

Appendix A – Priority Air Pollutants and Sources

In order to determine the focus of strategies, policy changes, and air quality program implementation, the City of Fort Collins evaluates common air pollutants and sources to determine priorities, considering such criteria as health impacts, air pollution trends, compliance with current state and federal standards, ability to effect improvements at the local level, and community and Council priorities.

Based on the evaluation of these criteria, levels of concern are assigned for common outdoor and indoor air pollutants. Tables A-1 and A-2, below, summarize each pollutant and associated concern levels. Note that some of the same pollutants, such as carbon monoxide (CO), have different levels of concern outdoors as compared to indoors.

TABLE A-1. CITY OF FORT COLLINS CONCERN LEVELS FOR COMMON OUTDOOR AIR POLLUTANTS

POLLUTANT	LEVEL OF CONCERN	SUPPORTING INFORMATION
OZONE (O_3)	High	<p>Ozone exposure reduces lung function and causes respiratory symptoms, such as coughing and shortness of breath. Ground-level ozone forms when emissions of NO_x and VOCs react in the presence of sunlight.</p> <p>Fort Collins, along with the Denver/North Front Range region, does is currently not in compliance with the U.S. Environmental Protection Agency (EPA) health-based standards for ozone. Ozone was identified as a City Council priority in 2019.</p>
PARTICULATE MATTER ($PM_{2.5}$ AND PM_{10})	High	<p>Exposures to fine particles ($PM_{2.5}$) can cause harmful effects on the cardiovascular system including heart attacks and strokes. Fine particles are also the main cause of reduced visibility (haze). To a lesser extent, larger particles (PM_{10}) also contribute to health impacts and visibility degradation.</p> <p>Fort Collins measurements show some moderately high days in winter, when temperature inversions trap pollutants closer to the ground. Sources of dust and wood smoke also cause localized and regional health and nuisance concerns. Particulate Matter was identified as a City Council priority in 2019.</p>
GREENHOUSE GASES (GHGs)	High	<p>GHGs are gases in the atmosphere that can absorb or emit heat. Carbon dioxide (CO_2) is most abundant GHG which is influenced by activity such as burning fossil fuels (e.g., coal, gasoline, and natural gas).</p> <p>While CO_2 is not directly associated with health effects, science attributes a warming of the Earth's atmosphere to an increase in levels of CO_2 and other GHGs. The City of Fort Collins tracks community and municipal emissions of GHGs, with a goal of carbon neutrality by 2050.</p>

NITROGEN DIOXIDE (NO₂)	Medium	<p>Nitrogen dioxide contributes to health effects, particle formation, ozone formation and acid rain.</p> <p>EPA regulations for power plants have contributed to reduced NO₂ nationally and local concentrations are expected to be below EPA health-based standards. NO₂ is a priority because it contributes to ozone nonattainment status.</p>
VOLATILE ORGANIC COMPOUNDS (VOCs)	Medium	<p>VOCs contribute to ozone formation and include Hazardous Air Pollutants (HAPs), where HAPs are known or suspected to cause cancer or other serious health effects.</p> <p>VOCs and HAPs are not routinely measured, and emissions are controlled through EPA and State regulations and permitting processes. VOCs are a priority due to potential impacts from HAPs, and contributions to ozone nonattainment status.</p>
CARBON MONOXIDE (CO)	Low	<p>At high concentrations, CO is a poisonous gas. The entire U.S. currently meets CO air quality standards, largely because of EPA emissions standards for new motor vehicles.</p>
SULFUR DIOXIDE (SO₂)	Low	<p>SO₂ contributes to health effects, particle formation and acid rain. It is primarily emitted from industrial sources such as coal-fire power plants (high sulfur fuels/coal).</p> <p>EPA regulations for power plants have contributed to reduced SO₂ nationally and local concentrations are expected to be below EPA health-based standards.</p>
LEAD (Pb)	Low	<p>Nationally, average lead concentrations decreased dramatically after the EPA's regulations reduced the lead content in on-road motor vehicle gasoline.</p>

