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**Bright City Lights Affect Air Pollution**

The sky glow that radiates from cities at night does more than obscure the stars—it also impacts daytime air pollution levels, according to new research from the Cooperative Institute for Research in Environmental Sciences (CIRES).

“This is the first time that this effect has been quantified,” said CIRES scientist Harald Stark, the lead author. “Previously, it was unknown if city lights could influence air pollution.” They do so by breaking down a compound called the nitrate radical that naturally helps cleanse the atmosphere. Acting as a “janitor” of the night sky, the nitrate radical scrubs away air pollutants such as volatile organic compounds that would otherwise form smog and ozone. The cleansing compound only works nightshifts, however, since sunlight destroys the light-sensitive molecule. But the new data reveal that urban lights in cities like Los Angeles are bright enough to also destroy the nitrate radical, decreasing levels by up to 4 percent in the skies over L.A.

The researchers report an encouraging finding, however. Although artificial lights break down the nitrate radical into nitrogen dioxide—an essential molecule for ozone production—it appears from model simulations that this has only a small effect on next-day levels of ozone, one of the major types of air pollutants. “One reason for this is that ozone doesn’t depend linearly on nitrogen compounds,” Stark said. “Other factors such as sunlight, volatile organic compounds and the amount of mixing between layers of the atmosphere also affect ozone production.” Another reason for the small effect could be that the model may have underestimated the impact of nitrate-radical loss on ozone production, Stark said. More detailed model calculations in the future could give more precise answers.

Still, “An important point to keep in mind is that even small changes in ozone levels may decide whether cities are below or above regulatory levels,” Stark said.  
   
Stark and his team flew several nighttime flights over L.A. in May and June 2010, measuring light intensities and concentrations of nitrogen compounds and ozone. They presented some of the initial results at the 2010 American Geophysical Union Fall Meeting and published the full results of their study as a Correspondence article in the November 2011 issue of *Nature Geoscience*.

The study also assessed the likelihood of urban lights elsewhere in the world altering nitrogen chemistry. Cities such as Chicago, Las Vegas, Valencia, New York City and Tokyo are much brighter than L.A., and the researchers’ calculations show that their nighttime glare likely degrades the nitrate radical at a much higher rate than above L.A., with unknown consequences to air quality.

The data come on the heels of other research showing that light pollution carries other negative effects, such as harming human health by upsetting circadian rhythms, disrupting animal behavior and wasting energy and money for misdirected lighting that shines into the night sky. Methods for reducing light pollution include using shielded light fixtures that direct the light to the ground, rather than into the sky; and intelligent lights that only switch on when they are needed.

Stark and his team next plan to study other cities with brighter lights (such as Chicago) and more pollution (like Beijing) to quantify how much nitrate-radical loss affects air pollution in these locations. Such research could help inform decision makers on new and better ways to improve air quality.

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