

## Diesel Vehicle Emission Control and its Benefits in Hong Kong

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## Major Sources of Air Pollution

Vehicle emissions

Stationary sources


- Power plants
- Fuel combustion sources
- Industries

## Causes of Air Pollution Problems

⊗ **Street level air pollution**

- High RSP and NO<sub>2</sub> levels caused by :

- ✓ High intensity of vehicle usage
  - 271 vehicles per km of road in HK
  - 33 vehicles per km of road in USA
- ✓ Heavy reliance on diesel vehicles
  - 30% of vehicle population in HK
  - 17% in Singapore
  - 4% in USA
- ✓ Poor dispersion at street level
  - dense urban setting and tall buildings



## Controlling Vehicle Emissions

- ❖ Comprehensive programme introduced in 1999
- ❖ Target – By end-2005 :
  - ✓ reduce particulates by 80%
  - ✓ reduce nitrogen oxides by 30%

### Control Measures for Vehicle Emissions (1)

**Cleaner Fuels:**  
Unleaded Petrol  
Ultra-Low Sulphur Diesel  
LPG

**EURO III**

**Advanced Engine**

**Strategies:**

- ✓ Clean alternatives to diesel vehicles
- ✓ Stringent new vehicle emission standards and fuel specification

### Control Measures for Vehicle Emissions (2)

**Cleaner Fuels:**  
Unleaded Petrol  
Ultra-Low Sulphur Diesel  
LPG

**Police Spotter**

**EURO III**

**Advanced Engine**

**Dynamometer Testing**

**Strategies:**

- ✓ Strengthened in-use diesel/petrol vehicle emission inspection
- ✓ Strengthened enforcement against smoky vehicles

### Control Measures for Vehicle Emissions (3)

**Cleaner Fuels:**  
Unleaded Petrol  
Ultra-Low Sulphur Diesel  
LPG

**Police Spotter**

**Trap/DOC**

**EURO III**

**Petrol Catalytic Converter**

**Advanced Engine**

**Mechanic**

**Dynamometer Testing**

**Strategies:**

- ✓ Retrofitting pre-Euro diesel vehicles with catalysts / traps
- ✓ Promote environmentally friendly driving and awareness of proper vehicle maintenance

### Controlling Vehicle Emissions Major Progress

- ❖ **Replace diesel taxis with LPG ones**
- ✓ Nearly all diesel taxis (about 99.8%) switched to LPG ones
- ❖ **Replace diesel light buses with LPG or electric ones**
- ✓ About 80% of newly registered public light buses are LPG ones
- ❖ **More stringent motor fuel**
- ✓ Since April 2002, Ultra low sulphur diesel (ULSD) became the statutory motor diesel standard in Hong Kong
- ❖ **More stringent motor vehicle emission standard**
- ✓ Euro III vehicle emission standards introduced in 2001

### Controlling Vehicle Emissions Major Progress (Continue)

- ❖ **Retrofit in-use vehicles with emission reduction devices**
  - ✓ About 80% of the eligible pre-Euro light diesel vehicles installed with particulate traps or catalysts
  - ✓ Nearly 60% of the pre-Euro heavy diesel vehicles installed with catalysts
- ❖ **Enforcement against smoky vehicles**
  - ✓ Penalty for smoky vehicles raised from \$450 to \$1000 since Dec 2000
  - ✓ All commercial vehicles to undergo a smoke test in the annual roadworthiness inspection
  - ✓ Dynamometer smoke test covers all diesel vehicles

### Inspection and Maintenance Programme for Diesel Vehicles

#### ❖ Annual Roadworthiness Inspection

- ✓ Transport Department Program
- ✓ Smoke check by
- ✓ Free Acceleration Smoke Test (FAS)
- ✓ Random testing using dyno (10%)

### Smoky Vehicle Control Programme

- ❖ **Implement by Environmental Protection Department to Control Vehicle Emissions**
  - ✓ Started at 1988
  - ✓ Require gross polluters to undergo smoke compliance test
  - ✓ Accredited spotters to report smoky vehicles
  - ✓ Summons vehicles concerned to undergo smoke compliance check
  - ✓ Designated Vehicle Emission Testing Centres conduct smoke test
  - ✓ Failure to comply may face license cancellation

### Road Side Enforcement by the Police on Diesel Smoke

- ✓ Not to exceed 60 HSU measured by smoke meter using free acceleration smoke test method
- ✓ Issue fixed penalty tickets to excessive smoky vehicles
- ✓ Report these smoky vehicles to EPD for follow-up action

### Enforcement against Smoky Vehicles

- ❖ These enforcements have alleviated the smoky vehicle problem but the improvement was not sufficient.
- ❖ Many spotted smoky vehicles are repeaters.  
The Reasons :
  - ✓ Tampering with the engine fuel pump can easily cheat the free acceleration smoke test.
  - ✓ Even checking engine speed as part of the free acceleration smoke test cannot stamp out this malpractice.

### Enforcement against Smoky Vehicles

- ❖ The Solution:
  - ✓ A smoke test that is more effective in screening out vehicles with tampered engines should replace with the free acceleration smoke test.

### Test Methods for Checking Compliance

#### A. Dynamometer Smoke Test

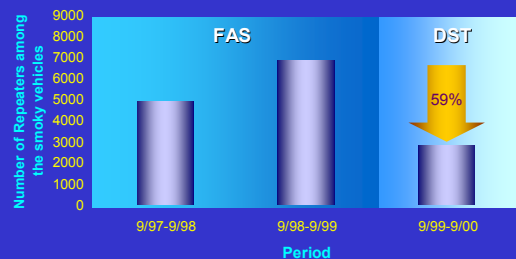
- ✓ Check rated rpm  $\pm$  5% manufacturer spec
- ✓ Check road power to at least 50% of manufacturer spec
- ✓ Smoke limit 50 HSU

#### B. Free Acceleration Smoke Test

- ✓ Check rated rpm  $\pm$  5% manufacturer spec
- ✓ Can not check road power
- ✓ Smoke limit:-
 

Pre- 90	60 HSU
Post 90	50 HSU

### Effectiveness of Advanced Smoke Test on Smoky Light Duty Diesel Vehicles



### Roadside Air Quality Improving

- ✓ RSP & NO<sub>x</sub> emissions from motor vehicles reduced by 63% & 28% respectively
- ✓ Compared with 1999, in 2003 concentrations of RSP and NO<sub>x</sub> at roadside dropped by 13% and 23% respectively
- ✓ The number of API recorded at roadside monitoring stations exceeding 100 has dropped by 35%
- ✓ Smoky vehicles spotted on road reduced by 70%

