

US EPA ARCHIVE DOCUMENT

APPENDIX B

SUMMARY OF CONTROL MEASURES IN THE PM, REGIONAL HAZE, AND OZONE PARTIAL ATTAINMENT ANALYSES

APPENDIX B.1

SUMMARY OF CONTROL MEASURES

This appendix contains a list of control measures used in the ozone, PM, and regional haze analyses. The list is sorted by affected source category and contains information on the pollutants reduced and the annual incremental cost per ton of pollutant reduced. All cost and emission reduction estimates for a given control measure are calculated incremental to controls already in place, or incremental to the next less stringent new control measure. For example, the cost and emission reductions associated with Selective Catalytic Reduction for Ammonia - Oil-Fired Reformers are incremental to application of Low-NOx Burners. The application of some control measures may result in cost savings (i.e., negative average incremental cost per ton values). In these cases, the estimated cost savings are due to the recovery of valuable products or to switching to technologies with lower long-run operating costs. Further, some control measures are assigned a zero incremental cost per ton. These measures involve either a long-run transition to a substitute technology with equivalent capital and operating costs, or behavioral change-inducing public information programs for which cost information could not be found or easily developed.

Some control measures have different cost and effectiveness values depending upon the analysis in which they are used. The baseline from which the control measure's cost and effectiveness is evaluated is slightly different for each analysis. For instance, the ozone analysis contains national application of more stringent Tier 2 light duty gasoline truck standards. The existence of this control measure affects the average incremental cost and effectiveness of any mobile source control measure affecting light duty gasoline trucks. Also, the cost and effectiveness of the PM and regional haze control measures are evaluated incremental to control measures selected to meet the current ozone standard, where the cost and effectiveness of the same controls in the ozone analysis are evaluated incremental to the 2010 CAAA baseline.

**TABLE B.1
SUMMARY OF CONTROL MEASURES**

STRAT Code ^a	MEAS ID ^b	SOURCE CATEGORY	MEASURE NAME	COUNT ^c	Pollutant Reduced						Average Nationwide Cost Per Ton ^d (single pollutant)				Range of Cost Per Ton Incidence ^e		
					VOC	SOA	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	NOx	SO ₂	PM ₁₀	Min.	Avg.	Max.
MOBILE SOURCE CONTROL MEASURES																	
O3INC	mOT5	Highway Veh - HD Diesels	HDDV Retrofit Program	3,078					Y	Y	0	0	0	25,500	25,500	25,501	25,667
PMINC	mOT5	Highway Veh - HD Diesels	HDDV Retrofit Program	3,078					Y	Y	0	0	0	25,500	25,500	25,501	25,667
O3BSE	mOT1	Highway Veh - LD Gas Trucks	Tier 2 Standards	3,020	Y	Y	Y				16,913	4,996	0	0	5,636	35,676	53,544
O3INC	mOT3	Highway Veh - LD Gasoline	High Enhanced I/M	313	Y	Y	Y				1,146	1,348	0	0	440	677	805
O3INC	mOT4	Highway Veh - LD Gasoline	Fleet ILEV	3,078	Y	Y					25,299	0	0	0	7,161	24,191	75,877
PMINC	mOT3	Highway Veh - LD Gasoline	High Enhanced I/M	313	Y	Y	Y				987	1,319	0	0	397	620	805
PMINC	mOT4	Highway Veh - LD Gasoline	Fleet ILEV	3,078	Y	Y					22,457	0	0	0	6,555	20,741	75,826
O3INC	mOT2	Highway Vehicles - Gasoline	Federal Reformulated Gasoline	354	Y	Y	Y		Y	Y	6,726	37,145	0	754,763	3,732	6,363	25,339
O3INC	mOT6	Highway Vehicles - Gasoline	Transportation Control Package	3,078	Y	Y	Y	Y	Y	Y	12,755	10,000	110,390	294,652	4,158	5,697	7,135
PMINC	mOT6	Highway Vehicles - Gasoline	Transportation Control Package	3,078	Y	Y	Y	Y	Y	Y	11,457	10,000	112,543	290,750	3,897	5,394	7,135
allcs	PHDRET	Nonroad Diesel Engines	Heavy Duty Retrofit Program	3,020					Y	Y	0	0	0	9,531	8,286	9,503	14,000
O3INC	VNRFG	Nonroad Gasoline Engines	Federal Reformulated Gasoline	4,158	Y	Y					3,879	0	0	0	200	4,387	27,100
POINT SOURCE CONTROL MEASURES																	
allcs	V0529	Aircraft Surface Coating	Incineration	104	Y	Y					8,937	0	0	0	8,768	8,943	9,047
allcs	n05603	Ammonia - NG-Fired Reformers	Oxygen Trim + Water Injection	1			Y				0	774	0	0	774	774	774
allcs	n05604	Ammonia - NG-Fired Reformers	Selective Catalytic Reduction	34			Y				0	5,354	0	0	5	7,859	22,828
allcs	n05701	Ammonia - Oil-Fired Reformers	Low-NOx Burners	2			Y				0	984	0	0	984	984	984
allcs	n05703	Ammonia - Oil-Fired Reformers	Selective Catalytic Reduction	2			Y				0	5,138	0	0	5,138	5,138	5,138
allcs	V0951	Bakeries	Incineration at Oven Vent	4	Y						1,470	0	0	0	1,470	1,470	1,470
allcs	V0349	Beverage Can Coating	Incineration	422	Y	Y					8,937	0	0	0	7,925	8,935	9,525
allcs	V0321	Carbon Black Manufacture	Flare	38	Y						1,089	0	0	0	892	1,653	7,674
allcs	V0211	Cellulose Acetate Manufacture	Carbon Adsorption	12	Y						998	0	0	0	549	9,470	20,878
allcs	n03301	Cement Manufacturing - Dry	Mid-Kiln Firing	10			Y				0	568	0	0	566	568	568
allcs	n03303	Cement Manufacturing - Dry	SNCR - Urea Based	18			Y				0	1,221	0	0	1,220	1,222	1,233
allcs	n03305	Cement Manufacturing - Dry	Selective Catalytic Reduction	133			Y				0	9,849	0	0	9,756	9,848	9,851
allcs	n03401	Cement Manufacturing - Wet	Mid-Kiln Firing	6			Y				0	516	0	0	516	516	516
allcs	n03403	Cement Manufacturing - Wet	Selective Catalytic Reduction	10			Y				0	4,925	0	0	4,925	4,925	4,926

Note: Inclusion of control measures in this analysis does not represent selection of such control measures in future implementation strategies. Measures are included for illustrative purposes only. All costs and emission reductions are estimates.

