

## ***PART5***

- **FORTAN Program**
- **Calculates particulate emission factors in gram/mile for 12 vehicle classes**
- **On-road vehicles, trucks, motorcycles**
- **Particle sizes less than or equal to 1.0 - 10.0 microns**
- **Name indicates consistency with MOBILE5a in format and fleet characterization data**

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## ***Diesel Vehicle Emission Factors***

- **Direct Sulfate (SO<sub>4</sub>)**
- **Soluble Organic Fraction (SOF)**
- **Remaining Carbon Portion (RCP)**
- **Exhaust Particulate Matter (PM)**

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## ***Gasoline Vehicle Emission Factors***

- **Lead**
- **Direct Sulfate (SO<sub>4</sub>)**
- **Carbon**
- **Exhaust Particulate Matter (PM)**

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## ***All Vehicle Types***

- **Indirect Sulfate (SO<sub>4</sub>)**
- **Brake-wear**
- **Tire-wear**
- **Total Particulate Matter (PM), includes:  
Exhaust PM, Indirect Sulfate,  
Brake-wear, Tire-wear**
- **Fleet average Unpaved Road Dust**
- **Fleet average Paved Road Dust**

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## ***Optional***

- **Idle emissions for heavy-duty diesel vehicle classes**
- **Gaseous Sulfur Dioxide (SO<sub>2</sub>)**

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## ***Diesel Vehicle Emission Factors***

- **“Regulatory Impact Analysis: Control of Sulfur and Aromatics Contents of On-Highway Diesel Fuel”, 1990**
- **“Heavy-Duty Vehicle Emission Conversion Factors II 1962-2000”, EPA-AA-SDSB-89-01**
- **“Development of Conversion Factors for Heavy-Duty Bus Engines g/bhp-hr to g/mile”, EPA-AA-EVRB-92-01**

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## **Heavy-Duty Diesel Emission Factors**

- G/bhp-hr to g/mi conversion factors are calculated by:

$$CF = \rho / BSFC * FE$$

where:

CF = conversion factor in bhp-hr/mi

$\rho$  = fuel density in lb/gal

BSFC = brake-specific fuel consumption in lb/bhp-hr

FE = fuel economy in mi/gal

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## **Sulfate Emission Factors**

- sulfur --> exhaust --> direct sulfate (SQ) in fuel  
OR  
--> gaseous sulfur dioxide (SO<sub>2</sub>)  
and --> indirect sulfate (SQ<sub>i</sub>) in atmosphere

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## ***Low Sulfur Fuel Effects***

- Calendar years preceding 1993 assume .25 weight % sulfur fuel
- Calendar years 1993 and later assume .05 weight % sulfur fuel

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## ***Diesel Carbon Portions***

- Soluble Organic Fraction (SOF)

$$\text{SOF}_{m,v} = [\text{EF}_{m,v} - \text{DSULF}_{m,v}] * \text{fraction}_{\text{SOF},v}$$

- Remaining Carbon Portion (RCP)

$$\text{RCP}_{m,v} = \text{EF}_{m,v} - \text{DSULF}_{m,v} - \text{SOF}_{m,v}$$

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## **Gasoline Vehicle Emission Factors**

- “Size-Specific Total Particulate Emission Factors for Mobile Sources”, EPA-460/3-85-005
- “Motor Vehicle-Related Air Toxics Study”, EPA-420-R-93-005

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## **Direct Sulfate for Catalyst Equipped Gasoline Vehicles**

- $DSULF_{m,v} = [FRAC_{cat/noair}(.005) + FRAC_{cat/air}(.016)]$ ,  
for speeds at or < 19.6 mph
- $DSULF_{m,v} = [FRAC_{ox/noair}(.005) + FRAC_{3w/noair}(.001) + FRAC_{ox/air}(.02) + FRAC_{3w/air}(.025)]$ ,  
for speeds at or > 34.8 mph

