



Light-Duty Diesels in the U.S.

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Diesel Potential

- EPA is excited about diesels
 - Improved FE, lower CO₂ emissions, increased torque
- Must be done consistent with EPA mandate to improve air quality
 - Gasoline vehicles have set a very high hurdle (very low emissions)
 - Diesels need to be on the same performance level





Focus on...

Technology

Infrastructure

Education



Technology basis

- Tier 2 standards apply to all vehicles, all fuel types
- Gasoline vehicles have very low levels of HC, PM & NO_x
 - 2006 MY – over 50% of engine families meet Bin 5 or cleaner levels
 - Use three-way catalysts that light-off very fast, providing almost immediate emission control
 - Good emission performance at:
 - Low temperatures
 - High loads
 - High altitude
- All have been challenges for diesels



Can diesels clear these hurdles?

- Yes!
 - New clean diesel technologies
 - Cooled EGR
 - HCCI
 - Diesel oxidation catalysts (DOC)
 - Particulate filters
 - NOx adsorbers (NSC, NAC, LNT)
 - Selective catalyst reduction (SCR)
 - Urea infrastructure--
 - Ensure that drivers will find SCR-quality urea when they need it.
 - Vehicle compliance--
 - Ensure that vehicles will meet the standards in use at all times.
 - Vehicle is always operated with urea
 - Need to address various technical issues, such as sulfur sensitivity, durability, user interface



Certification challenges for diesels

- Emissions from periodic regeneration
 - Periodic regeneration of the DPF & NOx adsorber can cause increases in emissions
 - Periodic regeneration may or may not occur during emission testing
 - Emissions from a regeneration event that occurs during an emissions test would almost certainly cause a failure
 - An emission test that doesn't account for regenerative emissions may not accurately reflect actual in-use emissions
 - Emission adjustment factors address these concerns



Certification challenges for diesels – adjustment factors

- Calculation of regeneration emissions adjustment factors:
 - Emissions with regeneration event (EF_H)
 - Emissions without a regeneration event (EF_L)
 - Frequency of regeneration events (F)
 - $EF_A = (F) (EF_H) + (1-F) (EF_L)$

- Use of adjustment factors:
 - Upward adjustment factors (UAF) used for emission tests where regeneration does not occur
 - $UAF = EF_A - EF_L$
 - Downward adjustment factors (DAF) used for emission tests where regeneration does occur
 - $DAF = EF_A - EF_H$



SCR Vehicle Compliance Strategies

- Warning System
- Driver Inducement
- Ability to Identify Urea
- Tamper-Proof Design
- Urea Refill Interval
- Cold Temperature Operation



SCR Vehicle Compliance Strategies - continued

■ Warning System

- Essential component of SCR system
- Must prompt driver to respond to warning & refill urea
- Avoid driver inducement phase

■ Driver Inducement

- Works in conjunction with warning system
- Driver inducement should ensure that vehicle won't operate w/o urea & exceed emission standards
- Should be last resort



SCR Vehicle Compliance Strategies - continued

■ Ability to Identify Urea

- SCR system needs to be able to identify when an incorrect reductant is being used (water, diluted urea, etc.)
- NOx sensor, urea quality sensor, or other mechanism
- Separately, industry working on urea quality specs

■ Tamper-Proof Design

- SCR system design needs to be as tamper-resistant as possible
- Discourage or make it difficult for vehicle owner to easily disconnect sensors, dosing valve, etc.



SCR Vehicle Compliance Strategies - continued

■ Urea Refill Interval

- Want longest refill interval possible
- Good warning system & driver inducement design make refill interval less of a concern
- Manufacturers will need to petition EPA for shorter allowable maintenance intervals (diesel catalyst interval is 100,000 miles)

■ Low Temperature Operation

- SCR systems need to operate at low temperatures
- Urea freezes at 11°F
- SCR systems can be designed to operate at low temperatures (electrically heated & insulated storage tanks & lines)



ULSD Infrastructure

- Refinery obligation to produce ULSD began on June 1, 2006
 - Large majority of highway diesel fuel production meeting ULSD levels
- Fuel showing up at retail outlets in advance of Oct. 15, 2006 deadline
- EPA actively addressing appropriate issues



SCR urea availability

- Essential to ensure widespread retail distribution
 - Adequate supply and primary distribution are important.
 - Obtaining urea needs to be convenient to drivers and address off-hour needs.
 - Needs to be a back-up plan (e.g., 1-800 number with 24 hr delivery)
- OEM-affiliated distribution channels not enough
- Service stations
- Oil change facilities
- Retail Outlets

- EPA will not mandate urea market



Consumer outreach

- EPA working with Clean Diesel Fuel Alliance
 - Joint effort of Industry, federal government, consumer association
 - 1-866-406-FUEL
 - www.clean-diesel.org



Government - Industry - Consumers
Clean Diesel Fuel Alliance
INFORMATION CENTER

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Ultra Low Sulfur Diesel (ULSD) fuel and new engines and vehicles with advanced emissions control systems offer significant air quality improvement.



Highway ULSD Fuel
New EPA standards require a major reduction in the sulfur content of diesel fuels beginning June 1, 2006.
[Highway Diesel](#)



New Diesel Technology
Ultra Low Sulfur Diesel (ULSD) is a cleaner-burning diesel fuel containing a maximum 15 parts-per-million (ppm) sulfur.
[Vehicle Performance](#)



Non-Road ULSD Fuel
New EPA fuel standards for diesel fuel will also apply to locomotive, marine and non-road engines and equipment, such as farm or construction equipment.
[Non-Road Diesel](#)



Environmental Benefits
ULSD fuel along with new engine and emission control system technologies will have an important role in improving air quality and providing human health benefits by significantly reducing current emissions.
[Environment and Health](#)



SCR Learning Curve

- Successful introduction of SCR will need consumer education efforts as well
 - Drivers not trained in use, handling of urea or SCR technologies
 - Improper operation will result in excessive air pollution, potential warranty issues
- We will expect OEMs to undertake a range of activities
 - Advertising
 - Owner manual information, vehicle labeling
 - Web info



Meeting the certification challenges

- EPA is working hard to develop guidance to help manufacturers navigate the certification challenges
 - Regeneration
 - SCR certification requirements
- Continue to meet with manufacturers to discuss certification issues



In conclusion...

- **TIE'** ing together success in all three focus areas will lead to ...
- Diesels having an appropriately larger role in the light-duty market