**TABLE B.1
SUMMARY OF CONTROL MEASURES**

STRAT Code ^a	MEAS ID ^b	SOURCE CATEGORY	MEASURE NAME	COUNT ^c	Pollutant Reduced						Average Nationwide Cost Per Ton ^d (single pollutant)				Range of Cost Per Ton Incidence ^e			
					VOC	SOA	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	NOx	SO ₂	PM ₁₀	Min.	Avg.	Max.	
allcs	V0541	Charcoal Manufacturing	Incineration	35	Y	Y						1,776	0	0	0	1,776	1,776	1,776
allcs	SCHEM	Chemical Manufacturing	FGD Scrubber	106				Y				0	0	1,627	0	232	7,317	71,688
allcs	P1001	Coal clean.-material handling	Local hood/venturi scrubber	449					Y	Y		0	0	0	1,527	331	8,360	94,156
allcs	P1002	Coal clean.-material handling	Local hood/fabric filter	452					Y	Y		0	0	0	500	17	974	8,456
allcs	P1003	Coal clean.-material handling	Water suppression	71					Y	Y		0	0	0	8,099	6,915	8,184	17,669
allcs	P1701	Coal cleaning - thermal dryers	Venturi scrubber	4					Y	Y		0	0	0	521	512	908	2,092
allcs	P0101	Coke mfg - oven pushing	Partial shed to baghouse	29					Y	Y		0	0	0	29,504	8,605	26,781	45,558
allcs	P0201	Coke sizing & screening - cold	Total enclosure to baghouse	1					Y	Y		0	0	0	4,244	4,244	4,244	4,244
allcs	n05901	Comm/Instit Incinerators	Selective Noncatalytic Redctn	7			Y					0	2,810	0	0	2,799	2,809	2,822
allcs	V1089	Fabric Coating	Incineration	1	Y							8,200	0	0	0	8,200	8,200	8,200
O3INC	n02405	Gas Turbines - Natural Gas	SCR + Steam Injection	72			Y					0	74,638	0	0	34,140	98,407	208,448
PMINC	n02405	Gas Turbines - Natural Gas	SCR + Steam Injection	178			Y					0	73,853	0	0	35,831	568,704	2,728,167
allcs	n02403	Gas Turbines - Natural Gas	Low-NOx Burners	64			Y					0	333	0	0	248	537	5,537
allcs	n02404	Gas Turbines - Natural Gas	SCR + Low-NOx Burners	6			Y					0	14,307	0	0	6,826	28,245	71,887
allcs	n02405	Gas Turbines - Natural Gas	SCR + Steam Injection	481			Y					0	48,132	0	0	668	49,502	466,613
allcs	n02406	Gas Turbines - Natural Gas	SCR + Water Injection	2			Y					0	38,266	0	0	32,795	40,607	48,418
allcs	n02301	Gas Turbines - Oil	Water Injection	1			Y					0	1,275	0	0	1,275	1,275	1,275
allcs	n02302	Gas Turbines - Oil	SCR + Water Injection	55			Y					0	19,311	0	0	17,500	19,717	24,233
allcs	n03104	Glass Manufacturing - Flat	Selective Catalytic Reduction	4			Y					0	1,483	0	0	1,440	17,071	63,833
allcs	n03105	Glass Manufacturing - Flat	Oxy-Firing	21			Y					0	15,121	0	0	10,101	44,568	534,000
allcs	n03005	Glass Mfg - Container	Selective Catalytic Reduction	16			Y					0	2,198	0	0	1,706	2,685	5,332
allcs	n03006	Glass Mfg - Container	Oxy-Firing	112			Y					0	23,797	0	0	15,695	32,302	96,303
allcs	n03206	Glass Mfg - Pressed/Blown	Oxy-Firing	26			Y					0	24,856	0	0	18,028	34,501	101,958
allcs	PGELE	Grain Elevators	Oil Suppression	190					Y	Y		0	0	0	2,413	2,409	2,416	2,424
allcs	n02210	IC Engines- Gas	Low Emission Combustion	1,980			Y					0	151	0	0	38	181	12,919
allcs	n02212	IC Engines- Gas	Nonselective Catalytic Redctn	1,964			Y					0	6,927	0	0	79	24,579	636,422
allcs	n02101	IC Engines- Oil	Ignition Timing Retard	22			Y					0	411	0	0	204	528	561
allcs	n04601	IC Engines - Gas, Diesel, LPG	Ignition Timing Retard	621			Y					0	545	0	0	467	553	800
allcs	n04604	IC Engines - Gas, Diesel, LPG	Selective Catalytic Reduction	622			Y					0	2,110	0	0	1,200	2,093	2,440
allcs	n02104	ICEngines- Oil	Selective Catalytic Reduction	1,310			Y					0	2,162	0	0	1,184	2,126	4,953

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STRAT Code ^a	MEAS ID ^b	SOURCE CATEGORY	MEASURE NAME	COUNT ^c	Pollutant Reduced						Average Nationwide Cost Per Ton ^d (single pollutant)				Range of Cost Per Ton Incidence ^e		
					VOC	SOA	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	NOx	SO ₂	PM ₁₀	Min.	Avg.	Max.
allcs	SICIX	ICI Boilers	Scrubber	1,626				Y			0	0	2,491	0	166	12,782	1,239,857
allcs	n04401	ICI Boilers - Bagasse	SNCR - Urea Based	41			Y				0	3,337	0	0	1,118	22,700	192,589
allcs	PICIC	ICI Boilers - Coal	Fabric Filter	956					Y	Y	0	0	0	4,190	23	25,505	474,751
allcs	n01401	ICI Boilers - Coal/Cyclone	Selective Noncatalytic Redctn	1			Y				0	1,917	0	0	1,917	1,917	1,917
allcs	n01404	ICI Boilers - Coal/Cyclone	Natural Gas Reburn	1			Y				0	2,975	0	0	2,975	2,975	2,975
allcs	n01201	ICI Boilers - Coal/FBC	SNCR - Urea Based	6			Y				0	1,431	0	0	841	1,920	3,467
allcs	n01301	ICI Boilers - Coal/Stoker	SNCR - Urea Based	29			Y				0	2,129	0	0	466	4,342	12,079
allcs	n01101	ICI Boilers - Coal/Wall	SNCR - Urea Based	9			Y				0	886	0	0	371	2,040	11,188
allcs	n01103	ICI Boilers - Coal/Wall	Low-NOx Burners	29			Y				0	864	0	0	366	3,302	47,897
allcs	n01104	ICI Boilers - Coal/Wall	Selective Catalytic Reduction	314			Y				0	10,272	0	0	115	49,101	1,302,848
allcs	n04201	ICI Boilers - Coke	SNCR - Urea Based	9			Y				0	778	0	0	363	1,154	2,712
allcs	n04203	ICI Boilers - Coke	Low-NOx Burners	8			Y				0	3,338	0	0	2,389	3,198	3,998
allcs	n04204	ICI Boilers - Coke	Selective Catalytic Reduction	9			Y				0	8,439	0	0	4,187	10,957	37,307
allcs	n01601	ICI Boilers - Distillate Oil	Low-NOx Burners	30			Y				0	3,978	0	0	284	4,347	50,742
allcs	n01602	ICI Boilers - Distillate Oil	LNB + Flue Gas Recirculation	34			Y				0	511,234	0	0	4,900	146,330	4,135,550
allcs	n01603	ICI Boilers - Distillate Oil	Selective Catalytic Reduction	492			Y				0	8,125	0	0	85	49,770	10,337,925
allcs	PICIG	ICI Boilers - Gas	Fabric Filter	1,972					Y	Y	0	0	0	13,267	22	68,861	6,996,274
allcs	n04501	ICI Boilers - Liquid Waste	Low-NOx Burners	33			Y				0	257	0	0	8	2,070	14,662
allcs	n04502	ICI Boilers - Liquid Waste	LNB + Flue Gas Recirculation	2			Y				0	9,707	0	0	3,092	9,165	15,237
allcs	n04503	ICI Boilers - Liquid Waste	Selective Catalytic Reduction	33			Y				0	1,167	0	0	151	14,185	116,392
allcs	n04301	ICI Boilers - LPG	Low-NOx Burners	22			Y				0	112	0	0	3	1,974	7,415
allcs	n04302	ICI Boilers - LPG	LNB + Flue Gas Recirculation	2			Y				0	8,911	0	0	7,250	8,318	9,386
allcs	n04303	ICI Boilers - LPG	Selective Catalytic Reduction	22			Y				0	1,496	0	0	184	22,354	116,461
allcs	n02001	ICI Boilers - MSW/Stoker	SNCR - Urea Based	41			Y				0	1,858	0	0	412	6,507	75,410
allcs	n01701	ICI Boilers - Natural Gas	Low-NOx Burners	48			Y				0	41	0	0	0	332	1,405
allcs	n01702	ICI Boilers - Natural Gas	LNB + Flue Gas Recirculation	361			Y				0	10,607	0	0	3,300	10,163	11,333
allcs	n01703	ICI Boilers - Natural Gas	Oxygen Trim + Water Injection	262			Y				0	487	0	0	12	1,199	12,390
allcs	n01704	ICI Boilers - Natural Gas	Selective Catalytic Reduction	4,953			Y				0	8,258	0	0	23	14,496	1,736,467
allcs	PICIO	ICI Boilers - Oil	Fabric Filter	2,530					Y	Y	0	0	0	10,678	375	42,426	7,257,569
allcs	n04101	ICI Boilers - Process Gas	Low-NOx Burners	8			Y				0	376	0	0	243	380	436

