

# How 'green' are environmentally friendly fireworks?

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Fireworks are used in celebrations around the world, including Independence Day in the U.S., the Lantern Festival in China and the Diwali Festival in India. However, the popular pyrotechnic displays emit

large amounts of pollutants into the atmosphere, sometimes causing severe air pollution. Now, researchers reporting in ACS' *Environmental Science & Technology* have estimated that, although so-called environmentally friendly fireworks emit 15-65% less particulate matter than traditional fireworks, they still significantly deteriorate air quality.

Fireworks displays can cause health problems, such as respiratory ailments, because they release high levels of air pollutants, including [particulate matter](#) (PM), sulfur dioxide, heavy metals and perchlorates. As a result, some cities have banned their use. But because the displays are an important aspect of many traditional celebrations, researchers and manufacturers have tried to develop more environmentally friendly pyrotechnics, including those with smokeless charges and sulfur-free propellants. Although research suggests that these [fireworks](#) emit less pollutants, their impact on air quality has not been evaluated. Ying Li and colleagues wanted to use data from a large fireworks display held in Shenzhen, China, on Chinese National Day on Oct. 1, 2019, to assess how "green" these fireworks really are.

The researchers estimated emissions of PM<sub>2.5</sub>, which is PM with a diameter of 2.5 μm and smaller, from the 160,000 environmentally friendly fireworks set off during the display, as well as emissions from traditional fireworks. They used information on the [wind direction](#), [wind speed](#), temperature and chemical composition of the fireworks to simulate the size, trajectory and peak PM<sub>2.5</sub> values for the smoke plume resulting from the event. Then, they compared their simulated values with actual data on PM<sub>2.5</sub> concentrations measured at 75 monitoring stations throughout the city following the fireworks display.

In agreement with the team's predictions, the data showed that the fireworks [smoke plume](#) began as a narrow band that traveled northward before being fully dispersed, with peak PM<sub>2.5</sub> levels similar to the predictions. The researchers used their validated simulation to estimate

that the use of environmentally friendly fireworks produces a much smaller, shorter-lasting plume, with 15-65% of the PM<sub>2.5</sub> emissions of a display using traditional fireworks. However, the peak concentration of PM<sub>2.5</sub> still greatly exceeds World Health Organization guidelines. This led the researchers to conclude that the number of "green" fireworks used at one time should be restricted.

**More information:** "Are Environmentally Friendly Fireworks Really "Green" for Air Quality? A Study from the 2019 National Day Fireworks Display in Shenzhen" *Environmental Science & Technology* (2021). [pubs.acs.org/doi/abs/10.1021/acs.est.0c03521](https://pubs.acs.org/doi/abs/10.1021/acs.est.0c03521)

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