Ammonia Pollution From Farming May Exact Hefty Health Costs

If the U.S. trade balance has a bright spot, it’s farming. The value of agricultural exports has doubled over the past decade, driven largely by demand from China and other developing countries. But when ships packed with corn, wheat, and pork depart for foreign ports, many kinds of pollution are left behind. One is ammonia, which wafts into the atmosphere from fertilizer used on fields and from urine and manure produced by livestock. Ammonia reacts with other air pollutants to create tiny particles that can lodge deep in the lungs, causing asthma attacks, bronchitis, and heart attacks.

A new analysis suggests that ammonia does even more health damage in the United States than was thought. The annual cost—associated with thousands of premature deaths—may even exceed the profit reaped by farmers. Some analysts say the startling numbers highlight the need for greater U.S. regulation of agricultural emissions and a review of farm subsidies. If the pollution caused by farming “makes us worse off, it doesn’t make any sense,” says Robert Mendelsohn, an economist at Yale University. “Ammonia may be the next big frontier in public health protection,” says Paul Miller, chief scientist of Northeast States for Coordinated Air Use Management, an association of air quality agencies, in Boston.

Ammonia enters the air mostly from farming activities. This model is coupled to another, which accounts for temperature, humidity, and abundance of NO₃ and SO₂. “It is a step forward over much of the modeling that’s been done before,” says air quality modeler Daven Henze of the University of Colorado, Boulder.

Paulot and Jacob used their model to calculate how much ammonia and PM₂.₅ is a result of the food that the United States exports. Next, they used equations developed by the U.S. Environmental Protection Agency (EPA) to calculate the health impact and associated economic costs (calculated by asking people how much they would pay to reduce the risk of premature death). About 5100 people die prematurely each year from PM₂.₅ exposure associated with the emissions, they reported online on 25 December in Environmental Science & Technology.

Ammonia’s Aerial Transformation

Although the health toll varies greatly by location, the burden is heaviest in cities, because of the concentration of NO₃ and people. And the total impact is eye-opening: about $100 per kilogram of ammonia, or $36 billion annually. In contrast, the net value of the exported food is $23.5 billion.

Some experts are skeptical of those numbers, pointing out that the new air pollution model has not yet been peer-reviewed and that the health effects of various PM₂.₅ chemistries are still uncertain. “Ammonia emissions do not appear to be a driver of toxicity,” says Kathy Mathers of the Fertilizer Institute in Washington, D.C. But Nicholas Muller, an economist at Middlebury College in Vermont, fears that farm-related health costs may in fact be even higher if other farm-related air pollutants are included, such as PM₂.₅ from diesel engines. “This study provides more evidence that, in certain cases, more stringent controls are likely justified,” Muller says.

So far, U.S. regulators have neglected ammonia emissions because it has been cheaper and easier to choke off sources of SO₂ and NOₓ, such as power plants. As a result, states in the heavily populated northeastern United States are already in compliance with EPA limits for PM₂.₅, even though they are downwind of many power plants. But these states are also downwind of major farming areas. If the PM₂.₅ standards are tightened, which is under discussion, ammonia may be regulators’ next target.

The biggest gains could be made by keeping livestock and dairy operations away from cities. Best management practices can also reduce losses from fertilizer and livestock. In North Carolina, Williams says he’s encouraged that many hog farmers are thinking about generating power from manure, which could reduce ammonia emissions. Other research is investigating how to capture ammonia for use as fertilizer. But with U.S. exports of pork to Asia continuing to rise, it may be a while before emissions in North Carolina and elsewhere start to head down.