Connecticut Department of Energy and Environmental Protection
Freight Movement and Air Quality

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SIPRAC
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Connecticut’s Freight Movement Study

• Goal is to develop a strategy to reduce emissions associated with freight movement in Connecticut
• de la Torre Klausmeier Consulting, Inc.
• Collect information on vehicles and practices
• Establish 2009 baseline of emissions from freight movement in the state
• Project emissions for 2020 and 2040
• Critically evaluate and identify options that could be implemented in CT
• Project the cost and environmental benefits of identified options
• Draft Report comments taken until September 6
• Finalize strategy in September
Executive Summary

• Freight movement is critical to the economy (3% of CT’s jobs)
• Emissions from freight movement are a significant air pollution concern
• Current system is 92% truck based
  — Congestion issues and road maintenance costs are big
• Business as usual will result in cleaner trucks, but problems and challenges remain
• Short term win
  — Idling reductions
• Lower emissions from transportation needed:
  — Well maintained trucks, rail and port equipment
  — Idling reductions
  — Value added freight shifted to lowest emitting freight movement mode
• Regional coordination is essential and occurring
Freight Movement Impacts Air Quality

- **VOC**
- **GHG**
- **NOx**

Image of freight containers and trucks.
Connecticut’s Freight-Related NOx Emissions are Significant*

2008 Total NOx: 91822 tons/year

- **Mobile - On-Road Diesel Heavy Duty Vehicles**
- **Mobile - Commercial Marine Vessels**
- **Mobile - Locomotives**
- **Mobile - Non-Road Equipment - Diesel**
- **Mobile - Non-Road Equipment - Gasoline**
- **Mobile - Non-Road Equipment - Other**
- **Fuel Comb - Electric Generation - Coal**
- **Fuel Comb - Residential - Natural Gas**
- **Fuel Comb - Residential - Oil**
- **Waste Disposal**

Source: EPA 2008 National Emissions Inventory (version 2; released April 10, 2012)

* Most emissions from the heavy duty diesel truck, commercial marine and locomotive categories are freight-related.
Health Effects of Ozone and PM$_{2.5}$

- **Ozone & PM$_{2.5}$**: airway irritation; reduced lung capacity; asthma aggravation; permanent lung damage

- **PM$_{2.5}$**: irregular heartbeat; heart attacks; premature death in those with heart or lung disease

- **Benefits of Attainment**: EPA estimates $2-17$ billion for ozone and $17-35$ billion for PM$_{2.5}$
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Health Risks-Cancer

Mobile Associated Cancer Risk
Source: NATA, 2005 Assessment

Mobile Associated Cancer Risk:
Health Benchmark—1 cancer illness in 1,000,000 population
Lifetime assumed to be 70 years

- less than or equal to benchmark
- 1.1 - 2.0 times benchmark
- 2.1 - 5.0 times benchmark
- 5.1 - 10.0 times benchmark
- >10 times benchmark

Source: (http://www.epa.gov/tnn/atwha2005/tables.html#table)
Note: Diesel particulate matter was modeled in the 2005 NATA, however because EPA has not determined a quantitative estimate of carcinogenic potency for this pollutant it is not included in the risk summary.
Air Quality in CT and throughout the I-95 Corridor Fails to Meet Health-Based Ozone Standard (75 ppb)
Trade and Freight are Regional Issues

Megaregion Trade Areas and GDP of Major U.S. Cities

I-95 Corridor Coalition, 2008, A 2040 Vision for the I-95 Coalition Region Supporting Economic Growth in a Carbon-Constrained Environment

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Freight Flows throughout the Northeast

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Modes of Transported Freight in CT

Tons of Freight by Mode 2009

- Rail: 2%
- Water: 6%
- Truck: 92%

de la Torre Klausmeier Consulting, Inc, “SUMMARY OF TRUCK FREIGHT MOVEMENT IN CONNECTICUT”, April 2012
3.2 million VMT per day is attributed to freight movement in Connecticut (2009):
Projected Truck Volumes Nearly Double by 2035

Source: Global Insight 2004 TRANSEARCH for AASHTO Freight Bottom Line Reports.
Connecticut Freight VMT Growth

Truck VMT Projections: 2009 to 2040
More Freight Will Come through Port of NY

(Source: Worley Parsons, Richard West)
Predicted Freight Trends through 2040

Top Commodities Transported, Through Freight, Statewide VMT, 2009-2040

- Food/Kindred
- Chemicals/Allied Secondary Moves
- Printed Matter
- Pulp/Paper/Allied
- Fabricated Metal
- Rubber/Plastics
- Farm
- Primary Metal
- Elec. Mach/Equip/Supp
- Trans. Equip.
- Petroleum/Coal

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Congestion Will Get Worse

Reference: NYMTC, The Basics of Freight Transportation in the New York Region
Congestion Delay Costs $ and Increases Emissions

Truck Congestion in 100 Most Congested Urban Areas

Connecticut Related Urban Areas Total:
32,957,000 hours of Truck Delay
2,421 Million Dollars of Congestion Costs

