



# National Clean Diesel Campaign

## International Efforts

**Verification Workshop  
December 13, 2007**

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National Clean Diesel Campaign  
Office of Transportation and Air Quality



# Overview

- Technologies Verified Abroad
- International Projects

# Technologies Verified Abroad

- Manufacturers may apply to EPA with data and verification from other programs
- Additional testing necessary
  - Different test cycles
  - Emission characteristics
  - NO<sub>2</sub>
- Consider conditional verification
- Key Factors
  - Same design & specifications
  - Experience with US engines & fleets
  - Regulatory requirements for fuel/additive registration

# International Retrofit Projects

An Update: December 13, 2007

# The Cities

- Mexico City
- Bangkok
- Beijing
- Santiago
- Pune (including two stroke retrofit)

# Mexico City

- Euro 1 and Euro 2 buses – 20 total
- ULSD for all (1 PPM Sulfur – from US)
- DOCs on Euro 1s and DPFs on Euro 2s
- On road emissions measured by RAVEM
  - PM reductions as expected for the devices
- Center for Sustainable Transport was key local partner
- Cummins Emission Solutions provided hardware
- World Resources Institute provided about 1/3 of the funding
- Status: Completed 2006

# Mexico City Rollout Event



# Vendor Exhibits (Mexico City Rollout)





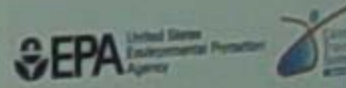
# Protecting ULSD (Mexico City)



# Sampling Fuel for Sulfur Level



tu salud,  
transporte más limpio



# Emission Testing (Mex City)



# Bangkok

- 5 Euro 2 buses with DPFs, 5 with DOCs.  
5 LD vans with DOCs, 5 small school buses with DOCs, 5 trash trucks with DOCs – 25 total
- Hardware from JM and Englehard
- Expect completion in December 2007 followed by final report
- 50 ppm diesel for DPFs
- Chassis dyno testing

