

Identifying sources of deadly air pollution in the United States

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A new study from University of Minnesota researchers provides an unprecedented look at the causes of poor air quality in the United States and its effects on human health.

The research, to be published Wednesday in the journal *Environmental Science and Technology Letters*, finds that air [pollution](#) from sources in the United States leads to 100,000 deaths in the U.S. each year. About half of these deaths are from burning [fossil fuels](#), but researchers also identified less obvious sources of lethal pollution.

"People usually think of power plants and cars, but nowadays, livestock and wood stoves are as big of a problem. It's also our farms and our homes," said Sumil Thakrar, postdoctoral research associate in the Departments of Bioproducts and Biosystems Engineering and Applied Economics.

The researchers found that while some sectors of the economy, such as electricity production and transportation, have reduced pollution amid government regulations, others have received less attention, including agriculture and residential buildings.

Researchers examined U.S. Environmental Protection Agency data on all pollution sources in the United States, including their location and how much pollution they emit. They then used newly-developed computer models to determine where pollution travels and how it affects human health.

Researchers focused on one particularly harmful pollutant: fine particulate matter, also known as PM2.5, which is associated with heart attacks, strokes, lung cancer and other diseases. In examining the data, they discovered that about half of all PM2.5 air pollution-related deaths are from burning fossil fuels, with the remaining largely from animal agriculture, dust from construction and roads, and burning wood for heating and cooking.

"Essentially we're asking, 'what's killing people and how do we stop it?'" Thakrar said. "The first step in reducing deaths is learning the impact of

each and every emission source."

In the U.S., air quality is largely regulated by the federal government, which sets maximum allowable levels of pollution in different areas. States and local governments are then charged with enforcing those limits. The authors suggest regulators can improve this broad-brush approach by focusing instead on reducing emissions from specific sources.

"Targeting particularly damaging pollution sources is a more efficient, and likely more effective, way of regulating air quality," said Jason Hill, professor in the Department of Bioproducts and Biosystems Engineering within the University's College of Food, Agricultural and Natural Resource Sciences and College of Science and Engineering. "Think of springing a leak in your boat while out fishing. Why fret too much about how much water is coming in when what you really should be doing is plugging the hole?"

The researchers also report a surprising finding about the sources of PM_{2.5} responsible for harming human health. Most people are familiar with PM_{2.5} as soot—such as the exhaust from a dirty bus—or road dust. But PM_{2.5} also forms from other pollutants like ammonia.

Ammonia is released from animal manure and the fertilization of crops. However, unlike many other sources of PM_{2.5}, ammonia is not regulated to any large extent, despite being responsible for about 20,000 deaths, or one-fifth of all deaths caused by PM_{2.5} pollution from human activity.

To improve air quality in the future, the authors suggest more drastic reductions of emissions from sources that are already regulated, such as electricity generation and passenger vehicles. They also suggest novel ways to target pollutant sources that have not been as extensively

regulated, such as manure management, changing personal diets and improving formulations of cleaning supplies, paints and inks.

This research—the underlying data and results of which are available to the public—can complement current efforts to mitigate climate change and other environmental problems.

"Our work provides key insights into the sources of damage caused by [air pollution](#) and suggests ways to reduce impacts," said Thakrar. "We hope policymakers and the public will use this to improve the lives of Americans."

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