
THE CLIMATE CRISIS AND BREAST CANCER

BREAST CANCER ACTION®



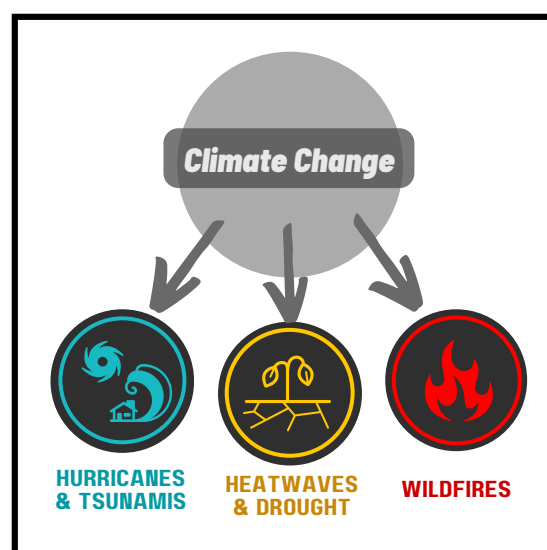
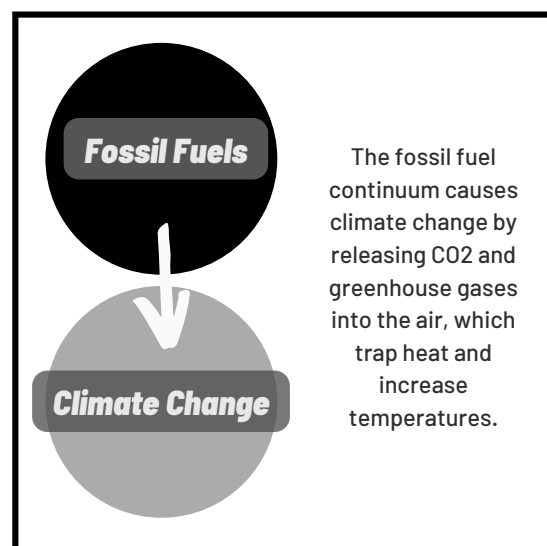
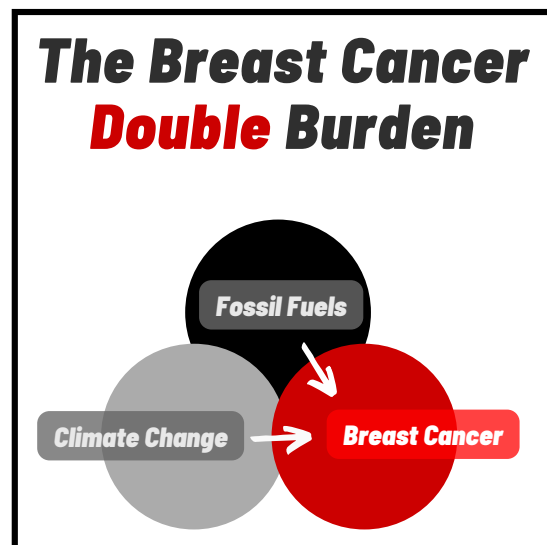
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FOSSIL FUELS

The global dependence on fossil fuels directly impacts our environment and our health, and increases our risk of breast cancer. The harmful chemicals used and released during fossil fuel production contaminate our air, soil, and water, making this industry one of the largest contributors to the climate crisis. Together, the fossil fuel industry and the climate catastrophe doubly impact and exacerbate the breast cancer crisis. As severe climate changes are projected to increase, so will the frequency of extreme weather events such as hurricanes and tsunamis, heat waves and drought, and wildfires. These events, each intensified by unprecedented climate change, are known to increase health risks globally,¹ which will affect people at risk of and living with breast cancer more severely.



¹ Flavelle, C. (2019, July 15). 'Toxic stew' stirred up by disasters poses long-term danger, new findings show. The New York Times. <https://www.nytimes.com/2019/07/15/climate/flooding-chemicals-health-research.html>

ENVIRONMENTAL TOXINS

Today in the U.S., people assigned female at birth have a one in eight chance of developing breast cancer in their lifetimes.² A growing body of evidence continues to confirm what has been known for decades: environmental toxins are directly related to an increased breast cancer risk. Chemicals of concern discussed in the document include: PCBs, PFAS, air pollution, and flame retardants. Each of these chemicals can be shown to increase the risk of breast cancer.