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					VOC	SOA	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	NOx	SO ₂	PM ₁₀	Min.	Avg.	Max.
allcs	n04103	ICI Boilers - Process Gas	Oxygen Trim + Water Injection	171			Y				0	383	0	0	8	854	10,000
allcs	n04104	ICI Boilers - Process Gas	Selective Catalytic Reduction	750			Y				0	6,416	0	0	10	18,771	656,400
allcs	n01501	ICI Boilers - Residual Oil	Low-NOx Burners	146			Y				0	658	0	0	65	1,298	36,570
allcs	n01502	ICI Boilers - Residual Oil	LNB + Flue Gas Recirculation	4			Y				0	3,520	0	0	1,100	3,213	5,100
allcs	n01503	ICI Boilers - Residual Oil	Selective Catalytic Reduction	2,192			Y				0	3,435	0	0	89	12,175	330,638
allcs	PICIW	ICI Boilers - Wood	Electrostatic Precipitator	767					Y	Y	0	0	0	1,905	81	13,243	688,124
allcs	n01801	ICI Boilers - Wood/Bark/Stoker	SNCR - Urea Based	823			Y				0	1,275	0	0	166	5,942	197,817
allcs	n06001	Industrial Incinerators	Selective Noncatalytic Redctn	45			Y				0	2,809	0	0	2,400	2,791	3,000
allcs	P0301	Iron & steel - casthouses	Total enclosure to baghouse	20					Y	Y	0	0	0	17,062	16,806	17,345	18,805
allcs	P0402	Iron & steel - casthouses	Local hood venting to baghouse	20					Y	Y	0	0	0	8,069	7,472	11,872	28,336
allcs	n03606	Iron & Steel Mills- Annealing	Low-NOx Burners + SCR	20			Y				0	9,677	0	0	9,136	9,672	10,220
allcs	n03502	Iron & Steel Mills- Reheating	Low-NOx Burners	4			Y				0	295	0	0	295	295	295
allcs	n03503	Iron & Steel Mills- Reheating	LNB + Flue Gas Recirculation	44			Y				0	1,326	0	0	1,309	1,331	1,391
allcs	P0501	Iron&steel-hot metal transfer	Movable canopy to baghouse	1					Y	Y	0	0	0	22,699	22,699	22,699	22,699
allcs	P1601	Kraft process	ESP	80					Y	Y	0	0	0	9,347	35	469,630	1,655,816
allcs	P1602	Kraft process	Scrubber	127					Y	Y	0	0	0	10,984	3	59,526	311,949
allcs	P1603	Kraft process	Demister	75					Y	Y	0	0	0	479	83	889	3,464
allcs	V0981	Leather Products	RACT Extended to Other Areas	1	Y	Y					1,538	0	0	0	1,538	1,538	1,538
allcs	n05801	Lime Kilns	Mid-Kiln Firing	28			Y				0	568	0	0	568	568	569
allcs	n05803	Lime Kilns	SNCR - Urea Based	28			Y				0	1,221	0	0	1,220	1,221	1,224
allcs	n05805	Lime Kilns	Selective Catalytic Reduction	140			Y				0	9,849	0	0	9,831	9,849	9,861
allcs	n03901	Medical Waste Incinerators	Selective Noncatalytic Redctn	3			Y				0	12,615	0	0	10,800	12,014	12,630
allcs	P0901	Min. prod. - material handling	Local hood/venturi scrubber	314					Y	Y	0	0	0	1,773	1	24,283	109,298
allcs	P0902	Min. prod. - material handling	Local hood/fabric filter	316					Y	Y	0	0	0	802	118	2,704	9,571
allcs	P0903	Min. prod. - material handling	Water suppression	170					Y	Y	0	0	0	8,162	7,221	8,234	16,347
allcs	P0601	Mineral prod- dryers/furnaces	Venturi scrubber	206				Y	Y	Y	0	0	15,685	2,804	493	23,828	760,680
allcs	P0602	Mineral prod- dryers/furnaces	Fabric filter system	56					Y	Y	0	0	0	1,375	275	3,405	20,749
allcs	P1201	Mineral prod- loading/storage	Water suppression	469					Y	Y	0	0	0	8,025	7,222	8,177	16,770
allcs	P1501	Mineral prod. - vehicle travel	Chemical suppression	82					Y	Y	0	0	0	255	239	253	726
allcs	SMINP	Mineral Products	FGD Scrubber	421			Y				0	0	10,149	0	902	34,663	399,254

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					VOC	SOA	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	NOx	SO ₂	PM ₁₀	Min.	Avg.	Max.
allcs	n03801	Municipal Waste Combustors	Selective Noncatalytic Redctn	4			Y				0	2,810	0	0	2,810	2,810	2,811
allcs	n02901	Nitric Acid Manufacturing	Extended Absorption	1			Y				0	8,650	0	0	8,650	8,650	8,650
allcs	n02903	Nitric Acid Manufacturing	Nonselective Catalytic Redctn	46			Y				0	11,482	0	0	8,521	10,346	20,669
allcs	P1801	Ore crushing	Fabric filter	1,193					Y	Y	0	0	0	10,923	32	13,259	54,574
allcs	P2001	Ore crushing/grinding	Fabric filter	5					Y	Y	0	0	0	22,149	14,079	22,423	27,803
allcs	P1901	Ore grinding	Fabric filter	734					Y	Y	0	0	0	7,222	79	8,558	66,224
allcs	V0971	Organic Acids Manufacture	RACT Extended to Other Areas	72	Y						1,607	0	0	0	1,538	1,609	1,616
allcs	SPETR	Petroleum Industry	FGD Scrubber	818				Y			0	0	6,745	0	86	35,852	459,256
allcs	P0701	Phosphate rock calcining	Venturi scrubber	5				Y	Y	Y	0	0	569	313	95	132	278
allcs	V0389	Plastic Parts Coating	Incineration	130	Y	Y					8,937	0	0	0	8,893	8,938	8,996
allcs	P0801	Prim. metals-material handling	Local hood/venturi scrubber	175					Y	Y	0	0	0	1,360	306	9,733	45,388
allcs	P0802	Prim. metals-material handling	Local hood/fabric filter	176					Y	Y	0	0	0	535	70	820	4,683
allcs	P0803	Prim. metals-material handling	Water suppression	13					Y	Y	0	0	0	8,127	7,884	8,109	8,673
allcs	SPMET	Primary Metal Production	FGD Scrubber	250				Y			0	0	7,266	0	187	31,971	363,162
allcs	P1301	Primary metals: vehicle travel	Chemical suppression	2					Y	Y	0	0	0	377	372	945	1,517
allcs	V1801	Printing - Letterpress	Carbon Adsorption	21	Y	Y					510	0	0	0	247	994	4,514
allcs	V1821	Printing - Lithographic	New CTG to Other Areas	46	Y	Y					(490)	0	0	0	(544)	(499)	(333)
allcs	n02504	Process Heaters-Distillate Oil	Ultra-low-NOx Burners	45			Y				0	948	0	0	292	1,376	3,067
allcs	n02506	Process Heaters-Distillate Oil	Low-NOx Burners + SNCR	60			Y				0	20,343	0	0	5,335	46,385	234,090
allcs	n02507	Process Heaters-Distillate Oil	Low-NOx Burners + SCR	225			Y				0	29,763	0	0	5,576	39,370	324,800
allcs	n04804	Process Heaters - LPG	Ultra-low-NOx Burners	2			Y				0	774	0	0	774	775	775
allcs	n04807	Process Heaters - LPG	Low-NOx Burners + SCR	2			Y				0	30,933	0	0	30,411	30,683	30,954
allcs	n02704	Process Heaters - Natural Gas	Ultra-low-NOx Burners	145			Y				0	810	0	0	20	1,556	14,157
allcs	n02706	Process Heaters - Natural Gas	Low-NOx Burners + SNCR	3,223			Y				0	15,765	0	0	4,083	30,521	4,140,200
allcs	n02707	Process Heaters - Natural Gas	Low-NOx Burners + SCR	3,275			Y				0	39,833	0	0	4,457	75,958	15,900,750
allcs	n04904	Process Heaters - Other Fuel	Ultra-low-NOx Burners	4			Y				0	531	0	0	463	484	539
allcs	n04907	Process Heaters - Other Fuel	Low-NOx Burners + SCR	4			Y				0	18,437	0	0	17,571	18,148	18,444
allcs	n04704	Process Heaters - Process Gas	Ultra-low-NOx Burners	579			Y				0	604	0	0	337	794	9,736
allcs	n04706	Process Heaters - Process Gas	Low-NOx Burners + SNCR	668			Y				0	13,991	0	0	5,200	27,278	826,133
allcs	n04707	Process Heaters - Process Gas	Low-NOx Burners + SCR	685			Y				0	36,070	0	0	19,332	57,984	1,204,600

Note: Inclusion of control measures in this analysis does not represent selection of such control measures in future implementation strategies. Measures are included for illustrative purposes only. All costs and emission reductions are estimates.

