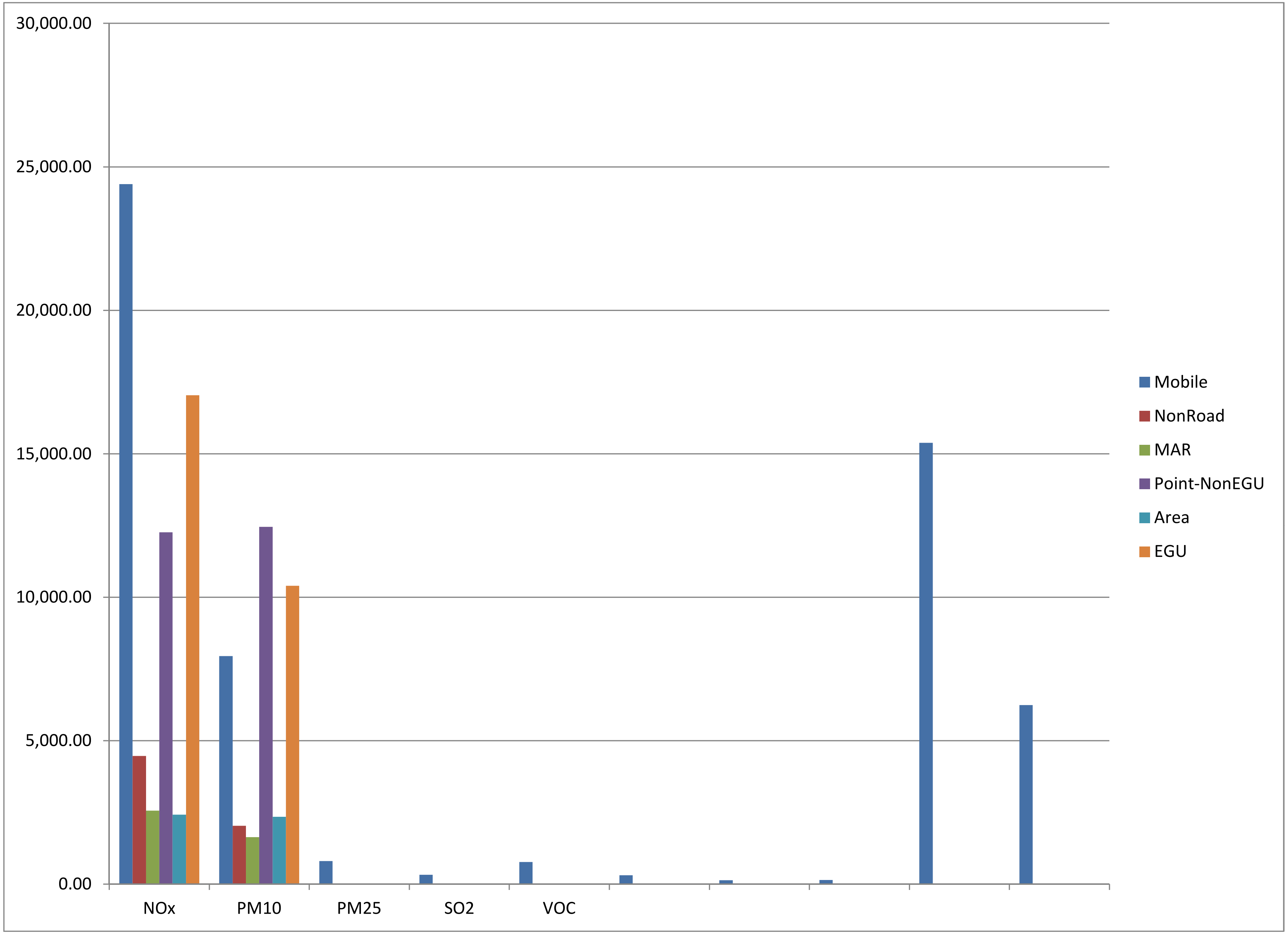
COMMONWEALTH OF VIRGINIA
STATE AIR POLLUTION CONTROL BOARD

OZONE ADVANCE ACTION PLAN
HAMPTON ROADS, VIRGINIA

Appendix A: Emission Estimates and Spreadsheets



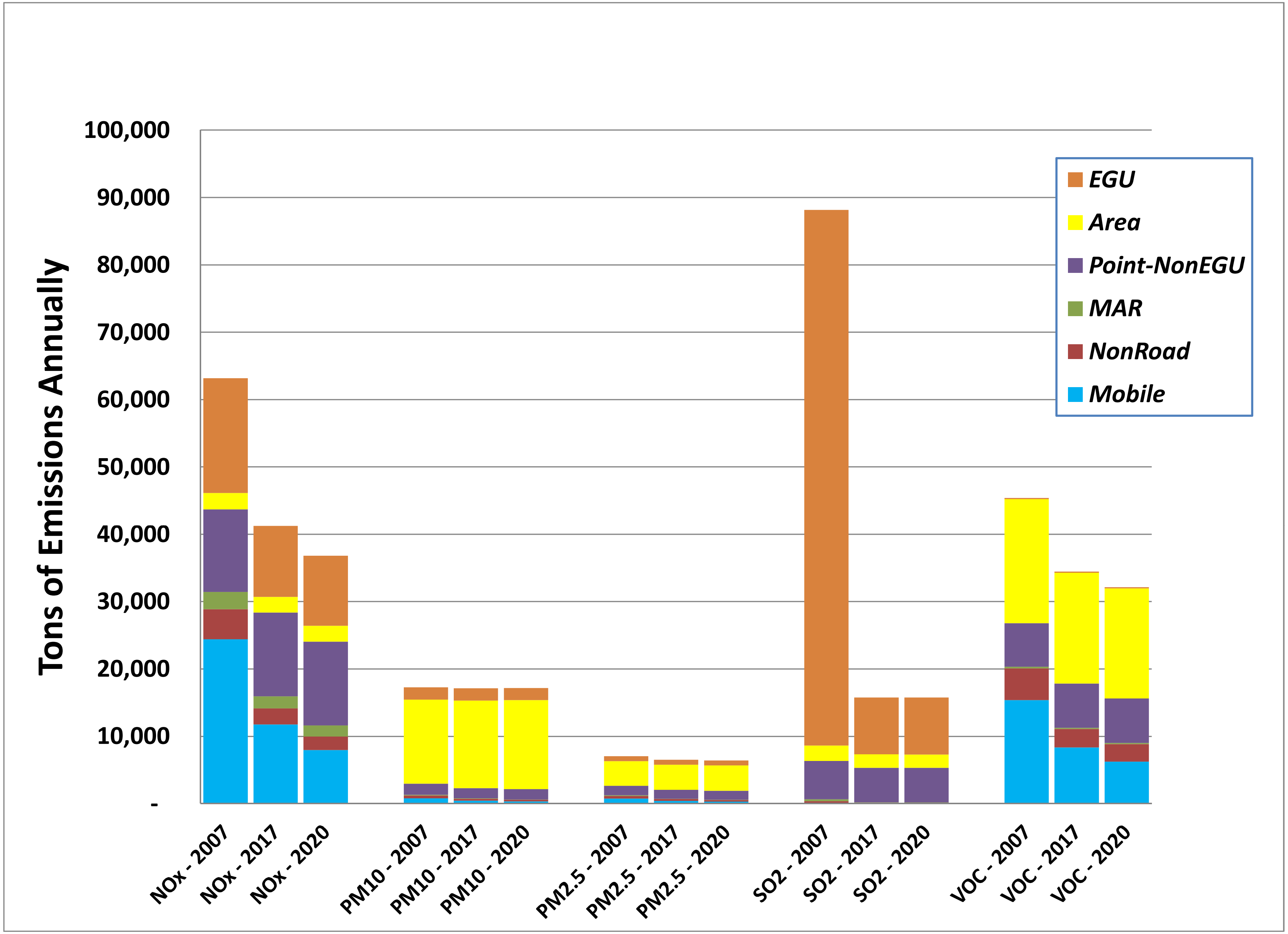
Appendix A-2007-2017-2020 OA Summary.xlsx-Rich-Pet Breakdown