1. PCBS

Polychlorinated biphenyls are a class of chemicals that are probable carcinogens and have been known to affect the immune, reproductive, nervous, and endocrine systems.^{3, 4}

2. PFAS

Per- and polyfluoroalkyl substances, also called PFAS, are known to cause some cancers and interfere with normal hormone functioning.⁵ In addition, PFAS have been shown to suppress the immune system, which can hinder the body's ability to prevent rogue cells from growing into breast cancer.⁶ Even low dose exposure to PFAS changes the structure of the mammary gland.⁷

² "Breast Cancer in Young Women." Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, 27 Sept. 2021, https://www.cdc.gov/cancer/breast/young_women/bringyourbrave/breast_cancer_young_women/index.htm.

³ EPA, Environmental Protection Agency, <https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls> pcbs#:~:text=The%20International%20Agency%20for%20Research,PCBs%20are%20carcinogenic%20in%20humans.

⁴ Braathen, Marte et al. "Estrogenic effects of selected hydroxy polychlorinated biphenyl congeners in primary culture of Atlantic Salmon (*Salmo salar*) hepatocytes." *Archives of Environmental Contamination and Toxicology* 56, 1 (2009): 111-22. doi:10.1007/s00244-008-9163-0.

⁵ Sonthithai, Pacharapan et al. "Perfluorinated chemicals, PFOS and PFOA, enhance the estrogenic effects of 17 β -estradiol in T47D human breast cancer cells." *Journal of Applied Toxicology* 36, 6 (2016): 790-801. doi:10.1002/jat.3210.

⁶ Beans, Carolyn. "How 'Forever Chemicals' Might Impair the Immune System." *Proceedings of the National Academy of Sciences*, vol. 118, no. 15, 2021, <https://doi.org/10.1073/pnas.2105018118>.

⁷ White, Sally S et al. "Gestational and chronic low-dose PFOA exposures and mammary gland growth and differentiation in three generations of CD-1 mice." *Environmental Health Perspectives* 119, 8 (2011): 1070-6. doi:10.1289/ehp.1002741.

3. AIR POLLUTION

Air pollution is a complex mix of toxicants, and can refer to a range of chemicals including nitrogen oxide (NO₂), particulate matter (PM 2.5), and polyaromatic hydrocarbons (PAHs).

- Exposure to NO₂ is associated with increased risk of breast cancer. This relationship is strongest for hormone receptor positive (ER+, PR+) breast cancer and premenopausal breast cancer.⁸
- PAHs are a group of over 100 chemicals that are classified as probable carcinogens and have also been known to mutate tumor suppressor genes.^{9, 10}
- PM_{2.5} has been associated with increased estrogen receptor positive (ER+) tumors and cancers in premenopausal women.¹¹

4. FLAME RETARDANTS

Some flame retardants are associated with elevated cancer risk, developmental and reproductive harm, and hormone disruption.¹²

THE BREAST CANCER CRISIS, THE CLIMATE CRISIS, AND THE FOSSIL FUEL INDUSTRY ARE INTERTWINED.

TO ADDRESS AND END THE BREAST CANCER CRISIS, WE MUST STOP FOSSIL FUELS AND STOP FUELING THE CLIMATE CRISIS, BOTH OF WHICH INCREASE OUR RISK OF THIS DEVASTATING DISEASE.

⁸ Lemarchand, Clémentine, et al. "Breast Cancer Risk in Relation to Ambient Concentrations of Nitrogen Dioxide and Particulate Matter: Results of a Population-Based Case-Control Study Corrected for Potential Selection Bias (the Cecile Study)." *Environment International*, vol. 155, 2021, p. 106604., <https://doi.org/10.1016/j.envint.2021.106604>.

⁹ Palli, Domenico et al. "A gene-environment interaction between occupation and BRCA1/BRCA2 mutations in male breast cancer?." *European Journal of Cancer* 40, 16 (2004): 2474-9. doi:10.1016/j.ejca.2004.07.012.

¹⁰ Mordukhovich, Irina et al. "Associations between polycyclic aromatic hydrocarbon-related exposures and p53 mutations in breast tumors." *Environmental Health Perspectives* 118, 4 (2010): 511-8. doi:10.1289/ehp.0901233.

¹¹ White, A.J., Gregoire, A.M., Neihoff, N.M., Bertrand, K.A., Palmer, J.R., Coogan, P.F., Bethea, T.N. (2021). Air pollution and breast cancer risk in the Black Women's Health Study. *Environ Res* 194, 110651.

