

### HOW OUR ENVIRONMENT PLAYS A ROLE IN CANCER

Cancer occurs when certain genetic changes happen in our bodies, altering the way cells function. Sometimes substances we're exposed to in our environment damage DNA within our cells, leading to the development of cancer. These toxic substances are called carcinogens. Some well-known examples of carcinogens include chemicals found in tobacco smoke, UV light from the sun, and other radiation.

The development of cancer is often the result of a combination of factors, including the genes you inherit from your parents, lifestyle choices (like diet, exercise, smoking, and alcohol consumption), age, and the carcinogens you're exposed to from the surrounding environment. Most environmental carcinogens require repeated exposure over time to contribute to the development of cancer. Some people are more susceptible to certain carcinogens than others. For example, while we know that tobacco smoke is a powerful carcinogen, certain life-long smokers won't develop cancer, while others will.



*Photo by winnievinzence from NounProject.com.*

Most of what has been learned about carcinogens has been through animal studies or studies related to occupational exposures. It's often impossible to establish what carcinogens led to the development of cancer once it occurs in an individual. Even if multiple people within a community develop the same type of cancer within a short time period, called a cluster, it's very difficult to determine if a carcinogen in their shared environment was responsible.

Once someone is diagnosed with cancer, it can be difficult to identify a specific carcinogen, partly because cancer can develop very slowly. Between exposure and a cancer diagnosis, carcinogens that were present in the environment may no longer be present. Additionally, people often don't live in the same place their entire lives or work the same type of job. Because of this, cancer could have been caused by something they used to live near or encountered in a prior job.

### ENVIRONMENTAL EXPOSURES TO CARCINOGENS

Some substances introduced into our environment by shale gas development (SGD), like benzene and radon, can cause cancer and therefore pose a risk to public health. However, it's not currently known whether those substances have actually caused cancer in populations living near shale gas sites. Two recent studies have shown a correlation between SGD (sometimes called fracking) and cancer:

- McKenzie et al. (2018)<sup>1</sup> measured air emissions at various distances from SGD facilities in Colorado and calculated the lifetime risk of cancer based on these measurements. For residents living within 152 meters (500 feet), the lifetime cancer risk exceeded the EPA's upper bound risk limit of 1 incidence in 10,000 people, actually registering at 8.3 likely incidences per 10,000 people, more than 8 times the EPA's recommended allowable risk. This risk was largely due to measured levels of benzene, a classified carcinogen.



Photo courtesy of Ted Auch, FracTracker Alliance, 2021. Aerial support provided by LightHawk.

What you can do to protect yourself from these carcinogens:

- Check the outdoor air quality in your area by visiting [airnow.gov](http://airnow.gov) and entering your zip code. AirNow analyzes air quality data to determine whether the current air quality is healthy or unhealthy. In the event of an unhealthy air quality day, children and other vulnerable populations (elderly, those with health conditions, pregnant individuals, etc.) should stay inside or limit going outdoors to short intervals.
- If possible, get an air filter to remove some particulate matter and chemicals from your indoor air. Information on recommended air filters, as well as how to make your own at home, can be found on [EHP's website](#).
- If you use well water, have your well tested yearly. If you notice any changes in taste, color, or smell, stop using the water immediately and have it tested as soon as possible. Be sure to vent your bathroom with an exhaust fan when showering.
- If you swim, fish, or recreate in streams or rivers, be aware of sewage treatment plant discharge point locations. If the sewage treatment plant accepts landfill leachate, the discharge may be a point of exposure to radioactive waste.

For more recommendations about how to protect your health and monitor your air, water, and soil quality, visit [EHP's website](#).

- Clark et al. (2022)<sup>2</sup> examined whether there was a correlation between exposure to SGD and cases of cancer, specifically acute lymphoblastic leukemia (ALL), the most common type of childhood cancer. The researchers gathered data from a public registry in which they identified 405 children in Pennsylvania diagnosed with ALL between 2009 and 2017. They then used a metric to determine environmental exposure to SGD. Researchers found that children living in proximity to SGD had up to 2 to 3 times the odds of developing ALL as children not living in proximity to SGD.

#### KNOWN CARCINOGENS BY EXPOSURE PATHWAY<sup>3</sup>

| AIR EMISSIONS  | FRACKING FLUID | WASTEWATER       |
|----------------|----------------|------------------|
| 1,3-Butadiene  | 1,3-Butadiene  | Radium 226 & 228 |
| Formaldehyde   | Formaldehyde   | Benzo(a)pyrene   |
| Radon          | Ethylene oxide | Beryllium        |
| Diesel exhaust | Arsenic        | Arsenic          |
| Benzene        | Benzene        | Benzene          |

<sup>1</sup> McKenzie, L. M., Blair, B., Hughes, J., Allshouse, W. B., Blake, N. J., Helmig, D., Milmoie, P., Halliday, H., Blake, D., & Adgate, J. (2018). Ambient nonmethane hydrocarbon levels along Colorado's northern front range: Acute and chronic health risk. *Environmental Science & Technology*, 52, 4514-4525. [10.1021/acs.est.7b05983](https://doi.org/10.1021/acs.est.7b05983)

<sup>2</sup> Clark, C. J., Johnson, N. P., Soriano, M., Warren, J. L., Sorrentino, K. M., Kadan-Lottick, N. S., Saiers, J. E., Ma, X., & Deziel, N. C. (2022). Unconventional Oil and Gas Development Exposure and Risk of Childhood Acute Lymphoblastic Leukemia: A Case-Control Study in Pennsylvania, 2009-2017. *Environmental Health Perspectives*, 130(8). <https://doi.org/10.1289/ehp11092>

<sup>3</sup> Elliott, E. G., Trinh, P., Ma, X., Leaderer, B. P., Ward, M. H., & Deziel, N. C. (2017). Unconventional oil and gas development and risk of childhood leukemia: Assessing the evidence. *Science of the Total Environment*, 576, 138-147. <https://doi.org/10.1016/j.scitotenv.2016.10.072>

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