Appendix D

Compliance Costs: Sources, Methods and Data

D.1 Compliance Cost Sources

CAPITAL EXPENDITURES

U.S. Environmental Protection Agency. *Environmental Investments: The Cost of a Clean Environment.* November 1990

U.S. Department of Commerce, Bureau of Economic Analysis. *Survey of Current Business.* Selected Issues

Historical data, 1973-89. EPA estimates, 1990.

OPERATING & MAINTENANCE EXPENDITURES

U.S. Environmental Protection Agency. *Environmental Investments: The Cost of a Clean Environment.* November 1990

U.S. Department of Commerce, Bureau of Economic Analysis. *Survey of Current Business.* Selected Issues

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports: Pollution Abatement Costs and Expenditures, 19__.*

Historical data for non-farm business aggregates
- 1973-1984 Complete
- 1985-1986, Revised data allocated on the basis of historical 1985-1986 shares
- 1987-1989, Revised data allocated on the basis of historical 1986 shares
- 1990 EPA estimates allocated on the basis of 1986 shares

Historical data for sectors within manufacturing
- 1973-1986, 1988 Complete
- 1987 Survey not taken or published. Numbers determined on the basis of historical shares within total manufacturing
- 1989-90 totals allocated on the basis of 1988 shares

RECOVERED COSTS

U.S. Department of Commerce, Bureau of the Census. *Current Industrial Reports: Pollution Abatement Costs and Expenditures, 19__.*

Historical data for manufacturing

1979-1986, 1988 Complete

1987 Survey not taken or published. Numbers for 1973-78 and 1987 determined on the basis of historical shares of total recovered costs

1989-90 totals and allocation based on 1988 shares

MOBILE SOURCES

U.S. Environmental Protection Agency. *Environmental Investments: The Cost of a Clean Environment.* November 1990 and Revisions.

U.S. Department of Commerce, Bureau of Economic Analysis. *Survey of Current Business.* Selected Issues

U.S. Department of Labor, Bureau of Labor Statistics. *Producer Price Indexes.* Selected Supplements

Historical data, 1973-1989. EPA estimates, 1990.

OTHER SOURCES

U.S. Department of Commerce, Bureau of Economic Analysis. *The National Income and Product Accounts of the United States.* Selected Releases

U.S. Department of Labor, Bureau of Labor Statistics. *Time Series on Input-Output Industries.* Selected Releases

Historical data, BEA, 1973-90, and BLS, 1973-89.

D.2 Compliance Cost Estimation Methods

Operating & Maintenance Expenditures: Manufacturing

Missing values in the Census data at the two-digit level were estimated, generally by linear interpolation. Depreciation expenses were removed from the annual O&M expenditures using the 1979 value share (the only year available). The resulting O&M outlays were aggregated across sectors to yield an industry total by year. Value shares then were computed from the sectoral data and the industry totals. The result was a matrix of sectoral shares of total O&M outlays for manufacturing in each year, 1973-1988. Share values for 1988 were used for 1989 and 1990. These share values were applied to the BEA (EPA) O&M totals for all manufacturing to yield the compliance costs reported below.

Recovered Costs: Manufacturing

Missing values in the Census data at the two-digit level were determined in one of two ways. Where data were present, the average share of air recovered costs in total recovered costs was applied to total recovered costs. This provided data for those situations in which total recovered costs were available but air recovered costs were not. The remaining missing values were estimated, generally by linear interpolation. These results then were aggregated to yield air recovered costs for total manufacturing by year. In many instances, these are very close to BEA's figures for all air-related recovered costs, manufacturing and non-manufacturing alike.

Operating & Maintenance Expenditures: Non-manufacturing

BEA capital expenditures on air pollution control equipment for non-manufacturing aggregates were allocated to sub-aggregates on the basis of BLS industry output shares. These capital expenditures were accumulated over time within each non-manufacturing sub-aggregate and aggregate capital by year was determined. Capital value shares by year for the sub-aggregates then were computed and applied to the BEA (EPA) O&M expenditures for the non-manufacturing aggregates to yield the compliance costs below.

In all cost categories, data for the years 1971 and 1972 were determined by linear interpolation between 1970, assumed to be zero, and 1973, the first full year of available information.

The compliance costs used in this analysis are reported fully in the pages that follow.

