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Fuel and Vehicle Effects on Particulate Emissions

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04/08/97 Page 1 of 8

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ERCA

TEST PROGRAM

TEST FUELS

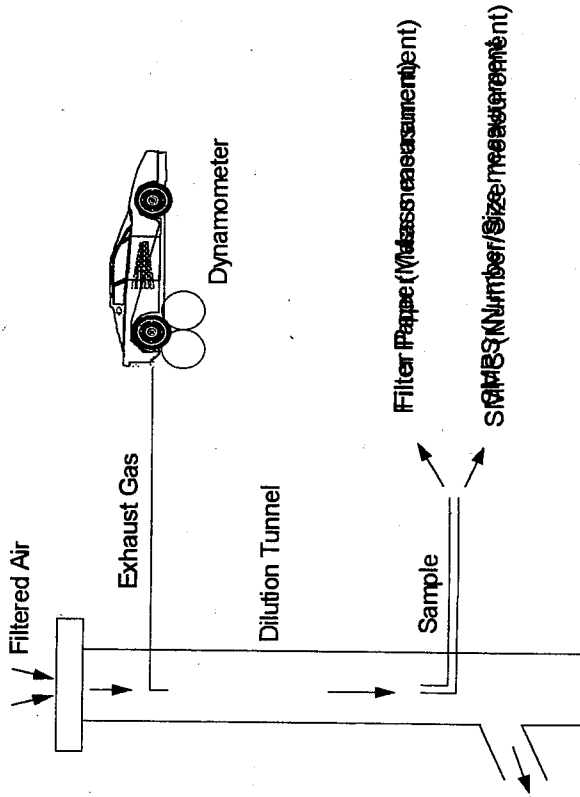
DIESEL
A: Heavy diesel
C: Light diesel
F: Swedish Class 1 Diesel
GASOLINE
G: UL Gasoline (95RON)

TEST VEHICLES

<u>Diesel</u>				
- Car	1.6L	IDI	TC/IC	catalyst
- Car	1.6L	IDI	TC/IC	no catalyst
- Car	2.5L	DI	TC/IC	catalyst
- Van	2.5L	DI	N/A	no catalyst
<u>Gasoline</u>				
- Car	1.8L	carburetor		no catalyst
- Car	1.8L	SPI		TWC

- Vehicles compared using fuels C,G
- Diesel Fuels compared using IDI car with catalyst
- Programme performed by Esso/AEA Technology
 - details in SAE 96108A 0

