

THE CHEMISTRY OF FIREWORK POLLUTION

Fireworks displays can be spectacular, but they can also have some negative effects on the environment. Here we take a look at some of the issues.

PARTICULATE MATTER

PM₁₀

Particulate matter 10 micrometres or less in diameter

PM_{2.5}

Particulate matter 2.5 micrometres or less in diameter

Fireworks produce a lot of very small particles, which can remain suspended in the air for some time after the display. This significantly increases the concentration of particulate matter in the air. Inhalation of these particles can have adverse effects on the respiratory and cardiovascular systems.

METALS

Sr

Ba

Cu

Pb

Cr

Sb

Ca

Na

Mg

Note: Lead (Pb) and chromium (Cr) are both banned in fireworks in the US and UK, but can still be found in some imported fireworks.

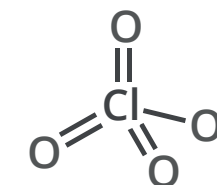
COLOURS

OTHER METALS

Metal compounds give fireworks their vivid colours and can also be present in oxidiser or mixtures. These metals persist in the environment. Small particles of toxic metals such as lead, chromium and antimony show increases in atmospheric concentrations in the days after fireworks displays.



PERCHLORATE POLLUTION



PERCHLORATE ION

Perchlorate concentration increase after a fireworks display in Albany, New York



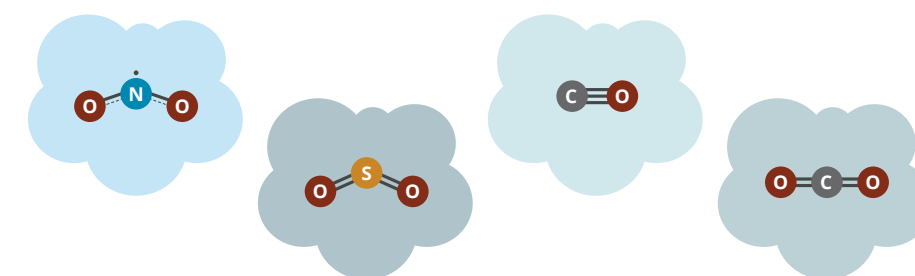
0.11 µg/L

519 µg/L

Source: Fate of perchlorate in a man-made reflecting pond following a fireworks display in Albany, New York, USA, Qian Wu and others, 2011, Environmental Toxicology and Chemistry 30, 11, 2449-2455.

Perchlorate compounds are used as oxidisers in some fireworks to aid the combustion reaction. These perchlorates can contaminate bodies of water near firework displays. Elevated concentrations of perchlorate in water can affect wildlife and it may also affect human health if it contaminates drinking water.

POLLUTING GASES



Fireworks lead to elevated levels of well-known polluting gases in the atmosphere. These gases include nitrogen dioxide and sulfur dioxide, which can cause respiratory problems, or exacerbate existing health problems such as asthma. They can also react in the atmosphere to form particulate matter.

