Health

Living near an oil refinery in the United States can be a serious health hazard. Toxic emissions, leaks, and spills from refineries can sicken communities in the short term, and potentially cause long lasting, chronic illnesses. Many neighborhoods in close proximity to oil refineries have polluted soil, water, and air. Many of those same neighborhoods are clusters of asthma, cancer, birth defects, and other life threatening and chronic diseases (*Refineries-Fact-Sheet_04-08.Pdf*).

Petroleum refineries operate twenty-four hours per day turning crude oil into an array of products from fuels such as gasoline, diesel, and jet fuel, to lubricants, rubber, and other oil products used in the chemical and plastics industries (Chen). These refineries are often located in poor and minority communities meaning that African Americans, Hispanic Americans, and the poor are at greater risk of developing diseases such as cancer (*Refineries-Fact-Sheet_04-08.Pdf*).

Dangerous and toxic substances are emitted from oil refinery smoke stacks including ammonia, formaldehyde, sulfuric acid, hydrogen sulfide, tiny particulate matter, and many more (*Analysis of Refinery Chemical Emissions and Health.Pdf*). Collectively, these substances are known as Total Petroleum Hydrocarbons, or TPHs, and they contaminate air, soil, and ground water in the neighborhoods outside the plants' fences (*Tp123-C1-b.Pdf*). As a group, TPHs are known to cause headaches, dizziness, nervous system disorders, cancer (especially of the blood), immune damage, damage to organs, skin and eyes, as well as reproductive and fetal development. Some of the most

serious substances are Benzene, Toluene, Xylene, and a group of chemical compounds known as Polycyclic Aromatic Hydrocarbons or PAHs.

Benzene is one of the most common components of refinery pollution and is also one of the most toxic. It is classified the U.S. Department of Health and Human Services as a carcinogen, meaning it is known to cause cancer in humans (*Tp3-C1-b.Pdf*). The most common route of exposure is through breathing polluted air. Benzene is present in vehicle exhaust and in cigarettes, but its most common source in the environment is from industry, including petroleum refineries. Living near petrochemical plants has been shown to cause greater exposure to benzene than living elsewhere. Benzene is absorbed quickly through the lungs with about 50% of the chemical in the inhaled air being absorbed. Once in the blood, benzene is converted into different substances called metabolites, which account for some of the toxicity. The metabolites are stored primarily in the liver and bone marrow where they can cause damage to the tissue that makes blood cells, leading to leukemia, anemia, and a drop in platelet production which could cause excessive bleeding. Benzene can also damage the immune system leading to greater risk of infection.

Toluene—another natural part of crude oil—is a byproduct of making fuel from crude oil. It is most commonly inhaled and is rapidly absorbed into the blood (*Tp56-C1-b.Pdf*). Daily exposure, such as what members of communities around oil refineries suffer, can cause accumulation of toluene in fatty tissue leading to many serious negative health impacts. Toluene can affect the nervous system causing headaches, dizziness, and loss of consciousness, and repeated exposure can impair coordination, cause cognitive problems, and disrupt vision and hearing. It can also cause profound problems with the development of children, notably mental retardation and stunted growth. Exposure to toluene has been linked to immune, kidney, liver, and reproductive damage. And day-after-day exposure results in tiredness, confusion, weakness, memory loss, nausea, loss of appetite, and impaired motor function.

Xylene is also absorbed through the lungs when contaminated air is inhaled. It is estimated that 50%-75% of inhaled xylene is absorbed into the blood (*Tp71-C1-b.Pdf*). Another substance present in crude oil, xylene affects mucous membranes in the eyes, nose and throat, and can cause heart, lung, kidney and nervous system damage. People exposed to xylene often experience headaches, loss of coordination, dizziness, confusion, and struggle with balance. Children often have more severe short-term symptoms because their smaller airways are less able to accommodate tissue swelling caused by xylene exposure.

