Study finds that choice of cool roofing materials can potentially impact region's air pollution

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Credit: Peter Griffin/public domain

In a groundbreaking study released today, scientists at the South Coast Air Quality Management District and the University of Southern California have found that widespread installation of certain "cool roof"

materials in the region could slightly increase ozone and fine particulate pollution levels.

The study explains how the predicted increase in ozone levels can be minimized or possibly avoided by requiring more comprehensive performance standards for cool-roofing materials. However, small increases in fine particulate (PM2.5) levels are predicted to occur with or without enhanced standards.

"Cool roofs have many benefits including reduced energy use for cooling and mitigation of the significant health impacts of heat waves." said Wayne Nastri, SCAQMD's executive officer.

"While the future, widespread use of certain kinds of cool roofing materials could slightly increase air pollution levels, we in no way want to discourage this technology. This study shows what needs to be done to help cool our cities and avoid increasing ozone levels as an unintended consequence."

The study, titled "Air Quality Implications of Widespread Adoption of Cool Roofs on Ozone and Particulate Matter in Southern California," was published today in the *Proceedings of the National Academy of Sciences*.

The scientific paper was produced by a team of SCAQMD scientists led by Scott A. Epstein, Ph.D., in collaboration with George Ban-Weiss, Ph.D., a professor of civil and environmental engineering at USC. They used sophisticated meteorology and air quality computer models, measurements of cool roofing materials and detailed databases of the region's rooftops to predict the air quality impacts of the increasing use cool roof materials—typically light-colored and highly reflective—that are expected to result from current statewide energy efficiency standards.

Numerous scientific studies have established that replacing darker roofs and building materials with highly reflective materials can reduce peak daytime temperatures and mitigate the so-called "urban heat island effect" where cities can be several degrees warmer than less-urbanized surrounding areas.

However, many cool-roofing materials reflect more ultraviolet light (UV) than their traditional counterparts, increasing the potential for ozone formation. UV rays fuel smog formation on their way down to Earth. When cool roofs bounce UV rays back up into the atmosphere they create a "double-shot" of ozone formation.

This ozone increase can be avoided if a comprehensive roofing standard is adopted to prevent the overall UV reflectance of newly-installed cool roofs from increasing. Cool roofing materials are available today that reflect the same amount or even less UV than traditional, roofing materials.

"This study highlights the importance of considering how strategies used to mitigate one environmental issue can have co-benefits and/or unintended consequences on other environmental systems," Ban-Weiss said. "Whether air pollution improves or worsens from cool roof installations depends on a host of competing chemical and meteorological factors.

"Given that our study focuses on the Los Angeles basin, future research is needed to investigate how these competing processes dictate air pollution impacts in cities around California and beyond."

While an increase in ozone formation can be mitigated by changing cool roofing materials, the predicted small increase in PM2.5 levels is due to overall cooler surface temperatures resulting in weaker sea breezes and lower inversion layers, and will occur regardless of UV reflectance of

roofing materials, according to the study.

The study also noted the installation of cool paving materials could have an even bigger impact on ozone and PM2.5 levels since the amount of area paved in the region is significantly larger than the total roofing area affected by state energy efficiency standards.

More information: Scott A. Epstein el al., "Air-quality implications of widespread adoption of cool roofs on ozone and particulate matter in southern California," *PNAS* (2017). www.pnas.org/cgi/doi/10.1073/pnas.1703560114

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