

## **Update on the US Diesel Retrofit Program**

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### **ABSTRACT**

The United States has about 150 million people living in areas that are in nonattainment with US ambient air quality standards. The presentation will start by reviewing US EPA's stringent exhaust emission and fuel sulfur standards. This "systems approach" to vehicle and fuel standards has resulted in wall flow particle filters on all new light and heavy-duty diesel highway vehicles beginning in 2007.

Unfortunately, stringent standards for new vehicles do not impact the existing fleet of more than 11 million "legacy" diesels in the US. These vehicles may last another 20-30 years. Thus EPA has implemented numerous retrofit projects to address the problem. The presentation will address our retrofit program in general, federal funding of retrofits, funding from other sources, our verification program for retrofit technologies, and our requirement for in-use testing of retrofit devices to ensure real world durability. The presentation will also touch on some diesel retrofit pilot projects we have implemented in developing countries and discuss our plans for further retrofits in the US in the future.

# Update on the US Diesel Retrofit Program

Merrylin Zaw-Mon, US EPA

11<sup>th</sup> ETH Conference on Combustion  
Generated Nanoparticles

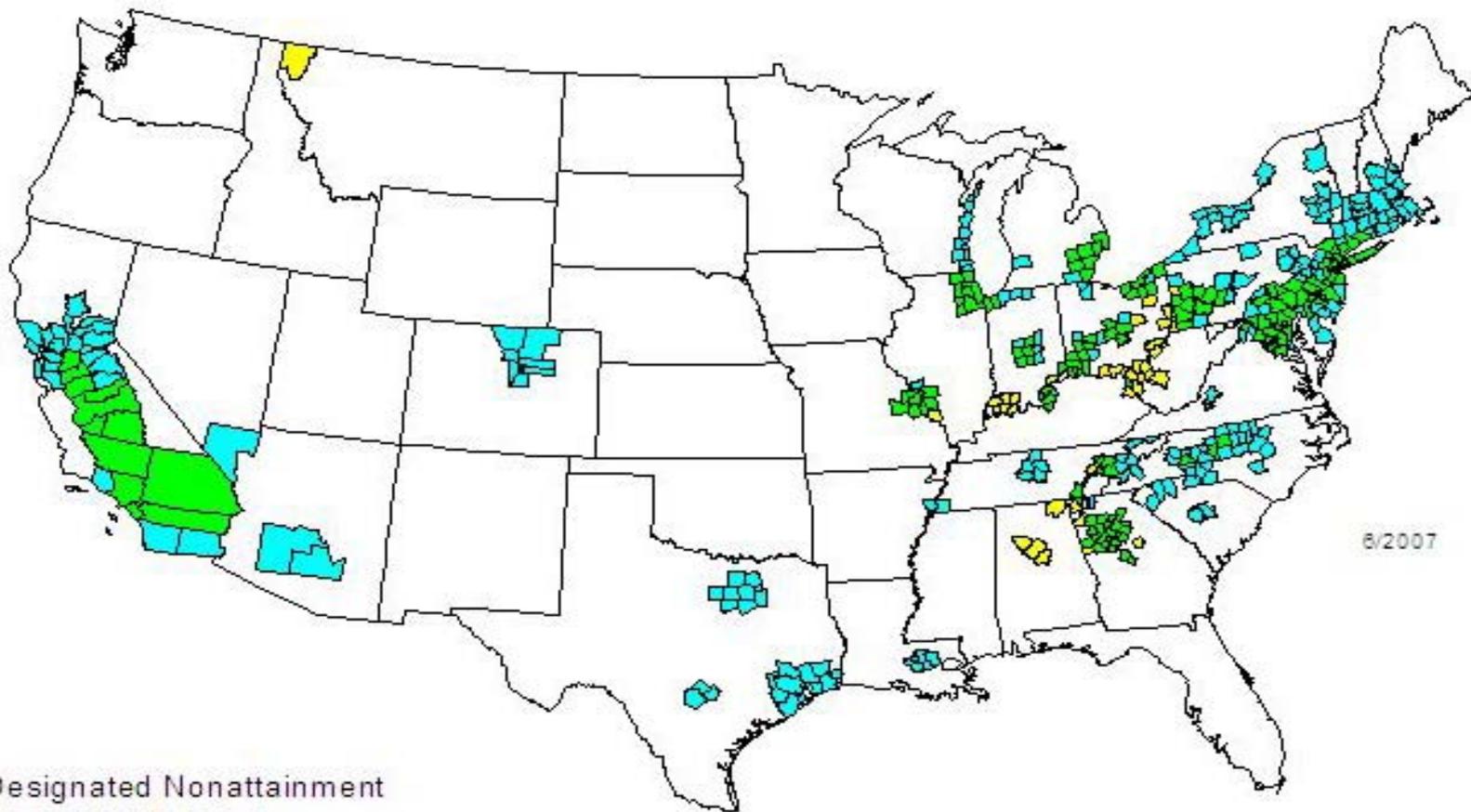
August 15, 2007

Zurich



# Ozone and PM2.5 Nonattainment

Counties Designated Nonattainment for PM-2.5 and/or 8-hour Ozone Standard



6/2007

Designated Nonattainment

- PM-2.5 Only
- PM-2.5 and 8-hour Ozone
- 8-hour Ozone Only

Several counties have only a portion of their county designated nonattainment. These counties are represented as whole counties on this map.

# Reconciling Diesels with the Environment: **EPA's National Clean Diesel Campaign**

## Tier 2 Light-Duty

final rule 1999

fully phased in 2009

Diesels held to same stringent standards as gasoline vehicles



## Heavy-Duty Highway

sales 800,000 / yr

40B gallons / yr

final rule 2000

fully phased in 2010



## Locomotive / Marine

sales 40,000/yr

(1,000 locomotives)