TEST PROCEDURE

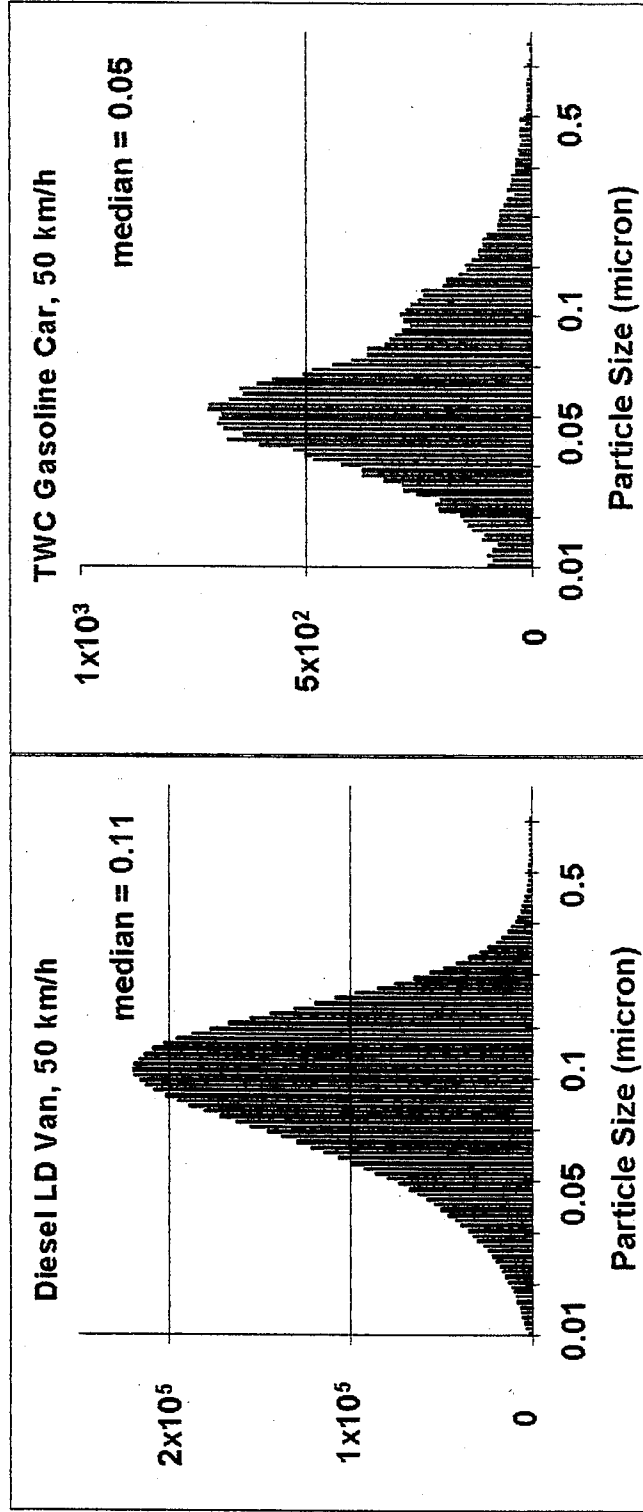


- NUMBER MEASUREMENT BASED ON SMPS
- PARALLEL MEASUREMENTS OF FILTER PAPER MASS MADE ON CYCLES

- SIZE ANALYSER NEEDS 2 MINUTES TO SCAN FULL SIZE RANGE
 - Cannot measure full size range over cycle
- STEADY STATE AND HOT CYCLE TESTS PERFORMED
 - repeated hot cycles at 25,50,100,200,400 nm

EMITTED PARTICLES ARE VERY SMALL

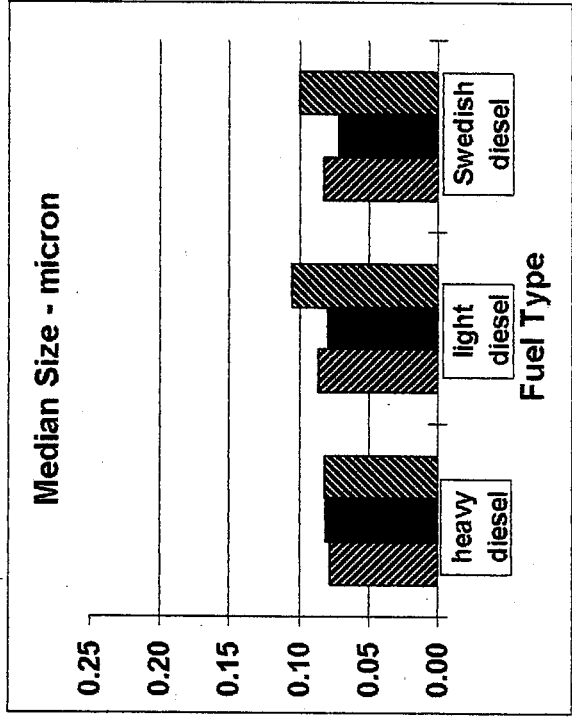
NUMBER OF PARTICLES PER cm^3 OF EXHAUST GAS