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## Particle Size Cutoff (PSC)

- Maximum aerodynamic diameter of particles included in the emission factor
- User input:  
 minimum 1.0 $\mu\text{m}$ \*  
 maximum 10.0 $\mu\text{m}$

\*exception: fugitive dust fleet average emission factors, minimum PSC is 2.5 $\mu\text{m}$

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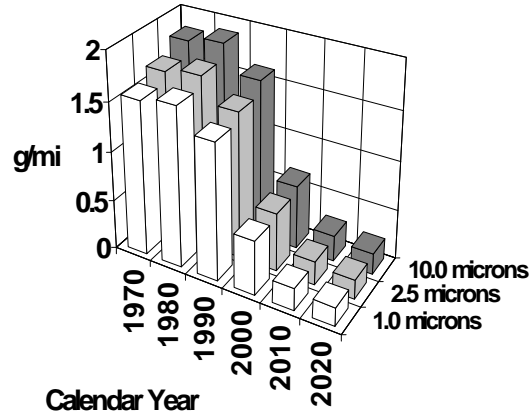
Particulate Emission Standards

Vehicle Type	Model Year Group	Particulate Standard
LDDV	1982-1986	0.60 g/mi
	1987-1993	0.20 g/mi
LDV	1994+	0.10 g/mi
LDDT	1982-1986	0.60 g/mi
LDDT, <3750 lbs.*	1987	0.26 g/mi
LDDT, >3750 lbs.	1987	0.50 g/mi
LDDT	1988-1993	0.26 g/mi
LDT1	1994+	0.10 g/mi
LDT2, <5750 lbs.	1994+	0.10 g/mi
LDT2, >5750 lbs.	1994+	0.12 g/mi
HDDV	1988-1990	0.60 g/bhp-hr
	1991-1993	0.25 g/bhp-hr
	1994+	0.10 g/bhp-hr
Buses	1988-1990	0.60 g/bhp-hr
	1991-1992	0.25 g/bhp-hr
	1993	0.10 g/bhp-hr
	1994-1995	0.07 g/bhp-hr
	1996+	0.05 g/bhp-hr, Cert. 0.07 g/bhp-hr, in-use

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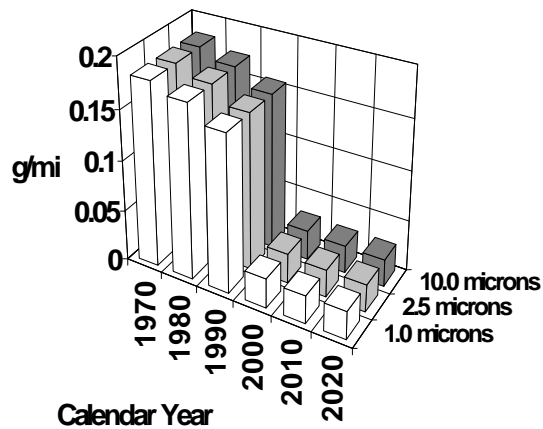
### PART5 Exhaust Particulate Emission Factors Medium Heavy-Duty Diesel Vehicles



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### PART5 Direct Sulfate (SO<sub>4</sub>) Emission Factors Medium Heavy-Duty Diesel Vehicles

