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Computational Study of Ventilation and Disease Spread in Poultry Houses JOHN CIMBALA, SOURABH PAWAR, EILEEN WHEELER, DARLA LINDBERG, Penn State University — The air flow in and around poultry houses has been studied numerically with the goal of determining disease spread characteristics and comparing ventilation schemes. A typical manure-belt layer egg production facility is considered. The continuity, momentum, and energy equations are solved for flow both inside and outside poultry houses using the commercial computational fluid dynamics (CFD) code FLUENT. Both simplified two-dimensional and fully three-dimensional geometries are modeled. The spread of virus particles is considered to be analogous to diffusion of a tracer contaminant gas, in this case ammonia. The effect of thermal plumes produced by the hens in the poultry house is also considered. Two ventilation schemes with opposite flow directions are compared. Contours of temperature and ammonia mass fraction for both cases are obtained and compared. The analysis shows that ventilation and air quality characteristics are much better for the case in which the air flow is from bottom to top (enhancing the thermal plume) instead of from top to bottom (fighting the thermal plume) as in most poultry houses. This has implications in air quality control in the event of epidemic outbreaks of avian flu or other infectious diseases.

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