European Commission

Science for Environment Policy

Greater efforts to reduce ammonia emissions needed to meet air pollution targets

18 December 2014
Issue 398

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Source: Bessagnet, B., Beauchamp, M., Guerreiro, C. *et al*. (2014). Can further mitigation of ammonia emissions reduce exceedances of particulate matter air quality standards? *Environmental Science & Policy*, *44*, 149–163. DOI:10.1016/j.envsci.2014.07.011

Contact: bertrand.bessagnet@ineris.fr

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

Levels of particulate matter (PM) in the atmosphere are linked to ammonia emissions. However, reducing ammonia emissions only as far as targets set out by the Gothenburg Protocol will not necessarily ensure compliance with EU PM limits, according to a new study. Greater reductions in ammonia emissions would reduce the number of days when PM limit values are exceeded, the researchers found.

In Europe, approximately a half of $PM_{2.5}$ (particles of less than 2.5 micrometres in size) and a third of PM_{10} concentrations (particles of less than 10 micrometres) are made up of particles produced by the reactions of three precursor gases—nitrogen oxides, sulphur oxides and ammonia. Atmospheric emissions of all three gases need to be reduced in order to make a meaningful impact on PM concentrations, but ammonia emissions, over 90% of which come from agriculture, are not falling as fast as nitrogen oxides and sulphur oxides emissions.

There are a number of European regulations[1] that limit ammonia emissions or set targets for their reduction. The Gothenburg Protocol also sets emissions ceilings for air pollutants including ammonia and the EU as a whole has committed to cutting emissions by 6% by 2020, compared to 2005 levels. However, it could be possible to reduce ammonia emissions still further, say the authors of this study, if proven methods, such as improved storage and application of manure and improved animal housing, are used in farming.

Applying three chemical transport models used in Europe to support policy, the researchers estimated the impact of emission reduction strategies on PM concentrations in 2020 under four different scenarios: one assuming the compliance with the Gothenburg Protocol in which ammonia emissions were reduced by 6% and three more in which they were reduced by an additional 10%, 20% and 30%.

The researchers examined PM concentrations in the context of Directive 2008/50/EC[2], which sets daily and yearly limit values for PM_{10} and a maximum number of days on which the daily limits can be exceeded. Meanwhile, $PM_{2.5}$ limits are based only on a yearly average. According to the modelling results, 12-21% fewer monitoring stations would exceed the PM_{10} limits on more than the allowable number of days if the Gothenburg emission targets were met.

If ammonia emissions were reduced by a further 10% on top of the Gothenburg target, the number of stations exceeding the PM_{10} daily limit value would be reduced by 13-23%, compared to the current situation. Additionally, if they were reduced by a further 20% or 30%, this number of stations would be reduced by 15-25%, or by 16-28%, respectively. The results suggest that PM_{10} falls more sharply for higher-level emissions reductions. In other words, a reduction in ammonia emissions of 30% would result in a reduction of PM concentrations totalling more than three times that achieved by a 10% reduction in ammonia.

For $PM_{2.5}$, reducing ammonia emissions to the Gothenburg target brings down the number of stations which exceed the yearly limit value by 26-35%. Ammonia emissions of another 10% only reduce the number of stations which exceed the yearly limit by 28-38%. However, emissions reductions of 30% offer more efficient $PM_{2.5}$ reductions, bringing the number of stations which exceed the yearly limit down by 29-40%.

According to the researchers, their study shows that although the Gothenburg Protocol will be an important step towards compliance with PM limits, larger reductions in ammonia emissions could bring more substantial benefits.

1. http://ec.europa.eu/environment/air/pollutants/ceilings.htm; http://europa.eu/legislation_summaries/environment/soil_protection/ev0027_en.htm; http://ec.europa.eu/environment/water/water-nitrates/index_en.html; http://ec.europa.eu/environment/water/water-framework/index_en.html; http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32011R0582

2. http://ec.europa.eu/environment/air/quality/legislation/existing_leg.htm