Performance and durability of PSA Peugeot Citroën’s DPF System on a Taxi Fleet in the Paris Area

Patrick COROLLER & Gabriel PLASSAT
(French Agency of Environment and Energy Management)

Presented by
Dr. Thierry SEGUELONG
(Aaqius&Aaqius)
Outlines of the presentation

- Objectives

- Methodology of the program

- Regulated exhaust emissions
  - Accumulation phase
  - Regeneration phase

- Non-regulated exhaust emissions
  - Gaseous emissions
  - Solid particles emissions

- Conclusions
Outlines of the presentation

- Objectives
- Methodology of the program
- Regulated exhaust emissions
  - Accumulation phase
  - Regeneration phase
- Non-regulated exhaust emissions
  - Gaseous emissions
  - Solid particles emissions
- Conclusions
DIESEL PARTICULATE FILTER SYSTEM

HDi engine

Common-rail injection

High pressure pump

Fuel tank

Feed pump

ADDITIVE TANK

Injector + regulator

Gas

Engine computer

Sensors: P and T

DPF

Silencer

Oxidation catalyst

Injector + regulator

COMMON-RAIL

ECU

Gas

DPF

1. Pilot injection
2. Main injection
3. Secondary injection

Particulates are trapped then burnt
Objectives of the study

The objectives are:

- to follow performance of 5 Peugeot 607 taxis running in Paris traffic over 80,000 km

- under severe conditions (low speed, long idle period, urban traffic jam, low exhaust temperature…)

- on the exhaust emissions

- in term of efficiency and durability of the PSA’s DPF System
Objectives

Methodology of the program

Regulated exhaust emissions
  - Accumulation phase
  - Regeneration phase

Non-regulated exhaust emissions
  - Gaseous emissions
  - Solid particles emissions

Conclusions
Evaluation programmes

- Five vehicles using a standard European Diesel fuel (350ppm sulfur)

- Characterizations and evaluation every 20,000 km over 80,000 km (EURO 3 standard requirement in durability)

- Regulated pollutants (CO, HC, NOx, particulates) over the MVEG Cycle

- Fuel consumption (MVEG and Field Operation)

- Non-Regulated Emissions

- Durability and reliability of the DPF System
Evaluation methodology

Start January 2001

14 months trial

1st test 4 months 8 months 80 000 km

5600 km

Preliminary results were presented during the 2002 SAE Powertrain & Fluid Systems Conf. SAE Paper # 2002-01-2790

DPF Cleaning And remanufacturing

120,000 km
Objectives

Methodology of the program

Regulated exhaust emissions
- Accumulation phase
- Regeneration phase

Non-regulated exhaust emissions
- Gaseous emissions
- Solid particles emissions

Conclusions
Test Repeatability (taxi 2041, fresh)

Comparison w/wo DPF

< 5 mg/km
CO exhaust emissions

Euro 3 = 0.64 g CO/km

Average CO emission (g/km)

Average fleet mileage (km)

- 5970 km: 0.144 g CO/km
- 81591 km: 0.234 g CO/km
NOx exhaust emissions

EURO 3 = 0,50g NOx/km

average NOx emissions (g/km)

average fleet mileage (km)

0.354

0.497
HC+NOx exhaust emissions

EURO 3 = 0,56g HC+NOx/km

Average HC+NOx emissions (g/km)

5970 81591

Average fleet mileage (km)
PM exhaust emissions

EURO 3 = 50mg PM/km
EURO 4 = 25mg PM/km

average fleet mileage (km)

average PM emissions (mg/km)
Average Fuel Consumptions

![Graph showing average fuel consumption (l/100km) vs. average fleet mileage (km) for different regions. The graph includes data for 5970, 81591, and the Paris Area.]
Emissions during DPF Regeneration

Every 400 to 600 km

CO, HC (x10), NOx, PM, Diesel Fuel Consumption (/10)

Cycle w/o DPF Regeneration

Cycle w/ DPF Regeneration

in g/km or l/100 km

0.003

0.009
Outlines of the presentation

- Objectives
- Methodology of the program
- Regulated exhaust emissions
  - Accumulation phase
  - Regeneration phase
- Non-regulated exhaust emissions
  - Gaseous emissions
  - Solid particles emissions
- Conclusions
Non-Regulated Emissions
Solid particles emissions

Very Low level of Particle emissions after the DPF:
- Sulfur: 2 to 7 ng depending on the vehicle
- Potassium or Calcium: 0,2 ng
- Iron and Nickel: traces
- Ceria: undetectable (even using PIXE analysis)

**Total Inorganic Ash analysis after 91200 km**

Good agreement in Ceria balance, and consistent with the VERT Certification
Outlines of the presentation

- Objectives
- Methodology of the program
- Regulated exhaust emissions
  - Accumulation phase
  - Regeneration phase
- Non-regulated exhaust emissions
  - Gaseous emissions
  - Solid particles emissions
- Conclusions
Conclusions

The « FAP » technology limits the particulate matter emissions under 5 mg/km over the MVEG cycle (far below the EURO 4 PM standards)

Even during DPF regenerations, the particulate emissions remain below the EURO 4 limitation

Non-regulated emissions are reduced by the DPF System under significant proportion

No Cerium leakage through the SiC-DPF

The efficiency, durability and reliability were demonstrated over 80000 km, even under severe driving cycle conditions (low speed, long idle)

Next step : durability at 120,000 km trap after re-manufacturing
The authors would like to thank:

- Institut Français du Pétrole (IFP)
- PSA Peugeot Citroën Group
- G7 Taxis Company
- and our colleagues

for making available the detailed results, graphs and pictures.