TABLE A-2. CITY OF FORT COLLINS PRIORITY LEVELS FOR COMMON INDOOR AIR POLLUTANTS

POLLUTANT	LEVEL OF CONCERN	SUPPORTING INFORMATION
RADON	High	<p>Radon is an invisible, odorless, radioactive gas that can accumulate in homes due to the natural decay of uranium in the soil.</p> <p>Radon is the second leading cause of lung cancer in US. In Fort Collins, >56% of tests return values higher than the EPA recommended action level for mitigation. Radon was identified as a City Council priority in 2019.</p>
VOCs	Medium	VOCs can accumulate indoors through use of cleaning products, paint, air fresheners, gasoline/fuels and other products.
PARTICLE POLLUTION	Medium	High concentrations of particles can accumulate indoors due to combustion (e.g., cooking and candles), dust, and mold.
CARBON MONOXIDE (CO)	Medium	Carbon monoxide is a by-product of incomplete combustion. Common sources indoors include water heaters, space heaters, gas stoves, furnaces, and vehicle exhaust from attached garages. High levels can accumulate indoors and cause carbon monoxide poisoning. Use of CO monitors is an effective way that CO poisoning can be avoided.
LEAD	Low	<p>Lead is a highly toxic metal that may cause a range of health problems, especially in young children. When lead is absorbed into the body, it can cause damage to the brain and other vital organs.</p> <p>Lead was commonly used in paint until banned in 1978. Lead can be found in household dust from sources such as deteriorating lead-based paint. High lead levels are sometimes found in older homes. Levels should be tested by trained, certified professionals.</p>

FORT COLLINS AIR QUALITY CONCENTRATION AVERAGES

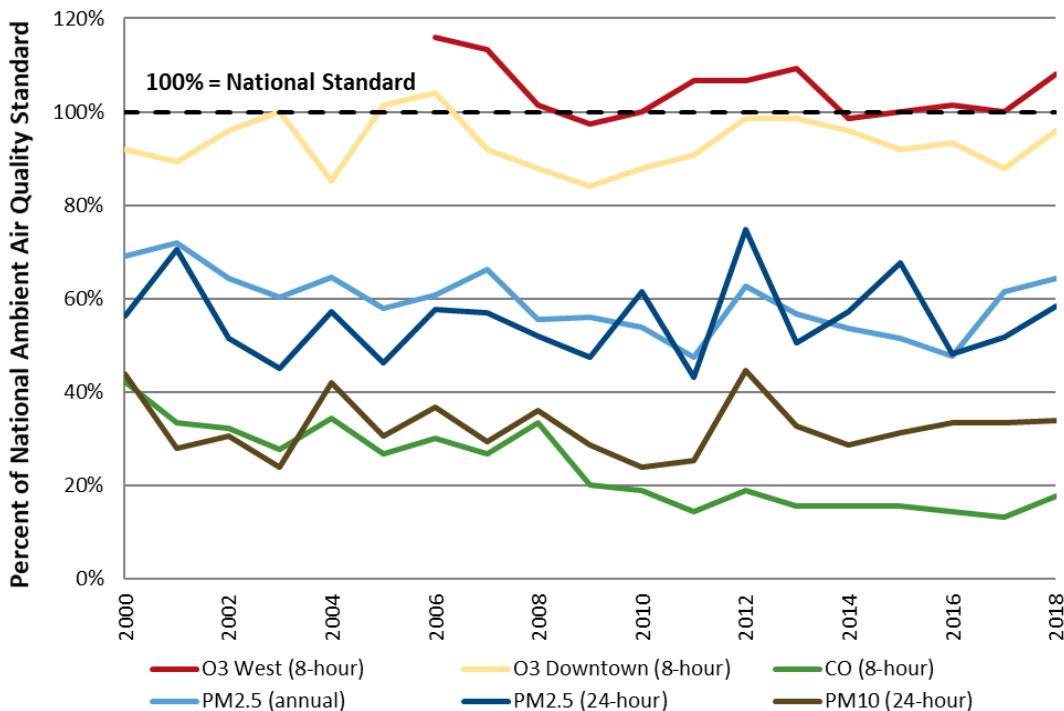


Figure A-1. Monitored Pollutant Trends in Fort Collins, Colorado.

Local Air Pollution Trends

Regulated pollutants, sometimes referred to as “criteria pollutants” are pollutants which have concentration standards or limits, as determined by the EPA. Regulated pollutants monitored in Fort Collins include O₃, PM and CO.¹ Figure A-1 presents a timeline of concentrations measured in Fort Collins, as compared to EPA standards. Monitored pollutants trends indicate that:

- O₃ values continue to exceed the national standard.
- None of the monitored pollutants show an increasing trend in recent years, despite a growing population.
- CO is well below the EPA standard and shows a decreasing trend.
- Annual PM_{2.5} averages show a slightly decreasing trend, but at time spikes in 24-hour concentrations approach the national standard.
- PM₁₀ levels are stable, and below the national standard.

Ambient Air Pollution Sources

Air pollutants are emitted from a variety of sources. Some pollutants are released directly into the atmosphere while other pollutants are formed in the air from chemical reactions. Table A-3 presents a summary of emissions for Larimer County, as updated in 2016.² As the table shows, pollutants are emitted by a variety of sources and some sources emit more than one pollutant. Major sources represented include:

- **Transportation Sources** – Includes vehicles such as cars and trucks, and other engine sources such as recreational and construction equipment.
- **Commercial/Industrial** –Includes large industrial facilities and electric power plants, and smaller industrial, non-industrial and commercial facilities

- **Nonpoint Sources** – Includes aggregates of emissions estimates for sources that are individually too small in magnitude to report as stationary/fixed sources. Examples include residential heating, commercial combustion, asphalt paving, and commercial and consumer solvent use.
- **Oil and Gas** – Emissions from the exploration and development of oil and gas sources.
- **Wildfires/Rx Burning** – Emissions from natural fires and permitted prescribed (Rx) fires.
- **Residential Wood Combustion** – Includes emissions from residential wood-burning appliances such as wood stoves.
- **Windblown Dust** – Natural dust, not associated with human activities.
- **Fugitive Dust** – Dust emitted due to human activity, such as dust associated with construction and earthmoving activities.