	O&M Expenditures, $Mn				
Industry	Metal mining	Coal mining	Crude & natural gas	Non-metallic mining	Construction
Year					
1973	5.83	8.14	27.93	6.51	42.11
1974	6.87	11.91	36.84	7.41	43.06
1975	7.69	15.70	45.22	8.67	50.85
1976	11.27	25.78	71.05	12.85	52.18
1977	15.26	37.39	105.04	18.06	59.28
1978	18.79	46.67	134.05	22.72	65.75
1979	22.99	57.10	168.50	27.46	68.40
1980	26.68	66.52	210.34	31.75	81.30
1981	29.37	73.88	250.14	35.03	92.52
1982	26.35	69.44	248.91	32.15	80.33
1983	29.66	79.73	295.28	36.78	91.21
1984	34.03	93.33	352.50	42.90	104.11
1985	36.37	101.87	390.32	46.76	110.76
1986	36.88	106.02	402.79	48.59	113.96
1987	37.60	110.42	417.47	50.69	115.95
1988	35.82	106.95	400.80	49.40	114.10
1989	37.09	111.96	417.17	52.19	121.20
1990	40.53	123.95	459.21	58.24	135.43

	O&M Expenditures, $Mn				
Industry	Food & products	Tobacco	Textile products	Lumber & products	Furniture & fixtures
Year					
1973	31.82	1.80	4.19	9.65	2.89
1974	37.31	2.67	5.87	11.87	3.53
1975	40.90	3.07	5.90	13.89	3.77
1976	43.96	3.50	5.72	16.13	4.44
1977	44.58	3.35	6.81	12.67	5.65
1978	53.30	3.92	11.91	16.93	4.96
1979	66.20	4.33	11.28	23.27	6.15
1980	63.54	4.51	10.55	24.54	6.74
1981	61.31	5.60	12.08	26.92	6.73
1982	59.22	6.54	9.28	16.14	5.51
1983	74.22	6.90	13.43	19.12	8.17
1984	78.01	9.57	16.22	25.25	9.73
1985	82.61	10.38	19.61	25.85	13.35
1986	100.22	9.27	18.51	39.06	16.89
1987	115.99	9.08	19.69	47.40	18.48
1988	123.72	8.27	19.52	52.42	18.82
1989	130.97	8.76	20.67	55.49	19.92
1990	146.60	9.80	23.13	62.11	22.29

	O&M Expenditures, $Mn				
Industry	Paper & products	Printing & publishing	Chemicals & products	Petroleum refining	Rubber & plastics
Year					
1973	44.43	4.87	148.28	182.90	10.04
1974	57.26	5.20	163.08	212.73	12.13
1975	71.54	6.20	192.20	304.61	16.08
1976	87.07	6.58	235.72	414.65	17.18
1977	93.42	6.20	268.04	539.17	15.40
1978	112.21	6.99	320.55	570.65	13.74
1979	118.49	7.96	369.47	637.57	23.68
1980	140.91	11.93	439.98	827.39	23.93
1981	152.96	13.62	468.49	1022.05	23.59
1982	146.44	15.48	447.04	1071.76	17.24
1983	161.35	26.15	505.12	1085.33	39.74
1984	199.38	35.83	501.32	1193.95	39.78
1985	224.35	46.55	547.29	1160.03	36.69
1986	234.17	54.24	538.18	1143.10	40.93
1987	260.71	61.76	578.71	1148.46	46.85
1988	269.30	65.02	579.64	1076.32	49.53
1989	285.09	68.83	613.63	1139.43	52.44
1990	319.09	77.04	686.81	1275.33	58.69

	O&M Expenditures, $Mn				
Industry	Leather & products	Stone, clay & glass	Primary metals	Fabricated metals	Non-electric machinery
Year					
1973	.70	54.53	224.44	22.37	16.66
1974	.73	68.61	270.54	26.86	19.31
1975	.88	76.67	344.33	25.51	22.69
1976	.80	85.07	457.05	27.46	24.39
1977	.80	99.46	570.19	31.42	26.72
1978	1.03	114.30	647.86	32.92	32.73
1979	.91	124.33	744.07	42.22	37.88
1980	.82	128.91	809.86	38.85	38.85
1981	.71	135.96	907.13	41.14	38.50
1982	.59	99.72	718.05	38.01	37.21
1983	1.11	126.32	727.72	64.40	46.56
1984	1.77	150.53	816.29	50.89	54.76
1985	1.79	153.46	863.99	62.82	61.40
1986	1.75	171.38	802.66	77.42	67.30
1987	1.88	180.10	823.74	95.96	63.64
1988	1.88	176.56	788.98	107.77	55.75
1989	1.99	186.91	835.24	114.08	59.01
1990	2.23	209.20	934.86	127.69	66.05

