On-Road Emissions Reductions and the Regional Comprehensive Goods Movement Plan – Background and Policy Questions

Presented to SCAG Regional Goods Movement Study Steering Committee

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Goods Movement Emissions as Percent of All Sources, South Coast Air Basin

- **NOₓ Emissions**: Goods Movement 42%
- **PM₂.₅ Emissions**: Goods Movement 12%
- **Diesel PM Emissions**: Goods Movement 54%

Source: South Coast AQMD, 2007 Air Quality Management Plan.
Discussion Scope & Purpose

• Committee input: Policy on the interplay between zero emission trucks and RTP projects.
• Emission reductions from other modes are being considered but are not in today’s discussion.
• Presentation Outline:
  – Current emissions, and major drivers of truck emissions in the future.
  – How can emission control strategies be incorporated into the goods movement plan?
  – Policy implications.
Current (2010) Goods Movement NO$_x$ Emissions in South Coast Air Basin

Source: ARB emission inventory data; OGV emissions from ARB ISOR for marine fuel rule.
Current (2010) Goods Movement PM$_{2.5}$ Emissions in South Coast Air Basin

Source: ARB emission inventory data; OGV emissions from ARB ISOR for marine fuel rule.
Current (2010) Goods Movement NO\textsubscript{x} Emissions in SCAG Air Districts

Source: ARB emission inventory data.
Current (2010) Goods Movement PM$_{2.5}$ Emissions in SCAG Air Districts

Source: ARB emission inventory data.
Policy Implications

- Goods movement related emissions in the SCAB are key to the region’s attainment strategy.

- What is the appropriate scope for emission mitigation in the goods movement plan:
  - Port emissions will recognize existing strategies (i.e., the port CAAP). Should we go further?
  - Infrastructure projects benefiting one air basin vs. vehicle technology measures benefiting the region?
  - Others?
Anticipated Heavy Duty Truck Emissions Reductions
U.S. EPA Truck Emission Standards

- New 2010 trucks have 90 to 95 percent lower emissions than 2006 and older trucks

**PM Standards**

<table>
<thead>
<tr>
<th>Year</th>
<th>1998-2003</th>
<th>2004-2009</th>
<th>2010+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grams per bhp-hr</td>
<td>0.12</td>
<td>0.06</td>
<td>0.02</td>
</tr>
</tbody>
</table>

**NO\textsubscript{x} Standards**

<table>
<thead>
<tr>
<th>Year</th>
<th>1998-2003</th>
<th>2004-2009</th>
<th>2010+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grams per bhp-hr</td>
<td>4.0</td>
<td>2.0</td>
<td>0.2</td>
</tr>
</tbody>
</table>
ARB In-Use Truck and Bus Rule

- Accelerates introduction of 2010-compliant trucks
- Applies only to trucks with GVW >14,000 lbs.
- Compliance schedule for trucks with GVW >26,000 lbs.:

<table>
<thead>
<tr>
<th>Existing Engine Model</th>
<th>Replace with 2010 Engine by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993 and older</td>
<td>January 1, 2015</td>
</tr>
<tr>
<td>1996-1997</td>
<td>January 1, 2017</td>
</tr>
<tr>
<td>1998-2000</td>
<td>January 1, 2020</td>
</tr>
<tr>
<td>2001-2004</td>
<td>January 1, 2021</td>
</tr>
<tr>
<td>2005-2006</td>
<td>January 1, 2022</td>
</tr>
<tr>
<td>2007-2009</td>
<td>January 1, 2023</td>
</tr>
</tbody>
</table>
Effect of In-Use Truck and Bus Rule on $\text{PM}_{2.5}$, SCAG Region

PM$_{2.5}$ (tons per day)

Year

Baseline

w/ Truck and Bus Rule

Source: ICF International analysis based on EMFAC 2007 and ARB regulation
Effect of In-Use Truck and Bus Rule on NO$_x$, SCAG Region

Source: ICF International analysis based on EMFAC 2007 and ARB regulation.
Policy Consideration

- 90-95% reduction in NO\textsubscript{x} and PM\textsubscript{2.5} emissions make many previous strategies less cost effective for mitigation.
- To what extent should the RTP mitigations consider cost effectiveness?
Trucks – Emission Reduction Options for 2025 and Beyond
Current Truck Emission Control Strategies

- Replacement with 2007/2010 truck
- Replacement with natural gas truck (similar to 2010 truck)
- Exhaust retrofits:

<table>
<thead>
<tr>
<th>Technology</th>
<th>Typical Applicability</th>
<th>PM Reduction (minimum)</th>
<th>NO\textsubscript{x} Reduction (minimum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel Oxidation Catalyst</td>
<td>1988-2002 Engines</td>
<td>25%</td>
<td>No Effect</td>
</tr>
<tr>
<td>Flow Thru Filter</td>
<td>1991-2002 engines and some 2003-2006 engines</td>
<td>50%</td>
<td>No Effect</td>
</tr>
<tr>
<td>Diesel Particulate Filter</td>
<td>1994-2006 engines</td>
<td>85%</td>
<td>No Effect</td>
</tr>
<tr>
<td>DPF+LNC</td>
<td>1993-2003 turbocharged engines</td>
<td>85%</td>
<td>25%</td>
</tr>
</tbody>
</table>
Current Truck Emission Control Strategies

