Continuous Monitoring of Particulate Matter at a Commercial Feedyard

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BACKGROUND

Recent developments in air-monitoring and data-acquisition technologies have made it possible to monitor particulate matter (PM) concentrations and transmit the monitoring data to a centralized personal computer in near real time. In early 2005, the Texas Agricultural Experiment Station (TAES), with financial assistance from the Texas Cattle Feeders Association (TCFA) and USDA-CSREES, installed a wireless network of tapered-element oscillating microbalances (TEOMs) along the perimeter of a commercial cattle feedyard in the Texas Panhandle to observe the trends in PM concentrations in response to diurnal factors (sunlight, cattle behavior, vehicle traffic, atmospheric stability) and random weather events (wind shifts, precipitation). The network consists of one upwind TEOM along the southern perimeter of the yard and two collocated TEOMs (see photo above) along the downwind, or northern, perimeter of the yard. The upwind TEOM is configured to monitor total suspended particulate (TSP) only; the two downwind TEOMs are configured to monitor TSP (right center) and PM_{10} (left center). We have also installed federal reference method (FRM) monitors for TSP (far left) and PM_{10} (far right) as a basis for comparing the time-averaged concentration values generated by the TEOM and its corresponding FRM.

OBJECTIVES

1. Demonstrate the viability of a wireless, Internet-linked, PM-monitoring network to permit near-real-time observation of PM concentrations near a cattle feedyard;
2. Develop a baseline database of upwind and downwind PM concentrations in near real time to characterize and explain their seasonal, diurnal and random variations;
3. Compare time-averaged TEOM data with corresponding FRM data to assess the quality of the correlation between the two monitoring methods; and
4. Develop an understanding of the variations in PM_{10}/TSP ratio in response to seasonal, diurnal and random variations among all the various processes that influence emissions and concentrations.

RESULTS / BENEFITS

- We will be able to determine the principal driver(s) of the well-known, evening “dust peak,” which will help us screen dust-control options for their likely effectiveness in reducing the potential for nuisance and/or noncompliance conditions.
- We will be able to use the seasonal and diurnal trends to refine a scheme for annualizing daily emission factors determined from dispersion modeling.
- We will be able to reduce the manpower and unit cost of concentration data at remote feedyards.

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