A Dispersion Modeling Approach to Determine the Maximum Sulfur Dioxide Exposure Area in Cedar Rapids, Iowa

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The American Meteorological Society and Environmental Protection Agency's Regulatory Model (AERMOD) was used to model surface sulfur dioxide (SO_2) concentrations in Cedar Rapids, Iowa. Actual and potential emissions for the years 2005 and 2006 for the regulated SO_2 sources in Cedar Rapids were examined. The model input included stack height and diameter, effluent temperature and flow rate, and configuration of facilities. Dispersion was calculated using preprocessed surface and upper air weather data for 2000 through 2004. All elevations for receptors, emission sources and buildings were interpolated from the United States Geological Survey's (USGS) Digital Elevation Model (DEM) data for Cedar Rapids North, Cedar Rapids South, Marion, Bertram, Springville and Mt. Vernon, Iowa topographic quadrangles. The analysis used EPA's BPIP-PRIME (Building profile Input Program- Plume Rise Model Enhancements) to calculate wind direction specific building dimensions for all sources. Model predicted concentrations for each of the receptors were exported to ArcGIS for map analysis.

No exceedances of the National Ambient Air Quality Standards (NAAQS) for SO_2 occurred when using the actual emission scenario while numerous and severe exceedances of the NAAQS occurred when using the potential emission scenario. Results indicate that exceedances of the short term NAAQS limits are more severe than the exceedances of the annual limits.

The highest predicted short term and annual concentrations occur roughly in the same locations and were produced by the same facility.

The relationship between the population densities and SO_2 concentrations showed that sensitive populations northwest of the IPL Sixth Street Generating Station could be exposed to SO_2 concentrations above the allowed limits.

The AERMOD predictions were compared to data from the three SO_2 monitors in the Cedar Rapids area. Concentrations predicted using the actual emission scenario were very similar to the monitor values while the model predicted concentrations using potential emissions were much higher than observed.

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