2008 Roadway Sound Barrier Tracer Study
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Goals of Work

- Determine the effects of roadside noise barriers on how pollutant emissions from roadway sources disperse into surrounding neighborhoods
  - Conduct experiments in conditions covering a range of atmospheric stabilities
  - Configure experiments to control for or minimize factors that could confound interpretation of the measurements
  - Provide roadway barrier dataset for use in the development and validation of roadway dispersion models

Approaches

- Wind tunnel studies (EPA Atmospheric Modeling and Analysis Division)
- Field studies (ARL)
  - Simulate roadway emissions using SF₆ tracer gas line sources on virtual roadways (Fig. 1)
  - Identical primary and control tracer sampling grids downwind of simulated roadways (Fig. 2)
  - Primary: Mock straw bale sound barrier (Fig. 3)
  - Control: No barrier
  - Crosswind configuration in aerodynamically similar terrain
  - Optimize orientations of straw bale sound barrier and roadways to be perpendicular to prevailing winds
  - Measure approach flow and flows and turbulence upwind and downwind of barrier (Fig. 4)
  - Collect tracer gas samples in programmable bag samplers and analyze using gas chromatography and electron capture detection (Fig. 4)

Accomplishments

Key Results:

- Concentration deficits developed in the wake zone of the barrier with respect to concentrations at the same relative locations on the control experiment at all atmospheric stabilities.
- The deficits almost always exceeded 50% and commonly ranged upwards to about 80%.
- The areal extent of higher concentrations and the absolute magnitudes of the concentration both increased as atmospheric stability increased.
- Lateral dispersion was significantly greater in the primary experiments than in the control experiments.
- The barrier tended to trap high concentrations on the “roadway” (upwind of the barrier) in low wind speed conditions, especially in stable conditions.
- Provide rigorously quality checked database to EPA AMAD for model development and evaluation.

Indicators of Success

- Atmos. Environ., v. 44 (2010) 204-214
- Widespread publicity and media interest. Examples:
  - Phone interviews and stories in Bergen Record and Boston Globe
  - Stories carried in Baltimore Sun and on Canadian wire service
  - Live phone interview for radio science show on Univision, Puerto Rico
  - Stories carried in trade and environmental journals (The Urban Transportation Monitor, Environmental Health Perspectives, J.R. Souken Information Systems in Japan)
  - Discoveries and Breakthroughs Inside Science (nationally syndicated science news service serving local TV markets around the country)
  - EPA AMAD using database for model development and validation
  - Researchers at Cornell University using database for roadway pollutant dispersion and modeling studies

Collaborators

- Environmental Protection Agency, Atmospheric Modeling and Analysis Division (EPA AMAD)

Future Directions

- “Real-world” roadway barrier study tentatively scheduled for 2012 in Raleigh, NC (pending funding)
- Improve atmospheric tracer research capabilities
  - Identify next-generation tracer(s) with qualities essential for being good tracers but with lower global warming potential than today’s standard tracers
  - Develop less expensive fast-response tracer measurement instrumentation
  - Evaluate potential alternative tracer gas measurement technologies