

**OFF-ROAD EQUIPMENT WHITE PAPER**

**DRAFT – April 1, 2015**

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The various emission sources included in the off-road equipment category are discussed in this section.

- Construction and Mining Equipment
- Industrial Equipment (Forklifts, Aerial Lifts, Sweepers/Scrubbers, etc.)
- Oil Drilling and Workover  
(Drilling and Workover Rigs, Compressors, Pumps, etc.)
- Lawn and Garden Equipment

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- Commercial Equipment (Compressors, Pumps, etc.)
- Transportation Refrigeration Units (TRU)
- Miscellaneous Equipment

### **III. Potential Emission Reduction Technologies**

#### 1. Overview: types of technologies; potential NO<sub>x</sub> reduction percentages; toxics and GHG co-benefits

- Cleaner Combustion Engines
  - Application – Heavy-duty engines > 300 hp
  - Potential Technologies
    - Aftertreatment and engine modifications (SCR, DPF) (generally implemented already)
- Hybrid Systems
  - Application –
    1. Equipment with energy recovery duty cycles or high percentage of idle/low power operation
    2. Equipment operating at remote sites with diesel fuel
  - Potential Technologies
    - hybrid-electric, hybrids with zero emission miles, etc.
- Alternative Fuels
  - Application –
    1. Equipment at fixed sites or returning to equipment yards
  - Potential Technologies
    - CNG/LNG; other alternative fuels; alternative fuels with hybrid systems
- Plug-In Hybrid Electric Systems
  - Application –
    1. Equipment with energy recovery duty cycles or high percentage of idle/low power operation.
    2. Equipment can operate at remote sites with conventional fuel or grid power if available at job site.
  - Potential Technologies
    - Plug-in hybrid-electric, hybrids with zero emission miles, etc.
- Fuel Cell
  - Application –
    1. Equipment with access to fueling infrastructure (i.e., equipment at fixed sites or returning to equipment yards at night)
  - Potential Technologies

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- Fuel cells for propulsion or for vocation (e.g., lifts, etc.)
- Battery Electric
  - Application –
    1. Equipment with high percentage standby time or low load time and located at site with access to grid power
  - Potential Technologies
    - Fuel cells for propulsion or for vocation (e.g., lifts, etc.)

### **IV. Technology Penetration Potential Assessment**

1. Aggregate potential reductions, and adequacy to meet attainment needs
  - Preliminary discussion of extent each technology has potential for—
    - business case
    - co-benefits for toxics, GHG, energy, mobility, local economy
  - Preliminary discussion of implementation/deployment challenges, e.g.—
    - technology feasibility
    - cost
    - infrastructure needs
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### **V. Recommended Actions**

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## **References**

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