Virginia Total

	Mobile	NonRoad	MAR	Point-NonE	Area	EGU	Total:
2007 CO	1,195,237	415,093	28,444	63,079	132,098	7,255	1,841,208
2017 CO	861,200	335,531	28,605	65,740	129,479	7,255	1,427,809
2020 CO	760,988	341,458	29,183	66,212	128,937	7,255	1,334,034
2007 NH3	4,041	45	17	1,618	43,394	212	49,328
2017 NH3	6,162	53	17	1,698	45,862	212	54,005
2020 NH3	6,798	55	18	1,709	46,434	212	55,227
2007 NOx	197,822	41,325	45,600	50,265	19,056	62,309	416,376
2017 NOx	97,694	23,658	32,268	53,236	18,411	30,650	255,917
2020 NOx	67,656	20,189	29,495	53,591	18,520	30,271	219,721
2007 PM1(	6,798	4,132	2,402	13,028	183,341	3,375	213,076
2017 PM1(	954	2,693	1,603	12,517	188,211	3,375	209,353
2020 PM1(	2,553	2,317	1,498	12,602	190,097	3,375	212,443
2007 PM2.	6,499	3,937	2,074	10,296	44,102	1,812	68,719
2017 PM2.	3,365	2,548	1,321	9,885	44,851	1,812	63,781
2020 PM2.	2,424	2,184	1,222	9,947	45,216	1,812	62,804
2007 SO2	1,434	2,329	4,674	54,486	17,098	187,671	267,692
2017 SO2	1,533	61	1,395	52,044	14,880	24,546	94,459
2020 SO2	1,562	63	1,214	52,338	14,616	24,600	94,394
2007 VOC	108,001	55,135	4,312	35,018	142,218	689	345,373
2017 VOC	59,957	32,141	3,710	35,461	135,379	689	267,338
2020 VOC	45,543	29,303	3,622	35,593	135,002	689	249,753

Richmond-Petersburg Totals

	Mobile	NonRoad	MAR	Point-NonE	Area	EGU	Total:
2007 CO	152,324	47,651	1,842	5,745	12,016	2,314	221,892
2017 CO	109,271	37,702	1,780	5,882	11,698	2,314	168,646
2020 CO	96,355	38,669	1,842	5,940	11,637	2,314	156,757
2007 NH3	541	5	1	1,329	793	93	2,762
2017 NH3	385	6	1	1,330	796	93	2,612
2020 NH3	338	6	1	1,330	798	93	2,566
2007 NOx	24,401	4,467	2,564	12,261	2,419	17,043	63,156
2017 NOx	11,747	2,398	1,792	12,433	2,334	10,546	41,252
2020 NOx	7,951	2,031	1,641	12,453	2,351	10,402	36,828
2007 PM1(	805	414	106	1,646	12,484	1,811	17,267
2017 PM1(	438	279	65	1,543	12,998	1,811	17,134
2020 PM1(	328	242	60	1,549	13,192	1,811	17,182
2007 PM2.	770	396	94	1,407	3,631	761	7,058
2017 PM2.	417	264	56	1,321	3,714	761	6,533
2020 PM2.	312	229	52	1,326	3,754	761	6,432
2007 SO2	135	248	275	5,679	2,298	79,532	88,167
2017 SO2	144	7	56	5,130	2,003	8,427	15,767
2020 SO2	147	7	41	5,147	1,968	8,439	15,750
2007 VOC	15,381	4,717	227	6,484	18,392	172	45,373
2017 VOC	8,349	2,728	184	6,576	16,437	172	34,447
2020 VOC	6,240	2,588	179	6,610	16,362	172	32,150