6B gallons / yr

proposal 2007

fully phased in 2017

## Nonroad Diesel

sales over 650,000 / yr

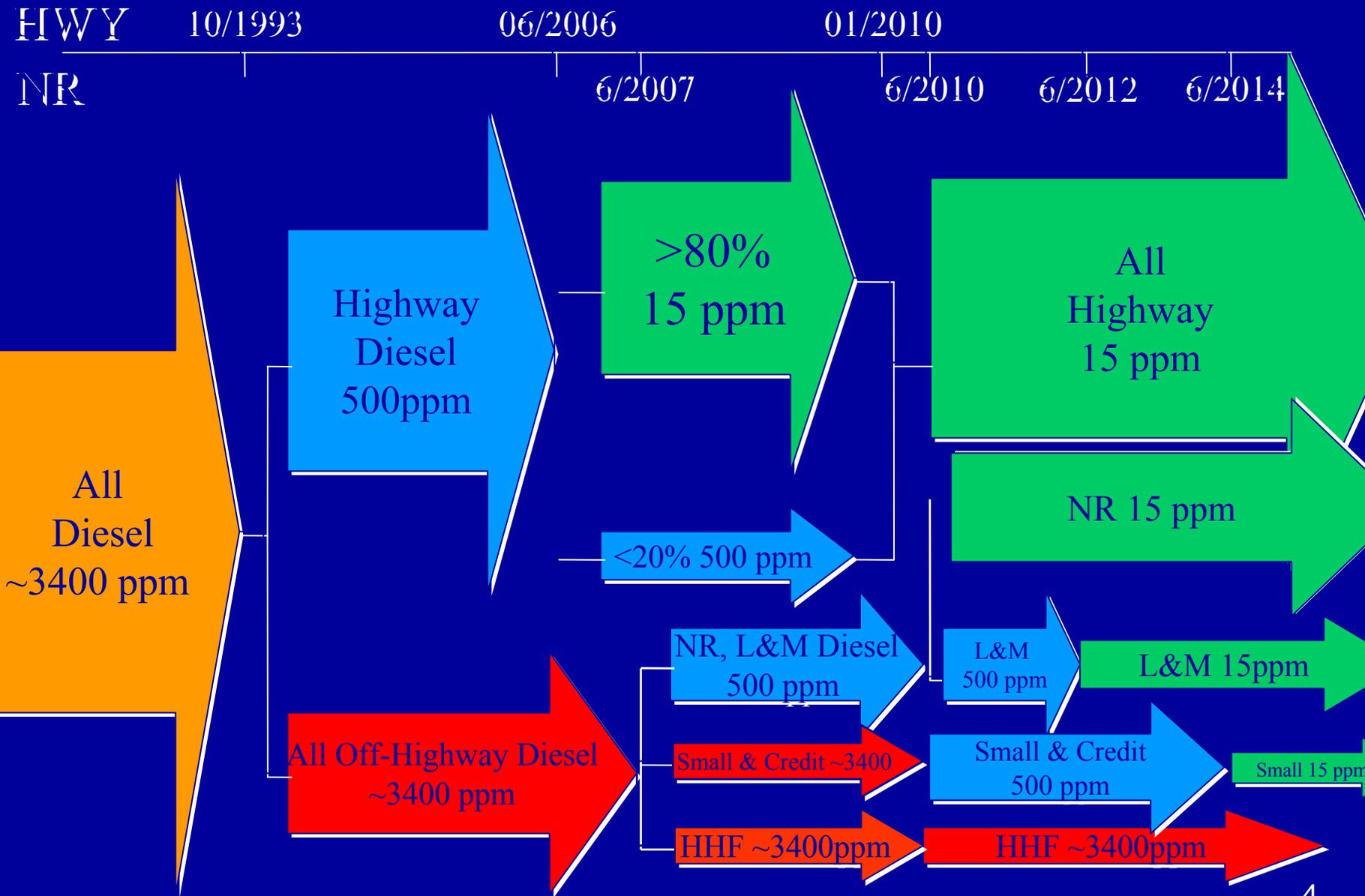
12B gallons / yr

final rule 2004

fully phased in 2015



# Highway + Nonroad Diesel Fuel Sulfur Specs\*



# Greenhouse Gases: New Fuel and Vehicle Rulemaking

- Landmark Supreme Court ruling in April told EPA it should regulate CO<sub>2</sub> under the Clean Air Act.
- On May 14, 2007, Pres. Bush issued Executive Order
- Directed EPA (along with DOE and DOT) to design a program for reducing GHGs from motor vehicles
  - 35 billion gallons of renewable or alternative fuel by 2017
  - Improve efficiency of cars & light-trucks by 4 percent per year
- Proposal by the end of 2007, with a final rule completed by October, 2008

# Need for Retrofit

- Our rules have major impacts on new diesel vehicles and engines
  - Impose filter-based standards
  - Require ULSD fuel
- But these rules won't fix the US “legacy fleet”!!
  - >11 million diesel engines in the US
    - 6 million on highway
    - 5 million nonroad equipment
    - 900,000 stationary engines

# Diesel Retrofit

Retrofit Technologies can be:

- Catalyst or filter
- Other devices or systems like SCR
- Engine upgrade or engine re-flash
- Early engine replacement
- Cleaner fuels or additives
- Closed Crankcase systems
- Idling control equipment
- Combination of above



# Federal Funding

## *National Clean Diesel Campaign*

- 2003
  - \$5 million (Clean School Bus USA)
- 2004
  - \$5 million for (Clean School Bus USA)
- 2005
  - **\$9.0 million**
- 2006
  - \$12 million
- 2007
  - \$8.5 million
- **2008**
  - President requested \$35 million
  - Congress may raise to \$50 million



# Other Funding for Retrofits

- Highly leveraged: Over 2 external dollars for every 1 federal dollar
