AMMONIA OVERLOAD IS DANGEROUS FOR HEALTH AND THE ENVIRONMENT

HOW AMMONIA EMISSIONS ARE BOOSTED BY OVERPRODUCTION OF MEAT AND DAIRY PRODUCTS

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WHAT IS AMMONIA?

Ammonia (NH_3) is a form of nitrogen, which is helpful for plant growth in moderate amounts. It is a colourless gas with a characteristic pungent and irritating odour, and it dissolves very easily in water. When dissolved in water, it is referred to as ammonium ion (NH_4^+) or ammonia (NH_4OH).

AMMONIA COMES MAINLY FROM LIVESTOCK FARMING

Ammonia emissions in the air come mainly from agriculture. They occur at different stages of the nitrogen cycle: ammonia and its derivatives are the main source of nitrogen for crops, an essential element for living organisms as it is a component of proteins.

In Europe, agriculture is the source of the vast majority of ammonia emissions (94%)[1]. Livestock farming is the main contributor to these agricultural ammonia emissions, accounting for 87%[2]. The highest emitting countries are Germany, France, Spain and Italy[3].

In Europe, livestock farming is responsible for

87% of agricultural ammonia emissions.

At national level, there is no register of the exact contribution of livestock farming to ammonia emissions. For example, the European Environment Agency figures do not include indirect emissions from livestock farming, i.e. from the application of synthetic fertilisers on crops used to feed animals. If we only look at direct emissions, then livestock farming in Europe is responsible for 71% of agricultural ammonia emissions[4]. Yet the majority of crops in the EU are used to feed animals[5]: this illustrates the lack of consideration of the environmental footprint of livestock farming related to animal feed, thus obscuring the impact of pigs and poultry, which are major consumers of grain.

Ammonia is the basis of the entire nitrogen fertiliser industry and is used in various forms of fertiliser (ammonium nitrate, ammonium sulphide, urea) to be applied to crops. Nitrogen is a fundamental building block of living organisms, and is found in amino acids and proteins. Depending on local weather conditions and how it is used, ammonia that is not consumed by plants may evaporate into the atmosphere or oxidise as nitrate.

Urea excreted by animals is the main source of ammonia emissions[6], either from livestock bedding or during storage of manure. Livestock manure and slurry also contain nitrogen in the form of ammonia, a fraction of which evaporates into the atmosphere[7].