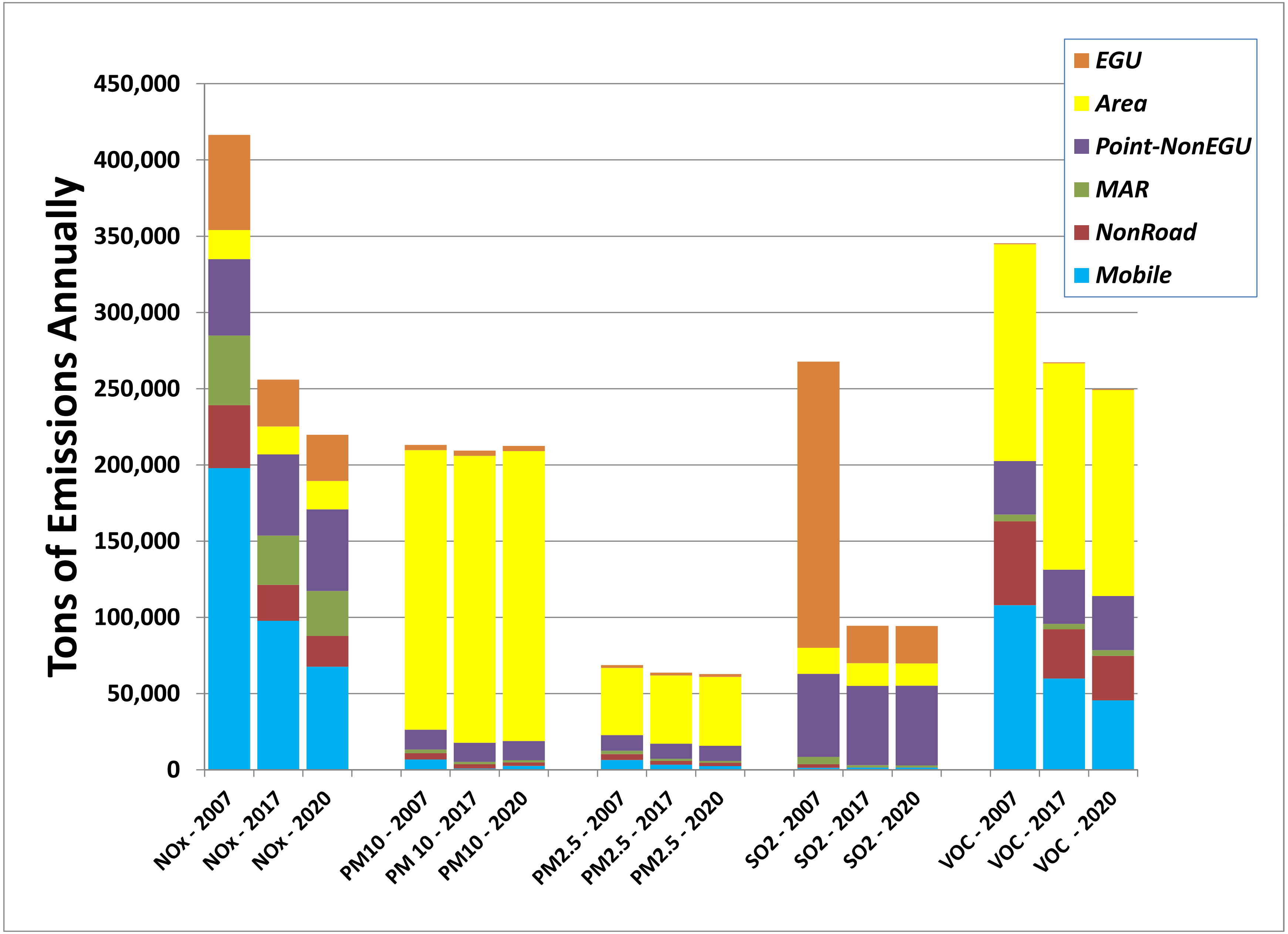


Appendix A-2007-2017-2020 OA Summary.xlsx-Rich-Pet Clustered

Richmond-Petersburg

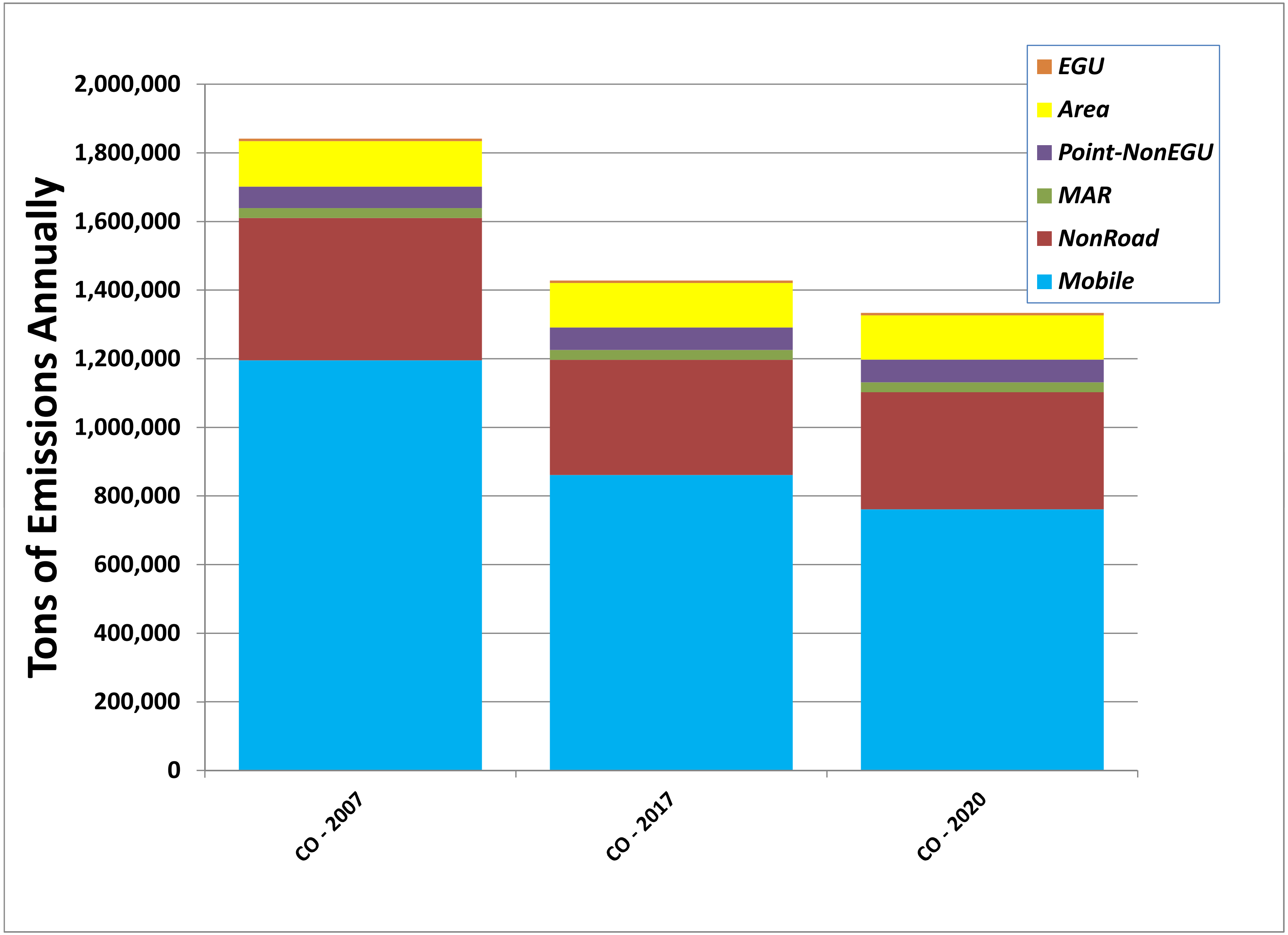
	NOx - 2007	NOx - 2017	NOx - 2020	PM10 - 2007	PM10 - 2017	PM10 - 2020	PM2.5 - 20(	PM2.5 - 20:	PM2.5 - 2020	SO2 - 2007	SO2 - 2017	SO2 - 2020	VOC - 2007	VOC - 2017	VOC - 2020
Mobile	24,401	11,747	7,951	805	438	328	770	417	312	135	144	147	15,381	8,349	6,240
NonRoad	4,467	2,398	2,031	414	279	242	396	264	229	248	7	7	4,717	2,728	2,588
MAR	2,564	1,792	1,641	106	65	60	94	56	52	275	56	41	227	184	179
Point-NonI	12,261	12,433	12,453	1,646	1,543	1,549	1,407	1,321	1,326	5,679	5,130	5,147	6,484	6,576	6,610
Area	2,419	2,334	2,351	12,484	12,998	13,192	3,631	3,714	3,754	2,298	2,003	1,968	18,392	16,437	16,362
EGU	17,043	10,546	10,402	1,811	1,811	1,811	761	761	761	79,532	8,427	8,439	172	172	172
Total:	63,156	41,252	36,828	17,267	17,134	17,182	7,058	6,533	6,432	88,167	15,767	15,750	45,373	34,447	32,150