**TABLE B.1
SUMMARY OF CONTROL MEASURES**

STRAT Code ^a	MEAS ID ^b	SOURCE CATEGORY	MEASURE NAME	COUNT ^c	Pollutant Reduced						Average Nationwide Cost Per Ton ^d (single pollutant)				Range of Cost Per Ton Incidence ^e		
					VOC	SOA	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	NOx	SO ₂	PM ₁₀	Min.	Avg.	Max.
allcs	n02604	Process Heaters - Residual Oil	Ultra-low-NOx Burners	1			Y				0	465	0	0	465	465	465
allcs	n02605	Process Heaters - Residual Oil	Low-NOx Burners + SNCR	3			Y				0	16,367	0	0	14,600	16,367	19,900
allcs	n02607	Process Heaters - Residual Oil	Low-NOx Burners + SCR	233			Y				0	18,427	0	0	17,566	18,495	22,650
allcs	SPULP	Pulp and Paper Industry	FGD Scrubber	277				Y			0	0	10,739	0	864	40,584	437,151
allcs	V1701	Service Stations- Stage I	Vapor Balance	3	Y	Y					68	0	0	0	62	88	135
allcs	V0571	SOCMI - Distillation	New CTG level control	64	Y	Y					1,372	0	0	0	817	2,737	8,069
allcs	V0561	SOCMI - Reactor Processes	New CTG level control	67	Y	Y					454	0	0	0	454	454	454
allcs	n05403	Space Heaters - Distillate Oil	Selective Catalytic Reduction	18			Y				0	12,987	0	0	2,826	34,065	251,459
allcs	n05503	Space Heaters - Natural Gas	Oxygen Trim + Water Injection	563			Y				0	774	0	0	717	774	825
allcs	n05504	Space Heaters - Natural Gas	Selective Catalytic Reduction	606			Y				0	8,777	0	0	87	23,748	326,473
allcs	P1401	Surface mining: vehicle travel	Chemical suppression	25					Y	Y	0	0	0	1,106	191	1,825	5,904
allcs	P1101	Surface mining-loading/storage	Water suppression	127					Y	Y	0	0	0	7,712	6,890	7,689	18,025
allcs	V0171	Terephthalic Acid Manufacture	Incineration	2	Y	Y					10,652	0	0	0	930	5,836	10,741
allcs	V0961	Urea Resins - General	RACT Extended to Other Areas	3	Y	Y					1,563	0	0	0	1,509	1,550	1,571
O3INC	n00206	Utility Boiler-Coal/Tangential	Selective Catalytic Reduction	39			Y				0	1,210	0	0	1,036	1,334	2,511
PMINC	n00206	Utility Boiler-Coal/Tangential	Selective Catalytic Reduction	39			Y				0	1,208	0	0	1,036	1,332	2,511
O3INC	n00107	Utility Boiler - Coal/Wall	Selective Catalytic Reduction	45			Y				0	1,066	0	0	889	1,213	2,643
PMINC	n00107	Utility Boiler - Coal/Wall	Selective Catalytic Reduction	45			Y				0	1,066	0	0	889	1,213	2,643
O3INC	n00510	Utility Boiler - Oil-Gas/Wall	Selective Catalytic Reduction	51			Y				0	6,050	0	0	1,088	27,863	193,699
PMINC	n00511	Utility Boiler - Oil-Gas/Wall	Selective Catalytic Reduction	110			Y				0	17,619	0	0	1,088	59,792	140,343
PMINC	PUTILC	Utility Boilers - Coal	Fabric Filter	53					Y	Y	0	0	0	2,695	316	4,298	11,389
PMINC	PUTILG	Utility Boilers - Gas	Fabric Filter	197					Y	Y	0	0	0	313,215	1,651	572,318	2,507,957
allcs	V0281	Vegetable Oil Manufacture	Stripper and Equipment	18	Y						(21)	0	0	0	(145)	804	7,479
allcs	V0531	Whiskey Fermentation - Aging	Carbon Adsorption	16	Y						34	0	0	0	34	34	34
allcs	V0399	Wood Furniture Coating	Incineration	290	Y	Y					8,937	0	0	0	8,855	8,937	8,987
AREA SOURCE CONTROL MEASURES																	
allcs	V2262	Adhesives - Industrial	SCAQMD 1168 (Content Limits)	2,933	Y	Y					2,109	0	0	0	2,022	2,109	2,178
allcs	V2263	Adhesives - Industrial	SC 1168 Am. (Content Limits)	2,780	Y	Y					7,189	0	0	0	4,500	7,178	9,900
allcs	V2483	Aerosols	CARB Tier 2 Stds - Reform.	2,972	Y	Y					293	0	0	0	292	293	295
allcs	Pagbu	Agricultural Burning	Bale Stack/Propane Burning	370					Y	Y	0	0	0	5,252	1,831	3,321	8,164

Note: Inclusion of control measures in this analysis does not represent selection of such control measures in future implementation strategies. Measures are included for illustrative purposes only. All costs and emission reductions are estimates.

