Study proves pipeline replacement programs are effective

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A vehicle equipped with instruments to detect methane gas leaks cruises through Time Square in New York City. Credit: Rob Jackson

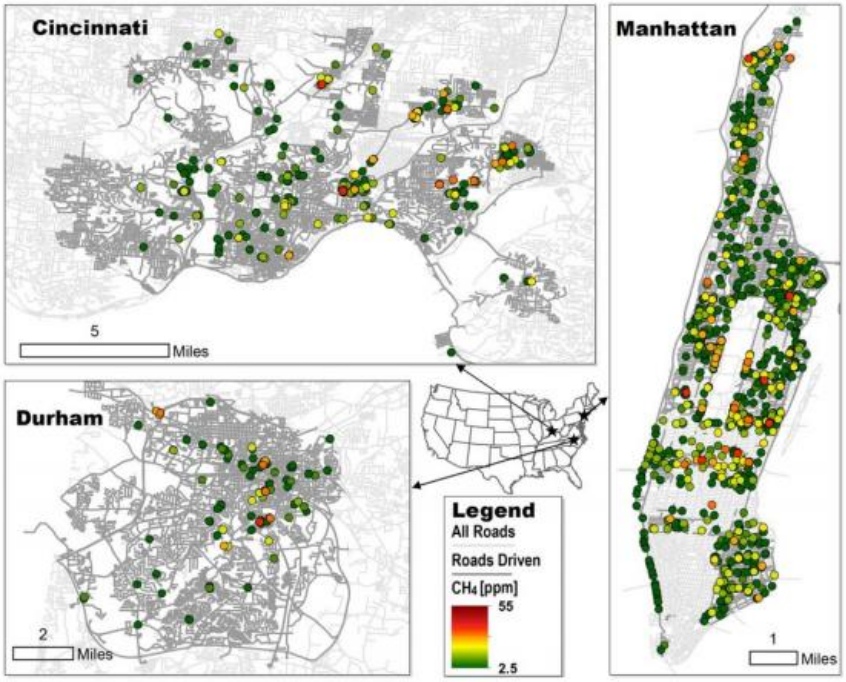
Invisible gas leaks from aging or damaged pipelines cost U.S. consumers billions of dollars every year, contribute to global warming, and, in rare cases, cause dangerous explosions. But pipeline replacement programs in cities can cut natural gas leaks by 90 percent, a new Stanford-led study finds. "The surprise wasn't that replacement programs worked," said Rob Jackson, the Michelle and Kevin Douglas Provostial Professor at Stanford. "It was that they worked so well."

Jackson and his team drove cars equipped with sensitive methane-mapping instruments across 1,600 road miles of Manhattan, NY, Cincinnati, OH, and Durham, NC. They discovered one-tenth the number of leaks per mile in Durham and Cincinnati, where public-private partnerships have replaced outdated pipelines, than in Manhattan or in Boston and Washington, DC, two cities that the team had mapped previously.

"Infrastructure investments save lives, help the environment, and, over time, will put money in people's pockets," said Jackson, who is also a senior fellow at the Stanford Woods Institute for the Environment and the Precourt Institute for Energy.

The team from Stanford, Duke University, the U.S. Department of Energy, Gas Safety, Inc., Ohio State University, and Boston University published their work this week in the peer-reviewed journal *Environmental Science & Technology Letters*.

Natural gas pipeline safety has improved substantially in the United States, but there were still 18 fatalities and 93 injuries from pipeline incidents in 2014. An additional $2 billion worth of natural gas was lost, much of it from older pipelines, some of which predate cars, telephones and light bulbs. "The oldest cast iron pipes were laid in the 1800s. They're well over a century old," Jackson said.



Maps of methane leaks surveyed in Cincinnati, OH (top left), Durham, NC (bottom left), and Manhattan, NYC, NY (right). Roads driven are outlined in darker gray, with leak locations marked by colored circles for methane concentration. Credit: Rob Jackson

In recent years the team mapped 3,400 natural-gas pipeline leaks across Boston and 5,900 leaks in Washington, D.C. The likelihood of a leak in those cities was similar to the value found in Manhattan-4.3 leaks per mile. In contrast, Durham and Cincinnati had only 0.22 and 0.47 leaks per mile, respectively. "The benefit of pipeline replacement was obvious driving around the cities," said postdoctoral scientist Morgan Gallagher of Stanford and Duke University.

Partnerships between cities, companies, and public utility commissions help explain the results. Durham, NC, finished replacing all of its cast-

iron and unprotected-steel pipes in 2008. A similar program in Cincinnati begun fifteen years ago is almost complete. In contrast, Manhattan still has hundreds of miles of corroded pipes beneath its streets.

Aging infrastructure, including roads, bridges, and natural gas and water mains, is an increasing concern. In 2011 the U.S. Pipeline and Hazardous Materials Safety Administration issued a Call to Action to "accelerate the repair, rehabilitation, and replacement of the highest-risk pipeline infrastructure." The President's new Climate Action Plan and Strategy to Reduce Methane Emissions both highlight pipeline replacements, because of methane's potency as a greenhouse gas and the role of hydrocarbons in catalyzing ozone formation.

Similar programs around the world should provide additional environmental, economic, and consumer safety benefits. "It's not just U.S. cities," Jackson said. "There are many cities in Europe and elsewhere with old, unprotected piping. We need smart financial incentives to upgrade our oldest pipelines. It's time to get them out of the ground."

Provided by Stanford University