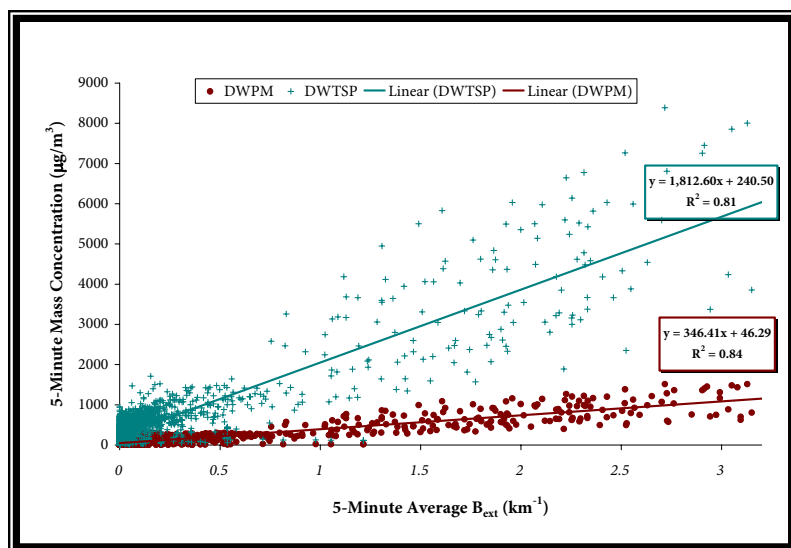


## Visibility as a Surrogate Measure of Ambient Dust Concentrations

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### Background

Measuring dust concentrations near a cattle feedyard or other agricultural source can be a personnel-intensive, expensive process. Currently accepted methods require careful pre-exposure and post-exposure



conditioning of fragile, glass-fiber filters, and the monitoring results give only time-averaged data that obscure important diurnal peaks and trends.

Obviously, fugitive dust reduces visibility to some extent. The downward change in visibility per unit increase in the concentration of dust in the air, which is the inverse slope of the regression lines in the graph to the left, is known as the dust's *atmospheric extinction efficiency*. Using visibility theory, we are developing new methods for monitoring dust concentrations in

air. These visibility-based methods provide nearly instantaneous data in an automated, remotely controlled scheme.

In this project, we are using the long-path visibility (LPV) transmissometer to measure visibility while we measure real-time dust concentrations along the downwind edge of a commercial cattle feedyard.

### Objective

Our main objective is to measure the *atmospheric extinction efficiencies*,  $\epsilon$ , of the various size fractions of feedyard dust, to include total suspended particulate (TSP); particles having an aerodynamic equivalent diameter (AED) less than 10 microns (PM<sub>10</sub>); and those having an AED less than 2.5 microns (PM<sub>2.5</sub>).

### Results and Benefits

- Visibility measurements correlate well ( $R^2 > 0.8$ ) with mass concentrations of fugitive PM<sub>10</sub> and TSP.
- Preliminary data collected in 2005 indicate that the extinction efficiencies of fugitive PM<sub>10</sub> and TSP from cattle feedyards are on the order of 3.0 and 0.6 m<sup>2</sup> g<sup>-1</sup>, respectively, which compare favorably with literature values for “coarse mass” (Malm, 1999). Gram for gram, small particles have more effect on visibility than larger particles of similar composition.
- Visibility impairment is more slightly strongly correlated with fugitive PM<sub>10</sub> from cattle feedyards than with fugitive TSP.
- Visibility methods hold promise that feedyard managers will eventually be able to assess air quality in the feedyard in semi-quantitative terms by simply observing a standardized target with their eyes.