**TABLE B.1
SUMMARY OF CONTROL MEASURES**

STRAT Code ^a	MEAS ID ^b	SOURCE CATEGORY	MEASURE NAME	COUNT ^c	Pollutant Reduced						Average Nationwide Cost Per Ton ^d (single pollutant)				Range of Cost Per Ton Incidence ^e		
					VOC	SOA	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	NOx	SO ₂	PM ₁₀	Min.	Avg.	Max.
allcs	Pagtl	Agricultural Tilling	Soil Conservation Plans	2,922					Y	Y	0	0	0	138	133	138	150
allcs	V2202	Architectural Coatings	SCAQMD 1113 (Phase I Limits)	3,078	Y	Y					4,076	0	0	0	3,856	4,127	22,281
allcs	V2462	Autobody Refinishing	CARB BARCT Limits	2,520	Y	Y					4,018	0	0	0	3,896	4,021	4,138
allcs	V2463	Autobody Refinishing	FIP VOC Content + Improved TE	2,520	Y	Y					15,177	0	0	0	15,073	15,176	15,740
allcs	V2712	Bakeries >100,000 lbs brd/day	Incineration	490	Y						1,470	0	0	0	1,469	1,470	1,471
allcs	Pcalf	Beef Cattle Feedlots	Watering	1,290					Y	Y	0	0	0	307	306	307	307
allcs	n10601	Comm/Instit - NG Consumption	Water Heater Replacement	2,964			Y				0	0	0	0	0	0	0
allcs	n10602	Comm/Instit - NG Consumption	Low NOx Water/Space Heater	2,964			Y				0	1,608	0	0	1,527	1,608	1,660
allcs	Penst	Construction Activities	Dust Control Plan	2,605					Y	Y	0	0	0	3,600	3,600	3,600	3,600
O3INC	VCONS	Consumer Solvent	CARB Mid-Term Limits	12,162					Y	Y	2,101	0	0	0	1,857	2,101	2,533
allcs	V2721	Cutback Asphalt	Switch to Emulsified Asphalts	2,612	Y	Y					0	0	0	0	0	0	0
allcs	V2222	Ind. Maintenance Coatings	SCAQMD 1113 (Phase I Limits)	2,500	Y	Y					4,083	0	0	0	3,804	4,065	14,732
allcs	n10001	Industrial Coal Combustion	RACT to 50 tpy (LNB)	1,530			Y				0	1,350	0	0	700	1,344	2,000
allcs	n10002	Industrial Coal Combustion	RACT to 25 tpy (LNB)	1,557			Y				0	1,350	0	0	850	1,352	2,200
allcs	n10201	Industrial NG Combustion	RACT to 50 tpy (LNB)	2,383			Y				0	770	0	0	714	771	900
allcs	n10202	Industrial NG Combustion	RACT to 25 tpy (LNB)	2,477			Y				0	770	0	0	650	770	867
allcs	n10101	Industrial Oil Combustion	RACT to 50 tpy (LNB)	2,880			Y				0	905	0	0	500	1,031	1,700
allcs	n10102	Industrial Oil Combustion	RACT to 25 tpy (LNB)	3,084			Y				0	1,010	0	0	100	1,005	2,100
allcs	V2474	Mach/Electr./Railrd Coating	SCAQMD 1107 (Content Limits)	1,192	Y	Y					3,888	0	0	0	2,822	3,930	5,404
allcs	V2519	Marine Surface Coating	Incineration	622	Y	Y					8,937	0	0	0	8,300	8,937	9,160
allcs	V2239	Metal Coil and Can Coating	Incineration	1,702	Y	Y					8,937	0	0	0	8,663	8,939	9,188
allcs	V2454	Metal Furn/Appli/Parts Coating	SCAQMD 1107 (Content Limits)	4,062	Y	Y					4,618	0	0	0	2,547	4,668	9,810
allcs	V2533	Misc Surf Coating- Electronics	SCAQMD 1164 (Add-on/Low-VOC)	1,947	Y	Y					6,795	0	0	0	5,975	6,861	7,300
allcs	V2549	Motor vehicle surface coating	Incineration	1,020	Y	Y					8,937	0	0	0	8,693	8,938	9,246
allcs	V2791	Oil and NG Production Fields	RACT (Equip/Maint) Extended	684	Y	Y					334	0	0	0	300	334	347
allcs	V2662	Open Burning	Advisory Program	4,031	Y		Y				0	0	0	0	0	0	0
allcs	V2329	Open Top/Convey. Degreasing	SCAQMD 1122 (Low-VOC Solvents)	9,820	Y	Y					100	0	0	0	100	100	100
allcs	PP170	Paved Road-Rural Major Coll.	Vacuum Sweeping	2,975					Y	Y	0	0	0	392	180	376	610
allcs	PP150	Paved Road-Rural Minor Art.	Vacuum Sweeping	2,975					Y	Y	0	0	0	348	198	333	479
allcs	PP190	Paved Road-Rural Minor Coll.	Vacuum Sweeping	2,975					Y	Y	0	0	0	491	208	436	707

Note: Inclusion of control measures in this analysis does not represent selection of such control measures in future implementation strategies. Measures are included for illustrative purposes only. All costs and emission reductions are estimates.

**TABLE B.1
SUMMARY OF CONTROL MEASURES**

STRAT Code ^a	MEAS ID ^b	SOURCE CATEGORY	MEASURE NAME	COUNT ^c	Pollutant Reduced						Average Nationwide Cost Per Ton ^d (single pollutant)				Range of Cost Per Ton Incidence ^e		
					VOC	SOA	NOx	SO ₂	PM ₁₀	PM _{2.5}	VOC	NOx	SO ₂	PM ₁₀	Min.	Avg.	Max.
allcs	PP130	Paved Road-Rural Oth Prin Art.	Vacuum Sweeping	2,975					Y	Y	0	0	0	159	93	156	224
allcs	PP290	Paved Road-Urban Minor Art.	Vacuum Sweeping	2,226					Y	Y	0	0	0	187	100	182	229
allcs	PP250	Paved Road-Urban Oth Freeway	Vacuum Sweeping	1,778					Y	Y	0	0	0	301	112	284	400
allcs	PP270	Paved Road-Urban Oth Prin Art.	Vacuum Sweeping	2,225					Y	Y	0	0	0	287	212	278	350
allcs	PP110	Paved Road - Rural Interstate	Vacuum Sweeping	2,972					Y	Y	0	0	0	1,066	660	1,055	1,432
allcs	PP210	Paved Road - Rural Local	Vacuum Sweeping	2,891					Y	Y	0	0	0	514	262	475	712
allcs	PP310	Paved Road - Urban Collector	Vacuum Sweeping	2,225					Y	Y	0	0	0	248	184	241	342
allcs	PP230	Paved Road - Urban Interstate	Vacuum Sweeping	2,158					Y	Y	0	0	0	650	249	634	1,008
allcs	PP330	Paved Road - Urban Local	Vacuum Sweeping	2,226					Y	Y	0	0	0	846	389	810	1,089
allcs	V2952	Pesticide Application	CA FIP Rule - Reformulation	3,106	Y	Y					9,300	0	0	0	8,067	9,302	11,150
allcs	Ppreb	Prescribed Burning	Increase Fuel Moisture	989					Y	Y	0	0	0	2,618	2,616	2,618	2,633
allcs	n10901	Residential NG Combustion	Water Heater Replacement	3,049			Y				0	0	0	0	0	0	0
allcs	n10902	Residential NG Combustion	Low NOx Water/Space Heater	3,049			Y				0	1,608	0	0	1,550	1,608	1,700
allcs	Presw	Residential Wood Combustion	Education and Advisory Program	3,159	Y	Y			Y	Y	947	0	0	1,320	895	982	4,657
allcs	V2441	Rubber & Plastics Mfg	SCAQMD 1145 (Low-VOC Coatings)	1,540	Y	Y					1,030	0	0	0	1,025	1,030	1,050
allcs	V2833	Serv.Stations- Undergrnd Tanks	P/V Vents + Vapor Balan	2,776	Y	Y					25	0	0	0	20	25	29
allcs	V2803	Service Stations - Stage I	P/V Vents + Vapor Balan	2,685	Y	Y					25	0	0	0	20	25	50
allcs	V2212	Traffic Marking Paints	SCAQMD 1113 (Phase I Limits)	2,958	Y	Y					3,940	0	0	0	3,837	3,941	4,100
allcs	PU270	Unpaved Rd-Urban Oth Prin Art.	Hot Asphalt Paving	218					Y	Y	0	0	0	508	0	421	1,360
allcs	PU170	Unpaved Road-Rural Major Coll.	Chemical Stabilization	1,664					Y	Y	0	0	0	2,348	0	2,995	7,250
allcs	PU150	Unpaved Road-Rural Minor Art.	Chemical Stabilization	93					Y	Y	0	0	0	1,199	784	1,208	2,417
allcs	PU190	Unpaved Road-Rural Minor Coll.	Chemical Stabilization	2,620					Y	Y	0	0	0	2,609	1,403	3,231	6,444
allcs	PU290	Unpaved Road-Urban Minor Art.	Hot Asphalt Paving	1,473					Y	Y	0	0	0	574	0	482	2,267
allcs	PU210	Unpaved Road - Rural Local	Chemical Stabilization	3,018					Y	Y	0	0	0	2,664	1,403	3,170	6,360
allcs	PU310	Unpaved Road - Urban Collector	Hot Asphalt Paving	1,799					Y	Y	0	0	0	566	0	557	1,836
allcs	PU330	Unpaved Road - Urban Local	Hot Asphalt Paving	2,191					Y	Y	0	0	0	548	0	627	1,821
allcs	V2851	Web Offset Lithography	New CTG level control	2,352	Y	Y					(105)	0	0	0	(120)	(105)	(100)

a Strat. Code = Code indicating whether the measure is evaluated incremental to partial attainment of the ozone standards (O3INC), PM standards (PMINC), or both (allcs)

b Meas. ID = Control measure identification code

c COUNT= Potential number of point sources (for points source measures) or counties (for area and mobile source measures) to which the control measure can be applied nationwide. (continued...)

