CPRC Update: Concentrations and Emissions of Airborne Pollutants at Various Poultry Operations

Introduction:
Agricultural operations contribute to the atmospheric burden of pollutants, mainly in the form of ammonia (NH_3), particulate matter (PM) and greenhouse gases (CH_4 and NO_2). Poultry operations are major emitters of PM and NH_3 whereas other pollutants are emitted to a lesser degree. Much still remains unknown about the variability in the emissions of pollutants.

Additional issues are evident with PM that relate to its composition, toxicity and pathogenicity. $PM_{2.5}$ are typically secondary particles formed by the reactions of specific gaseous pollutants that create fine airborne salts and liquid aerosols. Secondary inorganic aerosol (SIA) formation chemistry typically involves NH_3 as an alkaline precursor gas. As NH_3 is produced in poultry houses, SIA particles may be partly responsible for the high $PM_{2.5}$ levels observed. Thus, if SIA are being formed, it may be feasible to reduce the toxic $PM_{2.5}$ levels in the house by targeting gaseous NH_3 and/or the other reactive gases directly with control methods and thus reduce exposure to both poultry and barn workers.

Dr. Bill Van Heyst and his team from the University of Guelph's School of Engineering conducted a study to determine some of the impacts poultry production has on our environment.

Objectives:
The study investigated the indoor concentrations and emissions to the atmosphere of a variety of air contaminants from different poultry production systems. Measurements included:

- Air emissions from poultry housing units
- Air emissions from litter storage facilities
- Ammonia emissions from land application of litter
- Assessment of nitrogen loss via emissions from deadstock composting

The overall objective of this project was to provide a sound scientific knowledge base regarding actual agricultural air emissions. Contaminants focused on included: size fractionated particulate matter (PM), ammonia (NH_3), SIA concentrations and emissions as well as that for CH_4 and non-methane volatile organic compounds, sulfur dioxide and other gaseous gases.

Air emissions from poultry housing units:

a) **Broiler and Layer facilities**

Actual pollutant emissions were determined for broiler chicken (NH_3, $PM_{2.5}$, PM_{10} and CH_4), layer hen (NH_3 and $PM_{2.5}$ and PM_{10}), and turkey grow-out (NH_3 and $PM_{2.5}$ and PM_{10}) housing units

NH_3 and PM_{10} emissions peaked during the winter months, while $PM_{2.5}$ emissions peaked during the summer months in the layer hen facility

b) **Efficacy of a sprinkler system to control NH_3 and PM levels**

Use of a sprinkler system reduced pollutant emissions more so for PM_{10} and $PM_{2.5}$ than NH_3 emissions.

c) **Effectiveness of Poultry Litter Treatment (PLT) application**

Poultry litter treatments reduced ammonia emissions

Measurement of air emissions from litter/manure storage facilities:

a) Broiler litter storage facilities emit more CH_4 than that from cattle manure but less than liquid swine manure storage facilities.
b) Broiler litter storage facilities emit more N_2O than that from cattle manure and liquid swine manure storage facilities.

Measurement of air emissions from land application of manure/litter:

a) NH_3 losses from the broadcasted broiler manure were found to be 22% and 25% of the NH_4-N applied after 72 and 132 hours respectively.

Measurement of nitrogen loss via ammonia emissions from deadstock composting

a) The NH_3 emissions for piles using poultry litter were greater than that of the control (wood chips) and the finished/mature poultry compost, whereas the CH_4 emissions were the lowest.

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CPRC, its Board of Directors and member organizations are committed to supporting and enhancing Canada's poultry sector through research and related activities. For more details on these or any other CPRC activities, please contact The Canadian Poultry Research Council, 350 Sparks Street, Suite 1007, Ottawa, Ontario, K1R 7S8, phone: (613) 566-5916, fax: (613) 241-5999, email: info@cp-rc.ca, or visit us at www.cp-rc.ca.