¹² Institut national de la recherche scientifique - INRS. "Breast cancer: The risks of brominated flame retardants: Brominated flame retardants may lead to early mammary gland development." *ScienceDaily*. ScienceDaily, 12 March 2021. <www.sciencedaily.com/releases/2021/03/210312084702.htm>.

HOW FOSSIL FUELS DRIVE THE CLIMATE CRISIS

Extreme climate changes are a primary factor and growing cause of health harms including breast cancer. When fossil fuels are burned, they release large amounts of greenhouse gases into the air, including methane and carbon dioxide, two primary drivers of global warming.¹³

The burning of fossil fuels takes place at several stages along the fossil fuel continuum: during extraction (including gas flaring), during its processing and manufacturing, and by the end-user, including individuals who use fossil fuels for daily tasks like driving cars. From the beginning to the end of this process, the burning of fossil fuels accounts for about three-quarters of all carbon dioxide emissions in the U.S.¹⁴ In the extraction process, gas flaring is done to burn off waste and is a highly pollutant activity that produces health-harming volatile organic compounds (VOCs) and greenhouse gases such as methane and carbon dioxide (CO₂).¹⁵ Despite known health harms, consumers have come to rely on fossil fuels rather than alternative power sources because fossil fuels have been made more affordable and accessible. As a result, car exhaust emissions (nitrogen oxide or NO₂) and other fossil fuel outputs that worsen climate change continue to increase.



¹³ Troque. "Burning of Fossil Fuels." Understanding Global Change, 8 Mar. 2022, <https://ugc.berkeley.edu/background-content/burning-of-fossil-fuels/>.

¹⁴ "U.S. Energy Information Administration - EIA - Independent Statistics and Analysis." Where Greenhouse Gases Come from - U.S. Energy Information Administration (EIA), <https://www.eia.gov/energyexplained/energy-and-the-environment/where-greenhouse-gases-come-from.php>.

¹⁵ Earthworks. "Flaring Is (Still) Flamingly Stupid, but Unlit Flaring Is Worse." Earthworks, 9 Sept. 2021, <https://earthworks.org/blog/flaring-is-still-flamingly-stupid-but-unlit-flaring-is-worse/>.

These impacts are disproportionately experienced by different communities. Black, Brown, and Indigenous communities are systematically and more directly harmed by fossil fuel operations because these communities are often in closer proximity to areas with higher rates of exposure. As climate change linked to the burning of fossil fuels intensifies, extreme weather events are expected to increase, making chemical spills and accidents more likely. This will hit frontline communities first and worst. Although decades of racially-biased urban planning and zoning practices have resulted in Black, Brown, and Indigenous communities living on the front lines of these environmental injustices, fossil fuels impact us all. We all breathe the same air, and the health harms of the fossil fuel continuum extend beyond frontline communities.

This document will focus on three outcomes of the intensifying climate crisis and their impacts on the breast cancer crisis: hurricanes and tsunamis, heat waves and drought, and wildfires.

Why We Must Stop Fossil Fuels

It's time to stop fossil fueling the breast cancer crisis!

FOSSIL FUELS' CONNECTION TO BREAST CANCER

Benzene
Common exposure sources include car and truck exhaust and stored gasoline.

Dioxins
are highly toxic persistent environmental pollutants.

Pesticides & Herbicides
Linked to hormone disruption.

Polyaromatic Hydrocarbons
A class of chemicals that are released when wood, coal, crude oil, gasoline and diesel are burned.

COMMUNITIES OF COLOR HIT FIRST & WORST BY THE FOSSIL FUEL ECONOMY

- Racial bias in industrial zoning has led to extraction operations, chemical and plastic manufacturers, and refineries being disproportionately located in Black, Brown, and Indigenous communities.
- Extreme weather from climate change increases the risk of chemical spills and accidents in these industrial facilities.
- Decades of racially biased urban planning practices have led to a greater concentration of highways, ports, and trainlines located in close proximities to where people of color live.

EXTRACTION

PROCESSING & MANUFACTURING

PRODUCTS & BYPRODUCTS

INDIVIDUAL BODY BURDEN

THE FOSSIL FUEL CONTINUUM
Many chemicals in our air, water, food, and everyday items come from extracting, burning, and processing fossil fuels. The collective exposures throughout the fossil fuel continuum poses grave threats on our health, including breast cancer.

PLASTIC = FOSSIL FUELS IN SOLID FORM

Production:
Some plastics are produced from chemicals exposing communities.