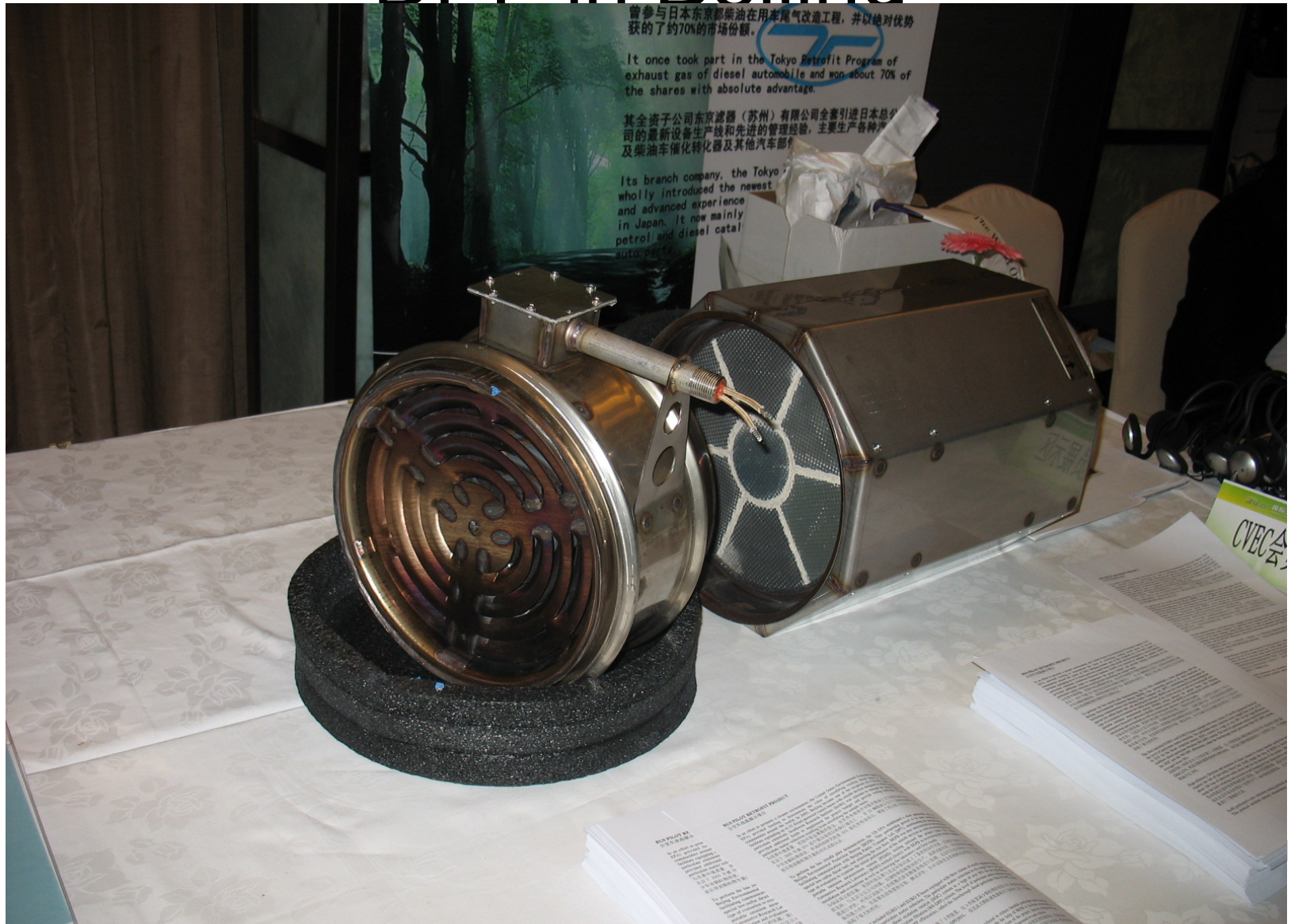
# Beijing

- **Project kicked off in Nov 2005**
- **Overseen by SwRI; DOCs by BASF; PFFs and DPFs through Cummins Emission Solutions**
- **DOCs, PFFs and DPFs 25 buses total**
- **50 ppm fuel for buses with DPFs**
- **Numerous problems with high engine-out emissions**
- **PM testing via PEMS (Dekati DMM-230)**
- **Results as expected for each category of device**
- **Final results due to EPA in December 2007**
- **Beijing EPB has begun to run several of its own projects**
  - **One project up to 100 vehicles**