PAHs are actually a group of toxic substances rather than a single chemical. PAHs are formed when oil is not burned completely and can be suspended in air as a vapor or stuck to tiny dust particles (*Tp69-C1-b.Pdf*). This means they can stay aloft for a long time and travel long distances before settling out or falling with rain. Once on the ground they can be taken up by plants where they accumulate, thus potentially contaminating food crops. The presence of PAHs in air, water, soil, and food mean that they can enter the body in many ways. Once inside the body they are stored in any fat containing tissue, primarily the kidneys, liver, and fat, but PAHs have also been found in the spleen, adrenal glands, and ovaries. PAHs have been shown to cause tumors and cancer, reproductive damage that can be passed on to unborn offspring, as well as low birth weight and immune system damage.

In 2015 the Environmental Protection Agency imposed new regulations under the Clean Air Act that required, effective January 2018, petroleum refineries to begin monitoring benzene levels around their fence lines (*Benzene-Report-2.6.20.Pdf*). A limit was set for benzene concentrations of 9 micrograms per cubic meter of air, with any exceedance triggering an analysis of the source and mandatory action to fix the problem. In all, at least a dozen refineries across the country, some of which are among the subjects of the story map linked below, were found to be emitting benzene at levels above the EPA's threshold (Hiar, E, reporter, et al.). In Philadelphia, the Philadelphia Energy Solutions refinery measured year-long average benzene levels at 49 micrograms per cubic meter of air, 444%

above the maximum limit (*Benzene-Report-2.6.20.Pdf*). Several others, including refineries in Port Arthur, TX; Pasadena, CA; and Corpus Christi, TX were found to be emitting benzene at rates more than 100% higher than the EPA's limit. Benzene is only one of the toxic substances coming from oil refineries, as detailed above, but the EPA chose to focus on it because they feel it is an "...indicator of other air toxics..." (Hiar, E, reporter, et al.).

Accidents and neglect at refineries are an additional danger. A Chevron refinery in North Richmond once covered the small community in black smoke for a week after an accident (Kay and Katz). A malfunctioning flare at the Marathon refinery spread foul odors across southwest Detroit, and the residents there are frustrated with the regularity of such problems (Dado). The same Philadelphia refinery mentioned above experienced a massive explosion on an early June morning in 2019. That explosion and the fire that it caused, sent a cloud of 5,200 pounds of hydrofluoric acid into the nearby Grays Ferry neighborhood (Hiar, E, reporter, et al.). In Artesia, NM neglected repairs and leaky valves were to blame for spewing toxic gasses into the air. Owned by HollyFrontier Corp., the refinery in Artesia was allowed by state regulators to delay repairs for more than a decade, which resulted in high levels of benzene and other toxics escaping into the surrounding community. One valve inspected by the EPA in 2019 had been releasing volatile organic compounds since May 2009. The valve was a known problem and workers at the refinery had sampled it monthly, finding VOCs as high as 500,000 parts per million.

The EPA inspection of the HollyFrontier refinery also discovered that VOC emissions from routine flares and the plant's cooling towers were beyond allowable limits by as much as 2,200% (Hiar, E, Thursday, et al.). And not all the pollutants were going into the air, some were entering the water system. A wastewater treatment facility at the plant used charcoal filters to remove toxic chemicals but the EPA inspectors found that "The company has 'never changed carbon in canisters ever'".

Industrial pollution in general—not confined to petroleum refineries, but certainly including them—disproportionally affects Black communities. Philadelphia as a whole is 44% Black (Villarosa), and Grays Ferry, where the Philadelphia Energy Solutions refinery is located, is 60% Black (city-data.com). In 2019, the American Lung Association warned Philadelphia residents that the air they breathe may be harmful to their health (Villarosa). And in 2016, the EPA determined that the refinery was the cause for most of the toxic chemicals in the city’s air. More broadly, research done in 2007 found that “People of color made up a majority of the population in communities within 1.8 miles of a polluting facility, and race—not income or property values—was the most significant predictor”. Another study determined that “African-American families with incomes of \$50,000 to \$60,000 were more likely to live in environmentally polluted neighborhoods than white households with incomes below \$10,000”.