- d Average nationwide cost per ton calculated by dividing total nationwide emission reduction for the specified pollutant by the total annual incremental cost of the control measure. All costs are expressed in 1990 dollars.
- e Range of cost per ton values derived from the array of cost per ton values for individual applications of each control measure (i.e., the collection of cost per ton values associated with the number of potentially affected sources in the COUNT column. The average cost per ton incidence is calculated as the average of each cost per ton value in the collection of cost per ton values associated with each potentially affected source, and may differ from the average nationwide cost per ton values appearing in the preceding columns. All costs are expressed in 1990 dollars.

APPENDIX B.2

DOCUMENTATION OF CONTROL MEASURES BY SOURCE CATEGORY¹

Source Category ²	Control Measure Description	Reference ³
STATIONARY POINT VOC SOURCES		
Aircraft Surface Coating	Incineration	Pechan, 1994a
Beverage Can Surface Coating	Incineration	Pechan, 1994a
Carbon Black Manufacture	Flare	Pechan, 1989
Cellulose Acetate Manufacture	Carbon Adsorption	Pechan, 1989
Charcoal Manufacturing	Incineration	Pechan, 1989
Commercial Bread Bakeries (>100,000 pounds of bread/day)*	Incineration at Oven Vent	Pechan, 1997
Fabric Coating	Incineration	Pechan, 1994b
Leather Products	RACT for Ozone Nonattainment Areas Extended to Attainment Areas	Pechan, 1994b
Organic Acids Manufacture	RACT for Ozone Nonattainment Areas Extended to Attainment Areas	Pechan, 1994b
Plastic Parts Surface Coating	Incineration	Pechan, 1994a
Printing - Letterpress	Carbon Adsorption	Pechan, 1989
Printing - Lithographic	New CTG Level of Control Extended to Other Areas	Pechan, 1994c
Service Stations- Stage I	Vapor Balance/Submerged Fill	Pechan, 1989
SOCMI - Distillation	New CTG Level of Control	Pechan, 1994c
SOCMI - Reactor Processes	New CTG Level of Control	Pechan, 1994c
Terephthalic Acid Manufacture	Incineration	Pechan, 1989
Urea Resins - General	RACT for Ozone Nonattainment Areas Extended to Attainment Areas	Pechan, 1994b
Vegetable Oil Manufacture	Stripper and Equipment	Pechan, 1989
Whiskey Fermentation - Aging	Carbon Adsorption	Pechan, 1989
Wood Furniture Surface Coating	Incineration	Pechan, 1994c
STATIONARY AREA/NONROAD VOC SOURCES		
Adhesives - Industrial*	VOC Content Limits (Based on SCAQMD's Rule 1168)	Pechan, 1997
Adhesives - Industrial*	VOC Content Limits (Based on SCAQMD's Amendments to Rule 1168)	Pechan, 1997
Aerosol Paints*	Reformulation (Based on CARB Tier 2 Standards)	Pechan, 1997
Architectural Coatings*	Phase I VOC Limits (Based on SCAQMD's Rule 1113)	Pechan, 1997
Autobody Refinishing	CARB BARCT Limits	Pechan, 1994a
Autobody Refinishing	VOC Content Limits + Improved Transfer Efficiency (Based on California Federal Implementation Plan Rule for Ozone Nonattainment Areas)	Pechan, 1994a
Commercial Bread Bakeries (>100,000 pounds of bread/day)*	Incineration	Pechan, 1997
Consumer Products*	CARB Mid-Term Limits	Pechan, 1997
Cutback Asphalt	Switch to Emulsified Asphalts	Pechan, 1989
Industrial Maintenance Coatings*	Phase I VOC Limits (Based on SCAQMD's Rule 1113)	Pechan, 1997
Machinery and Railroad Equipment Coating*	VOC Content Limits (Based on SCAQMD Rule 1107)	Pechan, 1997
Marine Surface Coating	Incineration	Pechan, 1994a
Metal Can and Coil Coating*	Incineration	Pechan, 1994a
Metal Furniture/Appliances/Miscellaneous Parts Coating*	VOC Content Limits (Based on SCAQMD Rule 1107)	Pechan, 1997
Miscellaneous Surface Coating - Electronics*	Add-on Control Equipment/Low-VOC Coatings (Based on SCAQMD's Rule 1164)	Pechan, 1997
Motor Vehicle and Mobile Equipment Surface Coating	Incineration	Pechan, 1994a
Nonroad Gasoline Engines	Federal Reformulated Gasoline	Pechan, 1994a
Oil and Natural Gas Production Fields	RACT for Ozone Nonattainment Areas Extended to Attainment Areas (Based on Equipment Inspection & Maintenance Program)	Pechan, 1989
Open Burning	Advisory Program	Pechan, 1994a

APPENDIX B.2 (continued)

DOCUMENTATION OF CONTROL MEASURES BY SOURCE CATEGORY¹

Source Category ²	Control Measure Description	Reference ³
Open-Top and ConveyORIZED Degreasing*	Low-VOC Solvents (Based on SCAQMD's Rule 1122)	Pechan, 1997
Pesticide Application	Reformulation (Based on California Federal Implementation Plan Rule for Ozone Nonattainment Areas)	Pechan, 1994a
Rubber & Plastics Manufacture*	Low-VOC Coatings (Based on SCAQMD's Rule 1145)	Pechan, 1997
Service Stations - Stage I	Pressure Vacuum Valves Installed on Underground Storage Tank Vents + Vapor Balance	Pechan, 1994a
Service Stations - Underground Tanks	Pressure Vacuum Valves Installed on Underground Storage Tank Vents + Vapor Balance	Pechan, 1994a
Traffic Marking Paints*	Phase I VOC Limits (Based on SCAQMD's Rule 1113)	Pechan, 1997
Web Offset Lithography*	New CTG Level of Control	Pechan, 1997
STATIONARY POINT NO_x SOURCES		
Ammonia - Natural Gas - Fired Reformers*	Oxygen Trim + Water Injection	Pechan, 1997
Ammonia - Natural Gas - Fired Reformers*	Selective Catalytic Reduction	Pechan, 1997
Ammonia - Oil-Fired Reformers*	Low-NO _x Burners	Pechan, 1997
Ammonia - Oil-Fired Reformers*	Selective Catalytic Reduction	Pechan, 1997
Cement Manufacturing - Dry Process	Mid-Kiln Firing	Pechan, 1996
Cement Manufacturing - Dry Process	Selective Catalytic Reduction	Pechan, 1996
Cement Manufacturing - Dry Process	Selective Noncatalytic Reduction - Urea Based	Pechan, 1996
Cement Manufacturing - Wet Process	Mid-Kiln Firing	Pechan, 1996
Cement Manufacturing - Wet Process	Selective Catalytic Reduction	Pechan, 1996
Gas Turbines - Natural Gas	Low-NO _x Burners	Pechan, 1996
Gas Turbines - Natural Gas	Selective Catalytic Reduction + Low-NO _x Burners	Pechan, 1996
Gas Turbines - Natural Gas	Selective Catalytic Reduction + Steam Injection	Pechan, 1996
Gas Turbines - Natural Gas	Selective Catalytic Reduction + Water Injection	Pechan, 1996
Gas Turbines - Oil	Selective Catalytic Reduction + Water Injection	Pechan, 1996
Gas Turbines - Oil	Water Injection	Pechan, 1996
Glass Manufacture - Container	Oxy-Firing	Pechan, 1996
Glass Manufacture - Container	Selective Catalytic Reduction	Pechan, 1996
Glass Manufacture - Pressed/Blown	Oxy-Firing	Pechan, 1996
Glass Manufacturing - Flat	Oxy-Firing	Pechan, 1996
Glass Manufacturing - Flat	Selective Catalytic Reduction	Pechan, 1996
ICI Boilers - Bagasse*	Selective Noncatalytic Reduction - Urea Based	Pechan, 1997
ICI Boilers - Coal/Cyclone	Natural Gas Reburn	Pechan, 1996
ICI Boilers - Coal/Cyclone	Selective Noncatalytic Reduction	Pechan, 1996
ICI Boilers - Coal/Fluidized Bed Combustion	Selective Noncatalytic Reduction - Urea Based	Pechan, 1996
ICI Boilers - Coal/Stoker	Selective Noncatalytic Reduction - Urea Based	Pechan, 1996
ICI Boilers - Coal/Wall	Low-NO _x Burners	Pechan, 1996
ICI Boilers - Coal/Wall	Selective Catalytic Reduction	Pechan, 1996
ICI Boilers - Coal/Wall	Selective Noncatalytic Reduction - Urea Based	Pechan, 1996
ICI Boilers - Coke*	Low-NO _x Burners	Pechan, 1997
ICI Boilers - Coke*	Selective Catalytic Reduction	Pechan, 1997
ICI Boilers - Coke*	Selective Noncatalytic Reduction - Urea Based	Pechan, 1997
ICI Boilers - Distillate Oil	Low-NO _x Burners	Pechan, 1996
ICI Boilers - Distillate Oil	Low-NO _x Burners + Flue Gas Recirculation	Pechan, 1996
ICI Boilers - Distillate Oil	Selective Catalytic Reduction	Pechan, 1996
ICI Boilers - Liquid Waste*	Low-NO _x Burners	Pechan, 1997
ICI Boilers - Liquid Waste*	Low-NO _x Burners + Flue Gas Recirculation	Pechan, 1997
ICI Boilers - Liquid Waste*	Selective Catalytic Reduction	Pechan, 1997
ICI Boilers - Liquified Petroleum Gas*	Low-NO _x Burners	Pechan, 1997
ICI Boilers - Liquified Petroleum Gas*	Low-NO _x Burners + Flue Gas Recirculation	Pechan, 1997
ICI Boilers - Liquified Petroleum Gas*	Selective Catalytic Reduction	Pechan, 1997
ICI Boilers - Municipal Solid Waste/Stoker	Selective Noncatalytic Reduction - Urea Based	Pechan, 1996

