

Unleaded Gasoline Particulate Emissions

	Catalyst Type	THC g/mile	Particulate mg/mile	Particulate as % THC
<u>Hammerle, et al., 1987 (SAE 920731) (1)</u>				
1991 Escorts (4 cars)	3-way/no air	0.2	2.3	1.2%
1991 Explorers (4 cars)	dual 3-way/no air	0.22	2.5	1.1%
Average		0.21	2.4	1.1%
<u>Lewtas, 1991 (POM Report) (2)</u>				
1978 Mustang II	ox cat		5.3	
<u>Lang et al., 1981 (SAE 811186) (3)</u>				
composite with 1976 Ply Fury (16 cars)	ox; 3-way+ox	2.52	31.7	1.3%
composite without Fury (15 cars)	ox; 3-way+ox	1.05	21	2.0%
ox cat with air (with Fury) (6 cars)		5.05	52.3	1.0%
ox cat with air (without Fury) (5 cars)		1.16	24.4	2.1%
ox cat/no air (5 cars)		1.46	22.2	1.5%
3-way+ox with air (5 cars)		0.53	16.4	3.1%
<u>Volkswagen, 1991 (4)</u>				
1982 Scirocco	ox cat	0.13	8.04	6.2%
1982 Jetta	ox cat	0.21	4.68	2.2%
1982 Jetta	ox cat	0.17	7.34	4.3%
1985 Jetta	ox cat	0.32	4.57	1.4%
1984 Audi 5000S	ox cat	0.26	7.07	2.7%
1985 Audi 5000S	ox cat	0.31	8.38	2.7%
1986 Audi 5000S	ox cat	0.2	6.27	3.1%
Average		0.23	6.62	3.2%
<u>Smith, 1981 (EPA 460/3-81-024 , High Mileage)</u>				
1978 Buick Regal	ox cat/no air	1.71	50.23	2.9%
1979 Mercury Marquis	3-way with air	0.69	26.95	3.9%
1979 Mercury Marquis	3-way with air	0.68	38.15	5.6%
1978 Ford Granada	ox cat with air	1.74	58.2	3.3%
1978 Volvo 245DL	3-way/no air	0.61	13.48	2.2%
1978 Olds Cutlass	ox cat/no air	0.87	31.02	3.6%
1978 Chev Malibu	ox cat with air	0.64	49.54	7.7%
1978 Chev Monte Carlo	ox cat/no air	0.45	32.02	7.1%
1978 Ford Fiesta	ox cat with air	0.64	56.46	8.8%
1978 Chrysler New Yorker	ox cat/no air	4.57	425.15	9.3%
Averages by catalyst type	ox/no air	1.01	37.76	4.5%
(New Yorker excluded)	ox with air	1.01	54.73	6.6%
	3-way with air	0.69	32.55	4.8%
	3-way/no air	0.61	13.48	2.2%
<u>Urban, 1980a (EPA 460/3-80-003)</u>				
1978 Chev Malibu	ox/no air	0.5	9.41	1.9%
1978 Chev Malibu (Calif.)	ox with air	0.31	5.5	1.8%

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1978 Ford Granada	ox with air	0.43	12.23	2.8%
1978 Ford Mustang II	ox/no air	0.51	9.27	1.8%
Averages by catalyst type	ox/no air			1.8%
	ox with air			2.3%
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Urban, 1980b (EPA 460/3-80-004)				
1978 Ford Pinto	3way+ox with ail	0.11	24.62	22.4%
1978 Pont. Sunbird	3-way	0.26	9.01	3.5%
1978 Saab 99	3-way	0.16	7.88	4.9%
Averages by catalyst type	3-way			4.2%
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Urban, 1980c (EPA 460/3-80-005)				
1979 Merc. Marquis	3-way+ox with a	0.21	3.23	1.5%

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CARB, 1986 (assumed all 3-way) (5)