		CO	
	CO - 2007	CO - 2017	CO - 2020
Mobile	152,324	109,271	96,355
NonRoad	47,651	37,702	38,669
MAR	1,842	1,780	1,842
Point-NonI	5,745	5,882	5,940
Area	12,016	11,698	11,637
EGU	2,314	2,314	2,314
Total:	221,892	168,646	156,757

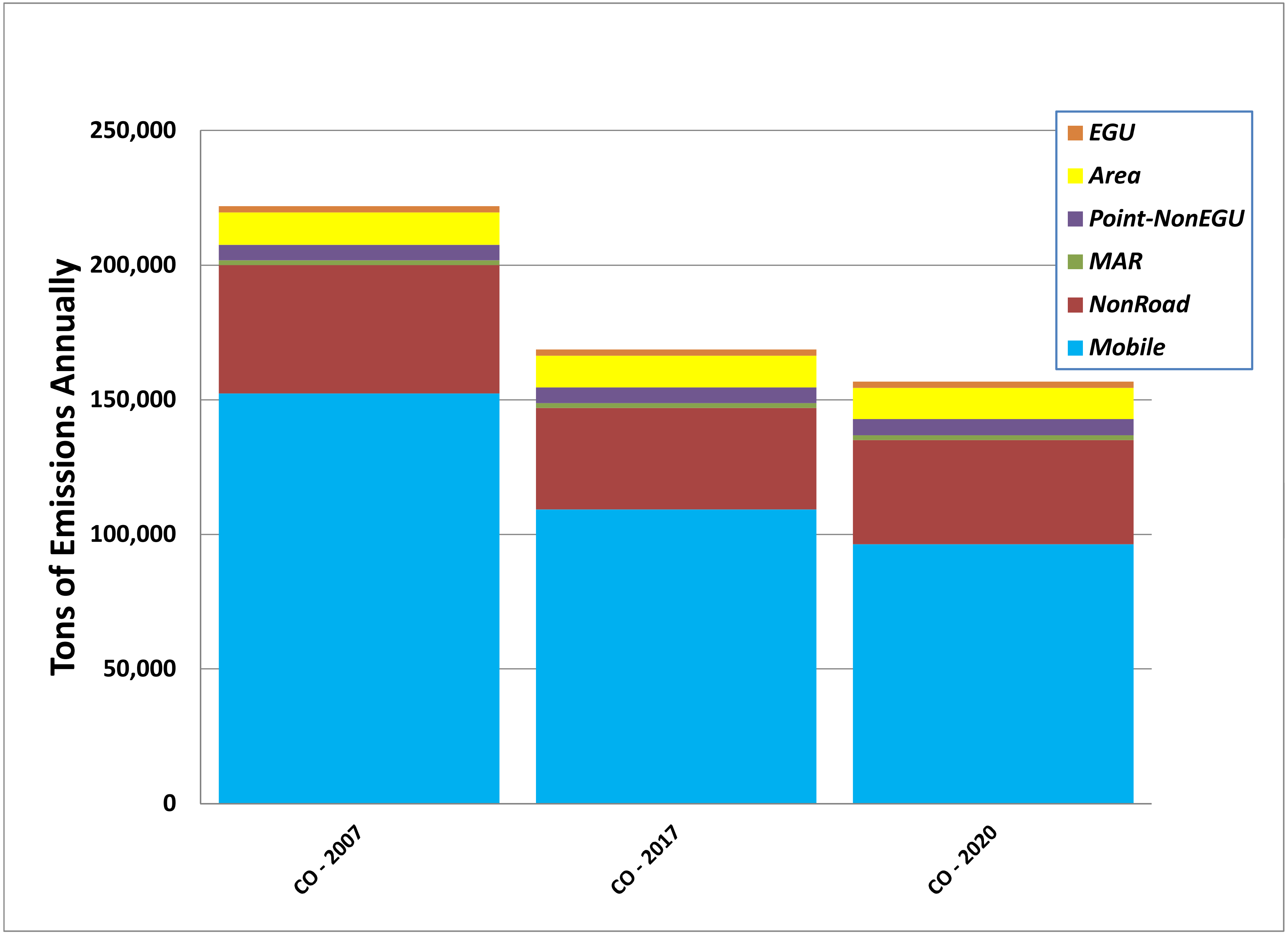


Appendix A-2007-2017-2020 OA Summary.xlsx-VA Clustered

Virginia-Wide		CO			NH3			NOx			PM10			PM25			SO2			VOC	
	CO - 2007	CO - 2017	CO - 2020	NH3 - 2007	NH3 - 2017	NH3 - 2020	NOx - 2007	NOx - 2017	NOx - 2020	PM10 - 2007	PM 10 - 2017	PM10 - 2020	PM2.5 - 2007	PM2.5 - 2017	PM2.5 - 2020	SO2 - 2007	SO2 - 2017	SO2 - 2020	VOC - 2007	VOC - 2017	VOC - 2020
Mobile	1,195,237	861,200	760,988	4,041	6,162	6,798	197,822	97,694	67,656	6,798	954	2,553	6,499	3,365	2,424	1,434	1,533	1,562	108,001	59,957	45,543
NonRoad	415,093	335,531	341,458	45	53	55	41,325	23,658	20,189	4,132	2,693	2,317	3,937	2,548	2,184	2,329	61	63	55,135	32,141	29,303
MAR	28,444	28,605	29,183	17	17	18	45,600	32,268	29,495	2,402	1,603	1,498	2,074	1,321	1,222	4,674	1,395	1,214	4,312	3,710	3,622
Point-NonEGU	63,079	65,740	66,212	1,618	1,698	1,709	50,265	53,236	53,591	13,028	12,517	12,602	10,296	9,885	9,947	54,486	52,044	52,338	35,018	35,461	35,593
Area	132,098	129,479	128,937	43,394	45,862	46,434	19,056	18,411	18,520	183,341	188,211	190,097	44,102	44,851	45,216	17,098	14,880	14,616	142,218	135,379	135,002
EGU	7,255	7,255	7,255	212	212	212	62,309	30,650	30,271	3,375	3,375	3,375	1,812	1,812	1,812	187,671	24,546	24,600	689	689	689
	1,841,208	1,427,809	1,334,034	49,328	54,005	55,227	416,376	255,917	219,721	213,076	209,353	212,443	68,719	63,781	62,804	267,692	94,459	94,394	345,373	267,338	249,753