I have included here only a small sample of the refineries that exist across the United States, and a similarly small sample of the communities affected by toxic pollution from those refineries. In every case, refineries and other dirty industry—including landfills, incinerators, chemical plants, and others—are located closer to poor and minority communities than to any others. It is not an accident that those populations take a disproportionate share of our national pollution. Systemic racism, segregation, and redlining have forced them into dirty areas where no one else wants to live, and persistent poverty has kept them there for generations. Follow this link: <https://arcg.is/0iOLGv> to a story map that explores the locations of some of these petroleum refineries and the stories of the communities they affect.

Sources:

Analysis of Refinery Chemical Emissions and Health.Pdf.

<https://oehha.ca.gov/media/downloads/faqs/refinerychemicalsreport032019.pdf>. Accessed 16 Nov. 2020.

Benzene-Report-2.6.20.Pdf. <https://www.environmentalintegrity.org/wp-content/uploads/2020/02/Benzene-Report-2.6.20.pdf>.

Accessed 28 Nov. 2020.

Chen, James. "Oil Refinery Definition." *Investopedia*, <https://www.investopedia.com/terms/o/oil-refinery.asp>. Accessed 24 Nov. 2020.

city-data.com. "Grays Ferry Neighborhood..." *City-Data.Com*, <http://www.city-data.com/neighborhood/Grays-Ferry-Philadelphia-PA.html>.

Accessed 29 Nov. 2020.

Dado, Larry Spruill, Natasha. "'Enough Is Enough': People Living near Marathon Refinery Want Out."

WDIV, 4 Feb. 2019, <https://www.clickondetroit.com/news/2019/02/04/enough-is-enough-people-living-near-marathon-refinery-want-out/>.

Hiar, Corbin, E. E. News reporter, et al. *OIL AND GAS: Toxic Refinery Leaks Imperiled Philadelphia*

Residents. <https://www.eenews.net/stories/1062097771>. Accessed 28 Nov. 2020.

Hiar, Corbin, E. E. News reporterPublished: Thursday, et al. *PUBLIC HEALTH: Years of Toxic Leaks Raise*

Cancer Risk in Refinery Town. <https://www.eenews.net/stories/1062744005>. Accessed 27 Nov. 2020.

Kay, Jane, and Cheryl Katz. "Low-Income Area Copes with Oil Refineries, Toxic Waste."

Climatecentral.Org, <https://www.climatecentral.org/news/one-low-income-community-cope-with-oil-refineries-and-toxic-waste-sites>. Accessed 29 Nov. 2020.

Refineries-Fact-Sheet_04-08.Pdf. https://earthjustice.org/sites/default/files/files/Refineries-Fact-Sheet_04-08.pdf. Accessed 24 Nov. 2020.

Tp3-C1-b.Pdf. <https://www.atsdr.cdc.gov/ToxProfiles/tp3-c1-b.pdf>. Accessed 24 Nov. 2020.

Tp56-C1-b.Pdf. <https://www.atsdr.cdc.gov/ToxProfiles/tp56-c1-b.pdf>. Accessed 24 Nov. 2020.

Tp69-C1-b.Pdf. <https://www.atsdr.cdc.gov/ToxProfiles/tp69-c1-b.pdf>. Accessed 24 Nov. 2020.

Tp71-C1-b.Pdf. <https://www.atsdr.cdc.gov/ToxProfiles/tp71-c1-b.pdf>. Accessed 24 Nov. 2020.

Tp123-C1-b.Pdf. <https://www.atsdr.cdc.gov/ToxProfiles/tp123-c1-b.pdf>. Accessed 24 Nov. 2020.

Villarosa, Linda. "Pollution Is Killing Black Americans. This Community Fought Back." *The New York*

Times, 28 July 2020. *NYTimes.com*, <https://www.nytimes.com/2020/07/28/magazine/pollution-philadelphia-black-americans.html>.