1	1986 GM Cutlass 22,834mi	0.329	10.5	3.2%
2	1986 Ford Marquis 21,535mi		6.7	
3	1985 Ford Thunderbird 59,697mi	0.582	13.1	2.3%
4	1986 Toyota Camry 9,672mi	0.21	5.7	2.7%
5	1986 GM DeVille 15,477mi	0.175	72.1	41.2%
6	1986 VW Golf 24,002mi		1.3	
7	1984 Mitsubishi Colt 67,570mi	0.436	10.4	2.4%
9	1976 Chrysler Valiant 130,274mi		81.8	
10	1978 Ford Fairmont 71,362mi			
11	1985 Nissen Sentra 52,317mi		3.5	
			8.9	
	Average (all)	0.35	21.4	10.3%
	Average (without vehicle 5 and removed)	0.39	9.93	2.6%

STUDY AVERAGES

3-Way/No Air

	Hammerle, et al. (8 cars)	0.21	2.40	1.1%
	EPA 460/3-81-024 (1 car)	0.61	13.48	2.2%
	EPA 460/3-80-004 (2 cars)	0.21	8.45	4.2%
	CARB, 1986 (4 cars)	0.39	9.93	2.6%
	Average by Study	0.36	8.57	2.5%
	Average by Number of Cars	0.28	5.95	2.0%

3-Way+Ox/Air

	Lang et al. (5 cars)	0.53	16.4	3.1%
	EPA 460/3-80-005 (1 car)	0.21	3.23	1.5%
	Average by Study	0.37	9.82	2.3%
	Average by Number of Cars	0.48	14.21	2.8%

Ox Cat/Air

	Lang et al. (5 cars)	1.16	24.4	2.1%
	EPA 460/3-81-024 (3 cars)	1.01	54.73	6.6%
	EPA 460/3-80-003 (2 cars)	0.37	8.87	2.3%
	Average by Study	0.85	29.33	3.7%
	Average by Number of Cars	0.96	30.39	3.5%

Ox Cat/No Air

	Lang et al. (5 cars)	1.46	22.2	1.5%
	EPA 460/3-81-024 (3 cars)	1.01	37.76	4.5%
	EPA 460/3-80-003 (2 cars)	0.51	9.34	1.8%
	Average by Study	0.99	23.10	2.6%
	Average by Number of Cars	1.14	24.30	2.5%

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All Ox Cat

Lang et al. (10 cars)	1.31	23.3	1.8%
VW (7 cars)	0.23	6.62	3.2%
EPA 460/3-81-024 (6 cars)	1.01	46.25	5.6%
EPA 460/3-80-003 (4 cars)	0.44	9.11	2.1%
Average by Study	0.75	21.32	3.2%
Average by Number of Cars	0.83	21.97	3.1%

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SUMMARY AVERAGES (# OF CARS)

3-Way/No Air	0.28	5.95	2.0%
3-Way+Ox/Air	0.48	14.21	2.8%
Ox Cat/Air	0.96	30.39	3.5%
Ox Cat/No Air	1.14	24.3	2.5%
All Ox Cat	0.83	21.97	3.1%

Footnotes:

(1) There were four Escorts and four Explorers tested. The average numbers in this table are the average of five sites except the single sample for the Explorer collected with the TX40 filter. The Escort value is the average of five sites. The Explorer value is the average of 27 data points. The vehicles were tested with and without MMT; the 'No MMT' values are in this table.

(2) The Mustang II was used by EPA to develop a unit risk for gasoline particulate, based on the comparison of this vehicle to the 1976 Plymouth Fury. Note that emissions for this vehicle were measured using the HFET cycle.

(3) The 1976 Plymouth Fury had an oil consumption problem which produced abnormally high particulate emissions. A total of 16 catalyst-equipped vehicles were tested; six were oxidation catalyst-equipped with air, five were oxidation catalyst-equipped without air, and five were 3-way plus oxidation catalyst-equipped without air.

(4) All the vehicles tested in the VW program were equipped with oxidation catalysts. Particle-bound carbon is included in the total particulate.

(5) Vehicle 5 exhibited exceptionally high Si, Cl, and SO₄.

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ages of all the samples at all
age of 30 data points and the
to MMT' data were used for

relative potency method.

ate emission rates.

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with air.

organics were not measured.