Appendix A-2007-2017-2020 OA Summary.xlsx-VA Clustered CO



Appendix A-2007-2017-2020 OA Summary.xlsx-Rich-Pet Clustered CO

COUNTY	FACILITY_NAME	Area	ORISPL_CODE	UNITID	Reg #	Facility #	Stack #	Point #	Seg #	2007 CO tpy	2007 NH3 tpy	2007 NOx tpy	2007 PM10 tpy	2007 PM2.5 tpy	2007 SO2 tpy	2007 VOC tpy	NUM_MONTHS_REPORTED	2007 HEAT_INPUT	2007 lbs SO2/mmbtu	2007 lbs NOx/mmbtu	2011 NOx tpy	2011 SO2 tpy	2011 HEAT_INPUT	2011 lbs SO2/mmbtu	2011 lbs NOx/mmbtu	Future Year Controls	2017 GF	2020 GF	2017 Heat Input (mmbtu)	2020 Heat Input (mmbtu)	2017 NOx lbs/mmbtu	2017 SO2 lbs/mmbtu	2020 NOx lbs/mmbtu	2020 SO2 lbs/mmbtu	2017 NOx tpy	2017 SO2 tpy	2020 NOx tpy	2020 SO2 tpy
Caroline	Ladysmith Combustion Turbine Sta	C	7838	1	40960	51-033-00040	1			0.118	0.000	23.488	3.960	3.960	2.427	1.090	12	1,046,257	0.0046	0.0449	14	0	801,454	0.0010	0.0360		0.633	0.533	662,281	557,655	0.0449	0.0046	0.0449	0.0046	14.87	1.54	12.52	1.29
Caroline	Ladysmith Combustion Turbine Sta	C	7838	2	40960	51-033-00040	2			0.798	0.000	28.214	4.158	4.158	3.228	1.082	12	1,096,031	0.0059	0.0515	11	0	655,792	0.0007	0.0345		0.633	0.533	693,787	584,184	0.0515	0.0059	0.0515	0.0059	17.86	2.04	15.04	1.72
Caroline	Ladysmith Combustion Turbine Sta*	C	7838	3	40960	51-033-00040	3														13	0	824,749	0.0008	0.0324	New unit that began ops after 2007 but prior to 2011. EFs and HI from 2011.	0.633	0.533	522,066	439,591	0.0324	0.0008	0.0324	0.0008	8.46	0.22	7.13	0.19
Caroline	Ladysmith Combustion Turbine Sta*	C	7838	4	40960	51-033-00040	4														13	0	844,508	0.0007	0.0310	New unit that began ops after 2007 but prior to 2011. EFs and HI from 2011.	0.633	0.533	534,574	450,123	0.0310	0.0007	0.0310	0.0007	8.29	0.19	6.98	0.16
Caroline	Ladysmith Combustion Turbine Sta*	C	7838	5	40960	51-033-00040	5														15	0	937,493	0.0007	0.0327	New unit that began ops after 2007 but prior to 2011. EFs and HI from 2011.	0.633	0.533	593,433	499,684	0.0327	0.0007	0.0327	0.0007	9.70	0.21	8.16	0.17
	Caroline Totals:									**0.916**	**0.000**	**51.702**	**8.118**	**8.118**	**5.655**	**2.172**		**2,142,288**			**67.543**	**1.583**							**3,006,141**	**2,531,238**					**59.17**	**4.19**	**49.82**	**3.53**
Chesapeake (City)	Chesapeake Energy Center	HR	3803	1	60163	51-550-00026	1			83.269	0.146	1,678.906	7.697	3.451	3,726.955	9.966	12	7,999,662	0.9318	0.4197	1,272	2,211	3,858,293	1.1459	0.6596	Retirement prior to 2017	0.963	0.967										
Chesapeake (City)	Chesapeake Energy Center	HR	3803	2	60163	51-550-00026	2			83.911	0.186	1,807.490	16.713	7.446	3,855.389	10.023	12	8,201,378	0.9402	0.4408	1,389	2,426	4,337,889	1.1183	0.6403	Retirement prior to 2017	0.963	0.967										
Chesapeake (City)	Chesapeake Energy Center	HR	3803	3	60163	51-550-00026	3			101.843	1.760	942.713	15.191	7.168	4,941.399	12.096	12	9,510,400	1.0392	0.1982	1,244	4,761	8,210,747	1.1598	0.3030	Retirement prior to 2017	0.963	0.967										
Chesapeake (City)	Chesapeake Energy Center	HR	3803	4	60163	51-550-00026	4			155.316	1.921	1,817.012	35.932	15.981	7,794.020	18.547	12	15,066,383	1.0346	0.2412	2,072	7,850	12,800,000	1.2266	0.3238	Retirement prior to 2017	0.963	0.967										
Portsmouth (City)	Cogentrix-Portsmouth	HR	10071	BLR01A	61049	51-740-00081	1	1	1	129.722	0.018	254.650	1.535	0.507	910.050	1.351	6	1,596,582	1.1400	0.3190	79	124	429,426	0.5796	0.3657	DLS installed 2008; EFs from 2011 data	0.963	0.967	1,537,508	1,543,895	0.3657	0.5796	0.3657	0.5796	281.16	445.57	282.33	447.42
Portsmouth (City)	Cogentrix-Portsmouth	HR	10071	BLR01B	61049	51-740-00081	1	2	1	124.635	0.017	244.670	1.475	0.487	874.370	1.298	6	1,533,974	1.1400	0.3190	70	111	397,865	0.5577	0.3508	DLS installed 2008; EFs from 2011 data	0.963	0.967	1,477,217	1,483,353	0.3508	0.5577	0.3508	0.5577	259.07	411.96	260.15	413.67
Portsmouth (City)	Cogentrix-Portsmouth	HR	10071	BLR01C	61049	51-740-00081	1	3	1	125.011	0.017	245.407	1.479	0.488	877.003	1.302	6	1,538,602	1.1400	0.3190	69	111	395,490	0.5623	0.3504	DLS installed 2008; EFs from 2011 data	0.963	0.967	1,481,674	1,487,828	0.3504	0.5623	0.3504	0.5623	259.62	416.58	260.70	418.31
Portsmouth (City)	Cogentrix-Portsmouth	HR	10071	BLR02A	61049	51-740-00081	2	4	1	130.018	0.018	263.206	1.539	0.511	912.127	1.354	6	1,600,222	1.1400	0.3290	72	110	410,344	0.5349	0.3508	DLS installed 2008; EFs from 2011 data	0.963	0.967	1,541,014	1,547,415	0.3508	0.5349	0.3508	0.5349	270.26	412.14	271.38	413.85
Portsmouth (City)	Cogentrix-Portsmouth	HR	10071	BLR02B	61049	51-740-00081	2	5	1	122.918	0.017	248.832	1.455	0.480	862.317	1.280	6	1,512,836	1.1400	0.3290	62	96	368,344	0.5209	0.3387	DLS installed 2008; EFs from 2011 data	0.963	0.967	1,456,861	1,462,912	0.3387	0.5209	0.3387	0.5209	246.74	379.42	247.76	381.00
Portsmouth (City)	Cogentrix-Portsmouth	HR	10071	BLR02C	61049	51-740-00081	2	6	1	115.729	0.159	234.279	1.370	0.452	811.884	1.205	6	1,424,358	1.1400	0.3290	62	95	367,933	0.5175	0.3380	DLS installed 2008; EFs from 2011 data	0.963	0.967	1,371,657	1,377,354	0.3380	0.5175	0.3380	0.5175	231.78	354.92	232.74	356.39
Chesapeake (City)	Elizabeth River Combustion Turbine Sta	HR	52087	CT-1	61108	51-550-00161	1			11.455	0.000	32.737	2.155	2.155	6.451	0.335	12	576,921	0.0224	0.1135	49	5	623,104	0.0168	0.1575		0.633	0.533	365,191	307,499	0.1135	0.0224	0.1135	0.0224	20.72	4.08	17.45	3.44