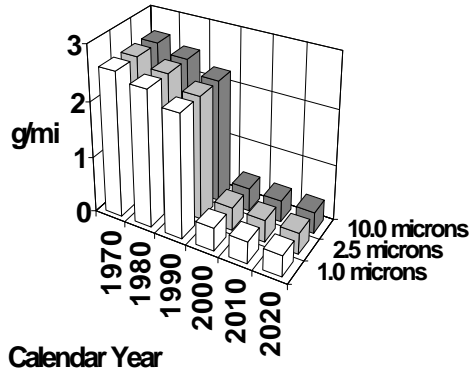


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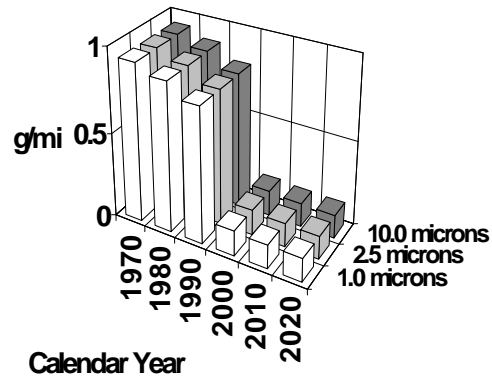
**PART5 Gaseous Sulfur Dioxide (SO<sub>2</sub>) Emission Factors  
Medium Heavy-Duty Diesel Vehicles**



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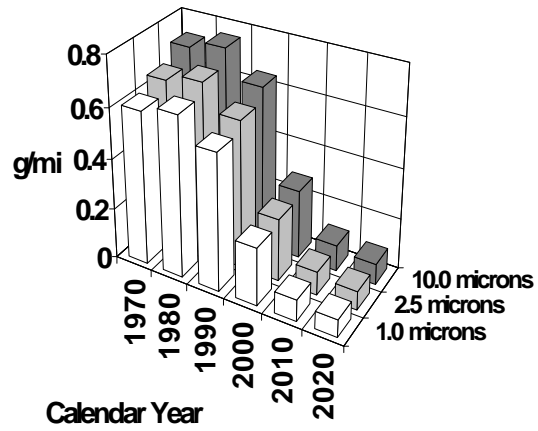
**PART5 Direct and Indirect Sulfate (SO<sub>4</sub>) Emission Factors  
Medium Heavy-Duty Diesel Vehicles**



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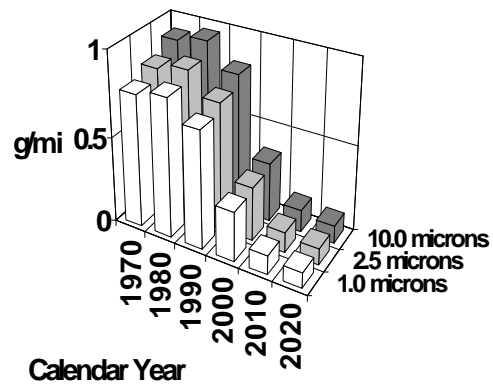
### PART5 Soluble Organic Fraction Emission Factors Medium Heavy-Duty Diesel Vehicles



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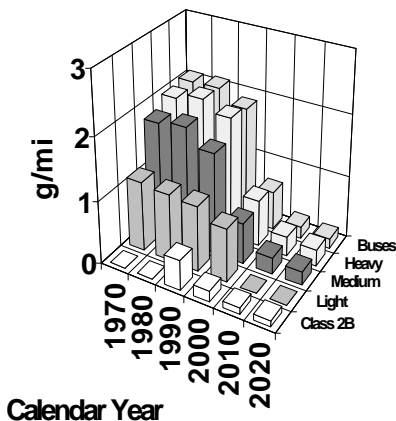
### PART5 Remaining Carbon Portion Emission Factors Medium Heavy-Duty Diesel Vehicles



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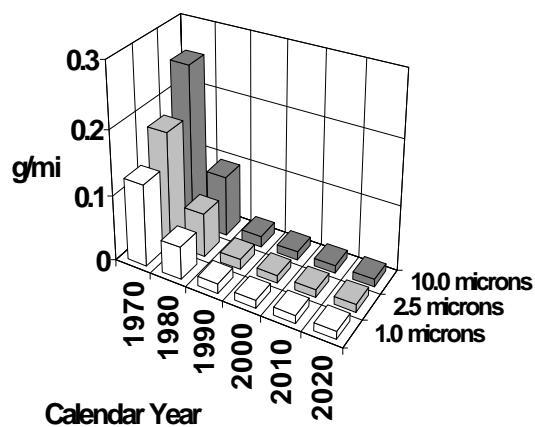
### PART5 Exhaust Particulate Emission Factors Heavy-Duty Diesels, Max Particle Size 10.0 $\mu\text{m}$