Use:
Many plastics, including food and drink packaging, leach hormone disrupting chemicals.

Disposal:
Disposed plastics can leach hormone disrupting chemicals.

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For more information on fossil fuels and breast cancer, visit bcaction.org/stop-fossil-fuels-factsheet/

HURRICANES AND TSUNAMIS

The climate catastrophe is warming the oceans to such an extent that chemicals linked to cancer, such as PCBs and PFAS, are continually dispersed into our environment through the resulting extreme weather events. Under a normal carbon cycle, the ocean absorbs the heat generated by carbon dioxide. However, there is a limit to how much heat it can absorb, and excess carbon dioxide causes the ocean to warm up overall.¹⁶ As a result, hurricanes and tsunamis occur more frequently and are often more extreme, causing more damage than they have caused in the past.¹⁷ These weather events disrupt the lives of thousands of people, devastate communities and resources, and increase our daily exposure to pollution.

Hurricanes and tsunamis disturb water sources and wastewater pipes, including those used in fracking. We not only drink water from these contaminated systems, we irrigate our agricultural lands with it, impacting our food production systems.



¹⁶ Earthlabs. (2021, May 13). 1D: Fossil Fuels, hydrocarbons, and CO₂. Climate and the Carbon Cycle. <https://serc.carleton.edu/eslabs/carbon/1d.html>.

¹⁷ Peñafort, T. (2001). GISS ICP: What effects do forest fires have on the storage of carbon? NASA. <https://icp.giss.nasa.gov/research/ppa/2001/tpenafort/>

PCBs were banned in the U.S. in 1976 due to their persistence in the environment, and some PCBs are linked to an increased risk of breast cancer. Hurricane Maria contaminated the soil with toxic levels of PCBs, exposing thousands of people to these same cancer-causing chemicals in the northeastern Caribbean Islands in 2017, and Hurricane Harvey forced PCBs and other pollutants into circulation in 2021.¹⁸ Floodwater that follows a hurricane or massive rain storm is typically contaminated with sewage, chemicals, and often sharp objects like metal and glass. After these extreme weather events, drinking water can be further contaminated when uprooted trees damage water line pipes, including those that transport waste from fracking. Recent science has revealed that in addition to PCBs, other chemicals of concern used during the fracking process pollute drinking water systems, including PFASs, also known as “forever chemicals.”¹⁹ Given that both PFAS and PCBs have been shown to increase breast cancer risk, the warming of the oceans and the resulting hurricanes, tsunamis, and flooding can be seen as devastating for those both at risk of and living with breast cancer.

¹⁸ Flavelle, C. (2019, July 15). 'Toxic stew' stirred up by disasters poses long-term danger, new findings show. The New York Times. <https://www.nytimes.com/2019/07/15/climate/flooding-chemicals-health-research.html>

¹⁹ Yost, E. E., Stanek, J., & Burgoon, L. D. (2017). A decision analysis framework for estimating the potential hazards for drinking water resources of chemicals used in hydraulic fracturing fluids. *Science of The Total Environment*, 574, 1544–1558. <https://doi.org/10.1016/j.scitotenv.2016.08.167>

HEAT WAVES AND DROUGHT

Heat waves and drought also intensify the breast cancer crisis by increasing pollution levels. Increased carbon dioxide in the atmosphere, caused by fossil fuel production, leads to significant increases in temperature. The resultant cycles of heat waves and widespread drought exacerbate one another.²⁰

NO₂ is a toxic gaseous air pollutant formed by the combustion resulting from vehicle emissions, industrial facilities, and oil and gas extraction. It has been linked to increased risk of developing breast cancer, and it is made more pervasive by heat waves and drought. The increase in heat makes NO₂ harder to break down in the environment, causing exposures to last longer. Much of the science on the health impacts of NO₂ has been done in urban areas because of their density. Large urban areas are particularly affected by heat waves, due to the concentrated release of heat from buildings, vehicles, and industries that is absorbed into the atmosphere, increasing NO₂ levels and again disproportionately affecting BIPOC and low-income communities.²¹

An increase in heat waves and drought also intensifies other extreme weather events, such as wildfires, that directly pollute the air with smoke. In these ways, the heat waves and droughts caused by the higher levels of carbon dioxide through fossil fuel production and consumption are not only worsening and becoming more frequent each year, but they are again contributing to the cyclical nature of the dysregulated carbon cycle and climate catastrophe.