Chesapeake (City)	Elizabeth River Combustion Turbine Sta	HR	52087	CT-2	61108	51-550-00161	2			11.865	0.000	34.103	2.335	2.335	7.998	0.364	12	615,298	0.0260	0.1109	42	5	502,177	0.0204	0.1688		0.633	0.533	389,483	327,954	0.1109	0.0260	0.1109	0.0260	21.59	5.06	18.18	4.26
Chesapeake (City)	Elizabeth River Combustion Turbine Sta	HR	52087	CT-3	61108	51-550-00161	3			11.180	0.000	32.748	2.183	2.183	7.415	0.340	12	577,976	0.0257	0.1133	44	4	523,582	0.0168	0.1695		0.633	0.533	365,859	308,061	0.1133	0.0257	0.1133	0.0257	20.73	4.69	17.45	3.95
York	Yorktown Power Station	HR	3809	1	60137	51-199-00001	3	5		105.418	0.309	1,969.999	17.218	2.295	10,387.513	12.717	12	10,682,654	1.9447	0.3688	1,505	6,339	5,639,793	2.2479	0.5339	Retirement prior to 2017	0.963	0.967			0	0						
York	Yorktown Power Station	HR	3809	2	60137	51-199-00001	3	6		96.322	0.984	1,647.866	15.775	2.053	9,226.273	11.523	12	9,446,340	1.9534	0.3489	1,679	6,848	6,219,219	2.2022	0.5398		0.963	0.967	9,096,826	9,134,611	0.3489	1.9534	0.3489	1.9534	1,586.89	8,884.90	1,593.49	8,921.81
York	Yorktown Power Station	HR	3809	3	60137	51-199-00001	2	3		143.272	22.885	1,519.755	332.020	242.111	4,613.462	21.890	12	9,509,966	0.9702	0.3196	241	755	2,072,165	0.7285	0.2330	This is unit is oil fired. No growth is expected for oil generation. Since IPM predicts the retirement of this unit, 2011 HI is used to estimate FY emissions, rather than 2007 HI.	--	--	2,072,165	2,072,165	0.3196	0.9702	0.3196	0.9702	331.15	1,005.25	331.15	1,005.25
	Hampton Roads Totals:									**1,551.884**	**28.437**	**12,974.373**	**456.072**	**290.103**	**49,814.626**	**105.591**		**81,393,551**			**9,953.105**	**31,851.516**	**47,156,373.084**						**21,155,455**	**21,053,047**					**3,529.70**	**12,324.57**	**3,532.77**	**12,369.34**
Prince William	Possum Point Power Station	NoVA	3804	3	70225	51-153-00002	3			1.010	0.899	38.945	2.225	2.225	0.176	0.148	12	588,134	0.0006	0.1324	19	0	303,543	0.0006	0.1255		0.633	0.533	372,289	313,475	0.1324	0.0006	0.1324	0.0006	24.65	0.11	20.76	0.09
Prince William	Possum Point Power Station	NoVA	3804	4	70225	51-153-00002	4			2.520	3.300	111.112	8.177	8.177	0.648	0.763	12	2,160,285	0.0006	0.1029	69	0	1,218,533	0.0006	0.1135		0.633	0.533	1,367,460	1,151,432	0.1029	0.0006	0.1029	0.0006	70.33	0.41	59.22	0.35
Prince William	Possum Point Power Station	NoVA	3804	5	70225	51-153-00002	5			87.846	14.055	561.663	79.411	57.411	1,928.948	13.104	12	5,520,827	0.6988	0.2035	77	273	930,798	0.5871	0.1650	This is unit is oil fired. No growth is expected for oil generation. Since IPM predicts the retirement of this unit, 2011 HI is used to estimate FY emissions, rather than 2007 HI.	--	--	930,798	930,798	0.2035	0.6988	0.2035	0.6988	94.70	325.22	94.70	325.22
Prince William	Possum Point Power Station	NoVA	3804	6A	70225	51-153-00002	9			94.015	15.717	52.100	41.227	41.227	3.855	2.370	12	8,359,321	0.0009	0.0125	48	3	8,981,995	0.0006	0.0108		0.633	0.533	5,291,450	4,455,518	0.0125	0.0009	0.0125	0.0009	32.98	2.44	27.77	2.05
Prince William	Possum Point Power Station	NoVA	3804	6B	70225	51-153-00002	10			126.056	15.746	61.879	30.524	30.524	14.997	1.714	12	8,343,683	0.0036	0.0148	66	3	11,500,000	0.0006	0.0114		0.633	0.533	5,281,552	4,447,183	0.0148	0.0036	0.0148	0.0036	39.17	9.49	32.98	7.99
Alexandria (City)	Potomac River	NoVA	3788	1	70228	51-510-00003	1			27.679	0.023	483.445	21.920	17.990	603.444	3.134	12	2,705,863	0.4460	0.3573	83	52	442,533	0.2328	0.3752	Retirement prior to 2017	0.963	0.967										
Alexandria (City)	Potomac River	NoVA	3788	2	70228	51-510-00003	2			28.911	0.026	444.174	22.840	18.750	596.209	3.279	12	2,819,555	0.4229	0.3151	83	51	443,110	0.2317	0.3743	Retirement prior to 2017	0.963	0.967										
Alexandria (City)	Potomac River	NoVA	3788	3	70228	51-510-00003	3			32.869	0.037	411.567	22.772	19.521	688.140	3.771	12	3,253,346	0.4230	0.2530	135	137	1,084,094	0.2525	0.2485	Retirement prior to 2017	0.963	0.967										
Alexandria (City)	Potomac River	NoVA	3788	4	70228	51-510-00003	4			42.359	0.450	481.394	29.420	25.220	909.402	4.868	12	4,203,130	0.4327	0.2291	133	136	1,073,083	0.2533	0.2484	Retirement prior to 2017	0.963	0.967										
Alexandria (City)	Potomac River	NoVA	3788	5	70228	51-510-00003	5			43.475	0.000	515.507	30.300	25.970	951.497	5.006	12	4,328,544	0.4396	0.2382	124	124	987,730	0.2508	0.2506	Retirement prior to 2017	0.963	0.967										
	NoVA Totals:									**486.740**	**50.253**	**3,161.786**	**288.816**	**247.015**	**5,697.316**	**38.157**		**42,282,688**			**836.859**	**779.241**	**26,965,419.029**						**13,243,549**	**11,298,407**					**261.83**	**337.67**	**235.43**	**335.70**
Richmond (City)	Bellemeade Power Station	RP	50966	1	50988	51-760-00389	1			24.283	8.375	38.167	0.981	0.981	3.552	1.560	12	1,879,377	0.0038	0.0406	36	3	2,327,715	0.0025	0.0306		0.633	0.533	1,189,646	1,001,708	0.0406	0.0038	0.0406	0.0038	24.16	2.25	20.34	1.89
Richmond (City)	Bellemeade Power Station	RP	50966	2	50988	51-760-00389	2			24.078	8.252	39.651	1.016	1.016	3.686	1.633	12	1,835,277	0.0040	0.0432	33	2	2,189,992	0.0020	0.0298		0.633	0.533	1,161,730	978,203	0.0432	0.0040	0.0432	0.0040	25.10	2.33	21.13	1.96
Chesterfield	Chesterfield Power Station	RP	3797	**8A	50396	51-041-00002	1	2		9.551	0.000	393.297	22.899	22.895	4.412	5.178	12	7,100,457	0.0012	0.1108	445	3	8,661,526	0.0007	0.1028		0.633	0.533	4,494,589	3,784,544	0.1108	0.0012	0.1108	0.0012	248.96	2.79	209.63	2.35