Rail Constraints

Capacity Constraints on the NEC

Source: NEC Master Plan Capacity Utilization, SYSTRA Consulting

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EPA Actions Will Reduce Freight Emissions

Annual U.S. Mobile Source NO\textsubscript{x} Emission Projections (kttons per year) Including C3 Marine (ECA) Control

52% Decrease From 2007-2020
EPA Initiatives - Highway

Regulation
• 2006: Low Sulfur Diesel Fuel (< 15 ppm)
• 2007: Heavy Duty Highway Engines and Vehicles
• 2010: NO\textsubscript{x} and Non-Methane Hydrocarbons
• 2011: Program to Reduce Greenhouse Gas Emissions and Improve Fuel Efficiency of Medium- and Heavy-Duty Vehicles

Voluntary
• 2003: SmartWay program
EPA Initiatives- Ships

- IMO North American Emission Control Area
  - Reduces emissions by fuel switching (2012-2016)
- EPA Marine Diesel Engine Standards
  - Varies with size
  - Phased in 2012 to 2017
EPA Initiatives- Rail

Regulatory: EPA Rules
- 2008 Locomotive and Marine Emission Standards
- 2008 Locomotive Idle Emissions Standards (new & rebuilt)

Voluntary:
- Low emission switch engines (Gen-set, battery)
- Electric cranes
- EPA best practices tool under development
Benchmarking
Modal Average (g/ton-mile) CO$_2$ Emissions

<table>
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<tr>
<th>Modal</th>
<th>2009</th>
<th>2020</th>
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<tr>
<td>Trucks</td>
<td>235</td>
<td>209</td>
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<tr>
<td>Rail</td>
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<tr>
<td>Commercial Marine Vessels</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>
Modal Average (g/ton-mile) PM$_{10}$ Emissions

*Commercial Marine Vehicles values are representative of National Average while other modes are CT specific values.

**NOTE:** Projected emissions reductions will only occur if older truck, rail & marine engines are replaced with engines meeting the newer standards.

*Reference:* dKC de la Torre Klausmeier Consulting, Draft 2012
Modal Average (g/ton-mile) NO\textsubscript{x} Emissions

- **Trucks**
  - 2009: 2.21
  - 2020: 0.79
  - 2040: 0.62

- **Rail**
  - 2009: 0.89
  - 2020: 0.53
  - 2040: 0.25

- **Commercial Marine Vessels**
  - 2009: 0.57
  - 2020: 0.4
  - 2040: 0.187

*Commercial Marine Vehicles values are representative of National Average while other modes are CT specific values.

**NOTE:** Projected emissions reductions will only occur if older truck, rail & marine engines are replaced with engines meeting the newer standards.

Reference: dKC de la Torre Klausmeier Consulting, Draft 2012
Every ton-mile of freight that moves by rail instead of truck reduces GHG emissions by two-thirds or more:

- 3X more fuel efficient than trucks
- 35% more fuel efficient than marine
- Railroads reduce congestion: a single train can take 280 trucks off the highway

86% fuel improvement over 16 years

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Best Freight Practices - Trucks

- Idle Reduction Technology
  - APUss
  - Auto Shut-Off
  - Air Brake Maintenance

- Alternate Fuels (CNG, LNG) and Hybrids
- Aerodynamics
- Double Wide Tires
- Retrofits
Best Freight Practices-Ports

- Shore Power & Idle Reduction
- Dredging Using Best Available Technology
- Gate Management
- Infrastructure for CNG & LNG
- Fuel Leakage, Evaporation & Emissions Control
- Clean Freight Handling Equipment (e.g. cranes & forklifts)
- Extension of Rail Spurs
- Harbor Speed Reduction

Best Freight Practices- Rail

- Early fleet turnover -> use best technology
- Idle reduction
- Low emission switch engines (Gen-set, battery)
- Electric cranes
- EPA best practices tool under development
Strategic Wins

- Decreased Idling
- Clean Trucks
- Remote Inspection of Truck Emission Controls
- Clean Marine Impacts
- Value Added Freight
*Replacement is only cost effective with older trucks, the use of which is concentrated at ports.
Freight Movement Costs

Cost per Ton-mile by Mode & Distance

- Truck
- Rail - Containers
- Rail - Bulk Materials
- Barge

Shipment Distance (mi) vs. Cost per Ton-mile
Preliminary Conclusions

1. Greatest emission reduction potential is from 2006 and earlier model trucks.

2. Reduced idling and congestion benefit both the environment and the economy.

3. Air pollution as well as freight movement are an I-95 corridor issue and strategy development should be coordinated.

4. Heavy duty truck I/M and clean port strategies should be analyzed.
Costs (Time, Energy, Environmental Impact) Are Associated with Each Segment
Multi-Modal System Requires Systems Analysis

- Trucks
- Idling
- Ships
- Pipeline Leakage & Evaporation
- Barge
- Rail
- Cargo Handling

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Questions and Comments

Comments by September 6 to:
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