03/ Emissions of acidifying substances

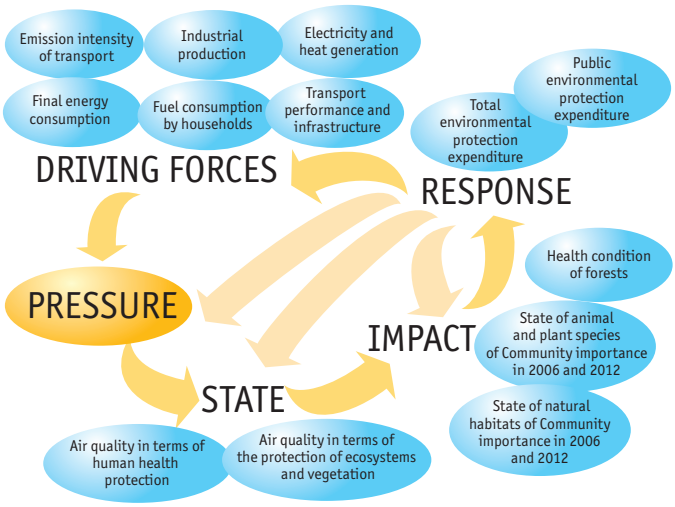
KEY QUESTION

Have we succeeded in reducing air pollution with acidifying substances that adversely affect human health and ecosystems?

KEY MESSAGES

Emissions of acidifying substances (SO_2, NO_x and NH_3) in the air have been decreasing steadily since 1990. Since 1990, the total emissions of acidifying substances decreased by 85.1%. Since 2000, they dropped by 35.9% and in 2013–2014 interannual comparison they decreased by 4.1%. In the long term, the amounts of emissions of acidifying substances have been below the national emission ceilings for the year 2010.

Of total emissions of acidifying substances in 2014, the emissions of NH_3 comprised 34.4%, SO_2 emissions 33.4% and NO_x emissions 32.2%.



OVERALL ASSESSMENT

Change since 1990	
Change since 2000	
Last year-to-year change	

REFERENCES TO CURRENT CONCEPTUAL, STRATEGIC AND LEGISLATIVE DOCUMENTS

Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)
- establishment of national emission ceilings for SO_2: 265 kt.year^{-1}, i.e. 8.28 kt.year^{-1} weighed by the acidifying equivalent[1]
- establishment of national emission ceilings for NO_X: 286 kt.year^{-1}, i.e. 6.22. kt.year^{-1} weighed by the acidifying equivalent
- establishment of national emission ceilings for NH_3: 80 kt.year^{-1}, i.e. 4.71. kt.year^{-1} weighed by the acidifying equivalent

Convention on Long-Range Transboundary Air Pollution (CLRTAP)
- prevention of the spread of transboundary air pollution on long distances

Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (The Gothenburg Protocol)
- reduction of areas with an excessive degree of acidification in Europe
- establishment of new emission ceilings for the year 2020 set as a percentage reduction in emissions compared to the state in 2005: for SO_2 the emission reduction is set to 45%, for NO_x it is 35% and for NH_3 it is 7%

State Environmental Policy of the Czech Republic 2012–2020
- meeting the national emission ceilings valid since 2010 and the reduction of the total emissions of SO_2, NO_x, NH_3 by 2020 in line with the commitments of the Czech Republic

National Emission Reduction Programme of the Czech Republic
- meeting the values set by the national emission ceilings for SO_2, NO_x and NH_3
- reduction of the environmental burden by the substances damaging ecosystems and vegetation

The Potential to Reduce Emissions of Pollutants in the Czech Republic by the Year 2020
- quantification of the reduction of pollutant emissions that the Czech Republic is able to achieve by 2020, if it takes the measures arising from the applicable national and European legislation, without the need for implementation of additional measures