COUNTY	FACILITY_NAME	Area	ORISPL_CODE	UNITID	Reg #	Facility #	Stack #	Point #	Seg #	2007 CO tpy	2007 NH3 tpy	2007 NOx tpy	2007 PM10 tpy	2007 PM2.5 tpy	2007 SO2 tpy	2007 VOC tpy	NUM_MONTHS_REPORTED	2007 HEAT_INPUT	2007 lbs SO2/mmbtu	2007 lbs NOx/mmbtu	**2011 NOx tpy**	**2011 SO2 tpy**	2011 HEAT_INPUT	2011 lbs SO2/mmbtu	2011 lbs NOx/mmbtu	Future Year Controls	2017 GF	2020 GF	2017 Heat Input (mmbtu)	2020 Heat Input (mmbtu)	2017 NOx lbs/mmbtu	2017 SO2 lbs/mmbtu	2020 NOx lbs/mmbtu	2020 SO2 lbs/mmbtu	**2017 NOx tpy**	**2017 SO2 tpy**	**2020 NOx tpy**	**2020 SO2 tpy**
Chesterfield	Chesterfield Power Station	RP	3797	3	50396	51-041-00002	2			57.425	0.117	1,089.793	43.658	18.943	4,546.528	6.865	12	5,507,763	1.6510	0.3957	**322**	**1,507**	1,768,969	1.7038	0.3641	FGD	0.963	0.967	5,303,976	5,326,007	0.3957	0.13	0.3957	0.13	**1,049.47**	**344.76**	**1,053.83**	**346.19**
Chesterfield	Chesterfield Power Station	RP	3797	4	50396	51-041-00002	3			93.079	0.894	1,187.961	44.420	19.231	7,619.790	11.126	12	9,369,521	1.6265	0.2536	**748**	**5,723**	6,658,416	1.7189	0.2245	FGD in 2012; year round SCR operation	0.963	0.967	9,022,848	9,060,327	0.2536	0.13	0.2536	0.13	**1,144.01**	**586.49**	**1,148.76**	**588.92**
Chesterfield	Chesterfield Power Station	RP	3797	5	50396	51-041-00002	4			234.592	1.569	2,584.377	146.698	63.356	19,308.797	28.104	12	22,786,942	1.6947	0.2268	**1,593**	**7,386**	12,600,000	1.1724	0.2529	FGD in 2012; year round SCR operation	0.963	0.967	21,943,825	22,034,973	0.1	0.13	0.1	0.13	**1,097.19**	**1,426.35**	**1,101.75**	**1,432.27**
Chesterfield	Chesterfield Power Station	RP	3797	6	50396	51-041-00002	5			428.537	3.234	4,923.361	1,174.816	508.418	39,616.351	51.284	12	43,289,213	1.8303	0.2275	**883**	**1,266**	33,900,000	0.0747	0.0521	FGD in 2008; year round SCR operation; FY EFs taken from 2011 EFs	0.963	0.967	41,687,512	41,860,669	0.0521	0.0747	0.0521	0.0747	**1,085.96**	**1,557.03**	**1,090.47**	**1,563.50**
Chesterfield	Chesterfield Power Station	RP	3797	7	50396	51-041-00002	1	1		8.311	0.000	410.094	20.344	20.322	24.488	4.455	6	5,912,951	0.0083	0.1387	**617**	**7**	9,538,954	0.0014	0.1293		0.633	0.533	3,742,898	3,151,603	0.1387	0.0083	0.1387	0.0083	**259.59**	**15.50**	**218.58**	**13.05**
Hopewell (City)	Cogentrix-Hopewell	RP	10377	BLR01A	50950	51-670-00055	1	1		259.145	0.054	844.950	28.680	12.429	3,370.300	0.030	6	5,171,137	1.3035	0.3268	**208**	**391**	1,217,798	0.6427	0.3420	DLS installed 2008; EFs from 2011 data	0.963	0.967	4,979,805	5,000,490	0.3420	0.6427	0.3420	0.6427	**851.59**	**1,600.36**	**855.12**	**1,607.00**
Hopewell (City)	Cogentrix-Hopewell	RP	10377	BLR01B	50950	51-670-00055	1	1									6				**183**	**319**	1,042,788	0.6113	0.3505	DLS installed 2008; EFs from 2011 data	0.963	0.967										
Hopewell (City)	Cogentrix-Hopewell	RP	10377	BLR01C	50950	51-670-00055	1	1									6				**217**	**398**	1,253,765	0.6342	0.3462	DLS installed 2008; EFs from 2011 data	0.963	0.967										
Hopewell (City)	Cogentrix-Hopewell	RP	10377	BLR02A	50950	51-670-00055	2	2		277.611	0.058	889.430	30.730	13.315	3,610.470	0.040	6	5,539,617	1.3035	0.3211	**212**	**423**	1,234,183	0.6860	0.3437	DLS installed 2008; EFs from 2011 data	0.963	0.967	5,334,652	5,356,810	0.3437	0.6860	0.3437	0.6860	**916.85**	**1,829.82**	**920.66**	**1,837.42**
Hopewell (City)	Cogentrix-Hopewell	RP	10377	BLR02B	50950	51-670-00055	2	2				119.123					6				**169**	**336**	980,659	0.6856	0.3444	DLS installed 2008; EFs from 2011 data	0.963	0.967										