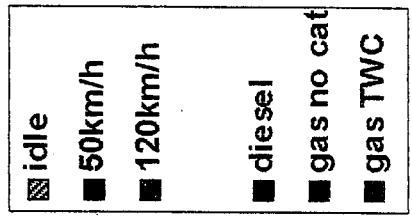
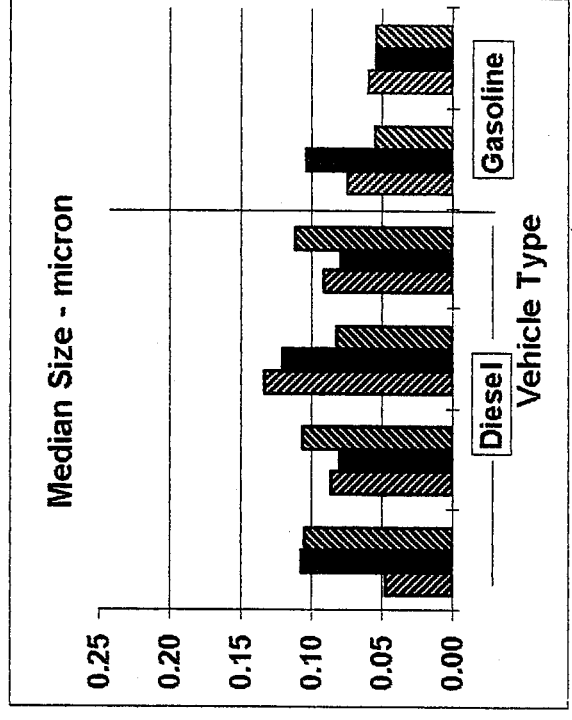
- Strong peak around 0.05-0.10 microns
- Secondary peaks seen occasionally

