Table VIII-1. Comparison of Residential Visibility Valuation Study Results

Study	City	Mean WTP ($1990)	Starting VR (miles)	Ending VR (miles)	b coefficient	WTP for 20% changes VR (3)
Eastern CVM Studies						
McClelland et al.[5]	Atlanta and Chicago	Unadj. $39 Partial $25 Full $18	17.6	20	305 196 140	$56 $36 $26
Tolley et al.[6]	Chicago	-$318 $305 $379	9 9 9	4 18 30	367	$67
Tolley et al[6]	Atlanta	-$265 $255 $381	12 12 12	7 22 32	414	$75
Tolley et al[6]	Boston	-$196 $187 $231	18 18 18	13 28 38	372	$68
Tolley et al[6]	Mobile	-$212 $227 $266	10 10 10	5 20 30	275	$68
Tolley et al[6]	Washington, DC	-$314 $323 $410	15 15 15	10 25 35	560	$102
Tolley et al[6]	Cincinnati	-$78 $77 $86	9 9 9	4 19 29	106	$17
Tolley et at[6]	Miami	-$134 $120 $141	13 13 13	8 19 29	226	$41
Rae[7]	Cincinnati	$175	11.4	16.4	531	$97
California CVM Studies						
Brooksire et al.[8]	Los Angeles	$115 $294 $161	2 2 12	12 28 28	105	$19
Loehman et al[9]	San Francisco	-$186 $109	18.6 16.3	16.3 18.6	1172	$214
California Property Value Study	Los Angeles					$216-$579 $437-$487
Trijonis et al[10]	San Francisco					
Trijonis et al[10]						

Note: VR - Visual Range

Source: Chestnut et al., 1994.

Table VIII-2

Average Natural Background Levels of Aerosols and Light Extinction

	Average Concentration East $\mu g/m^3$	Average Concentration West $\mu g/m^3$	Error Factor	Extinction Efficiencies[a] m_2/g	Extinction Contributions East Mm^{-1}	Extinction Contributions West Mm^{-1}
Fine Particles ($\leq$2.5µm)						
Sulfates (as NH_4HSO_4	0.2	0.1	2	2.5	0.5	0.2
Organics	1.5	0.5	2	3.75	5.6	1.9
Elemental Carbon	0.02	0.02	2-3	10.5	0.2	0.2
Ammonium Nitrate	0.1	0.1	2	2.5	0.2	0.2
Soil dust	0.5	0.5	1.5-2	1.25	0.6	0.6
Water	1.0	0.25	2	5	5.0	1.2
Coarse Particles (2.5-10µm)	3.0	3.0	1.5-2	0.6	1.8	1.8
			Rayleigh Scatter		12	11
				Total	26$\pm$7	17$\pm$2.5

[a]The extinction efficiencies are based on the literature review by Trijonis et al. (1986 & 1988). All the extinction efficiencies represent particle scattering, except for elemental carbon where the 10.5 m^2/g value is assumed to consist of 9 m^2/g absorption and 1.5 m^2/g scattering. Note that the 0.6 m^2/g value for coarse particles is a "pseudo-coarse scattering efficiency" representing the total scattering by all ambient coarse particles (2.5 µm) divided by the coarse particle mass between 2.5 and 10 µm.

Table VIII-3. Dry particle light extinction efficiency values used in 1993 analysis of IMPROVE data.

Aerosol Constituent	Extinction Efficiency (in m^2/g)
Sulfates	3.0
Organics	3.0
Elemental carbon	10.0
Nitrates	3.0
Soil dust	1.0
Coarse particles	0.6

Source: Sisler et al., 1993

Table VIII-4. Comparison of total light extinction to estimated natural light extinction for several eastern and western locations.

REGION	TOTAL LIGHT EXTINCTION 1988-1994 (in Mm^{-1})		VISUAL RANGE (in km)	
	Annual	Summer	Annual	Summer
Eastern U.S., estimated natural light extinction	**26 +/- 7**	**NA**	**150+/- 45**	**NA**
Appalachian	126	182	31	21
Boundary Waters	62	63	63	62
Northeast	77	95	51	41
Washington, D.C.	177	207	22	19
Western U.S., estimated natural light extinction	**17 +/- 2.5**	**NA**	**230 +/- 40**	**NA**
Colorado Plateau	32	33	122	119
Cascades	74	73	53	54
Southern California	74	87	53	45
Northern Rockies	57	48	69	82

Sources: Sisler et al., 1996; NAPAP 1991.

Table VIII-5

Visibility Model Results:
Anthropogenic Light Extinction Budgets[a]

	East[b]	Southwest[c]	Northwest[d]
Sulfates	65	39	33
Organics	14	18	28
Elemental carbon	11	14	15
Suspended dust	2	15	7
Nitrates	5	9	13
Nitrogen dioxide	3	5	4

[a]Percentage contribution by specific pollutant to anthropogenic light extinction in three regions of the United States.