People at risk of or living with breast cancer are each distinctly impacted by heat waves, drought, and the resulting air pollution. The existing air pollution that is worsened by heat waves includes PAHs, which increases the risk of the disease. When temperatures reach extreme levels, people living with breast cancer, who are also in treatment and possibly dealing with its side effects, are adversely impacted and may be at a higher risk for heat-related illness.²² Additionally, rising temperatures can also make it harder for our bodies to break down and get rid of toxic chemicals (detoxify) by weakening our natural metabolism and excretion processes.²³



²⁰ Di Liberto, T. (2021, June 23). Record-breaking June 2021 HEAT WAVE impacts the U.S. West: NOAA Climate.gov. Record-breaking June 2021 heatwave impacts the U.S. West | NOAA Climate.gov. <https://www.climate.gov/news-features/event-tracker/record-breaking-june-2021-heatwave-impacts-us-west>.

²¹ USGCRP indicator Details. GlobalChange.gov. (2019). <https://www.globalchange.gov/browse/indicators/us-heat-waves>.

²² Gesualdi, L. (2021, July 3). After this week's massive heat wave, how can cancer patients navigate those hot summer days? SurvivorNet. <https://www.survivornet.com/articles/after-this-weeks-massive-heat-wave-how-can-cancer-patients-navigate-those-hot-summer-days/>.

²³ <https://www.bcpp.org/top-4-ways-climate-change-may-increase-your-breast-cancer-risk/#:~:text=Top%204%20ways%20climate%20change,pollute%20the%20water%20we%20drink>.

WILDFIRES

Wildfires occur naturally in the environment, most commonly a result of lightning. However, the combustion of fossil fuels contributes to the environmental conditions that result in an increasing number of wildfires taking place all over the U.S.²⁴ Because of rising temperatures due to the warming of the planet, plant matter dries out faster, creating debris that then serves as tinder for more intense fires that spread farther.²⁵ This process is cyclical: wildfires release carbon dioxide, pushing the carbon cycle further out of balance and contributing to ongoing climate change.²⁶

Additionally, the expansion of the fossil fuel industry requires continual deforestation. Fewer trees means an increased amount of greenhouse gases in the atmosphere given that trees regulate our carbon cycle by sequestering and storing carbon dioxide.²⁷

Multiple evidence streams have found a correlation between ambient air pollution and breast cancer. These findings suggest that a decrease in air pollution would lower breast cancer risk.²⁸ Pollution from wildfires contains a variety of hydrocarbons and other pollutants that are released when structures are burned. Concentrations of PM2.5 microscopic air pollution reach highs in the “unhealthy” range in the months following wildfires²⁹ and these same PM2.5 pollutants are suspected to increase breast cancer risk.



²⁴ Shirkey, R. (2020, August 29). From fossil fuels to forest fires: Let's finally connect the dots. The Daily Californian. <https://www.dailycal.org/2020/08/28/from-fossil-fuels-to-forest-fires-lets-finally-connect-the-dots/>.

²⁵ Dunne, D. (2021, April 23). Explainer: How climate change is affecting wildfires around the world. Carbon Brief. <https://www.carbonbrief.org/explainer-how-climate-change-is-affecting-wildfires-around-the-world>.

²⁶ Huang, Y. A. (2018). Frequently Asked Questions: Wildfire Emissions. Frequently Asked Questions: Wildfire Emissions | California Air Resources Board. <https://ww2.arb.ca.gov/resources/documents/frequently-asked-questions-wildfire-emissions>.

²⁷ Dunne, D. (2021, April 23). Explainer: How climate change is affecting wildfires around the world. Carbon Brief. <https://www.carbonbrief.org/explainer-how-climate-change-is-affecting-wildfires-around-the-world>.

²⁸ Weitekamp CA, Lein M, Strum M, et al. An Examination of National Cancer Risk Based on Monitored Hazardous Air Pollutants. Environmental Health Perspectives. 2021;129(3):037008-1-037008-12. doi:10.1289/EHP8044

²⁹ Popovich, N., & Katz, J. (2021, July 21). See how wildfire smoke spread across america. The New York Times. <https://www.nytimes.com/interactive/2021/07/21/climate/wildfire-smoke-map.html>.

