

# Fairfax County Diesel Retrofit Projects



**Fairfax County, VA**  
**Department of Vehicle Services**  
August 15, 2008

# Objectives of a Retrofit Project



- **Regulator**
  - Cut legacy fleet emissions – any pollutant
  - Keep cost under control
- **Fleet manager**
  - Keep fleet on the road
  - Control cost
  - Cut emissions – that affect our air

# Cost Metric



- **Regulator – \$ per ton**
  - Low \$ per ton: Save more tons
- **Fleet manager – \$ per vehicle**
  - Low \$ per vehicle: Spend fewer \$

# Options – What is Out There?



- **Diesel Oxidation Catalyst**
- **Diesel Particulate Filter**
- **Alternative Fuels**
- **Closed Crankcase Vent/Filter**
- **Fuel Treatments**
- **ECM Calibration (1)**
- **Lean NOx Catalyst (1)**
- **EGR/DPF (1)**
- **SCR (1)**

# Fleet View of a Retrofit Project



- **What we had**
- **What we wanted**
- **How we got there**

# Background



- **Air quality non-attainment**
  - Health and welfare of residents
  - Jeopardized transportation funds
- **Prior interest in alternative fuels**
- **Grant programs for emissions improvements**

# Project Goals



- **Reduce diesel fleet contribution to air pollution (especially ozone)**
- **School buses as first phase of complete diesel fleet retrofit**
- **Concurrent initiatives**
- **2-year project for school buses**
- **5-year window for entire diesel fleet**

# School bus engine types



- **International T444E (436)**
- **Cummins 5.9 (188)**
- **International DT466 (139)**
- **Ford 6.6 (119)**
- **Caterpillar 3126 (81)**
- **Caterpillar 3208 (20)**
- **International 7.3 (19)**
- **International DT360A (6)**
- **Caterpillar 3116 (3)**
- **International T444E (ineligible for reflash) (2)**

# Heavy duty truck engine types



- **Volvo VED 12 (17)**
- **Cummins ISM (17)**
- **DDC Series 60 (12)**
- **Cat 3126 (9)**
- **Volvo VE 7.3 (7)**
- **Int'l T444E (6)**
- **Cummins L10 (5)**
- **Ford FD1460 (4)**
- **MBE 9000 (2)**
- **Cummins NTC400 (2)**
- **Volvo VE275 (2)**
- **Cummins B5.9 (2)**
- **Caterpillar C10 (2)**
- **Caterpillar C12 (1)**
- **Cummins 3354 (1)**
- **DDC 12.9 (1)**
- **Ford FD1060 (1)**
- **Ford 210 (2)**
- **Ford 7.8 (1)**
- **Ford 8.3 (2)**
- **Int'l DT466 (2)**
- **Int'l D210F (1)**
- **Cummins ISB (1)**
- **Volvo 10.8 (1)**
- **Volvo 11L (1)**

# Planning



- **Which technology**
- **How to pay for it**
- **Install ourselves or contract**
- **Work space**
- **Availability of vehicles for work**
- **Quality control**
- **Logistics and administration**
- **“Put yourself in the other guy’s shoes”**

# Candidate technologies



- **EPA Voluntary Diesel Retrofit Program “Verified Technologies”**
  - Diesel Oxidation Catalyst (DOC)
  - Diesel Particulate Filter (DPF)
  - Fuel treatments
  - Alternative fuels
- **Other technologies accepted by EPA**

# School bus project concept



- Replacement of mufflers with diesel oxidation catalysts (HC, PM, CO)
- Reprogram of ECMs on T444E engines (NOx, PM)
- Limited number of early demonstrations
- Documentation of processes
- Follow-on Class 8 trucks: DOC only

# School bus contract procedures



- **Two “tasks,” multiple awards possible**
- **Offered County work space, or vendor could use own**
- **Both winners chose to work outside where buses were parked**
- **Most retrofits conducted while bus was in for PM**

# Other provisions



- **Provided list of bus configurations**
- **Evidence of ability to complete work**
- **Additional work procedures**
- **Minimum number of buses**
- **Must bid on all buses in Task**
- **Vendor removes scrap**
- **County QC audits**
- **Documentation of processes**
- **Minimum warranty of one year**

# School bus bid evaluation



- **Cost per bus**
- **Reductions beyond benchmarks (Task B only)**
- **Compliance with specification**
  - EPA-accepted
  - No special fuel or additive
  - No additional maintenance
  - Meets minimum emissions reductions

# School bus timeline



- **Pre-bid conference Feb. 5, 2004**
- **Awarded April 2, 2004**
- **Work began July 2004**
- **2-year completion goal**
- **Last buses completed Feb. 1, 2005**

# School bus cost-benefit



- **436 buses retrofitted with ECM+DOC**
  - 25% NOx reduction
  - 175 tons over remaining life of buses
  - Cost: \$1.3M (\$7,300/ton)
- **576 buses retrofitted with DOC only**
  - 50% HC reduction
  - 30 tons over remaining life of buses
  - Cost: \$487K (\$16,000/ton)

# Heavy truck project



- **DOC retrofit on 113 class 8 trucks**
- **IFB with one award**
- **Complicated by wide variety of truck configurations**

# What to think about



- **What do we want to accomplish?**
- **What is available?**
- **How confident are we about claims?**
- **How much are we willing to pay for it?**
- **Can we get help with funding?**

# More to think about



- **Who will do the work?**
- **Where will the work be done?**
- **How do we ensure the right vehicle is available when its materials arrive?**
- **How to keep track of what vehicles are done?**
- **How to track partial completions?**
- **How to know the work is done right?**

# And more . . .



- **Communication with vendor**
- **Invoicing and payment procedures**
  - Frequency
  - Method of payment
  - Required information on invoice
  - Credits
- **Grant compliance**

# What would we do differently?



- **Clarify state of development of proposed program**
  - What fleets have this retrofit?
  - If none, what procedures are in place?
- **Strict reporting procedures for daily work completion**
- **More attention to configuration variations**
- **Consult more with other users**

# Further information



- **Contract Administrator:**  
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- **Technical representative:**  
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# BACKUP



# Candidate technologies -- DOC



- + High reduction (50%) of HC (ozone precursor)
- + Easy to install
- + Fairly widely available
- + Lower cost
- + No periodic maintenance
- + Useable on any diesel engine
- + No special fuel
- Lower emissions reductions than others
- No NOx benefit

# Candidate technologies -- DPF



- + High reduction of HC, CO, and PM
- + Easy to install
- + Widely available
- No NOx benefit
- Moderately high cost
- Requires periodic maintenance
- Electronically controlled engines only
- Requires ULSD

# Candidate technologies -- Fuel treatments



- **PuriNOx**
- **B20 (Biodiesel)**
- **Cetane enhancers**
- **Fuel-borne catalyst**

# Candidate technologies -- Alternative fuels



- **CNG**
- **Propane**
- **M100 (Methanol)**
- **B100 (Biodiesel)**

# School bus project structure



***Contracted retrofit (parts and labor) for all buses with 3 years or more remaining life***

- **Reprogramming of predominant electronic engine ECM (T444E)**
- **DOC treatment of choice**
- **Documentation of processes**