Modeling Truck Idling Emissions in Central Texas

2015 EPA Emissions Inventory Conference

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Presentation Overview

• Background
• Estimation of Extended Truck Idling in Central Texas
• Estimation of Short-Term Truck Idling in Central Texas
• Truck Idling Driver Survey
• Conclusion, Implications, and Recommendations
Assumptions About Truck Idling in MOVES Model

Extended Truck Idling

- Idling while combination long-haul driver is sleeping
- Duration: 1 hour or more
- Assumed duration: 8 hours
- Assumed to operate at high RPM with AC or heat
- Occurs off-network at truck stops, rest areas, parking lots, frontage roads

Short-Term Truck Idling

- Idling while waiting to pick up or deliver goods
- Duration: less than 1 hour
- Any kind of truck
- Occurs off-network anywhere that trucks operate
- Unclear that it is fully accounted for in MOVES
Idling Restrictions in Central Texas

- Locally Enforced Idling Restrictions Since 2004
- Restricts Idling >5 minutes
- Applies to All Vehicles with GVWR > 14,000 lbs
- Enforceable Against Truck Drivers, Owners, and Property Owners
- Exemptions for Federally Mandated Rest Periods:
  - May 2006 – September 2009: Legislative Exemption
  - September 2009 – August 11, 2011: No Exemption
  - August 11, 2011 – Present: Administrative Exemption
  - Not exempt if within 2 miles of facility with idle reduction infrastructure
- Exemptions for PTO use, emergency vehicles, etc.
Central Texas & Austin-Round Rock MSA
Central Texas & Austin-Round Rock MSA
Data Collection at Truck Stops
Truck Stop Observations

• Summary Statistics:
  – 7 Truck Stops Observed in Austin-Round Rock MSA
  – 170 Hourly Observations
  – 6,632 Parking Space-Hours Observed
  – 3,837 Truck-Hours Observed (56% Occupancy Rate)
  – 2,102 trucks idling (55% idling rate)
  – Avg. Idling Rate = 0.32 trucks idling per parking space
• Statistical Analysis:
  – Significant Variation by Day Type and Time of Day
  – 1 Location Had Unique Profile
## Trucks Idling Per Parking Space Per Hour

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>12 am – 6 am</td>
<td>IH-35 Truck Stops</td>
<td>0.65</td>
<td>0.65</td>
<td>0.37</td>
<td>0.28</td>
</tr>
<tr>
<td>6 am – 8 am</td>
<td>IH-35 Truck Stops</td>
<td>0.39</td>
<td>0.39</td>
<td>0.31</td>
<td>0.23</td>
</tr>
<tr>
<td>8 am – 8 pm</td>
<td>IH-35 Truck Stops</td>
<td>0.26</td>
<td>0.12</td>
<td>0.19</td>
<td>0.15</td>
</tr>
<tr>
<td>8 pm – 12 pm</td>
<td>IH-35 Truck Stops</td>
<td>0.47</td>
<td>0.27</td>
<td>0.27</td>
<td>0.20</td>
</tr>
<tr>
<td>24 Hours</td>
<td>IH-35 Truck Stops</td>
<td><strong>0.40</strong></td>
<td><strong>0.30</strong></td>
<td><strong>0.26</strong></td>
<td><strong>0.20</strong></td>
</tr>
<tr>
<td>24 Hours</td>
<td>Mustang Ridge</td>
<td>0.12</td>
<td>0.10</td>
<td>0.06</td>
<td>0.04</td>
</tr>
</tbody>
</table>
Idling Location Inventories – Aerial Imagery

50 Spaces Added in 2012

Dirt Parking Area
## Short-Term Idling – Truck Trips by NAICS Codes

<table>
<thead>
<tr>
<th>NAICS Codes</th>
<th>Description</th>
<th>Employees</th>
<th>Daily Truck Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td>212</td>
<td>Mining &amp; Quarrying</td>
<td>895</td>
<td>4,310</td>
</tr>
<tr>
<td>31-33</td>
<td>Manufacturing</td>
<td>37,419</td>
<td>3,080</td>
</tr>
<tr>
<td>42</td>
<td>Wholesale Trade</td>
<td>39,368</td>
<td>2,363</td>
</tr>
<tr>
<td>44-45</td>
<td>Retail Trade</td>
<td>90,874</td>
<td>15,449</td>
</tr>
</tbody>
</table>
Avg. Duration of Short-Term Idling by Establishment Type (minutes per truck trip)