As shown in regards to heat waves and drought, the impacts of these extreme weather events affect different communities disproportionately. PM2.5 pollutants are shown to be more prevalent in urban areas, and due to a history of redlining, intentional disenfranchisement, and segregation, communities of color are more likely to live in the urban, more densely-populated areas. In 2021, people living in densely populated urban areas were shown to be hit the hardest by pollution from wildfires, and had to endure smoke for the longest periods of time.³⁰ Consequently, a disproportionate number of Black, Brown, and Indigenous people and low-income communities suffer the most from the toxicity of these events. Given this environmental injustice, it is no surprise that the association of PM2.5 and breast cancer has been shown to be stronger among people of color.^{31, 32}

In the U.S., the area currently most directly affected by wildfires is the West Coast, but smoke from wildfires can spread as far as the Midwest and East Coast.³³ Currently more than 40% of Americans live in places with unhealthy levels of air pollution.

Air pollution from wildfires is not the only concern when it comes to breast cancer. The practices and chemicals involved in managing these fires may cause additional harm to communities directly impacted by wildfires. When a fire takes place, large concentrations of toxic and persistent chemicals are dumped over the affected area.³⁴ PFAS are a class of chemicals often found in firefighting foam which is used to quickly extinguish and keep them from reigniting. Two of the most notorious chemicals within this class, PFOA and PFOS, have been used in drinking water, and become a major contributor to drinking water contamination nationally.³⁵ Flame retardants are another group of chemicals that prevent or slow the growth of fire. This class of chemicals has been criticized for adversely affecting the endocrine, immune, and reproductive systems.

³⁰ Carlsen, A., McMinn, S., & Eng, J. (2020, September 23). 1 in 7 Americans have experienced dangerous air quality due to wildfires this year. NPR. <https://www.npr.org/2020/09/23/915723316/1-in-7-americans-have-experienced-dangerous-air-quality-due-to-wildfires-this-ye>.

³¹ Tessum C, Paoletta D, Chambliss S, Apte J, Hill J, Marshall J, et al. PM2.5 pollutants disproportionately and systemically affect people of color in the United States. *Science Advances*. 28 Apr 2021; Vol. 7, no. 18, eabf4491. DOI: 10.1126/sciadv.abf4491

³² White AJ. Invited Perspective: Air Pollution and Breast Cancer Risk: Current State of the Evidence and Next Steps. *Environ Health Perspect*. 2021 May;129(5):51302.

³³ Popovich, N., & Katz, J. (2021, July 21). See how wildfire smoke spread across america. *The New York Times*. <https://www.nytimes.com/interactive/2021/07/21/climate/wildfire-smoke-map.html>.

³⁴ Lerner, Sharon. "The U.S. Military Is Spending Millions to Replace Toxic Firefighting Foam with Toxic Firefighting Foam." *The Intercept*, *The Intercept*, 10 Feb. 2018, <https://theintercept.com/2018/02/10/firefighting-foam-afff-pfos-pfoa-epa/>.

³⁵ Office, U.S. Government Accountability. "Firefighting Foam Chemicals: DOD Is Investigating Pfas and Responding to Contamination, but Should Report More Cost Information." *Firefighting Foam Chemicals: DOD Is Investigating PFAS and Responding to Contamination, but Should Report More Cost Information* | U.S. GAO, <https://www.gao.gov/products/gao-21-421>.

SUMMARY

The fossil fuel industry is fueling both the climate crisis and the breast cancer crisis. The current effects of the climate crisis include intensified hurricanes and tsunamis, heat waves and drought, and wildfires, and all of these effects are aggravated by the production and consumption of fossil fuels. The increased occurrence of these devastating events intensifies exposure to many chemicals that have been linked to higher breast cancer rates and worsening outcomes, creating the double burden of both fossil fuels and the climate crisis on the breast cancer crisis.

Our environment and our bodies are being contaminated by PFAS, PAHs and other hydrocarbons, and other toxic chemicals through fossil fuel production practices. All of the aforementioned effects disproportionately impact BIPOC communities, urban communities, and people with low incomes, due to increased exposure levels and additional systemic barriers with few effective solutions. Inequitable access to care is made worse by the damage caused by extreme weather events. Prevailing health injustices will be exacerbated if environmental conditions continue to worsen.

Too often we are involuntarily exposed to these chemicals, which is why it's critical to understand the full impact of how chemicals in the environment impact our health. To salvage the planet we live on and maintain the health of our bodies, the single most effective thing we can do is to immediately phase out fossil fuels. The breast cancer crisis, the climate crisis, and the fossil fuel industry are becoming increasingly intertwined, and finding solutions to one cannot come without considering the others.



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