

Living near oil and gas wells increases air pollution exposure, according to new research

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Oil wells operating in Signal Hill, a city in Los Angeles County, California. Researchers found that drilling and operating wells emits harmful levels of pollution that may affect the health of nearby residents. Credit: David Gonzalez

In a 14-year analysis of air quality across California, Stanford researchers observed higher levels of air pollutants within 2.5 miles of oil and gas wells, likely worsening negative health outcomes for nearby

residents.

The scientists analyzed local air quality measurements in combination with atmospheric data and found that oil and gas wells are emitting toxic particulate matter (PM_{2.5}), carbon monoxide, nitrous oxide, ozone and volatile organic compounds (VOCs). The findings, which appear in the journal *Science of the Total Environment*, will help researchers determine how proximity to oil and gas wells may increase the risk of adverse health outcomes, including preterm birth, asthma and heart disease.

"In California, Black and Latinx communities face some of the highest [pollution](#) from oil and gas wells. If we care about environmental justice and making sure every kid has a chance to be healthy, we should care about this," said lead author David Gonzalez, who conducted research for the study while a Ph.D. student in Stanford's Emmett Interdisciplinary Program in Environment and Resources (E-IPER). "What's novel about our study is that we've done this at a population, state-wide scale using the same methods as public health studies."

The findings align with other smaller-scale studies that have measured emissions from a handful of wells. At least two million Californians live within one mile of an active oil or gas well.

"It's really hard to show air quality impacts of an activity like oil and gas production at a population scale, but that's the scale we need to be able to infer health impacts," said senior study author Marshall Burke, an associate professor of Earth system science at Stanford's School of Earth, Energy & Environmental Sciences (Stanford Earth). "While it's not necessarily surprising that drilling and operating oil and gas wells emit air pollutants, knowing the magnitude of the effect improves our broader understanding of who is exposed to what and how to intervene to improve health outcomes."

A global killer

The research reveals that when a new well is being drilled or reaches 100 barrels of production per day, the deadly particle pollution known as PM_{2.5} increases two micrograms per cubic meter about a mile away from the site. A recent study published in *Science Advances* found that long-term exposure to one additional microgram per meter cubed of PM_{2.5} increases the risk of death from COVID-19 by 11 percent.

"We started in 2006 because that's when local agencies started reporting PM_{2.5} concentrations," said Gonzalez, who is now a postdoctoral researcher at the University of California, Berkeley. "We're very concerned about particulate matter because it's a leading global killer."

The team evaluated about 38,000 wells that were being drilled and 90,000 wells in production between 2006 and 2019. They developed an econometric model incorporating over a million daily observations from 314 air monitors in combination with global wind direction information from the National Oceanic and Atmospheric Administration (NOAA) to determine if the pollutants were coming from the wells.

Other factors that could be contributing to elevated [emissions](#) were controlled for—such as wildfire smoke or industrial activities—and monitors located far from drilling sites were used to identify those factors unrelated to wells. They also analyzed locations with air quality data from both before and after a well was drilled.

"Sometimes the wind is blowing from the well, sometimes it's not, and we found significantly higher pollution on days when the wind is blowing from the wells," Gonzalez said. "As a control, we assumed wells that are downwind of the air monitor shouldn't contribute any pollution—and that is indeed what we saw."

The research also reveals that ozone—a powerful oxidant that can cause wheezing, shortness of breath and aggravated lung disease—was present up to 2.5 miles from wells. Children are at the greatest risk from exposure to ozone because their lungs are still developing, according to the Environmental Protection Agency (EPA).

Chronic exposure

The new study contributes to a growing body of evidence about the dangers of living near oil and gas wells that may help guide ongoing policymaking around residential setbacks from drilling sites. For example, LA County recently voted to phase out oil and gas drilling, citing issues of [climate change](#), environmental impacts and equity, and other California cities are in discussion about neighborhood drilling regulations.

"Many of California's oil fields have been operating for decades. People that live near them have been chronically exposed to higher levels of pollution—and a lot of these wells are located in neighborhoods that are already burdened by pollution," Gonzalez said. "Our study adds to the evidence that public health policies are needed to reduce residents' exposure to air pollution from wells."

Although data for the research is from California, the co-authors say the findings are likely applicable to other regions with oil and gas operations.

"We've had earlier papers suggesting that proximity to oil and gas production worsens [health outcomes](#), and the likely channel was through air pollutants, but we previously didn't have a good way to demonstrate that was the case," Burke said. "This new work is helping confirm that air pollution was the missing link between this type of energy production and the bad outcome that we cared about."

More information: David J.X. Gonzalez et al, Upstream oil and gas production and ambient air pollution in California, *Science of The Total Environment* (2021). [DOI: 10.1016/j.scitotenv.2021.150298](https://doi.org/10.1016/j.scitotenv.2021.150298)

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