

Review of Studies to Characterize Diesel



South Coast Air Quality Management District
December 9th, 2003

Background

- Complex Nature of Diesel Exhaust
- Use of Elementary Carbon
- No Unique Laboratory Method

Diesel Exhaust Emissions Studies

Laboratory

- Engine Type
- Load
- Temperature
- Fuel
- Lubricating Oil



Exhaust Measurements

Particulate Matter

- Size Distribution
- Density
- Structure
- Chemical
- Molecular Composition)

-Gaseous Emissions



Tunnel Studies

Diesel Fingerprints



Diesel Exhaust Characteristics

Gases

-Nitrogen, oxygen, carbon dioxide, water vapor, carbon monoxide, sulfur oxides, nitrogen oxides, volatile hydrocarbons, and polycyclic aromatic hydrocarbons (PAH's)

Particulates

-Bimodal overlapping size distribution

Organic Fraction

-Consists of aldehydes, large alkanes/alkenes, high molecular weight PAH's and PAH derivatives.

Inorganic Fraction

-Elemental Carbon, metals

Literature Search

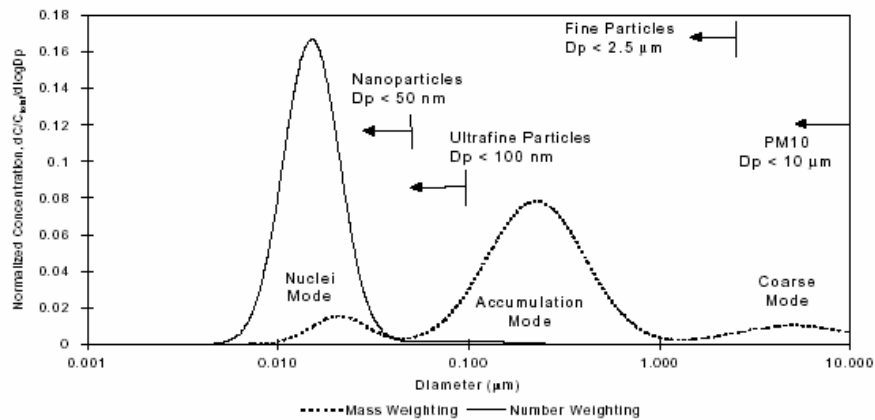
-Evaluation of Elemental Carbon as a Marker for Diesel Particulate Matter, - Schauer, *J. Expos. Analysis and Environ. Epidem*, 2003

-Source Apportionment of Fine Particulate Matter by Clustering Single-Particle Data:

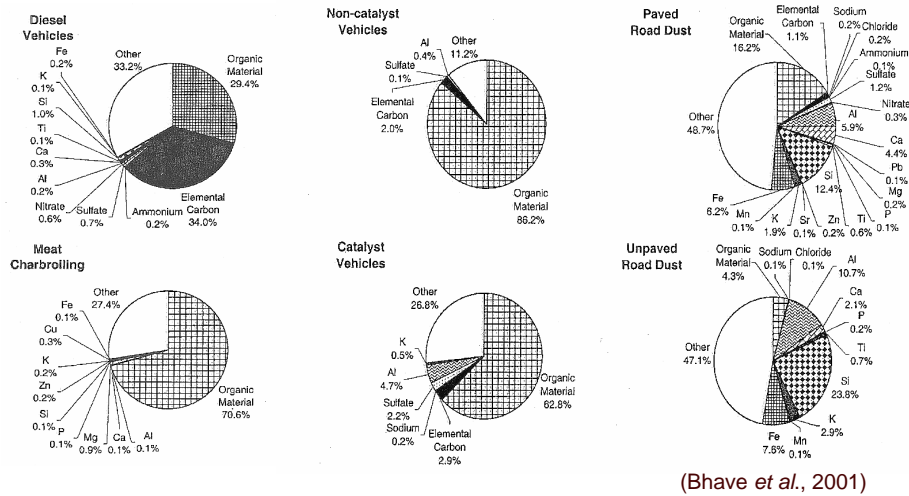
-Tests of Receptor Model Accuracy, (Bhave *et al*, *Environ. Sci. Tehnol.*, 2001)

-Engines and Nano-particles: A Review (Kittleson, *J. Aerosol Sci.*, 1998)

-Sources of Polycyclic Aromatic Compounds in Diesel Engine Emissions - Rhead and Hardy, *Fuel*, 2003



Composition of Particle Emissions <2.5µm from Major Southern California Sources



Laboratory Methods

- Particulate Matter Total Mass
- Organic Carbon (OC) and Elemental Carbon (EC)
- Polycyclic Aromatic Hydrocarbons
- Trace Metals
- Other Compounds ?

Literature Search

- Measurement Methods to Determine Compliance with Ambient Quality Standards for Suspended Particles (Chow. J., *J. Air & Waste Manage. Assoc.* 1995)
- Method Comparisons for Particulate Nitrate, Elemental Carbon, and PM2.5 Mass in Seven U.S. Cities (Babich *et al*, *J. Air & Waste Manage. Assoc.* 2000)
- Time Resolved Characterization of Diesel Particulate Emissions (*Environ. Sci. Techol.* 2001)

Proposed Next Steps

- Continue literature review
- Input from Advisory Group
 - Form sub-group
- AQMD staff in-house work on methods evaluation