IMPACTS ON HUMAN HEALTH AND ECOSYSTEMS

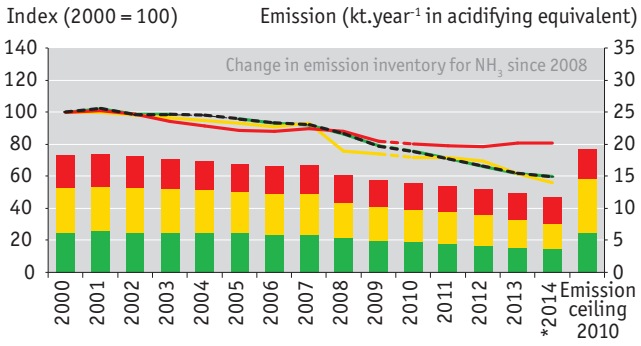
Even a short-term exposure to acidifying substances causes irritation of the respiratory system which may limit its functions and also reduce the organism's resistance to infectious diseases. Exposure to acidifying substances worsens the problems of people suffering from asthma (bronchoconstriction) and allergies, particularly of those who experience increased sensitivity to additional allergens. Long-term exposure to high concentrations of NO_x may increase the number of patients with acute respiratory problems, especially in sensitive groups of the population (people suffering from allergies, children, the elderly, etc.).

Emissions of acidifying substances increase the hydrogen ion concentration in water and soil, which leads to the reduction of pH and the leaching of toxic metals (Al, Cd, Pb and Cu). Furthermore, the flow of nutrients may deteriorate, which can lead to the disruption of the root system and, consequently, to the disruption of the runoff regime and to increased erosion. Increased acidity of the environment alters the representation of nutrients, which leads to the reduction of biodiversity and to the disruption of the balance among the single ecosystems.

[1] *All the data on emissions, presented both in the texts and charts are based on the values expressed using the so-called acidifying equivalent (acidification). The acidifying equivalent factors are as follows for the below substances: for NO_x = 0.02174; for SO_2 = 0.03125 and for NH_3 = 0.05882. The total emissions equal the sum of total annual emissions of the individual substances expressed in tonnes and multiplied by their respective acidifying equivalent factors.*

INDICATOR ASSESSMENT

Chart 1 ➜ **Development of total emissions of acidifying substances in the Czech Republic and the level of national emission ceilings for 2010 [index, 2000 = 100]; [kt.year^{-1} in acidifying equivalent], 2000–2014**



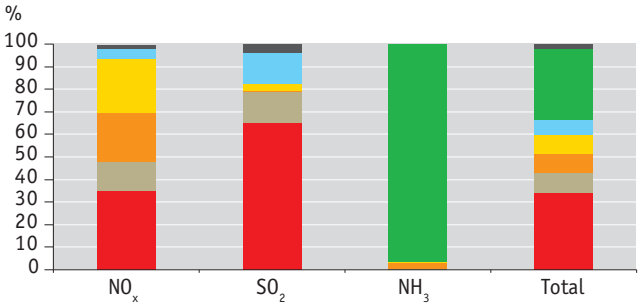
- NH_3 (left axis)
- SO_2 (left axis)
- NO_x (left axis)
- NH_3 (right axis)
- SO_2 (right axis)
- NO_x (right axis)
- Total emissions of acidifying substances

Source: Czech Hydrometeorological Institute

** Preliminary data*

Emissions from the use of nitrogen fertilisers have been included in the NH_3 emission balance since 2008.
The correction of emission inventories was carried out for the presented period 2000-2014 due to the adjustments of emission factors.

Chart 2 ➜ **Sources of emissions of acidifying substances in the Czech Republic [%], 2013**



- Others
- Agriculture
- Household heating
- Services, households and agriculture
- Transport
- Industrial energy
- Public electricity and heat production

Source: Czech Hydrometeorological Institute

Emissions of NH_3 from agriculture come from livestock breeding and the use of mineral nitrogen fertilisers.
Emissions in the sector of services, households and agriculture come from mobile and stationary combustion sources (excluding household heating).
A correction of emission inventories was carried out for the period 2000–2014 due to the adjustments of emission factors.
Data for the year 2014 are not, due to the methodology of their reporting, available at the time of publication.