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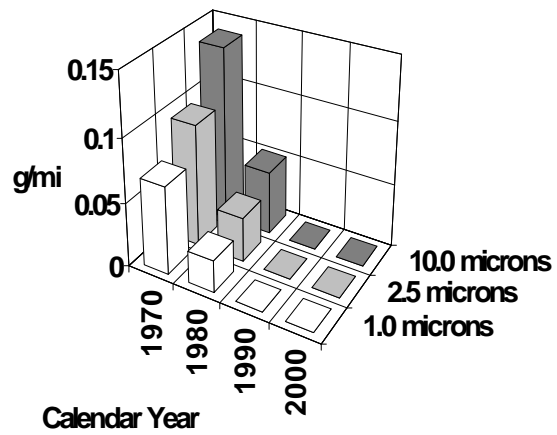
### PART5 Exhaust Particulate Emission Factors Passenger Cars



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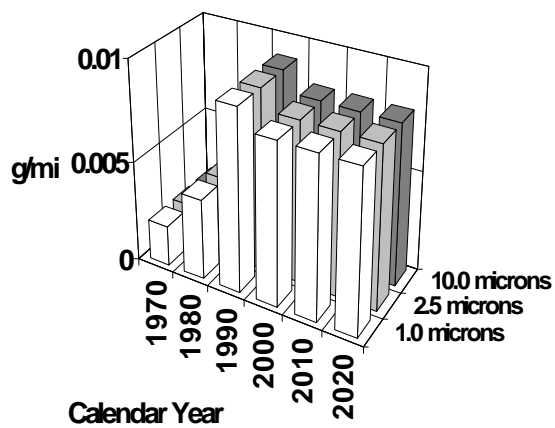
### PART5 Lead Emission Factors Passenger Cars



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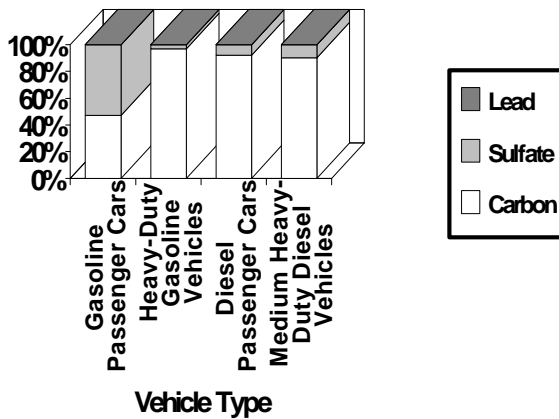
### PART5 Direct Sulfate Emission Factors Passenger Cars



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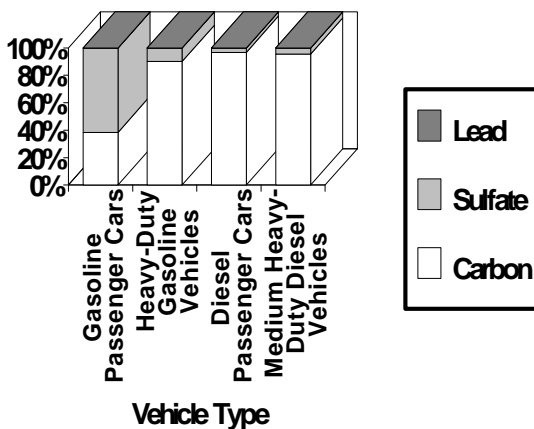
**PART5 Exhaust Particulate Composition  
Max Particle Size 10.0 um, Calendar Year 1990**



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**PART5 Exhaust Particulate Composition  
Max Particle Size 10.0 nm, Calendar Year 2000**



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