

Completed Research

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Project #F010

Monitoring Ammonia and Particulate Matter Concentrations at Property Fence Lines

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"Checking Ammonia and Particulate Matter Exhausted from Broiler Houses"

Air emissions from animal feeding operations have become a growing concern for producers and their neighbors. Much work has been done to quantify emission rates; however, little information has been provided about air quality downwind from these facilities. The objective of this study was to measure ammonia (NH₃) concentrations emitted from broiler houses when ventilation rates would be at a maximum, depicting a worse-case scenario for downwind NH₃ concentrations. Open-path laser spectrometers were utilized for this study and were placed 100, 200, 300, and 500 ft downwind from the houses. Particulate matter that was of a size 2.5 microns or less (PM_{2.5}) was measured in real time using aerosol monitors and from a time-integrated basis using cyclone samplers. Data were collected during the last 4 weeks of a 56 day grow-out cycle during a summer flock on a 4-house broiler farm located in Northeast Georgia.

This study took place over the last four weeks of the grow-out period of eight-week-old birds on built-up litter (had been used for 2 previous flocks). Average NH₃ concentrations were less than 0.5 ppm for both study periods (bird age 28-49 days and bird age 50-56 days) at distances of 61 m (200 ft) or greater from the houses tunnel ventilation fans' output. Over the course of the entire four-week study, the maximum downwind NH₃ concentration (15-min average) measured was less than 3 ppm. Ammonia concentrations were 0.5 ppm or less for approximately 60%, 75% and 85% of the measurements made at 61, 91, and 152 m (200, 300 and 500 ft) respectively. Wind direction had a substantial effect on downwind NH₃ concentrations with the highest downwind concentrations occurring when the wind was from the west (azimuth 190 to 300°) and the sensors were downwind of the houses. Mean downwind NH₃ concentrations, for distances from the houses greater

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than 30 m (100 ft) were roughly three to four times higher when the wind was from the west when compared to winds blowing from all other directions. Wind speed also had a significant effect on downwind NH_3 concentrations. Peak concentrations tended to occur when wind speeds were less than 3.2 km/h (2 mph), normally associated with climatic stable conditions. The wind stream created by the tunnel ventilation fans tended to overpower the effect of ambient wind direction and speed on downwind concentrations at 30 m (100 ft.)

$\text{PM}_{2.5}$ concentrations showed some tendency to increase at locations close to the houses, but based on the data observed, the effect of background levels of particulate matter in the area appear to be a more significant factor than the contribution from the poultry houses at the distances measured.

These data indicate that emissions from broiler houses dissipate rather quickly and in the case of NH_3 was 1 ppm or less for 85%, 90% and 95% of the measurements taken during this period of time at 200, 300 and 500 ft downwind respectively. $\text{PM}_{2.5}$ concentrations were influenced more by existing background levels of PM than by exhaust from the broiler houses. These data can be used by poultry industry representatives to provide factual information about the air quality downwind of broiler facilities. In nuisance complaints these data suggest that if poultry houses are 300ft or more from dwelling houses that emissions are well below those that have health effects. In these cases, people with complaints are probably picking up odors from broiler facilities, but are not being affected by NH_3 and $\text{PM}_{2.5}$ concentrations that are of health concerns.

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