Model selection and characteristics of a modeled roadway, such as length and width, impact estimates of near-road concentrations. As modelers seek to maximize simulation efficiency without sacrificing the quality of model results, we explore dispersion modeling methods using three AERMOD source types to estimate dispersion from a roadway:

- AERMOD version 18081 LINE
- AERMOD version 2100X RLINE
- AERMOD version 18081 VOLUME

In this work, we determine if a reduction in the length of the modeled roadway sources results in a reasonable representation of the original sources. Additionally, we contrast model simulation time from shorter sources with model performance.

### BACKGROUND/INTRODUCTION

- The Research LINE source model for near-surface releases (R-LINE). R-LINE is a research dispersion modeling tool designed to characterize mobile sources along roadways, simulated as line source emissions. R-LINE was developed for near-surface releases in a flat terrain environment and contains formulations for vertical and lateral dispersion, low-wind meander, and Monin-Obukhov similarity profile of surface winds, and uses AERMET hourly surface meteorology (Snyder, M. G. and D. K. Heist, 2013).

- R-LINE Integration into AERMOD. The U.S. EPA Office of Air Quality Planning and Standards (OAQPS) is collaborating with the U.S. Department of Transportation’s Federal Highway Association (FHWA) to evaluate impacts of traffic emissions on near-road air quality. As part of this effort, EPA has initiated the integration of the R-LINE version 1.2 model code and algorithms into the current version (18081) of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) dispersion model. The integrated code, described here as “D19XXX”, has not yet been released, but offers an opportunity to evaluate near-road surface releases using multiple AERMOD source types, including the new, developmental “RLINE” source type.

- Las Vegas Field Study. In a joint effort between the EPA and the FHWA, a long-term field study was conducted from December 2008 to December 2009 in Las Vegas to measure air pollutants, including CO, at various distances.

### RESULTS

#### AERMOD LINE Source

<table>
<thead>
<tr>
<th>Length (All Sources)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Southbound traffic lanes at the study site (16 total source combinations for the LINE and RLINE source types)</td>
<td></td>
</tr>
</tbody>
</table>

#### AERMOD RLINE Source

<table>
<thead>
<tr>
<th>Length (All Sources)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Southbound traffic lanes at the study site (16 total source combinations for the LINE and RLINE source types)</td>
<td></td>
</tr>
</tbody>
</table>

#### AERMOD VOLUME Source

<table>
<thead>
<tr>
<th>Length (All Sources)</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Southbound traffic lanes at the study site (16 total source combinations for the LINE and RLINE source types)</td>
<td></td>
</tr>
</tbody>
</table>

### CONCLUSIONS

- Shorter source lengths result in a reduction in modeled concentrations for each of the modeled source types and wind directions.

- A source length of 8x the receptor distance is sufficient (based on the 100-m downwind receptor for the base-case) for modeling concentrations from a roadway, while a source length of 4x the receptor distance is insufficient (300 m downwind receptor for the 0.25 test-case). Addition of additional receptors at intermediate distances is required for refinement of a recommended source length.

- Simulation time decreases proportionally with decreases in the number of VOLUME sources modeled, with model results comparable for the base-case and 0.75 test-case.

- The VOLUME source type requires significantly longer computational time compared to the LINE or RLINE source types.

### REFERENCES/ACKNOWLEDGEMENTS

- Flat terrain at top of 20° sloping embankment.
- The VOLUME source type simulates near-surface releases by numerically integrating point source emissions. RLINE does not account for terrain elevation variations, but includes vertical and lateral dispersion rates, based on flat and wind tunnel studies, and horizontal meander.

### DISPERSION MODELING APPROACH

- **Source Types:**
  - LINE: Defined to represent heavy-duty (HD) and light-duty (LD) vehicles for each of the 4 Northbound and 4 Southbound traffic lanes at the study site (16 total source combinations for the LINE and RLINE source types).
  - Parameters: Source parameters for release height (1.3 m for LD; 3.4 m for HD) and initial vertical dimension (1.2 m for LD; 3.2 m for HD) in accordance with Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas Appendix J.

- **Parameters:**
  - Emissions - AERMOD was processed with hourly emissions (HOURERMS) varying for each source.
  - Emissions rates were generated for Clark County, NV, with the EPA Motor Vehicle Emission Simulator (MOVES), system for 13 vehicle types (4 LD and 9 HD).

- **Modeling:**
  - Scenario - March 10, 2009 Hour 06 through September 29, 2009 Hour 13.
  - Meteorology - Las Vegas McCarran International Airport (KLAS) MMS surface and Mercury Desert Rock, NV (KDIR) upper air meteorological data processed using AERMET version 18081.
  - Receptors - 4 receptors based on the location of study monitor sites.

- **Model options:**
  - Modeling was performed using the FLAT option, due to the R-LINE model formulation as a flat-terrain model and the URBANOPT with a population of 1,000,000.