PARTICLE SIZE INSENSITIVE TO FUEL, VEHICLE

FUEL EFFECTS



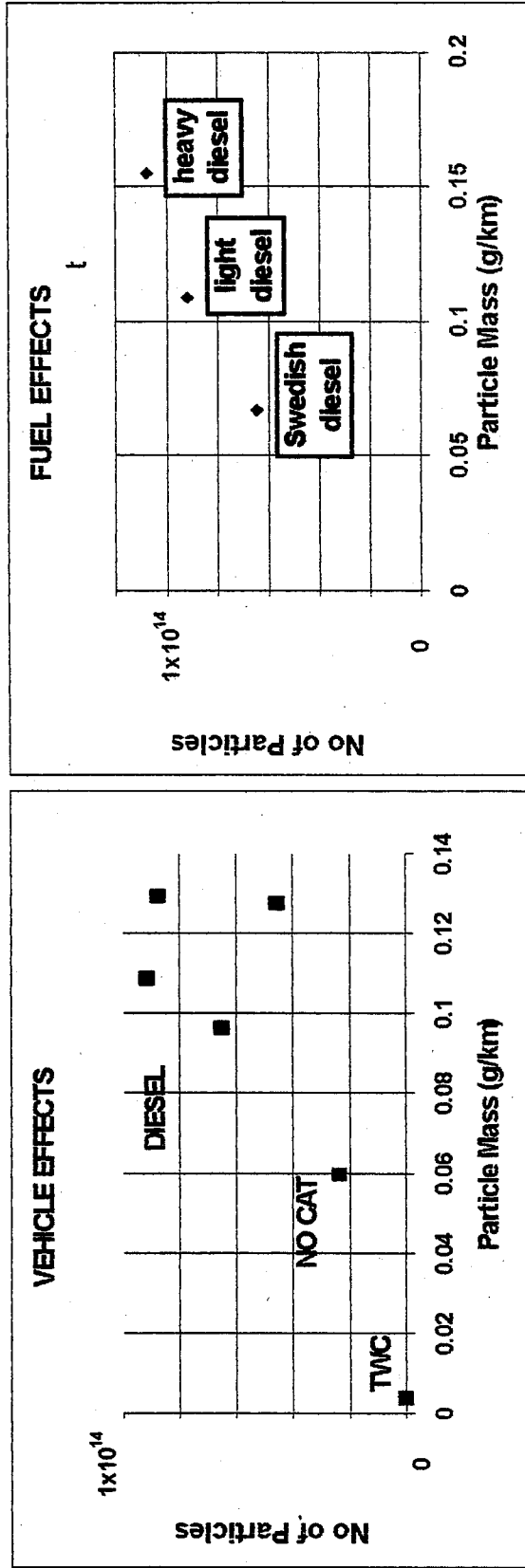
VEHICLE EFFECTS



- **MEDIAN PARTICLE SIZE USED AS INDICATOR OF SIZE RANGE**

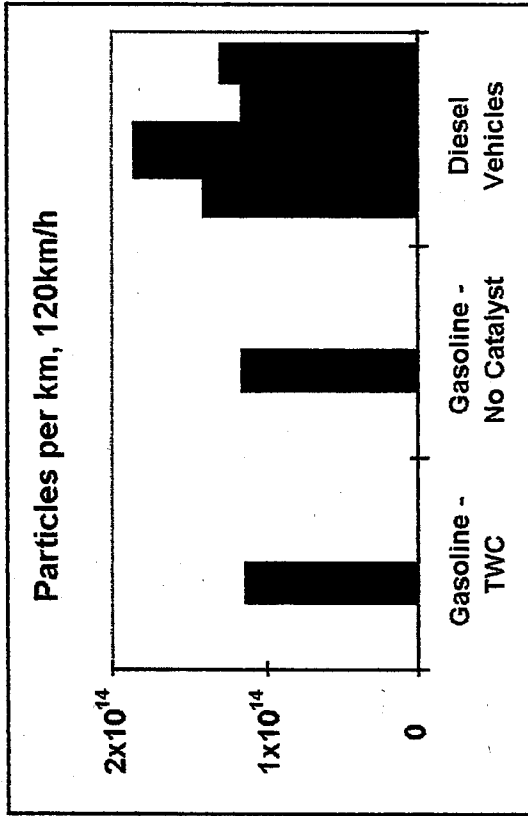
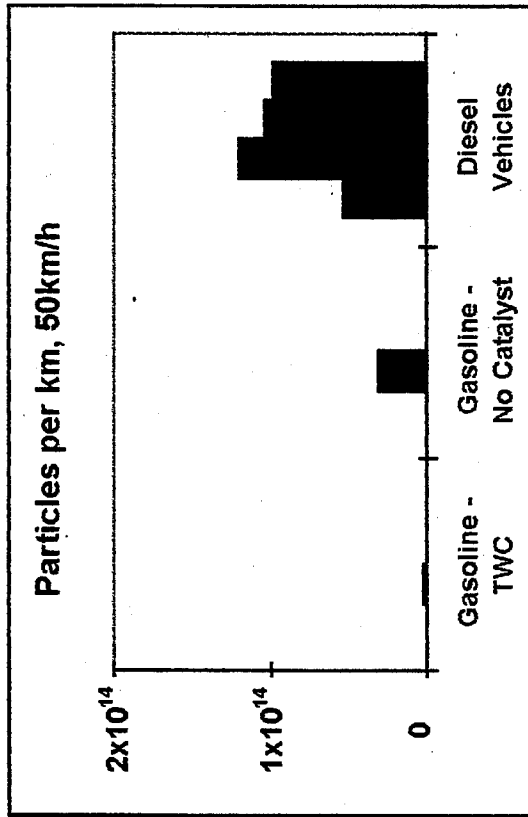
- Diesel fuel quality had no effect
- Size similar at idle, 50, 120 km/h
- Differences between vehicle types considered small

NUMBER OF PARTICLES CORRELATED WITH MASS



- PARTICLE NUMBER AND MASS WERE MEASURED OVER HOT CYCLE
 - Ranking of vehicle types or fuels was not affected by choice of measurement
 - Fuel effects consistent with EPEFE programme

GASOLINE EMISSIONS SIMILAR TO DIESEL AT HIGH SPEED



- **GASOLINE PERFORMANCE DIFFERENT FOR HIGH AND LOW SPEEDS**

- At 50km/h gasoline emissions lower than diesel
- At 120km/h gasoline emissions similar to diesel