- **Retail**
  - Idling > 5 Minutes: 7
  - All Idling: 8

- **Basic**
  - Idling > 5 Minutes: 23
  - All Idling: 25
## 2012 Summer Weekday Activity and Emissions (tpd)

<table>
<thead>
<tr>
<th>Idling Type</th>
<th>Hours</th>
<th>CO</th>
<th>NO\textsubscript{x}</th>
<th>VOC</th>
<th>CO\textsubscript{2}</th>
<th>PM\textsubscript{10}</th>
<th>PM\textsubscript{2.5}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Term</td>
<td>5,958</td>
<td>0.48</td>
<td>0.54</td>
<td>0.08</td>
<td>151.06</td>
<td>0.0259</td>
<td>0.0252</td>
</tr>
<tr>
<td>Extended</td>
<td>5,176</td>
<td>0.51</td>
<td>1.09</td>
<td>0.29</td>
<td>52.19</td>
<td>0.0265</td>
<td>0.0244</td>
</tr>
<tr>
<td>Combined</td>
<td>11,134</td>
<td>0.99</td>
<td>1.63</td>
<td>0.37</td>
<td>203.24</td>
<td>0.0524</td>
<td>0.0496</td>
</tr>
</tbody>
</table>
Truck Idling Driver Survey

- Surveys conducted in July & August 2011
- Total responses: 118 drivers
  - Sleeper Cabs (Combination Long-Haul Trucks): 71
  - Day Cabs (Combination Short-Haul Trucks): 46
- Questions:
  - Truck & Engine Characteristics
  - Trip Characteristics
  - Idling Behavior
  - Idling Control Strategies
Engine Speed While Idling?

- **Idling < 1 Hour**
  - "Low" Speed (RPM < 1000): 80%
  - "High" Speed (RPM >= 1000): 20%

- **Idling 1+ Hours**
  - "Low" Speed (RPM < 1000): 82%
  - "High" Speed (RPM >= 1000): 18%
## Literature Review - Idling Engine Speed

<table>
<thead>
<tr>
<th>Study</th>
<th>Sample Size</th>
<th>Average RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brodrick (2001)</td>
<td>233</td>
<td>850</td>
</tr>
<tr>
<td>Irick (2002) – Drivers</td>
<td>100</td>
<td>965</td>
</tr>
<tr>
<td>Irick (2002) – Fleets</td>
<td>100</td>
<td>964</td>
</tr>
<tr>
<td>Lutsey (2003)</td>
<td>315</td>
<td>866</td>
</tr>
<tr>
<td>Texas Transportation Institute (2003)</td>
<td>16</td>
<td>838</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>764</strong></td>
<td><strong>886</strong></td>
</tr>
</tbody>
</table>

- MOVES Assumes All Idling Occurs in “High” RPM Setting with A/C
- Avg. of 1991-2006 “High RPM/AC” Data = 1050 RPM
- Potential Implication: Idling Emission Rates May be Too High
Truck Driver Survey Results – Control Strategies

Presence of On-Board Idle Reduction Technology

- None
- Diesel Heater
- Battery-Powered APU
- Engine Coolant Heaters
- Diesel Gen-Set
- Automatic Stop-Start Controls
- Thermal Storage Cooling
- Other
Willing to Use Idle Reduction Infrastructure?

- On-Board Idle Equipment Present: 60%
- On-Board Idle Equipment Not Present: 29%
- All Responses: 42%

% "Yes"
Are There Idling Restrictions in Place?

- No: 42%
- Unsure: 43%
- Yes: 15%

Would You Be Willing to Comply?

- No: 31%
- Unsure: 19%
- Yes: 51%
Conclusions, Implications, and Recommendations

- Bottom-Up Data Collection Efforts
- Extended Idling v. Short-Term Idling
- Engine Speed Assumptions
- On-Board Idling Technology Assumptions
- Challenges for Control Strategies
  - Truck Stop Electrification
  - Idling Restrictions
Questions?
THANK YOU!

Capital Area Council of Governments
Air Quality Program

http://www.capcog.org/airquality

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