Emissions of acidifying substances (SO_2, NO_x and NH_3) have been declining in the long-term; between the years 1990–2014 they experienced an overall decrease by 85.1%, i.e. from 79.0 to 11.7 kt.year^{-1} in acidifying equivalent. In the period 1990–2014 the biggest drop in SO_2 emissions was recorded, namely by 93.2% to 3.9 kt.year^{-1} in acidifying equivalent. Therefore, during this period the emissions dropped to less than their tenth. NO_x emissions decreased by 68.4% to 3.8 kt.year-1 in acidifying equivalent, the smallest decline was recorded for the NH_3 emissions – by 56.0% to 4.0 kt.year^{-1} in acidifying equivalent. The most significant decrease took place in the 1990s, mainly due to the structural changes in the economy. Since 2000, the decline has been slowing down.

Between the years **2000–2014** emissions of acidifying substances decreased by 35.9%, while the most significant decrease was recorded for SO_2 emissions, i.e. by 44.0%, NO_x emissions decreased by 40.3% and NH_3 emissions decreased by 19.1% (Chart 1). The most significant interannual decline in this period occurred between 2007 and 2008, namely by 10.1%, which was mainly the result of the recession of the national economy caused by economic crisis.

In the **interannual 2013–2014 comparison**, a decrease in emissions of acidifying substances by 4.1% was tracked. This decrease was mainly caused by the reduction of SO_2 emissions, namely by 9.0%. NO_x emissions fell by 3.3% and NH_3 emissions stagnated.

Based on the 2013 data, **the main sources of emissions of acidifying substances** in the Czech Republic (Chart 2) were the sector of public electricity and heat production (34.0%, i.e. 4.0 kt.year^{-1} in acidifying equivalent), agriculture (31.6%, i.e. 3.9 kt.year^{-1} in acidifying equivalent) and industrial energy sector (9.2%, i.e. 1.1 kt.year^{-1} in acidifying equivalent). The representation of individual emissions of acidifying substances is, however, different. SO_2 emissions come mainly from combustion processes of fossil fuels containing sulphur. Therefore, the most significant source in 2013 was the sector of public electricity and heat production (65.1%), industrial energy (14.0%) and household heating (13.6%). NO_x emissions are produced during fuel combustion and also chemical-technological processes. In 2013,

the main sources of these emissions were public electricity and heat production (34.9%); a significant source of NO_x emissions in the long-term is also the transport sector (a total of 21.9% in 2013) and combustion processes in the sector of services, households and agriculture (23.7% in 2013). The main producer of NH_3 emissions is the sector of agriculture, particularly livestock breeding and the use of nitrogen fertilizers (comprising the total of 96.4% in 2013), 3.0% of NH_3 emissions were produced in 2013 by the transport sector.

SO_2 emissions are steadily decreasing, which is, in particular, the result of desulphurization of coal power plants in the 1990s, the use of fuels with a lower sulphur content and the gradual reduction of energy intensity of the economy. The amount of emissions produced by the household heating sector greatly depends on temperature conditions in the heating season in the given years. Emissions of acidifying substances SO_2 and NO_x are also slightly decreasing due to the reduction of the consumption of solid fuels in the sector of public electricity and heat production, where the importance of nuclear energy and of energy from renewable energy sources is growing, and also due to legislative obligations on meeting emission ceilings. The export nature of electricity production in the recent years, however, counteracts even stronger drops in emissions, making electricity production in the Czech Republic significantly exceed its consumption.

Reduction of the total emissions of **NO_x** acidifying substances is significantly related to the decrease in these emissions from the transport sector. This change can be attributed to the renewal of the car fleet, fulfilment of EURO emission standards, introduction of modern technologies of removing emissions, such as three-way catalytic converters and the system of selective catalytic reduction (SCR), and also to the reduction of energy consumption in the transport sector.

The decline in emissions of **NH_3** acidifying substances is associated with a decrease in the quantity of livestock (mostly pigs) resulting from the agricultural policy of the Czech Republic and further with the implementation of the plans of good agricultural practice and the change in the means of financing agriculture after the entry of the Czech Republic into the EU.

DETAILED INDICATOR ASSESSMENT AND SPECIFICATIONS, DATA SOURCES

CENIA, key environmental indicators
http://indicators.cenia.cz