	O&M Expenditures, $Mn				
Industry	Electrical machinery	Motor vehicles	Other transport equip.	Instruments	Misc. manufacturing
Year					
1973	15.70	23.84	6.19	1.81	4.89
1974	16.58	27.00	8.98	4.16	5.59
1975	20.26	33.38	8.69	5.04	4.39
1976	19.50	36.33	9.11	7.36	5.95
1977	20.27	38.67	9.48	7.66	4.02
1978	22.52	50.98	11.19	6.23	3.08
1979	32.44	59.85	13.60	8.56	4.74
1980	33.61	74.42	15.83	9.77	4.06
1981	38.73	75.73	20.77	11.13	4.86
1982	40.42	67.42	17.62	11.01	7.31
1983	57.02	104.54	22.84	21.45	9.51
1984	54.87	118.88	37.09	20.19	5.71
1985	57.89	120.04	38.69	20.89	7.32
1986	67.07	119.89	43.75	17.58	4.62
1987	70.45	131.32	45.37	18.88	6.51
1988	69.04	133.73	43.90	18.90	7.93
1989	73.08	141.58	46.47	20.00	8.40
1990	81.80	158.46	52.01	22.39	9.40

	O&M Expenditures, $Mn				
Industry	Transportation	Communications	Electric utilities	Gas utilities	Trade
Year					
1973	24.21	8.91	390.00	8.07	40.04
1974	38.78	9.46	649.00	14.54	45.79
1975	48.81	11.47	678.00	16.27	61.90
1976	60.47	11.92	691.00	21.34	78.72
1977	73.82	13.57	839.00	24.61	91.89
1978	82.92	15.03	1016.00	26.53	101.11
1979	93.09	15.60	1488.00	32.10	115.27
1980	107.42	18.61	1928.00	45.57	132.75
1981	132.80	21.36	1986.00	66.40	141.54
1982	123.74	18.65	1979.00	73.12	126.99
1983	140.05	21.38	2008.00	91.34	143.85
1984	162.94	24.47	2049.00	112.02	167.65
1985	176.48	26.08	2138.00	127.06	180.45
1986	184.19	26.97	2137.00	132.06	187.19
1987	190.39	27.50	2227.00	138.47	200.33
1988	179.49	27.23	2214.00	131.41	201.40
1989	183.71	29.07	2346.00	135.37	218.33
1990	198.78	32.67	2609.00	147.37	248.74

	O&M Expenditures, $Mn		
Industry	Finance, insurance & real estate	Other services	Government enterprises
Year			
1973	23.35	33.43	5.47
1974	26.53	39.18	5.65
1975	35.58	53.02	6.82
1976	45.34	68.03	7.05
1977	53.13	79.95	7.99
1978	58.83	88.82	8.78
1979	67.49	102.93	9.09
1980	78.46	120.82	10.77
1981	83.86	129.82	12.27
1982	75.71	117.90	10.70
1983	86.40	135.09	12.23
1984	101.17	158.89	13.99
1985	109.48	172.44	14.93
1986	114.71	181.17	15.47
1987	124.84	197.56	15.79
1988	127.78	202.89	15.73
1989	140.27	224.71	16.92
1990	162.09	261.82	19.17

	Recovered Cost Values, $Mn				
Industry	Food & products	Tobacco	Textile products	Lumber & products	Furniture & fixtures
Year					
1973	13.44	.99	.48	2.63	.45
1974	21.51	1.46	.43	4.43	.96
1975	25.80	1.93	1.14	6.03	1.15
1976	26.25	2.40	1.43	8.84	1.67
1977	21.97	2.87	1.13	5.47	2.18
1978	23.53	2.88	.96	9.25	1.79
1979	39.50	2.90	.80	6.30	2.30
1980	31.80	5.30	1.00	11.50	3.70
1981	40.40	3.57	1.10	6.00	3.30
1982	21.00	1.83	.70	5.75	.70
1983	10.60	.10	2.20	3.00	3.70
1984	19.50	1.13	2.20	6.00	3.50
1985	11.90	2.15	1.70	6.00	1.70
1986	21.47	3.18	1.60	7.30	7.10
1987	31.03	4.21	2.05	9.60	6.75
1988	40.60	5.24	2.50	11.90	6.40
1989	41.15	5.31	2.53	12.06	6.49
1990	46.07	5.94	2.84	13.50	7.26

