

MEASUREMENT OF AIR POLLUTANT EMISSIONS FROM A CONFINED
POULTRY FACILITY

by

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ABSTRACT

Measurement of Air Pollutant Emissions from a Confined Poultry Facility

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Air emissions from animal feeding operations have become a growing concern. Much work has been done to study occupational exposures and the exhaust concentrations associated with animal facilities; however little information has been provided about air quality around the houses. Ammonia (NH_3), ethanol (EtOH), nitrous oxide (N_2O), carbon dioxide (CO_2), and particulate matter ($\text{PM}_{2.5}$ and PM_{10}) emissions were monitored in two different buildings for laying hens in northern Utah. Over the six-month sampling period, the observed average temperatures for the west and east fan banks of the high-rise building were 21.2 ± 4 and $19.4 \pm 1.3^\circ\text{C}$, respectively, and the average inside relative humidities during the same period were 43.7 ± 7.2 and $48.4 \pm 7.9\%$, respectively. Furthermore, the observed average temperatures for the west and east fan banks of the manure-belt building were 20.6 ± 4.4 and $17.9 \pm 2.7^\circ\text{C}$, respectively, and the average percent inside relative humidities during the same period were 44.4 ± 7.6 and $49.3 \pm 7.4\%$, respectively.

The ventilation rates ranged from $0.80 \text{ m}^3 \text{ h}^{-1} \text{ bird}^{-1}$ to $4.80 \text{ m}^3 \text{ h}^{-1} \text{ bird}^{-1}$ with an average of $2.02 \text{ m}^3 \text{ h}^{-1} \text{ bird}^{-1}$ for the high-rise barn and from $0.80 \text{ m}^3 \text{ h}^{-1} \text{ bird}^{-1}$ to $6.0 \text{ m}^3 \text{ h}^{-1} \text{ bird}^{-1}$ with an average of $2.20 \text{ m}^3 \text{ h}^{-1} \text{ bird}^{-1}$ for the manure-belt building over the sampling period of September, October, November, and December 2008 and January 2009. Average NH_3 emission factors were $72 \pm 17 \text{ g d}^{-1} \text{ AU}^{-1}$ for the high-rise system and $9.1 \pm 7 \text{ g d}^{-1} \text{ AU}^{-1}$ for the manure-belt (1 AU is equal to 500 kg of animal live weight). The NH_3 emission reduction factor for the manure-belt technique compared to the high-rise technique was 87%. Ammonia levels outside the house appeared to be less than 1 ppm.

No significant emissions were registered for N_2O , H_2S , and EtOH , which were consistently close to zero for both techniques. The carbon dioxide (CO_2) emission factor from the high-rise building was $104 \pm 11 \text{ g day}^{-1} \text{ AU}^{-1}$ and from the manure-belt building, $105 \pm 20 \text{ g day}^{-1} \text{ AU}^{-1}$. PM emissions were greater from the manure-belt system in comparison with the high-rise system, showing mean values of 165 vs. 114 $\text{g day}^{-1} \text{ AU}^{-1}$ for $\text{PM}_{2.5}$, 1,987 vs. 1,863 $\text{g day}^{-1} \text{ AU}^{-1}$ for PM_{10} and 4,460 vs. 3,462 $\text{g day}^{-1} \text{ AU}^{-1}$ for TSP respectively. None of the 24-h $\text{PM}_{2.5}$ measurements collected from both management techniques exceeded the U.S. EPA 24-hr National Ambient Air Quality Standard (NAAQS) of $35 \mu\text{g}/\text{m}^3$.

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