Reducing the health effect of particles from agriculture

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This autumn, the European Union (EU) Parliament will have a crucial vote on the future of air pollution policy in Europe. For discussion is a commission proposal for new national emission ceilings,[1] as amended by the European Parliament Environment Committee in July, 2015. The proposed emission ceilings cover not only emissions of primary, directly emitted particulate matter but also emissions from precursor gases. These gases include ammonia, sulphur dioxide, and nitrogen oxides, which react in the atmosphere to form solid (particulate) ammonium sulphates and nitrates. These secondary inorganic aerosols (SIA) can be as much as 50% of the total fine particulate mass in the air. The contribution of ammonia emissions, almost exclusively from agriculture, through SIA formation, often represents 10–20% of fine particle mass in densely populated areas in Europe, higher in areas with intensive livestock farming.[2] Additionally, ammonia speeds up atmospheric reactions of primary sulphur dioxide and nitrogen oxide emissions, leading to larger concentrations of total SIA.

Two questions are especially relevant: what are the health effects of these SIA? and which precursor emissions are most important?

Much work has been devoted over the past two decades to identify specific particle components that might be more or less harmful than others. This work has not convincingly shown that some particle components contribute more to the health risks than others. This is disappointing at one level because it would be nice to concentrate pollution abatement efforts on a selection of important sources. On another level, however, this suggests that health benefits can be expected from all efforts to reduce the mass of fine particles in the air. WHO, in a recent report, emphasised the importance of SIA as having "substantial exposure and health research finding associations and effects".[3]

The results of a large time-series study from the Netherlands, reported 15 years ago, showed that sulphate and especially nitrate were more closely associated with mortality than was the particle mass it was part of.[4] A cohort study from California, USA, found that nitrate was the strongest predictor of mortality in a series of components tested.[5] A study from Taiwan found that nitrate and elemental carbon were associated with emergency room visits for haemorrhagic stroke.[6] So if anything, SIA are directly associated with adverse health effects, which makes further reduction of precursor emissions a priority.

In keeping with such insights, the proposal for national emission ceilings asks for reductions in emissions of sulphur dioxide, nitrogen oxides, and ammonia, but at very different percentages: for 2020, relative to 2005, emissions of sulphur dioxide across the EU need to be reduced by 59%, emissions of nitrogen oxides by 42%, but emissions of ammonia by just 6%. Larger reductions are proposed for 2025 and 2030, but the disparity between sulphur and nitrogen oxides on the one hand and ammonia on the other hand remain. This is hard to defend scientifically, because there is good evidence that all precursor gases need to be reduced in step to achieve the maximum reduction in fine particle concentrations, and that abatement of ammonia is a key factor for abating SIA. Ammonia reductions, which are technically possible, contribute more to reducing particle concentrations than do reductions of sulphur and nitrogen oxides.[7]

Ammonia emissions in Europe are almost exclusively from farming, especially livestock farming, whereas other sources, including road traffic and waste management, typically contribute an additional 10%. The social cost of all nitrogen pollution in the EU member states has been estimated at €75–485 billion per year, of which close to half is attributed to health damage from SIA air pollution.[8] For the USA, health costs of ammonia emissions associated with agricultural exports alone were estimated at US$60 billion per year.[9] Of course, abatement measures come at a cost, but the total cost for the proposed emission controls by agriculture are a mere 2–3% of the total emission control costs estimated for the complete package (about €2·5 billion per year of €91 billion per year).[10] This is also a small percentage of the total volume of subsidies of about €60 billion that flow from the European Commission to the agricultural sector through the Common Agricultural Policy. In view of the contribution of agriculture to fine particle concentrations in Europe, the health damage caused by particles from agriculture is estimated to be far greater than is the burden placed on this sector by the current proposal for national emission ceilings. This is undoubtedly an inconvenient truth, but it is time for policy makers to take this problem more seriously and to propose and fund measures that do not threaten the livelihood of the farmer.

As the EU starts to promote the circular economy (COM/2014/0398),[11] there is a strong case to reduce ammonia emissions as part of innovation to increase economy-wide nitrogen use efficiency. European nitrogen pollution losses have a fertiliser value of about €20 billion per year based on the European nitrogen assessment[12] and a fertiliser price of about €0·80/kg nitrogen. This points to a major business opportunity to improve emission reduction and recycling technologies that further strengthen the case for revision of the national emission ceilings.

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Mycobacterium abscessus in people with cystic fibrosis: considerations for psychosocial care

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Mycobacterium abscessus is a multiresistant, non-tuberculous mycobacteria that infects increasing numbers of people with cystic fibrosis worldwide. It is associated with a rapid deterioration in lung function and increased rates of morbidity and mortality.[1] Although some patients with cystic fibrosis and *M abscessus* infection undergo successful lung transplantation, post-operative complications can occur.

There is evidence of shared strains among patients with cystic fibrosis and global dissemination,[2] although mechanisms of transmission remain unclear. The results from the first study with next-generation sequencing of *M abscessus* strains suggested acquisition occurred in hospital and outpatient settings, but attempts to isolate *M abscessus* from these environments were unsuccessful.[3] Conversely, there was no evidence of transmission between patients in another study.[4] Despite this difference in findings, the focus of UK guidelines[5] is on the reduction of patient-to-patient transmission in health-care settings by advocating routine screening and enhanced segregation practices.

Since the mid-1990s, people with cystic fibrosis have been segregated from each other to prevent cross infection with harmful bacteria (primarily *Pseudomonas aeruginosa* and *Burkolderia cepacia* complex). Much has been written about the emotional effect of these