What are the main air pollutants emitted by cars and trucks?

Automotive emissions have long been a public health concern, which led to their regulation starting in the 1970s. These regulations have become stricter over the decades. Maximum limits for per-car or per-truck emissions have reduced considerably. However, the growing volume of vehicles has in many regions offset or even overwhelmed these reductions.

Pollutants of primary concern, from road transport, are:

NOx, nitrogen oxides – NOx causes inflammation of respiratory systems, i.e. the windpipes and lungs of humans and animals. It is a key contributor to asthma. Especially vulnerable to NOx are those whose systems already are compromised or less robust: the young, the elderly and the sick.

Other pollutants of primary concern are caused by the reaction of NOx with other constituents of the atmosphere. Particles are formed by the combination of NOx with other gases and with solids. Ozone is created by the reaction of NOx with hydrocarbons.

NOx is a mixture of nitrogen oxide (NO) and nitrogen dioxide (NO_2). It is created from the nitrogen and oxygen present in air under conditions of high temperature and/or high pressures – such as in an engine in a car or truck.

Particles, sometimes called particle matter or PM – particles cause inflammation of respiratory and cardiovascular systems, i.e. the windpipes and lungs and the heart and blood-circulation of humans and animals. They aggravate heart and vascular function, even causing heart attacks, and they contribute to asthma. Especially vulnerable to particles are those whose systems already are compromised or less robust: the young, the elderly and the sick. Particles also have been linked to some forms of cancer. Particles can have heavy concentrations of black carbon, which is a significant source of global warming. The World Health Organisation (WHO) confirmed in 2012 that diesel emissions are a group one carcinogen to humans (http://www.bbc.co.uk/news/health-18415532).

Particles emitted by cars or trucks usually start as tiny pieces of unburnt fuel. Often these combine with other gases and solids when in the air. Particularly dangerous are the smallest particles, those less than 2.5 microns in diameter (a micron is a millionth of a metre), which can penetrate most deeply into the lungs.

Hydrocarbons (HCs), or volatile organic compounds (VOCs) – under sunny skies, airborne hydrocarbons and NOx react to form ozone (O_3), a highly reactive gas. By itself or in combination with particles, ozone is often referred to as smog. Ozone causes inflammation of the respiratory system, i.e. the windpipes and lungs of humans and animals, and contributes to bronchitis, emphysema and asthma. Especially vulnerable to ozone are those whose systems already are compromised or less robust: the young, the elderly and the sick. Ozone is also harmful to the respiratory systems of many plants.

Chemically, ozone at ground level is the same material as that in the ozone layer, which encircles the earth some 10-50 kilometers above the surface. At ground level, ozone is very harmful, whereas in the stratosphere, it protects the earth against cosmic radiation that is dangerous to life.