APPENDIX B.2 (continued)

**DOCUMENTATION OF CONTROL MEASURES
BY SOURCE CATEGORY¹**

Source Category²	Control Measure Description	Reference³
ICI Boilers - Natural Gas	Low-NO _x Burners	Pechan, 1996
ICI Boilers - Natural Gas	Low-NO _x Burners + Flue Gas Recirculation	Pechan, 1996
ICI Boilers - Natural Gas	Oxygen Trim + Water Injection	Pechan, 1996
ICI Boilers - Natural Gas	Selective Catalytic Reduction	Pechan, 1996
ICI Boilers - Process Gas*	Low-NO _x Burners	Pechan, 1997
ICI Boilers - Process Gas*	Oxygen Trim + Water Injection	Pechan, 1997
ICI Boilers - Process Gas*	Selective Catalytic Reduction	Pechan, 1997
ICI Boilers - Residual Oil	Low-NO _x Burners	Pechan, 1996
ICI Boilers - Residual Oil	Low-NO _x Burners + Flue Gas Recirculation	Pechan, 1996
ICI Boilers - Residual Oil	Selective Catalytic Reduction	Pechan, 1996
ICI Boilers - Wood & Bark Waste/Stoker	Selective Noncatalytic Reduction - Urea Based	Pechan, 1996
Incinerators (Commercial/Institutional)*	Selective Noncatalytic Reduction	Pechan, 1997
Incinerators (Industrial)*	Selective Noncatalytic Reduction	Pechan, 1997
Internal Combustion Engines - Gas, Diesel, Liquified Petroleum Gas*	Ignition Timing Retard	Pechan, 1997
Internal Combustion Engines - Gas, Diesel, Liquified Petroleum Gas*	Selective Catalytic Reduction	Pechan, 1997
Internal Combustion Engines - Natural Gas	Low Emission Combustion	Pechan, 1996
Internal Combustion Engines - Natural Gas	Nonselective Catalytic Reduction	Pechan, 1996
Internal Combustion Engines- Oil	Ignition Timing Retard	Pechan, 1996
Internal Combustion Engines- Oil	Selective Catalytic Reduction	Pechan, 1996
Iron & Steel Mills- Reheating	Low-NO _x Burners	Pechan, 1996
Iron & Steel Mills- Reheating	Low-NO _x Burners + Flue Gas Recirculation	Pechan, 1996
Iron & Steel Mills- Annealing	Low-NO _x Burners + Selective Catalytic Reduction	Pechan, 1996
Lime Kilns*	Mid-Kiln Firing	Pechan, 1997
Lime Kilns*	Selective Catalytic Reduction	Pechan, 1997
Lime Kilns*	Selective Noncatalytic Reduction - Urea Based	Pechan, 1997
Medical Waste Incinerators	Selective Noncatalytic Reduction	Pechan, 1996
Municipal Waste Combustors	Selective Noncatalytic Reduction	Pechan, 1996
Nitric Acid Manufacturing	Extended Absorption	Pechan, 1996
Nitric Acid Manufacturing	Nonselective Catalytic Reduction	Pechan, 1996
Open Burning	Advisory Program	Pechan, 1994a
Process Heaters (Industrial) - Distillate Oil*	Ultra-Low-NO _x Burners	Pechan, 1997
Process Heaters (Industrial) - Distillate Oil*	Low-NO _x Burners + Selective Catalytic Reduction	Pechan, 1997
Process Heaters (Industrial) - Distillate Oil*	Low-NO _x Burners + Selective Noncatalytic Reduction	Pechan, 1997
Process Heaters (Industrial) - Liquified Petroleum Gas*	Ultra-Low-NO _x Burners	Pechan, 1997
Process Heaters (Industrial) - Liquified Petroleum Gas*	Low-NO _x Burners + Selective Catalytic Reduction	Pechan, 1997
Process Heaters (Industrial) - Natural Gas	Ultra-Low-NO _x Burners	Pechan, 1996
Process Heaters (Industrial) - Natural Gas	Low-NO _x Burners + Selective Catalytic Reduction	Pechan, 1996
Process Heaters (Industrial) - Natural Gas	Low-NO _x Burners + Selective Noncatalytic Reduction	Pechan, 1996
Process Heaters (Industrial) - Other Fuel*	Ultra-Low-NO _x Burners	Pechan, 1997
Process Heaters (Industrial) - Other Fuel*	Low-NO _x Burners + Selective Catalytic Reduction	Pechan, 1997
Process Heaters (Industrial) - Process Gas*	Ultra-Low-NO _x Burners	Pechan, 1997
Process Heaters (Industrial) - Process Gas*	Low-NO _x Burners + Selective Catalytic Reduction	Pechan, 1997
Process Heaters (Industrial) - Process Gas*	Low-NO _x Burners + Selective Noncatalytic Reduction	Pechan, 1997
Process Heaters (Industrial) - Residual Oil	Ultra-Low-NO _x Burners	Pechan, 1996
Process Heaters (Industrial) - Residual Oil	Low-NO _x Burners + Selective Catalytic Reduction	Pechan, 1996
Process Heaters (Industrial) - Residual Oil	Low-NO _x Burners + Selective Noncatalytic Reduction	Pechan, 1996
Space Heaters (Industrial) - Distillate Oil*	Selective Catalytic Reduction	Pechan, 1997
Space Heaters (ICI) - Natural Gas*	Oxygen Trim + Water Injection	Pechan, 1997
Space Heaters (ICI) - Natural Gas*	Selective Catalytic Reduction	Pechan, 1997
Utility Boilers - Coal/Cyclone ⁴	Selective Catalytic Reduction	EPA, 1996

APPENDIX B.2 (continued)