- State funds -- Over \$500 million has been provided to date
- CMAQ funding for highway and nonroad retrofits
- Legal settlements, civil penalty money
  - E.g. \$20 million auto manufacturer settlement
- Other funds from partners



# EPA Retrofit Verification

- **FOUR STEPS**
  - Application
  - Test Plan Preparation
  - Testing
    - Manufacturer must provide
      - Degreened device (25-125 hours)
      - Aged device (1000 hours)
      - Test engine
  - Data Review and Analysis
- We work closely with CARB and accept CARB verified technologies

**CAN BE DONE IN 6 MONTHS; HAS BEEN  
DONE IN 4**

# In-use Testing

- Required when sales of a particular verified technology reach 500
- Performed by manufacturer on engine dyno
  - Phase I: Four units at 25% of useful life
  - Phase II: Four units at 75% of useful life
- One program done; several underway
  - Results confirm verified levels

# We're looking at VERT

- We are studying the VERT verification process and looking for opportunities to use its data
  - Understand VERT's focus on carbon particles
  - Impressed by variety of engines retrofitted in Europe
  - Significant differences exist between EPA and VERT programs
  - Our standards, including proposed standards, are all mass-based
  - Will continue to look for ways VERT data could be used in our process
  - Welcome discussions on this topic

# The future?

- Need more verified nonroad retrofit technologies; including locomotives
- Need more verified NOx technologies
- Participate in the nonroad retrofit showcase in California
- Work together on verification
  - Harmonize or use test data where possible

# Contact information

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- Verified products list [epa.gov/OTAQ/retrofit](http://epa.gov/OTAQ/retrofit)