	Recovered Cost Values, $Mn				
Industry	Paper & products	Printing & publishing	Chemicals & products	Petroleum refining	Rubber & plastics
Year					
1973	26.84	2.02	40.53	31.54	2.42
1974	41.68	2.02	50.97	59.45	10.24
1975	55.15	2.25	68.62	98.05	6.56
1976	67.63	3.92	92.03	130.87	8.30
1977	74.12	2.65	100.66	169.75	4.04
1978	86.31	3.34	112.81	186.41	4.20
1979	83.10	7.40	124.60	200.00	8.90
1980	107.10	6.70	152.20	310.10	6.90
1981	133.40	6.50	181.20	356.00	7.60
1982	112.50	4.10	182.60	335.30	7.00
1983	159.30	6.90	148.80	341.10	4.00
1984	47.70	5.80	158.40	423.30	5.20
1985	52.30	6.90	119.40	406.60	5.90
1986	58.80	8.90	145.00	406.90	6.90
1987	98.85	14.65	180.00	396.30	7.50
1988	138.90	20.40	215.00	385.70	8.10
1989	140.79	20.68	217.92	390.94	8.21
1990	157.60	23.15	243.94	437.62	9.19

	Recovered Cost Values, $Mn				
Industry	Leather & products	Stone, clay & glass	Primary metals	Fabricated metals	Non-electric machinery
Year					
1973	.03	19.28	39.90	3.04	3.64
1974	.03	26.05	59.58	2.74	2.82
1975	.03	32.82	73.83	2.50	3.05
1976	.03	46.67	78.02	2.10	4.08
1977	.03	54.07	97.85	1.17	4.52
1978	.06	58.87	109.78	1.50	3.80
1979	.10	67.50	182.40	5.00	2.30
1980	.10	59.90	137.20	8.00	5.00
1981	.06	68.70	156.00	9.20	6.90
1982	.03	56.00	109.10	3.60	4.00
1983	.01	38.90	74.20	9.10	8.00
1984	.06	36.80	133.60	10.10	2.00
1985	.10	26.10	107.80	4.80	2.50
1986	.10	33.50	139.50	8.10	2.20
1987	.10	59.50	141.65	8.15	2.75
1988	.10	85.50	143.80	8.20	3.30
1989	.10	86.66	145.75	8.31	3.34
1990	.11	97.01	163.16	9.30	3.74

	Recovered Cost Values, $Mn				
Industry	Electrical machinery	Motor vehicles	Other transport equip.	Instruments	Misc. manufacturing
Year					
1973	8.15	1.57	.65	.56	.57
1974	8.94	1.02	.50	.89	.67
1975	6.30	1.16	.26	1.09	.96
1976	15.72	1.31	.20	2.94	1.24
1977	10.44	1.18	.24	1.54	.98
1978	7.05	1.47	.27	1.27	1.29
1979	12.90	.40	.00	2.00	1.80
1980	9.00	.60	.20	2.80	2.40
1981	12.20	.40	.70	1.60	2.20
1982	6.40	.40	.50	4.00	1.35
1983	5.90	.30	1.00	4.60	.50
1984	6.10	2.40	1.30	3.68	.80
1985	5.50	2.20	1.10	2.76	1.00
1986	6.50	5.00	1.10	2.70	1.40
1987	11.60	5.60	1.50	3.82	1.50
1988	16.70	6.20	1.90	4.94	1.60
1989	16.93	6.28	1.93	5.00	1.62
1990	18.95	7.03	2.16	5.60	1.82

	Total Air Pollution Control Outlays, $Mn				
Industry	Nonfarm business	Government enterprise	Air control investment	O&M expenditures	Recovered cost values
Year					
1973	2968	82	3050	1436	199
1974	3328	104	3432	1895	296
1975	3914	102	4016	2240	389
1976	3798	156	3954	2665	496
1977	3811	197	4008	3223	557
1978	3977	205	4182	3724	617
1979	4613	285	4898	4605	750
1980	5051	398	5449	5568	862
1981	5135	451	5586	6123	997
1982	5086	508	5594	5815	857
1983	4155	422	4577	6292	822
1984	4282	416	4698	6837	870
1985	4141	328	4469	7186	768
1986	4090	312	4402	7255	867
1987	4179	277	4456	7599	987
1988	4267	243	4510	7474	1107
1989	4760	235	4995	7916	1122
1990	4169	226	4395	8842	1256

