
ENVIRONMENTAL Fact Sheet



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Fireworks and New Hampshire's Lakes

In New Hampshire, fireworks are regulated by the Department of Safety under RSA 160. In most New Hampshire towns, it is legal for citizens to purchase, possess and ignite consumer-grade fireworks for personal use. In addition, there are numerous larger firework displays coordinated by towns and local businesses in order to celebrate special events, such as the Fourth of July.

Despite the fact that the visual displays can be quite spectacular, there are growing concerns about the potential for fireworks to pollute lakes and groundwater. Fireworks are comprised of a long list of chemicals used to create colors, noise and propulsion into the sky. Often, these displays occur near or over water to enhance viewing pleasure. Once launched, the chemicals can potentially be deposited directly into a waterbody or washed in from the shore after a rainstorm. In addition, the debris left behind after fireworks explosions can be coated with these same harmful chemicals.

Potential for pollution

Any debris deposited into New Hampshire waterways could be considered a water quality violation under Env-Wq 1703.03. While the amount of debris left after the ignition of fireworks displays may seem minor, multiple home displays around a lake (especially at the ends of docks) or repeated commercial displays can cumulatively contribute a significant amount of debris to a waterbody. That debris is not only unsightly; it serves as a potential source of chemical contaminants if deposited or washed into the water.

Heavy metals, such as copper, and other elements are used in fireworks to create many of the colors we observe. These chemicals, in concentrations above certain levels called water quality standards, can be harmful to humans and aquatic life. Another chemical compound, perchlorate (ClO_4^-), is used to assist in the skyward propulsion of fireworks. At this time, perchlorate is an unregulated compound in New Hampshire but studies have raised concerns regarding its ability to disrupt the body's synthesis of thyroid hormones. Fish development can also be affected by high concentrations of perchlorate. Massachusetts has set a standard for perchlorate concentration in drinking water of 2 $\mu\text{g/L}$. Fireworks can also contain nutrients (phosphorus and nitrogen compounds) that contribute to algal and plant growth in lakes.

Research on the environmental impact of fireworks

Four relatively recent studies provide insight on some of the effects that fireworks can have on water and air quality. In 2009, a study from Lake George, NY, indicated that perchlorate had no effect on water quality with concentrations in water samples below 2 $\mu\text{g/L}$ before and after a municipal firework displays¹. A study of groundwater conducted in Dartmouth, MA, from 2004 – 2006 indicated that perchlorate concentrations were elevated in groundwater test wells (maximum 62 $\mu\text{g/L}$) and soils (maximum 560 $\mu\text{g/kg}$) near fireworks launch areas². A study of a small Oklahoma lake from 2004 – 2006 reported that after commercial fireworks displays, perchlorate concentrations in water samples averaged 44 $\mu\text{g/L}$ but dissipated to below 1 $\mu\text{g/L}$ after 20 days³. Also,

a study of air quality in Pearl City, Hawaii, from 2004 – 2011 documented high levels of metals in air samples during commercial fireworks displays. In some cases, certain metals exceeded EPA air quality benchmarks (lead, chromium, manganese and cadmium)⁴. However, metal concentrations in the air dissipated within 24 hours of the fireworks display.

The American Fireworks Standards Laboratory (AFSL) has published lists of approved and banned chemicals for use in commercial and home consumer fireworks. However, it is important to note many of the fireworks sold in the United States are imported from other countries, primarily China, and may not conform to these requirements, nor are those imported fireworks regularly tested.

Recommended Best Management Practices

In order to reduce the potential for surface water contamination as a result of fireworks displays, there are several reasonable options that are recommended:

1. Be respectful of your neighbors and consider the timing and frequency of fireworks displays. Identify any local ordinances that pertain to fireworks. Some New Hampshire towns have special restrictions on fireworks. For more information about these restrictions, go to: <https://www.nh.gov/safety/divisions/firesafety/special-operations/fireworks/documents/CommunityRestrictionsList.pdf>.
2. Become knowledgeable of surrounding drinking water supplies and avoid using land near those supplies as launch areas.
3. Devise a plan that minimizes potential runoff from launch areas, especially if fireworks are launched from bare soil or sand.
4. Launch fireworks at a steep angle that promotes maximum height, allowing for complete ignition and combustion. Fireworks launched at a low trajectory may result in premature submersion in the water and incomplete burning of potentially hazardous compounds.
5. Rake the launch area and clean up all debris immediately following a fireworks display. Retrieve any visible non-combusted materials from the water.
6. Collect and dispose of all “duds” in accordance with manufacturer recommendations.

Finally, it should be noted that fireworks are likely a very small source of nutrients and metals compared to stormwater runoff from roads, sidewalks and lawns. New Hampshire’s lakes have clearly documented pollution problems from lawn fertilizers, road runoff, leaking septic systems and even pet waste. The most effective way to protect your favorite lake is to allow for a buffer of natural vegetation next to the lake, eliminate fertilizers and pesticides from lawn maintenance, clean-up after pets and maintain your septic system on a regular basis.

Summary

Fireworks contain chemicals that can be harmful to humans and aquatic life. Research suggests that the potential exists for short-term elevated concentrations of these chemicals in surface water, groundwater and the air immediately following larger commercial fireworks displays. At this time, there is no information available about the potential negative impact of consumer-grade fireworks displays on surface waters. However, it is reasonable to expect that a small but unknown amount of contaminants reach the surface water. Best management practices offer solutions to minimize these potential impacts.

1. LGA. 2010. An initial study into the effects of fireworks on the water quality of Lake George. The Lake George Association, Lake George, New York.
2. MDEP. 2007. Evaluation of perchlorate contamination at a fireworks display Dartmouth, Massachusetts. Massachusetts Department of Environmental Protection, Boston, Massachusetts.
3. Wilken, Richard, D. Fine, N. Burnett. 2007. Perchlorate behavior in a municipal lake following fireworks displays. *Environmental Science and Technology* 41:3966-3971.
4. J. Licudine, H. Yee, W. Chang, A. Whelen. 2012. Hazardous metals in ambient air due to New Year fireworks during 2004-2011 celebrations in Pearl City, Hawaii. *Public Health Reports*, July – August 2012, Volume 127, Pg. 440-450.