

# NO<sub>x</sub> Regulation

## Helping to Reduce Nitrogen Impacts at Rocky Mountain National Park

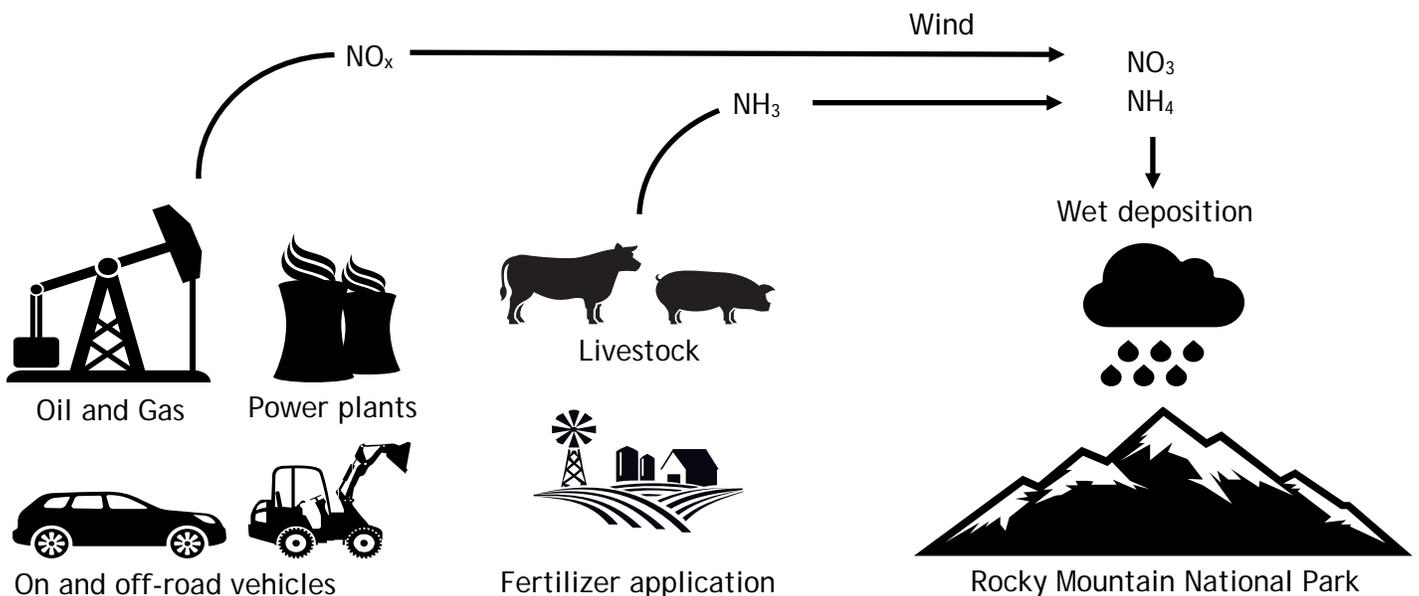


Regulation of nitrogen oxides (NO<sub>x</sub>) is helping to reduce nitrogen deposition and impacts to Rocky Mountain National Park's sensitive ecosystem. Colorado agricultural producers are working to protect the park through voluntary management of ammonia emissions.

### Where does nitrogen come from?

Nitrogen emissions come from a variety of man-made and natural sources. The two main types of nitrogen emissions are nitrogen oxides (NO<sub>x</sub>) which comes from vehicles, power plants, cement kilns, oil and gas, and off-road equipment, and ammonia (NH<sub>3</sub>) which primarily comes from livestock and fertilizer. NO<sub>x</sub> and NH<sub>3</sub> rise into the atmosphere where they mix with other gases to form ammonium nitrate, which can travel great distances and is deposited by rain and snow. This mixture flows into rivers and lakes across Colorado. This process is called nitrogen deposition and excessive amounts change water chemistry and disrupt ecosystems.

### Nitrogen Emission and Deposition Process



### Too much of a good thing

Rocky Mountain National Park's high elevation ecosystems use very little nitrogen. The alpine tundra, aquatic plants, soil and water quality are particularly sensitive to nitrogen deposition. Scientists are concerned that excess nitrogen promotes non-native plants and reduces forest health. Nitrogen is transported into the park by winds blowing from the west, and by upslope winds from the east, which are common in the spring and summer. As these winds transport nitrogen into the park, it mixes with moisture in the

air, and is deposited by rain or snow. Unfortunately, there is much more nitrogen being deposited into the park than it needs. This is similar to a farmer applying more nitrogen fertilizer than a crop can use to meet reasonable yield goals.

## What is being done?

NO<sub>x</sub> emissions are being reduced through regulations that are enforced by the Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE).



Power plants

The Colorado Regional Haze State Implementation Plan (SIP) requires controls on specific coal-fired power plants and cement kilns resulting in significant NO<sub>x</sub> emission reductions. Overall, 16 facilities (that have 31 boilers or “units”) were controlled. Of these, 10 units will be decommissioned, and an additional unit either decommissioned or converted to natural gas. Twelve units installed various NO<sub>x</sub> control systems. One unit was converted to natural gas.



Oil and Gas

Colorado requires various existing natural gas-fired engines over a certain size to install emission controls if the retrofit control cost is below \$5,000 per ton of NO<sub>x</sub>. Colorado requires new and relocated engines to meet emission performance standards that reduce NO<sub>x</sub> emissions statewide.



On and off-road vehicles

The Colorado Automobile Inspection and Readjustment (AIR) Program (in effect since the 1970s) reduces motor-vehicle-related pollution through the inspection and emissions-related repair of gasoline-powered motor vehicles.

Federal on-road vehicle TIER II, III and IV gasoline and diesel exhaust standards, gasoline and diesel fuels standards, and federal off-road and small engine standards, which are being phased in over a period of years depending on the type of vehicle, provide significant NO<sub>x</sub> emission reductions.

The 2010 EPA fuel efficiency and vehicular gas emissions standards for medium- and heavy-duty trucks promotes a new generation of cleaner more fuel efficient trucks and will cover model years starting in 2018 and 2021, depending on the type and size of vehicle.

NO<sub>x</sub> emissions controls are extremely effective and have been widely implemented, resulting in NO<sub>x</sub> levels decreasing by about 50% in the Northern Front Range since the 1980s. These reductions are a key component of ground-level ozone reduction efforts, Colorado’s Regional Haze SIP and the 2010 Colorado Clean Air-Clean Jobs Act. Statewide, NO<sub>x</sub> emissions continue to decrease due to regulations; however, concerns about elevated ozone levels in the Denver area and a new lower ozone standard may require additional NO<sub>x</sub> emission controls in the future.

## Agriculture’s Voluntary Ammonia Management



Agriculture

Since 2006, the National Park Service, CDPHE, EPA, and Colorado livestock and crop producers, and other federal and state partners, have collaborated on voluntary best management practices for ammonia emissions from agriculture. The group developed an Early Warning System ([www.rmwarningsystem.com](http://www.rmwarningsystem.com)) to identify specific times for producers to reduce ammonia emissions contributing to nitrogen deposition in the park.

More information about this partnership is available at:

<https://www.colorado.gov/pacific/cdphe/rocky-mountain-national-park-initiative>

<https://www.colorado.gov/pacific/cdphe/ammonia-reduction>