**DOCUMENTATION OF CONTROL MEASURES
BY SOURCE CATEGORY¹**

Source Category²	Control Measure Description	Reference³
Utility Boilers - Coal/Tangential ⁴	Selective Catalytic Reduction	EPA, 1996
Utility Boilers - Coal/Wall ⁴	Selective Catalytic Reduction	EPA, 1996
Utility Boilers - Natural Gas/Tangential ⁴	Selective Catalytic Reduction	EPA, 1996
Utility Boilers - Natural Gas/Wall ⁴	Selective Catalytic Reduction	EPA, 1996
STATIONARY AREA/NONROAD NO_x SOURCES		
Commercial/Institutional - Natural Gas Consumption*	Replace Conventional Water Heaters with Low-NO _x Units	Pechan, 1997
Commercial/Institutional - Natural Gas Consumption*	Replace Conventional Water Heaters & Space Heaters with Low-NO _x Units	Pechan, 1997
Industrial Coal Combustion	RACT Extended to Sources with NO _x Emissions of 25 tpy or more (Based on Low-NO _x Burners)	Pechan, 1996
Industrial Coal Combustion	RACT Extended to Sources with NO _x Emissions of 50 tpy or more (Based on Low-NO _x Burners)	Pechan, 1996
Industrial Natural Gas Combustion	RACT Extended to Sources with NO _x Emissions of 25 tpy or more (Based on Low-NO _x Burners)	Pechan, 1996
Industrial Natural Gas Combustion	RACT Extended to Sources with NO _x Emissions of 50 tpy or more (Based on Low-NO _x Burners)	Pechan, 1996
Industrial Oil Combustion	RACT Extended to Sources with NO _x Emissions of 25 tpy or more (Based on Low-NO _x Burners)	Pechan, 1996
Industrial Oil Combustion	RACT Extended to Sources with NO _x Emissions of 50 tpy or more (Based on Low-NO _x Burners)	Pechan, 1996
Open Burning	Episodic Ban (Modeled as one measure for VOC and NO _x)	Pechan, 1994a
Residential Natural Gas Combustion	Replace Conventional Water Heaters with Low-NO _x Units	Pechan, 1996
Residential Natural Gas Combustion	Replace Conventional Water Heaters & Space Heaters with Low-NO _x Units	Pechan, 1996
STATIONARY POINT PM-10 AND PM-2.5 SOURCES		
Coal Cleaning - Material Handling*	Water Suppression	Pechan, 1997
Coal Cleaning - Material Handling*	Local Hood Vented to Fabric Filter	Pechan, 1997
Coal Cleaning - Material Handling*	Local Hood Vented to Venturi Scrubber	Pechan, 1997
Coal Cleaning - Thermal Dryers*	Venturi Scrubber	Pechan, 1997
Coke Manufacture - Oven Pushing*	Partial Shed Vented to Fabric Filter	Pechan, 1997
Coke Sizing & Screening - Cold*	Total Enclosure Vented to Fabric Filter	Pechan, 1997
Grain Elevators*	Oil Suppression	Pechan, 1997
ICI Boilers - Coal	Fabric Filter	Pechan, 1995
ICI Boilers - Gas	Fabric Filter	Pechan, 1995
ICI Boilers - Oil	Fabric Filter	Pechan, 1995
ICI Boilers - Wood/Bark Waste*	Electrostatic Precipitator	Pechan, 1997
Iron & Steel Production - Casthouses*	Local Hood Vented to Fabric Filter	Pechan, 1997
Iron & Steel Production - Casthouses*	Total Enclosure Vented to Fabric Filter	Pechan, 1997
Iron & Steel Production - Hot Metal Transfer*	Movable Canopy Hood Vented to Fabric Filter	Pechan, 1997
Kraft Process*	Demister	Pechan, 1997
Kraft Process*	Scrubber	Pechan, 1997
Kraft Process*	Electrostatic Precipitator	Pechan, 1997
Mineral Products - Dryers/Furnaces*	Fabric Filter	Pechan, 1997
Mineral Products - Dryers/Furnaces*	Venturi Scrubber	Pechan, 1997
Mineral Products - Loading/Storage*	Water Suppression	Pechan, 1997
Mineral Products - Material Handling*	Water Suppression	Pechan, 1997
Mineral Products - Material Handling*	Local Hood Vented to Fabric Filter	Pechan, 1997
Mineral Products - Material Handling*	Local Hood Vented to Venturi Scrubber	Pechan, 1997
Mineral Products - Vehicle Travel*	Chemical Suppression	Pechan, 1997
Ore Crushing & Grinding Operations*	Fabric Filter	Pechan, 1997
Ore Crushing Operations*	Fabric Filter	Pechan, 1997
Ore Grinding Operations*	Fabric Filter	Pechan, 1997

APPENDIX B.2 (continued)

DOCUMENTATION OF CONTROL MEASURES BY SOURCE CATEGORY¹

Source Category ²	Control Measure Description	Reference ³
Phosphate Rock Calcining*	Venturi Scrubber	Pechan, 1997
Primary Metals Production - Material Handling*	Water Suppression	Pechan, 1997
Primary Metals Production - Material Handling*	Local Hood Vented to Fabric Filter	Pechan, 1997
Primary Metals Production - Material Handling*	Local Hood Vented to Venturi Scrubber	Pechan, 1997
Primary Metals Production - Vehicle Travel*	Chemical Suppression	Pechan, 1997
Surface Mining - Loading/Storage*	Water Suppression	Pechan, 1997
Surface Mining - Vehicle Travel*	Chemical Suppression	Pechan, 1997
Utility Boilers - Coal	Fabric Filter	Pechan, 1995
Utility Boilers - Gas	Fabric Filter	Pechan, 1995
STATIONARY AREA/NONROAD PM-10 AND PM-2.5 SOURCES		
Agricultural Burning	Bale Stack/Propane Burning	Pechan, 1995
Agricultural Tilling*	Soil Conservation Plans	Pechan, 1997
Beef Cattle Feedlots	Watering	Pechan, 1995
Construction Activities*	Dust Control Plan	Pechan, 1997
Nonroad Heavy Duty Diesel Engines*	Retrofit Program	Pechan, 1997
Paved Roads - Rural	Vacuum Sweeping	Pechan, 1995
Paved Roads - Urban	Vacuum Sweeping	Pechan, 1995
Prescribed Burning*	Increase Fuel Moisture	Pechan, 1997
Residential Wood Combustion*	Public Awareness & Education Program/Mandatory Curtailment	Pechan, 1997
Unpaved Roads - Rural *	Chemical Stabilization	Pechan, 1997
Unpaved Roads - Urban*	Hot Asphalt Paving	Pechan, 1997
STATIONARY POINT SO₂ SOURCES		
Chemical Manufacturing*	Flue-Gas Desulfurization Scrubber	Pechan, 1997
ICI Boilers*	Flue-Gas Desulfurization Scrubber	Pechan, 1997
Mineral Products*	Flue-Gas Desulfurization Scrubber	Pechan, 1997
Petroleum Industry*	Flue-Gas Desulfurization Scrubber	Pechan, 1997
Primary Metal Production*	Flue-Gas Desulfurization Scrubber	Pechan, 1997
Pulp and Paper Industry*	Flue-Gas Desulfurization Scrubber	Pechan, 1997
ON-HIGHWAY VEHICLE SOURCES		
Gasoline Vehicles & Trucks*	Federal Reformulated Gasoline	Pechan, 1997
Gasoline Vehicles & Trucks*	Transportation Control Package	Pechan, 1997
Heavy-Duty Diesel Vehicles*	Retrofit Program	Pechan, 1997
Light-Duty Gasoline Trucks*	Tier 2 Standards	Pechan, 1997
Light-Duty Gasoline Vehicles & Trucks*	Fleet Inherently Low-Emission Vehicle	Pechan, 1997
Light-Duty Gasoline Vehicles & Trucks*	High Enhanced Inspection & Maintenance Program	Pechan, 1997

Notes: ¹ Complete list of control measures included in ERCAM.

² Measures followed by an asterisk (*) are new or revised control measures for this RIA.

³ References for measures documented in previous reports.

⁴ For the integrated ozone/PM/Regional Haze cost analysis, NO_x control measures for utility boilers are modeled using the Integrated Planning Model rather than ERCAM (EPA, 1996). Note that the measures shown for the utility boilers in this table are not the complete list of measures that may have been modeled in the IPM analysis. See reference EPA, 1996.

BARCT=Best Available Retrofit Control Technology; CARB=California Air Resources Board; CTG=Control Techniques Guideline document; ICI=Industrial, Commercial, and Institutional; RACT=Reasonably Available Control Technology; SCAQMD=South Coast Air Quality Management District; SOCM=Synthetic Organic Chemical Manufacture Industry; and tpy=tons per year.

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