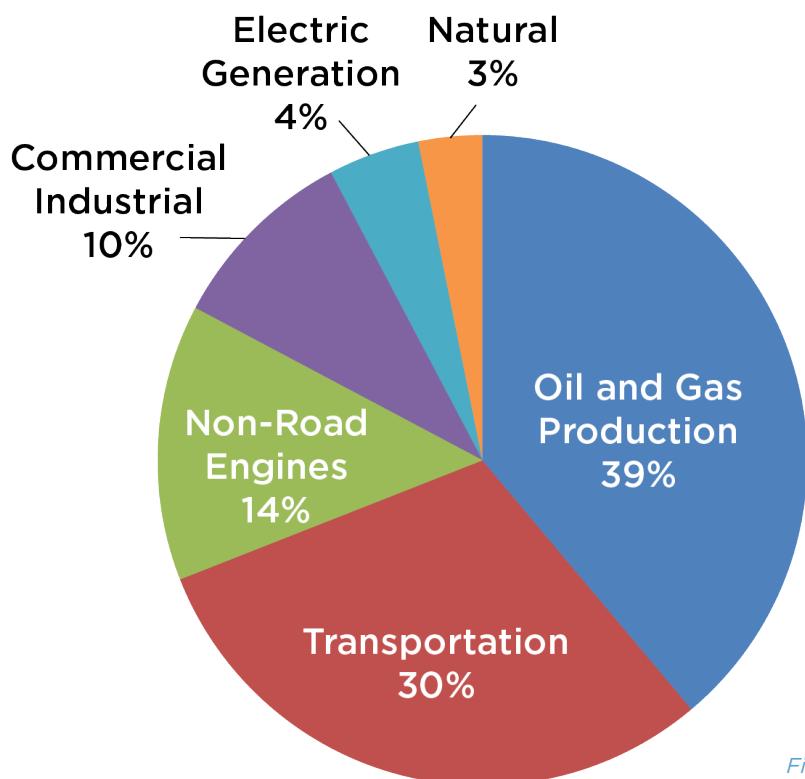


Figure A-2. Estimated source contributions to ozone formation in Fort Collins.³

TABLE A-3. LARIMER COUNTY EMISSIONS SUMMARY

POLLUTANT	CO	NOX*	VOC*	SO2	CH4	PM2.5	PMC**
tons/year	58,342	10,253	11,765	1,040	4,779	2,545	6,338
CATEGORY							
TRANSPORTATION	85%	71%	54%	3%	7%	13%	0%
COMMERCIAL/INDUSTRIAL	2%	23%	10%	92%	73%	14%	4%
NONPOINT	0%	4%	17%	0%	1%	5%	0%
OIL AND GAS PRODUCTION	0%	1%	6%	0%	13%	0%	0%
WILDFIRES/RX BURNING	5%	1%	6%	3%	2%	5%	0%
RESIDENTIAL WOOD COMBUSTION	7%	1%	6%	1%	5%	23%	0%
WINDBLOWN DUST	0%	0%	0%	0%	0%	5%	19%
FUGITIVE DUST	0%	0%	0%	0%	0%	34%	77%

*Ground-level ozone (O_3) forms when emissions of NOx and VOCs react in the presence of sunlight.

**PMC, or coarse particulates, includes particles measured between 2.5 and 10 microns in diameter.

Notably, while the table summarizes sources that originate within Larimer County, many sources that contribute to air pollution in Fort Collins originate from outside the County. Ground-level ozone, for example, forms when emissions of NO_x (NO and NO₂) and VOCs react in the presence of sunlight.

Figure A-2 presents the sources modeled to contribute to ozone measurements in Fort Collins from regional sources in the Denver Metro/North Front Range non-attainment area, which includes Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson and parts of Larimer and Weld counties. The major sources include oil and gas production, transportation sources, and non-road engines (such as lawn and garden equipment).

ENDNOTES

- ¹ Data from local air quality monitors is available at <https://www.colorado.gov/airquality/>
- ² Emissions data represent the 2011b emissions platform as provided through the Intermountain West Data Warehouse at <http://views.cira.colostate.edu/tsdw/>
- ³ Data from Denver 2017c Local Source Analysis, available through <http://views.cira.colostate.edu/tsdw>