

Urban CO₂ domes increase deaths, poke hole in cap-and-trade proposal

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Everyone knows that carbon dioxide, the main greenhouse gas driving climate change, is a global problem. Now a Stanford study has shown it is also a local problem, hurting city dwellers' health much more than rural residents', because of the carbon dioxide "domes" that develop over urban areas. That finding, said researcher Mark Z. Jacobson, exposes a serious oversight in current cap-and-trade proposals for reducing emissions of heat-trapping gases, which make no distinction based on a pollutant's point of origin. The finding also provides the first scientific basis for controlling local carbon dioxide emissions based on their local health impacts.

"Not all [carbon dioxide emissions](#) are equal," said Jacobson, professor of civil and environmental engineering. "As in real estate, location matters."

His results also support the case that California presented to the Environmental Protection Agency in March, 2009, asking that the state be allowed to establish its own CO₂ emission standards for vehicles.

Jacobson, director of the Atmosphere/Energy Program at Stanford, testified on behalf of California's waiver application in March, 2009. The waiver had previously been denied, but was reconsidered and granted subsequently. The waiver is currently being challenged in court by industry interests seeking to overturn it.

Jacobson found that domes of increased [carbon dioxide](#) concentrations - discovered to form above cities more than a decade ago - cause local

temperature increases that in turn increase the amounts of local [air pollutants](#), raising concentrations of health-damaging ground-level ozone, as well as particles in urban air.

In modeling the health impacts for the contiguous 48 states, for California and for the Los Angeles area, he determined an increase in the death rate from [air pollution](#) for all three regions compared to what the rate would be if no local carbon dioxide were being emitted.

The results of Jacobson's study are presented in a paper published online by *Environmental Science and Technology*.

The cap-and-trade proposal passed by the U.S. House of Representatives in June 2009 puts a limit on the amount of greenhouse gases that each type of utility, manufacturer or other emitter is allowed to produce. It also puts a price tag on each ton of emissions, which emitters will have to pay to the federal government.

If the bill passes the Senate intact, it will allow emitters to freely trade or sell their allowances among themselves, regardless of where the pollution is emitted.

With that logic, the proposal prices a ton of CO₂ emitted in the middle of the sparsely populated Great Plains, for example, the same as a ton emitted in Los Angeles, where the population is dense and the air quality already poor.

"The cap-and-trade proposal assumes there is no difference in the impact of carbon dioxide, regardless of where it originates," Jacobson said. "This study contradicts that assumption."

"It doesn't mean you can never do something like cap and trade," he added. "It just means that you need to consider where the CO₂ emissions

are occurring."

Jacobson's study is the first to look at the health impacts of carbon dioxide domes over cities and his results are relevant to future air pollution regulations. Current regulations do not address the local impacts of local carbon dioxide emissions. For example, no regulation considers the local air pollution effects of CO₂ that would be emitted by a new natural gas power plant. But those effects should be considered, he said.

"There has been no control of carbon dioxide because it has always been thought that CO₂ is a global problem, that it is only its global impacts that might feed back to air pollution," Jacobson said.

In addition to the changes he observed in local air pollutants, Jacobson found that there was increased stability of the air column over a city, which slowed the dispersal of pollutants, further adding to the increased pollutant concentrations.

Jacobson estimated an increase in premature mortality of 50 to 100 deaths per year in California and 300 to 1,000 for the contiguous 48 states.

"This study establishes a basis for controlling CO₂ based on local health impacts," he said.

Current estimates of the annual air pollution-related death toll in the U.S. is 50-100,000.

Provided by Stanford University

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