DRAFT – FOR DISCUSSION PURPOSE

GOODS MOVEMENT WHITE PAPER

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1. On-Road Trucks
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IV. Potential Emission Reduction Technologies and Efficiency Measures

1. Overview: types of technologies and efficiency measures; potential NOx reduction percentages; toxics and GHG co-benefits
   - Aftertreatment and engine modifications
   - Alternative fuels and power
   - Combinations (e.g. alt fuels with advanced aftertreatment/ hybridization)
   - Efficiency measures

2. Specific source categories: measures and potential emission reduction percentages
   - On-Road Trucks
     - Aftertreatment and engine modifications
       - SCR, DPF (generally implemented already)
     - Alternative fuels and power
       - Natural gas, LNG, biofuels, hydrogen blending, etc.
       - BEV, hybrid-electric, PHEV, hybrids with zero emission miles, fuel cells, catenary, etc.
     - Combinations
       - alt fuel-electric hybrids, alt fuels with advanced aftertreatment
     - Efficiency measures
       - Intelligent transportation systems, on-dock railyards, etc.

   - Oceangoing Vessels
     - Aftertreatment and engine modifications
       - IMO Tier 3, EGR, water scrubbing, etc.
       - At-berth emissions capture and control
     - Fuels and power
       - LNG, emulsified fuels etc
       - Shore power
     - Efficiency measures
       - Heat Recovery Systems

        - New Hull Designs
        - Slow Steaming, etc.

- Locomotives
    - Aftertreatment and engine modifications
        - Tier 4
    - Fuels and power
        - Catenary electric, hybrid-electric, battery tender car, LNG, etc.
    - Combinations
        - LNG with advanced aftertreatment, etc.
    - Efficiency measures

- Cargo Handling Equipment
    - Aftertreatment and engine modifications
        - SCR, DPF etc (generally implemented already)
    - Fuels and power
        - Natural gas, LNG, biofuels, hydrogen blending, etc.
        - BEV, hybrid-electric, PHEV, hybrids with zero emission miles, fuel cells, etc.
    - Efficiency measures
        - Wide-span gantry cranes, etc.

- Harbor Craft
    - Aftertreatment and engine modifications
        - SCR, DPF, etc.
    - Fuels and power
        - Hybrid-electric, LNG, biofuels
    - Efficiency measures
        - New Hull Designs, etc.

- Aircraft Engines
    - Engine modifications
        - New Engine Development to Meet ICAO/ U.S. EPA Emission Standards
        - New Engine Research – FAA CLEEN Program
    - Fuels and power
        - Biofuels, Fuel Cell Technologies
    - Efficiency measures
        - Wing and Hull Designs
        - LTO Operations, etc.

- Ground Service Equipment
  - Aftertreatment and engine modifications
    - SCR, DPF, etc.
  - Fuels and power
    - Electrification, Hybrid-electric, Alternative fuels, biofuels
  - Efficiency measures

3. System-wide Efficiency
   - Intelligent Transportation Systems, etc.

V. NOx Emissions Reduction Scenarios

Potential approaches:

1) Working Back from Attainment – Determine emission reductions for each source category needed to attain regional NOx carrying capacities in attainment deadline years.
   - At least one scenario would assume even distribution of emission control obligations across source categories; other scenarios would modify that distribution based on factors relating to feasibility.
   - Various scenarios could be designed to achieve specific purposes, e.g. minimize needed technology changes between 2023 and 2032 attainment deadlines, or illustrate emission tradeoffs between various penetration rates
2) Looking Forward – Assume a range of performance standards and deployment rates, and project emissions in attainment deadline years.

VI. NOx Emissions Reduction Scenario Assessment

1. Aggregate potential reductions, and adequacy to meet attainment needs
   - Preliminary discussion of extent each scenario has potential for—
     - business case
     - co-benefits for toxics, GHG, energy, mobility, local economy
   - Preliminary discussion of implementation challenges for each scenario, e.g.—
     - technology feasibility
     - cost
     - infrastructure needs
     - operational impacts

VII. Recommended Actions

1. Studies
2. Technology development and demonstration
3. Foster clean technology markets and technology deployment
   - Outreach, funding, incentives, project conditions, regulations
4. Infrastructure
   - Alternative Fuels
   - Electricity Generation/Charging
   - Transportation (Roads, etc.)
5. Funding
   - Public and private investments
6. Federal Assistance
7. Interagency Coordination
8. Public/Private Partnerships
9. Additional Recommendations??

References

Appendices