Poultry waste management in developing countries

Aerosol contamination

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INTRODUCTION
Aerosol contamination from poultry production can generally be characterized as pollutants, including gases (such as ammonia), particulates (dust) and microbial pathogens suspended in the airspace within and transported from the birds’ housing or containment areas. Dust from poultry operations can include feed dust, manure, feather dust, bacteria, mould spores, endotoxins, insects, insect parts and ammonia absorbed in dust. The transport of aerosols can be an important consideration when establishing the separation distances between poultry production facilities to reduce the risk of aerial transmission of communicable disease-transmitting microorganisms. Depending on their concentration, aerosol pollutants can be harmful to the respiratory health of birds within the containment areas, and may also be harmful to the health of workers or inhabitants living close to poultry production areas. However, at the international level, comprehensive studies regarding the human health effects of aerosols from poultry operations are lacking.

Aerial-transported ammonia can affect local and distant ecosystems, depending on the ecological sensitivity of the water source(s) into which the ammonia is deposited as dry or wet fall. Aerosol ammonia is also a precursor gas for ambient particulate matter, under certain atmospheric conditions, and there is evidence of negative human health effects from exposure to particulate matter, especially fine particulate matter.

Regardless of their location or size, existing and new poultry production operations should consider mitigating the risks associated with aerosol emissions to ensure the future sustainability of poultry production practices.

SOURCE AND EMISSION OF AEROSOLS
Even under the best management conditions, poultry production can be a source of aerosol contaminants, including gases, odour, dust and microorganisms. These gaseous compounds and living organisms are generated from natural biological processes associated with poultry manure decomposition soon after the manure is produced, during manure and litter storage and treatment, and during application of the manure or litter to fertilize cropland. Particulate matter as dust can originate from both feed and the birds. However, the generation rate of these gases, microorganisms and particulates is highly variable, depending on the weather, the species and age of the birds, housing conditions, and the manure handling system, feed type and management system(s) used.

Once aerosol pollutants are generated, they can be emitted from their sources through the production unit’s ventilation system, which is characteristic of larger units, or by natural weather-sourced ventilation, in smaller or naturally ventilated larger units. The emission rates of the pollutants depend on many factors including time of year and day, temperature, humidity, wind speed and other weather conditions, ventilation rates, housing type, and manure properties and characteristics – for example, dryer manure and litter result in more particulate emission, while moist conditions are likely to result in increased emission of ammonia. It is extremely difficult to determine specific aerosol emission rates from point sources such as poultry housing units, manure or litter storage areas, and during application to cropland, and definitive information is lacking. This remains a very active area of research in many parts of the world.

EFFECTS OF AEROSOL POLLUTION
Aerosol emissions can compromise bird health and productivity (feed conversion, meat and egg yield). Aerosol emissions from poultry operations can transmit communicable diseases to neighbouring poultry flocks; scientific evidence shows that some pathogenic microorganisms can remain viable and be transported for appreciable distances (from 50 to more than 500 m) in ambient air. Evidence also shows that the health of farm workers can be affected by day-to-day exposure to aerosols. Primary effects are on respiratory function, which is not surprising considering the composition of typical aerosol pollutants associated with poultry production (ammonia, dust, microorganisms and endotoxins).

Clean housing surfaces, good ventilation and good management will reduce risks caused by bio-aerosols in poultry houses.
An aerosol of particular ecological and human health importance is ammonia. A growing body of evidence shows that appreciable concentrations of ammonia are released from poultry (and livestock) production operations; increases in nitrogen concentration resulting from wet and dry atmospheric deposition of ammonia are having serious impacts on some ecosystems globally (resulting in decreased forest productivity, increased nitrate concentrations in surface and groundwaters, and increased risk of eutrophication); and ammonia is a precursor gas for the formation of ambient fine particulate matter (human exposure to elevated fine particulate matter has been linked to a variety of adverse health effects, including acute respiratory conditions and increased mortality risks).

**MITIGATING THE RISKS OF AEROSOL POLLUTION**

The most effective strategy for reducing aerosol pollution is to reduce its source. Management strategies such as improving hygiene in poultry production buildings (by constructing them so that they do not encourage dust build-up), controlling manure and litter moisture, and formulating feeds to reduce nitrogen in the excreta all help decrease aerosol concentrations. Technologies such as biofilters and/or bioscrubbers as components of point source ventilation exhausts are not economically practical in developing and many developed countries. Farm workers can reduce health risks by practising good hygiene and wearing protective eye shields and dust masks when possible and practical, especially in dusty poultry production environments.

**REFERENCES**