# Vendor measuring for fit (Beijing)



# Cleaire Electrically Regenerated DPF in Beijing

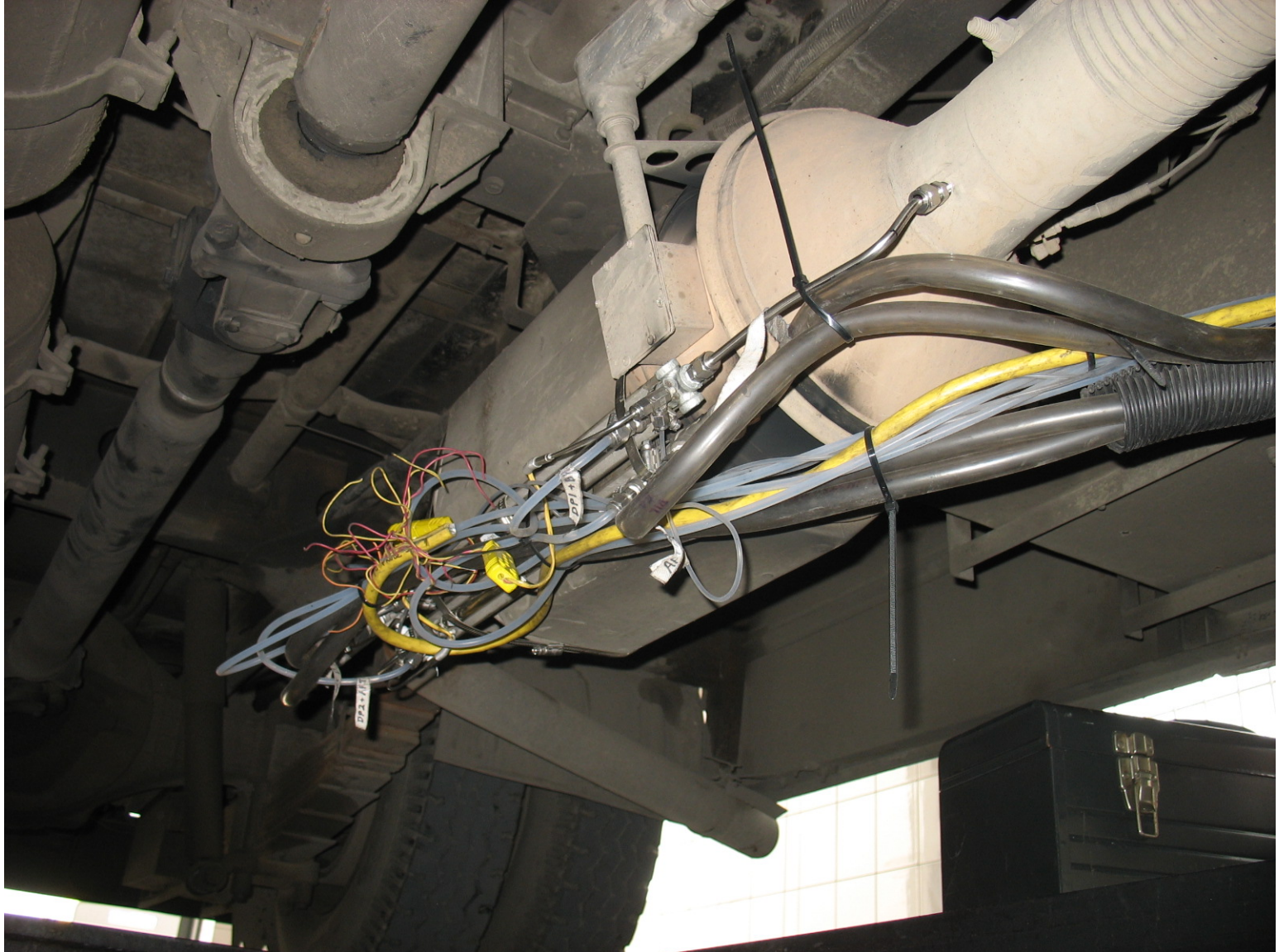




# Dekati DMM-230 devices for PM



# Beijing – Up and downstream sampling



# Sample lines on Beijing bus



Whose device is this?



# Santiago Chile

- 10 Euro 2 trucks
- DPFs only
- 50 ppm fuel in place in Santiago
- Emission testing by in chassis dyno lab
- Final emission results due December 2007

# Device on Truck (Santiago)



# Emission Testing (Santiago)



# Pune India

- 20-24 Euro 1 and Euro 2 buses
- JM DOCs, PFFs and DPFs
- Project Started in October 2007
- DOCs and PFFs are on the buses now
- DPFs (CCRTs) to be added after trial period with DOCs and PFFs
- 50 ppm fuel for buses with DPFs
- SwRI selected to support project
- PEMS testing to be used as in Beijing



# Pune – Kickoff Ceremony



# Pune – Kickoff Ceremony





Pune Mahanagar Parivahan  
Mahamandal Limited (PMPML)



नीरी  
NEERI



# Heavy Duty Diesel Vehicle Retrofitment

For Pune City Buses

# Heavy Duty Diesel Vehicle Retrofitment

For Pune City Buses

The Best Of Pune...Ride With Pune's Best

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PUNE MUNICIPAL CORPORATION

Central Pollution Control Board

Government of India  
Ministry of Environment & Forests

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Ministry of Environment & Forests



# Partial flow filter in Pune



# DOC in Pune



# Pune -- Motorcycles

- Two stroke motorcycles are huge problem in Asian megacities
- Two stroke three wheelers are used as cabs
  - Heavily loaded
  - Long duty cycles
- Applying Envirofit (CSU) kits to modify two strokes to direct injection
- 70-90% reductions in HC, CO and PM claimed
- 30% reduction in CO<sub>2</sub>. Fuel Economy up
- Hope to install three kits in Pune in January 2008
- Will perform chassis dyno and PEMS testing.



**RTM**

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DF MEX.

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México, la Ciudad de la Esperanza

SECRETARÍA DE MEDIO AMBIENTE Y  
RECURSOS NATURALES



**EPA** United States  
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Agency

Centro de  
Transporte  
Sustentable



**CAPRE**

**THE END**