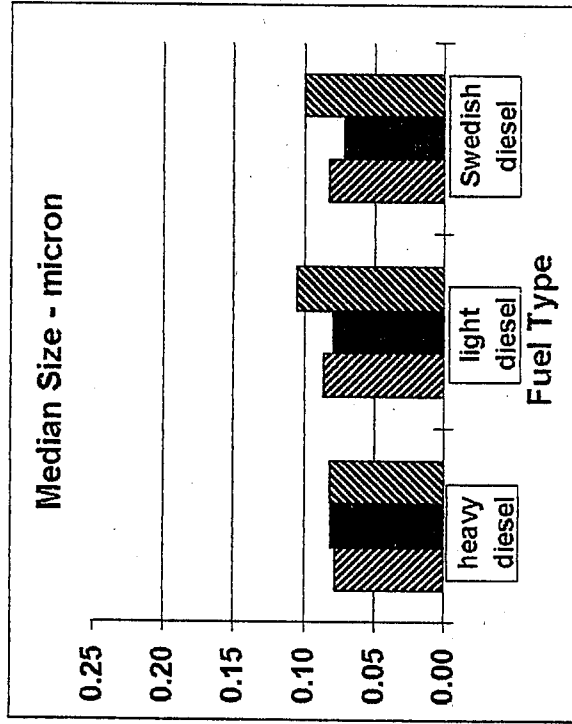
KEY ISSUES/QUESTIONS

- **Broad correlation between number/mass emissions**
 - controls based on mass are effective
- **How robust are number measurements?**
 - distributions can vary between instruments
 - test conditions important?
- **Why do we see high gasoline particle numbers at high speed?**
 - are they real or artefacts?
- **Are particles above SMPS range important?**
- **How do tailpipe emissions relate to ambient air quality?**
- **What size range is of most importance?**
 - need to understand exactly what we should measure.

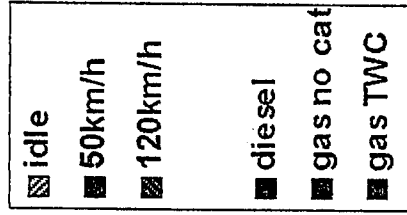
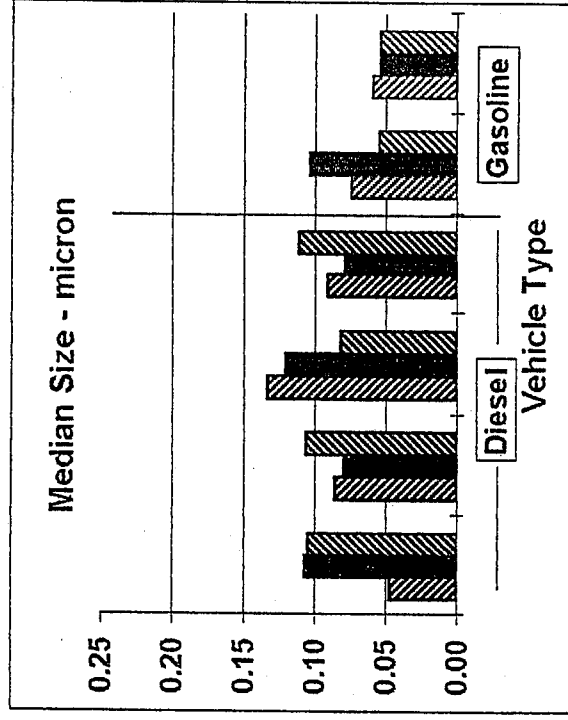
Where industry standard tests have been used, we have endeavoured to use the test methods detailed by the relevant standards organisation. Where this has not been possible a suitable alternative method has been used, details of which are available upon request. Due to the nature of this development work appropriate standard test methods are not always available. In this circumstance, suitable test methods have been developed and used for product evaluation and details are available upon request.

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FUEL EFFECTS



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