



# CANFARMSAFE™

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## All Cooped Up - Part 1 Gas Emissions from Laying Hen Housing

The increasing public concern for animals to be raised, transported, and slaughtered humanely is pushing the livestock industry progressively towards improving animal welfare in Canada and around the world. However, air quality is an issue in these next-generation livestock buildings mainly due to an increase in animal activity and the addition of bedding materials. These changes are particularly clear in the poultry industry where producers are moving away from conventional cages (Figure 1) to systems where hens can express more of their natural behavior, such as enriched cages and aviaries (Figures 2 and 3). The *Developing Strategies to Minimize Health Risks in Next Generation Livestock Buildings Integrating Modern Animal Welfare Considerations* project sampled 12 laying hen facilities to compare the air quality between conventional and alternative housing systems. Barns were selected in the south of the province of Quebec with mechanical ventilation systems and a similar number of hens. Samples were collected in the fall of 2020 and winter of 2021 to measure gas emissions as well as bioaerosol concentrations. Preliminary results are presented here as a total of 18 barns will be sampled over the course of the project and a detailed statistical analysis will be completed once all the samples are collected.



Figures 1 to 3: Conventional cages, enriched cages and aviary production systems

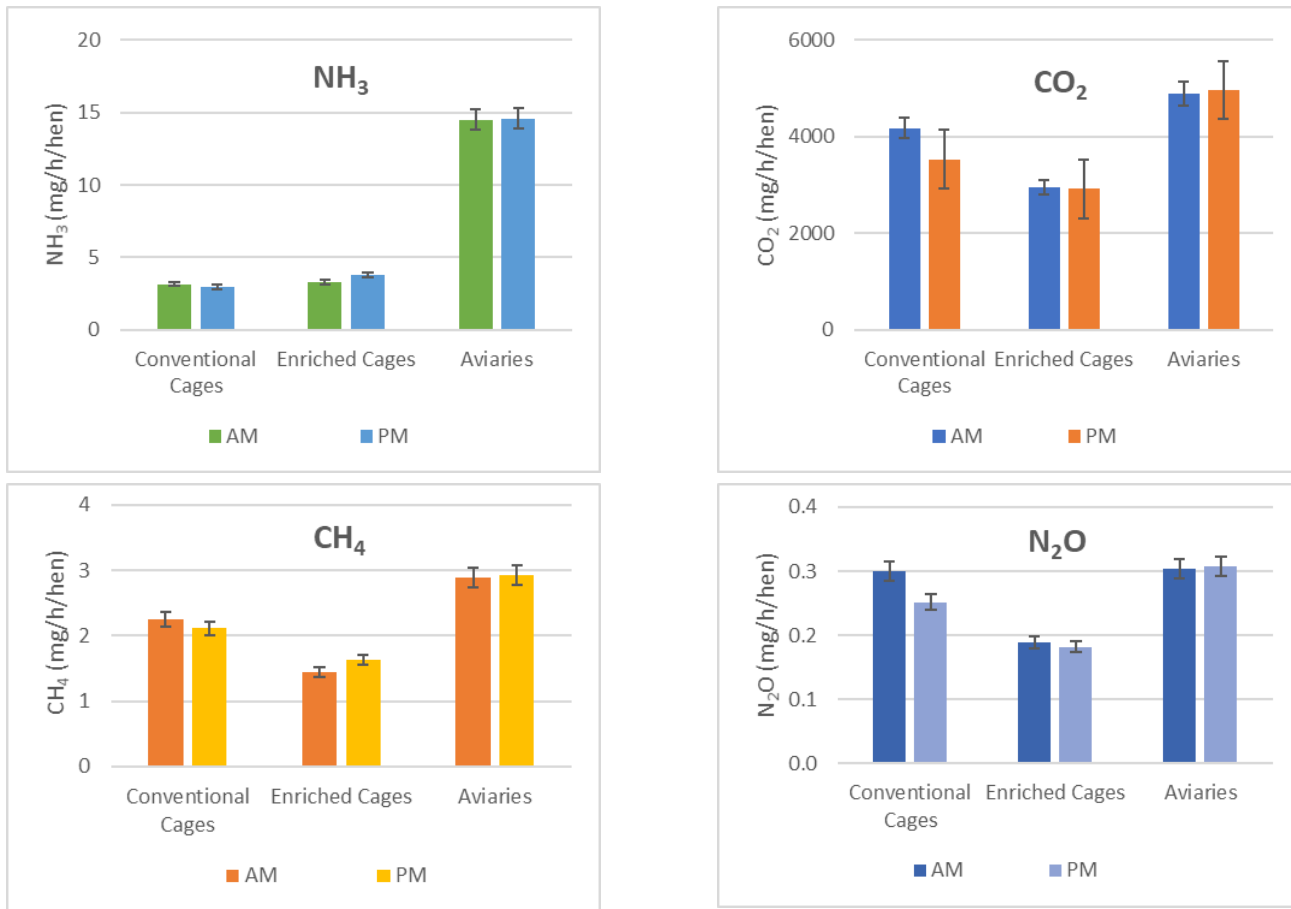
### Materials and Methods

The concentrations of ammonia ( $\text{NH}_3$ ) and three greenhouse gases (carbon dioxide -  $\text{CO}_2$ , methane -  $\text{CH}_4$  and nitrous oxide -  $\text{N}_2\text{O}$ ) were measured with an infrared gas analyzer (FTIR DX4040, Gasmeter). The air velocity, humidity and temperature were also measured using a telescopic multifunction probe (KIMO - VT 210 M) in order to calculate the airflow rate. The emission rate of each gas was then calculated using the concentration and airflow rate and expressed as mass per unit of time per hen.



Figure 4: FTIR Gas Analyzer

## Preliminary Results



Figures 5 to 8: Gas Emissions per Hen

The preliminary results for NH<sub>3</sub>, CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from the 12 barns are presented in Figures 5 to 8 respectively. NH<sub>3</sub> emissions were similar for both the conventional and enriched cage systems (2.9 to 3.8 mg/h/hen) but were much higher for the aviaries (around 14.5 mg/h/hen). For the three greenhouse gases, the differences in emissions between the three production systems were not as apparent. The detailed statistical analysis will be required to determine if these differences are statistically significant.

## Conclusion

Cage-free laying hen housing systems, such as aviaries, are meant to allow hens to display a broader range of natural behaviors such as perching, dust bathing, foraging, scratching, kneeling, ruffling feathers, and pecking activities. However, from these preliminary results, air quality in these housing systems is lower compared to systems with enriched or conventional cages. Thus, techniques and strategies to reduce ammonia emissions will certainly need to be implemented in commercial buildings using cage-free housing system for laying hens.



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