- Current strategies will have little to no effect by 2020/2025

VMT from pre-2007 Trucks

<table>
<thead>
<tr>
<th>Year</th>
<th>Light Heavy Duty</th>
<th>Medium Heavy Duty</th>
<th>Heavy Heavy Duty</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>80%</td>
<td>60%</td>
<td>40%</td>
</tr>
<tr>
<td>2015</td>
<td>70%</td>
<td>50%</td>
<td>30%</td>
</tr>
<tr>
<td>2020</td>
<td>60%</td>
<td>40%</td>
<td>20%</td>
</tr>
<tr>
<td>2025</td>
<td>50%</td>
<td>30%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Potential Future Low Emission Truck Technologies

- Hybrid-electric drive
  - Parallel hybrid
  - Series hybrid
  - Other configurations
- Hydraulic hybrid
- Full battery electric
- Fuel cell vehicles
- Electric drive with overhead catenary system
- Electric drive with electromagnetic induction (power system in roadway)
- Electric drive with third rail power
How to Implement Low Emission Truck Technologies?

• Barriers (URS will discuss specific technologies)
  – Vehicle cost.
  – Limited performance (range, speed, load, charging time).
  – Highly dispersed ownership of trucks.

• Implementation mechanisms
  – Use of facility access to encourage purchase and use of low emission trucks (limited by fleet that must use those facilities).
  – Use of vehicle purchase incentives (limited by cost).
Facility Access Limitations – Ports and Yards

• Ports
  – SPB Port trucks account for 5 to 10 percent of total SCAB truck VMT and emissions (2008)

<table>
<thead>
<tr>
<th></th>
<th>All SCAB HDTs</th>
<th>SPB port Trucks</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMT/Average Weekday</td>
<td>21,863,585</td>
<td>1,175,979</td>
<td>5%</td>
</tr>
<tr>
<td>NO\textsubscript{x} (tons/day)</td>
<td>231</td>
<td>20.9</td>
<td>9%</td>
</tr>
<tr>
<td>PM\textsubscript{2.5} (tons/day)</td>
<td>7.6</td>
<td>0.5</td>
<td>7%</td>
</tr>
</tbody>
</table>

• Intermodal yards
  – 9 major yards

Source: Port of LA Air Emissions Inventory; Port of LB Air Emissions Inventory.
Facility Access Limitations – Highways

- Major N/S and E/W truck corridors

- Accounts for ~20 percent of total SCAB truck VMT (2008)

<table>
<thead>
<tr>
<th></th>
<th>All SCAB HDTs</th>
<th>Thru Trucks on Major N/ S and E/ S Corridors</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMT/Weekday</td>
<td>21,863,585</td>
<td>3,670,000</td>
<td>17%</td>
</tr>
</tbody>
</table>

Source: ICF International estimate based on Caltrans truck counts.
Truck Purchase Incentives

- **Existing programs**
  - Ports’ Clean Truck Program
  - Carl Moyer Program
  - State and Federal tax incentives for alt fuel vehicles

- **To have a significant impact, costs could be huge**
  - More than 400,000 HDTs in SCAG region
  - More than 80,000 Class 8 trucks (HHDT)
  - Incremental costs may be $50,000/vehicle, or much more
Policy Implications

• How should projects in the goods movement plan implement specific emission reduction strategies:
  - Access limitations to encourage adoption of specific technologies (i.e., electric trucks)?
  - Provide adequate right-of-way to subsequently build enabling infrastructure (i.e., ability to accommodate catenary power)?
  - Providing specific technologies under RTP projects (i.e., catenary power and funds to purchase trucks)?
Next Steps for Consultant Team

- Evaluate the effectiveness of truck and rail emission reduction strategies in 2023 and 2035
  - Identify goods movement markets/segments to target emission reduction strategies
  - Assess emissions impacts of selected infrastructure and operations strategies
  - Assess truck emission reduction strategies
  - Assess rail emission reduction strategies
  - Estimate cost to achieve target emission reductions in select market segments
Guidance Recap

• What is the appropriate scope for emission mitigation in the goods movement plan:
  - Port Emissions, or other sources not directly effected by the RTP, will recognize existing strategies (i.e., the port CAAP). Should we go further?
  - Infrastructure projects benefiting one air basin vs. vehicle technology measures benefiting the region?
  - Others?

• To what extent should the RTP mitigations consider cost effectiveness?
Guidance Recap (cont)

- How should projects in the goods movement plan implement specific emission reduction strategies:
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