[b]Based on Table 9, Table 18, Figure 45, Appendix A, and Appendix E of NAPAP Visibility SOS/T Report (Trijonis et al., 1990). It is assumed that sulfates (3% natural) account for 60% of non-Rayleigh extinction, organics (33% natural) account for 18%, elemental carbon (3% natural) accounts for 10%, suspended dust (50% natural) accounts for 4%, nitrates (10% natural) account for 5%, and nitrogen dioxide (10% natural) accounts for 3%.

[c]Based on Table 9, Table 18, Figure 45, Appendix A, and Appendix E of the NAPAP Visibility SOS/T Report (Trijonis et al., 1990). It is assumed that sulfates (10% natural) account for 33% of non-Rayleigh extinction, organics (33% natural) account for 20%, elemental carbon (10% natural) accounts for 12%, suspended dust (50% natural) accounts for 23%, nitrates (105 natural) account for 8%, and nitrogen dioxide (10% natural) accounts for 4%.

[d]Extinction efficiencies (relative to organics are chosen as 1.5 for sulfates, 2.5 for elemental carbon, 0.3 for fine crustal materials, and 1.5 for nitrates (Trijonis et al., 1988, 1990). Coarse dust extinction is assumed to be three times fine dust extinction (Trijonis et al., 1988, 1990). Natural aerosol particle fractions are assumed to be one-tenth for sulfates, one-third for organics one-tenth for elemental carbon, one-half for crustal materials, and one-tenth for nitrates. These assumptions are applied using the fine mass concentrations in Trijonis et al., (1990). The percentage contribution for

nitrogen dioxide is assumed to be 4%.

Source: NRC, 1993.

Table VIII-6. Percentage Contribution by Source Category to Fine Particle (and Precursor) Emissions in the East, Southwest, and Northwest

EAST	SOx	Organic Particles	VOC's	Elemental Carbon	Suspended Dust	NH3	NOx
Electric utilities	78.0	--	--	--	--	--	39
Diesel-fueled mobile sources	1.5	--	--	47	--	--	16
Gasoline vehicles	1.0	34	31	29	--	--	26
Petroleum and chemical industries	4.5	--	11	--	--	--	--
Industrial coal combustion	7.0	--	--	--	--	--	--
Residential wood burning	--	20	13	15	--	--	--
Fugitive dust (on-road/off-road traffic)	--	--	--	--	100	--	--
Feedlots and livestock waste mgmt.	--	--	--	--	--	66	--
Miscellaneous	8.0	46	45	9	--	34	19
SOUTHWEST	**SOx**	**Organic Particles**	**VOC's**	**Elemental Carbon**	**Suspended Dust**	**NH3**	**NOx**
Electric utilities	33	--	--	--	--	--	19
Diesel-fueled mobile sources	12	5	--	52	--	--	23
Gasoline vehicles	5	38	42	31	--	--	32
Petroleum and chemical industries	22	--	12	--	--	--	--
Copper smelters	19	--	--	--	--	--	--
Fugitive dust (on-road/off-road traffic)	--	--	--	--	100	--	--
Residential wood burning	--	8	5	6	--	--	--
Feedlots and livestock waste mgmt.	--	--	--	--	--	75	--
Miscellaneous	9	49	41	11	--	25	26
NORTHWEST	**SOx**	**Organic Particles**	**VOC's**	**Elemental Carbon**	**Suspended Dust**	**NH3**	**NOx**
Electric utilities	30	--	--	--	--	--	8
Diesel-fueled mobile sources	12	--	--	37	--	--	29
Gasoline vehicles	4	15	31	16	--	--	36
Petroleum and chemical industries	19	--	10	--	--	--	--
Residential wood burning	--	22	25	22	--	--	--
Forest management burning	--	45	13	20	--	--	--
Fugitive dust (on-road/off-road traffic)	--	--	--	--	100	--	--
Feedlots and livestock waste mgmt.	--	--	--	--	--	81	--
Primary metallurgical process	8	--	15	--	--	--	--
Organic solvent evaporation	--	--	15	--	--	--	--
Miscellaneous	27	18	6	5	--	19	27

Source: NRC, 1993.

Table VIII-7. Percentage contributions of aerosol constituents to annual average total light extinction in the Washington, D.C. and southern California areas.

Location	Sulfate	Nitrate	Organics	Elemental Carbon	Soil and Coarse
Wash, DC	49	16	16	11.9	6.9
So. Calif.	14	44	18	9.0	13.9

Source: Sisler et al., 1993