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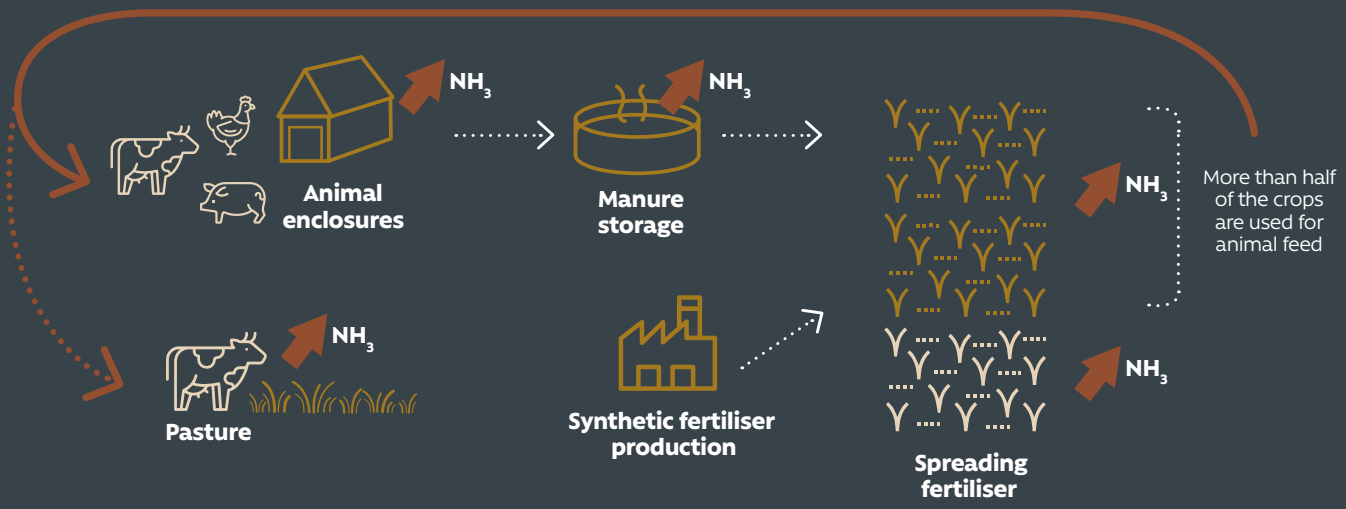
1. European Environment Agency, National air pollutant emissions data viewer 2005-2020. Data for the year 2020. https://www.eea.europa.eu/data-and-maps/dashboards/necd-directive-data-viewer-6
2. Westhoek H., Lesschen J.P., Leip A., Rood T., Wagner S., De Marco A., Murphy-Bokern D., Pallière C., Howard C.M., Oenema O. & Sutton M.A. (2015) Nitrogen on the Table: The influence of food choices on nitrogen emissions and the European environment. (European Nitrogen Assessment. Special Report on Nitrogen and Food.) Centre for Ecology & Hydrology, Edinburgh, UK. This figure includes all emissions associated with livestock production, both direct and indirect.
3. European Environment Agency, National air pollutant emissions data viewer 2005-2020. Data for the year 2020. https://www.eea.europa.eu/data-and-maps/dashboards/necd-directive-data-viewer-6
4. European Environment Agency, National air pollutant emissions data viewer 2005-2020. Data for the year 2020. https://www.eea.europa.eu/data-and-maps/dashboards/necd-directive-data-viewer-6 This figure only takes into account direct emissions from animals, their manure and the spreading of this manure. However, it does not take into account indirect emissions, linked to the application of synthetic fertilisers on crops used to feed the animals.
5. Greenpeace, False sense of security, 2020. https://www.greenpeace.org/static/planet4-eu-unit-stateless/2020/10/85cc908b-false-sense-of-security_final_en.pdf
6. Id.
7. See the methodology: https://www.eea.europa.eu/publications/emep-eea-guidebook-2016/part-b-sectoral-guidance-chapters/4-agriculture/3-b-manure-management-2016

> DIFFERENT EMISSION ROUTES OF AMMONIA FROM LIVESTOCK



EXCESSIVE AMMONIA CONCENTRATIONS HARMFUL TO AIR, WATER AND SOIL

Ammonia is a natural compound, but excessive concentration in air, water and soil can have a number of harmful impacts on the environment. Although ammonia remains in the atmosphere for a short time, it causes a cascade of effects on animals, plants and air quality.

More than 3 million tonnes of ammonia are dispersed into the air each year in Europe[8].

Ammonia is considered to have an acute toxicity in aquatic environments[9]. It can, for example, cause gill lesions and asphyxiation in sensitive fish species.

Ammonia also contributes to the eutrophication of environments:[10] in rivers, estuaries or coastal waters, excess nutrients, including ammonia, encourage the proliferation of plants on the surface (green algae and phytoplankton). This stimulates the activity of certain bacteria that consume the oxygen dissolved in the water, to the detriment of other species present in the environment. This phenomenon is the cause of green tides and the colouring of water in estuaries and at sea.

Ammonia also contributes (albeit in a minor way) to acid rain and the acidification of water and soil,[11] which can affect their biological activity and alter their structure.

