Railroad Emissions – Background and Mitigation Options

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February 24, 2011
Presentation outline

• What will affect railroad emissions over the next 25 years?
• What are the options for reducing emissions?
• Points of discussion for Steering Committee
Goods movement emissions 2010 vs. 2035

**NOx Emissions, South Coast Air Basin**

- Harbor Craft (2%)
- CHE (4%)
- Ocean Going Vessels (14%)
- Trains (6%)
- Heavy Duty Trucks (74%)

**PM2.5 Emissions, South Coast Air Basin**

- Harbor Craft (2%)
- CHE (3%)
- Ocean Going Vessels (32%)
- Trains (6%)
- Heavy Duty Trucks (57%)

**2010**

- Ocean Going Vessels (31%)
- Heavy Duty Trucks (49%)
- Trains (16%)

**2035**

- Ocean Going Vessels (31%)
- Heavy Duty Trucks (55%)
- Trains (16%)

3
Key factors affecting rail emissions
Growth in rail activity

- Driven mostly by port container throughput
- Also limited growth in carload, bulk, auto traffic
EPA locomotive emission standards

• New 2015 locomotives will have 76-85% lower emissions than Tier 2 line-haul.
Effect of EPA standards

Locomotive NOx Emissions, California

Baseline

w/ EPA locomotive stds

-33%

Locomotive PM2.5 Emissions, California

Baseline

w/ EPA locomotive stds

-55%
Emission reduction strategies

- Line-haul strategies
- Switcher strategies

<table>
<thead>
<tr>
<th>Locomotive Type</th>
<th>NOx</th>
<th>PM2.5</th>
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<tbody>
<tr>
<td></td>
<td>tons/day</td>
<td>percent</td>
</tr>
<tr>
<td>Freight Line-Haul</td>
<td>14.3</td>
<td>72%</td>
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<tr>
<td>Freight Yard/Switch</td>
<td>2.6</td>
<td>13%</td>
</tr>
<tr>
<td>Passenger</td>
<td>2.9</td>
<td>14%</td>
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<tr>
<td>Total</td>
<td>19.7</td>
<td>100%</td>
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• Approx. 600 line-haul locos operating in SCAB on a given day
• Tier 4 locos
  – Introduction in 2015
  – 18% of fleet in 2020
  – 62% of fleet in 2035
Accelerate Tier 4 deployment

• Hypothetical goal – 100% Tier 4 by 2035 implies:
  – 350 more Tier 4 locos on a given day
  – 1,400 more Tier 4 locos in fleets

• Costs
  – ~$3M per locomotive

• Challenges
  – New technology – performance, uptake, and deployment uncertain
Electrification

• Challenges
  – Difficult to electrify entire system
    • Intermodal yards
    • Low volume segments
  – New technology, cost
  – Transition zone outside Basin

• Opportunities
Railyard emissions

Diesel PM Emissions from Major Southern California Railyards, 2005

- Hobart/Commerce/Shelia/Eastern
- BNSF San Bernardino
- UP Colton
- UP ICTF/Dolores
- UP City of Industry
- UP LATC
- UP Mira Loma
- BNSF Watson

Tons of PM Emissions Per Year

Other Sources
Cargo Handling Equipment
Locomotives
Example of railyard HRA

Estimated Potential Cancer Risks from Railyards (chances per million people), 2005
Switcher locomotives in Basin

- Tier 0/Pre-0 (69)
- GenSet (78)
- Battery Hybrid (10)
- LNG (4)
Switcher emission reduction strategies

- Replace older switchers with GenSets
- Upgrade GenSets with exhaust retrofits
- Upgrade GenSets to Tier 4 nonroad
Next steps for consultant team

- Refine calculations of strategy emissions benefits and costs
- Further assess operational impacts
- Implementation options in Goods Movement Plan
Discussion points

• To what extent should the Regional Goods Movement Plan incorporate railroad emission reduction strategies?

• How can the region implement accelerated locomotive turnover and/or retrofit strategies?

• How to address both regional emission reduction targets and localized health impacts?