	Mobile Source Emissions Control Costs, $ Mn				
	EPA				
	Investment in Vehicles	Investment in Aircraft	O & M Expenditures	Fuel Price Penalty	Fuel Economy Penalty
Year	(All Vehicle Types)		(All Vehicle Types)	(All Vehicle Types)	(All Vehicle Types)
1973	276		-26	91	1700
1974	242		-98	244	2205
1975	1567	3	-289	358	2213
1976	1953	8	-514	468	2106
1977	2233	15	-738	568	1956
1978	2501	12	-1527	766	1669
1979	2937	4	-1826	1187	1868
1980	2944	5	-2120	1912	1998
1981	3526	8	-2386	2181	1594
1982	3518	33	-2542	2071	1026
1983	4271	60	-2739	1956	628
1984	5670	9	-2651	2012	313
1985	6379	8	-2838	3057	118
1986	6876	10	-3859	2505	-40
1987	6839	12	-4126	2982	-158
1988	7193	13	-4492	3127	-210
1989	7037	16	-4794	3476	-318
1990	7299	13	-5089	3754	-481

	Mobile Source Emissions Control Costs, $ Mn				
	EPA, Light Duty Vehicles Only				
	Inspection-Maintenance	Maintenance Credit	Fuel Price Penalty	Fuel Economy Penalty	Fuel Density Credit
Year					
1973		38	91	1466	3
1974		113	244	1913	14
1975	5	309	345	1928	40
1976	6	536	442	1841	69
1977	24	784	529	1748	106
1978	26	1578	711	1604	242
1979	28	1840	1065	1831	345
1980	31	2125	1696	2048	533
1981	44	2393	1915	1754	650
1982	117	2628	1782	1232	619
1983	147	2845	1641	847	580
1984	483	3152	1653	582	592
1985	553	3399	2630	403	584
1986	834	4754	2117	216	469
1987	913	5086	2513	152	512
1988	952	5464	2590	105	500
1989	993	5780	2910	79	581
1990	1034	6087	3108	58	720

	Other Air Pollution Control Expenditures, $Mn						
	Private R&D expenditures were not included in CAA costs						
	Abatement		Regulation & Monitoring		Research & Development		
Year	Federal	State & Local	Federal	State & Local	Private	Federal	State & Local
1973	47		50	115	451	126	6
1974	56		52	131	492	100	7
1975	88	1	66	139	466	108	8
1976	105	1	69	135	543	131	6
1977	106	1	80	161	654	144	7
1978	90		93	183	789	146	8
1979	103		100	200	924	105	7
1980	95		122	207	869	130	5
1981	85		108	226	852	131	
1982	87		93	230	912	126	2
1983	136	4	88	239	1315	133	6
1984	115	14	101	250	1359	165	4
1985	98	12	103	250	1427	247	3
1986	67	14	106	307	1499	217	4
1987	80	15	110	300	1574	200	2
1988	65	10	120	320	1652	220	1
1989	70	12	130	360	1718	230	2
1990	71	13	133	343	1820	231	2

	Mobile Source Emissions Control Costs, $ Mn			
	BEA			
	Investment in Vehicles	O & M Expenditures	Fuel Price Penalty	Fuel Economy Penalty
Year	(All Vehicle Types)	(All Vehicle Types)	(All Vehicle Types)	(All Vehicle Types)
1973	1013	1104		697
1974	1118	1380	5	1180
1975	2131	1520	97	1344
1976	2802	1420	309	1363
1977	3371	1289	701	1408
1978	3935	1136	1209	1397
1979	4634	931	1636	1792
1980	5563	726	2217	2320
1981	7529	552	2996	2252
1982	7663	409	3518	1876
1983	9526	274	4235	1582
1984	11900	118	4427	1370
1985	13210	165	4995	1133
1986	14368	-331	4522	895
1987	13725	-453	3672	658
1988	16157	-631	3736	420
1989	15340	-271	1972	183
1990	14521	-719	1370	-55