The natural biogeochemical cycle of nitrogen is heavily disturbed by human activities. Global releases of nitrogen into the oceans, in the form of ammonia or nitrates, should not exceed a limit estimated at between 62 and 82 million tonnes per year, according to the best available science. However, the current level of global nitrogen emissions into the oceans is estimated to be over 150 million tonnes annually.[12]

The manufacture of synthetic fertilisers (partly to fertilise crops to feed animals) also has an impact on the planet. The production of ammonia contributes to global heating, since it is produced using fossil gas and coal, particularly in China, the world's largest exporter of nitrogen fertilisers, along with Russia.[13] The use of nitrogen fertilisers also contributes to the production of nitrous oxide (N_2O), a powerful greenhouse gas. Even though a small fraction (less than 2%) of fertiliser inputs are lost as N_2O,[14] the total effect is significant because the global warming potential of this gas is 265 times that of carbon dioxide.[15]

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8. European Environment Agency, National air pollutant emissions data viewer 2005-2020, data for the year 2020. https://www.eea.europa.eu/data-and-maps/dashboards/necd-directive-data-viewer-6 9. Pollutant sheet - NH3. ATMO BFC, 2013.
10. Ammonia (NH3) emissions, European Environment Agency. https://www.eea.europa.eu/data-and-maps/indicators/eea-32-ammonia-nh3-emissions-1
11. INERIS, Environmental and toxicological data sheets: ammonia, 2012. https://substances.ineris.fr/fr/substance/getDocument/2709
12. Commissariat général au développement durable , Disruption of the biogeochemical cycles of nitrogen and phosphorus, 2019. https://www.notre-environnement.gouv.fr/themes/societe/limites-planetaires-ressources/article/perturbation-des-cycles-biogeochimiques-de-l-azote-et-du-phosphore
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AMMONIA, A PRECURSOR OF FINE PARTICLES THAT IMPACT OUR HEALTH

Ammonia affects the health of farmers and animals, especially in buildings where the concentration is highest. At moderate concentrations in the air, ammonia can cause irritation of sensitive areas (eyes, trachea) and a slight cough. At higher concentrations, it can cause respiratory problems (asthma, chronic bronchitis), reduce immunity and increase susceptibility to bacterial and viral infections.[16]

Ammonia is also toxic through direct exposure and its use is regulated.[17]

Ammonia can recombine in the atmosphere with nitrogen and sulphur oxides to form fine particles (PM2.5). Ammonia makes a significant contribution to peaks of fine particulate matter pollution in early spring,[18] when fertiliser and livestock manure are applied.

Ammonia contributes fine particulate matter pollution

The European Environment Agency considers that air pollution is the greatest environmental health risk in Europe and that it has a significant impact on the health of the European population.[19] While emissions of many air pollutants and their concentrations in ambient air have decreased significantly over the last two decades in Europe, air quality remains poor in many regions.[20] If the level of exposure to fine particles had been below the limits recommended in the WHO 2021 guide, 238,000 premature deaths could have been avoided in the European Union in 2020.

In 2020 alone, 238,000 premature deaths could have been avoided in the European Union if the level of exposure to fine particles had not exceeded the limits recommended by the WHO.[21]

Under the 2008 EU Air Quality Directive, 16 EU countries met their commitments in 2020, while 11 countries must still reduce their emissions. The European Environment Agency states that: «The biggest challenge for the period 2020-2029 is reducing emissions of ammonia.»[22]

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17. European Chemicals Agency, Substance infocard : ammonia. https://echa.europa.eu/fr/substance-information/-/substanceinfo/100.028.760
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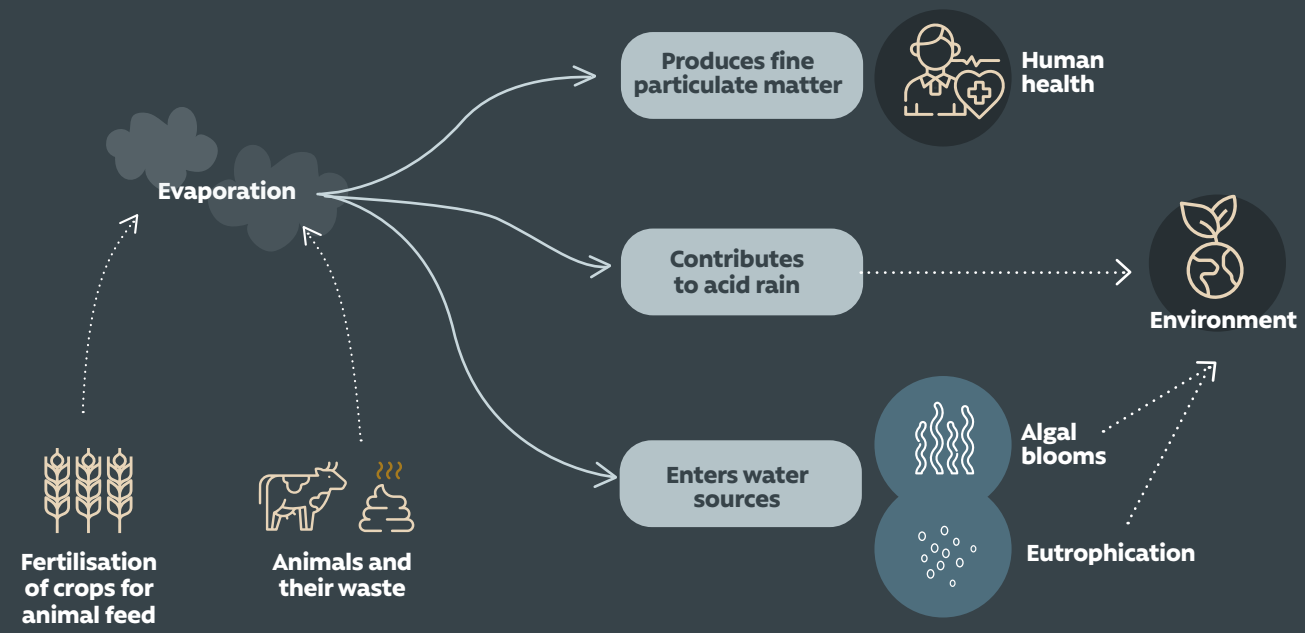
> ENVIRONMENTAL AND HEALTH IMPACTS OF AMMONIA EMISSIONS FROM LIVESTOCK PRODUCTION



INDUSTRIALISATION OF LIVESTOCK FARMING BOOSTING OVERPRODUCTION OF MEAT AND DAIRY

Ammonia emissions depend on the type of animal (poultry, pigs, cattle, etc.), the type of product (milk, meat, eggs, etc.), the farming system to a certain extent, but above all the number of animals raised. Although the most intensive livestock farms may have lower emissions per kilo of meat or per litre of milk, the number of animals on these factory farms is so high that their emissions in absolute terms are much higher than on smaller livestock farms.

The impacts of these ammonia emissions are closely related to local conditions and concentrations. What matters is not so much the amount of ammonia emitted per amount of meat produced, but the overall emissions over a territory. There is a clear correlation between the concentration of ammonia in the atmosphere and the density of livestock farms.[23] To limit the impact of ammonia emissions from livestock farms, it is necessary to introduce a quota per region in the EU's industrial emissions directive (2010/75/EU), currently under revision.

Ammonia emissions in Europe are mainly linked to livestock farming, whether through direct emissions from urea and manure or through indirect emissions from the fertilisers used to produce animal feed.

Excess of ammonia is hugely problematic, and this excess is linked to high livestock densities in many European regions. This high livestock density creates an imbalance with the capacity of the land, which is not able to supply enough feed and therefore leads to massive imports, and is neither able to adequately absorb the ammonia-heavy waste the animals produce.

Reducing livestock production in the densest regions must therefore be a priority in order to restore the nitrogen cycle that is now broken due to these excessive ammonia and nitrate levels. This reduction must be accompanied by public support for ecological livestock farming, which works with nature instead of against it.

23. European Environment Agency, National Emission reduction Commitments Directive reporting status 2022. https://www.eea.europa.eu/publications/national-emission-reduction-commitments-directive-2022/national-emission-reduction-commitments-directive

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