Hopewell (City)	Cogentrix-Hopewell	RP	10377	BLR02C	50950	51-670-00055	2	2				123.260					6				**151**	**299**	898,494	0.6653	0.3362	DLS installed 2008; EFs from 2011 data	0.963	0.967										
Henrico	Darbytown Combustion Turbine	RP	7212	1	50997	51-087-00156	1			0.066	0.000	43.864	1.786	1.786	7.752	0.457	6	491,721	0.0315	0.1784	**21**	**0**	324,718	0.0009	0.1300		0.633	0.533	311,259	262,087	0.1784	0.0315	0.1784	0.0315	**27.77**	**4.91**	**23.38**	**4.13**
Henrico	Darbytown Combustion Turbine	RP	7212	2	50997	51-087-00156	2			0.040	0.000	30.477	1.253	1.253	1.696	0.382	6	372,265	0.0091	0.1637	**18**	**0**	271,112	0.0007	0.1327		0.633	0.533	235,644	198,417	0.1637	0.0091	0.1637	0.0091	**19.29**	**1.07**	**16.24**	**0.90**
Henrico	Darbytown Combustion Turbine	RP	7212	3	50997	51-087-00156	3			0.148	0.000	31.637	1.290	1.290	5.257	0.336	6	357,422	0.0294	0.1770	**18**	**0**	267,422	0.0018	0.1331		0.633	0.533	226,248	190,506	0.1770	0.0294	0.1770	0.0294	**20.03**	**3.33**	**16.86**	**2.80**
Henrico	Darbytown Combustion Turbine	RP	7212	4	50997	51-087-00156	4			0.167	0.000	37.067	1.511	1.506	5.973	0.496	6	420,317	0.0284	0.1764	**21**	**0**	312,111	0.0010	0.1343		0.633	0.533	266,061	224,029	0.1764	0.0284	0.1764	0.0284	**23.46**	**3.78**	**19.76**	**3.18**
Hanover	Doswell Limited Partnership	RP	52019	501	51018	51-085-00061	1	1		43.294	16.566	78.411	45.798	3.653	5.806	7.159	12	3,622,608	0.0032	0.0433	**87**	**2**	6,327,815	0.0007	0.0274		0.633	0.533	2,293,111	1,930,850	0.0433	0.0032	0.0433	0.0032	**49.63**	**3.68**	**41.79**	**3.09**
Hanover	Doswell Limited Partnership	RP	52019	502	51018	51-085-00061	2	2		47.164	17.791	85.405	49.415	3.815	3.873	7.630	12	3,754,462	0.0021	0.0455	**102**	**2**	6,301,042	0.0006	0.0323		0.633	0.533	2,376,574	2,001,128	0.0455	0.0021	0.0455	0.0021	**54.06**	**2.45**	**45.52**	**2.06**
Hanover	Doswell Limited Partnership	RP	52019	601	51018	51-085-00061	3	3		48.750	18.425	70.542	51.714	3.853	1.534	7.789	12	4,050,240	0.0008	0.0348	**84**	**2**	5,037,037	0.0006	0.0335		0.633	0.533	2,563,802	2,158,778	0.0348	0.0008	0.0348	0.0008	**44.65**	**0.97**	**37.60**	**0.82**
Hanover	Doswell Limited Partnership	RP	52019	602	51018	51-085-00061	4	4		48.237	17.919	70.874	50.078	3.782	2.325	7.683	12	3,936,597	0.0012	0.0360	**100**	**2**	5,447,992	0.0008	0.0366		0.633	0.533	2,491,866	2,098,206	0.0360	0.0012	0.0360	0.0012	**44.86**	**1.47**	**37.78**	**1.24**
Hanover	Doswell Limited Partnership	RP	52019	CT1	51018	51-085-00061	8	8		11.193	0.000	22.899	2.888	1.130	3.051	1.584	12	1,055,959	0.0058	0.0434	**18**	**0**	1,031,420	0.0009	0.0346		0.633	0.533	668,422	562,826	0.0434	0.0058	0.0434	0.0058	**14.50**	**1.93**	**12.21**	**1.63**
Hopewell (City)	Hopewell Cogeneration Facility	RP	10633	1	50967	51-670-00058	1			18.392	0.000	186.526	3.614	2.485	54.570	2.382	12	2,844,021	0.0384	0.1312	**180**	**5**	3,179,697	0.0029	0.1135		0.633	0.533	1,800,265	1,515,863	0.1312	0.0384	0.1312	0.0384	**118.07**	**34.54**	**99.42**	**29.09**
Hopewell (City)	Hopewell Cogeneration Facility	RP	10633	2	50967	51-670-00058	2			14.840	0.000	129.561	2.941	1.999	40.432	2.007	12	2,324,961	0.0348	0.1115	**174**	**5**	3,285,521	0.0032	0.1061		0.633	0.533	1,471,700	1,239,204	0.1115	0.0348	0.1115	0.0348	**82.01**	**25.59**	**69.06**	**21.55**
Hopewell (City)	Hopewell Cogeneration Facility	RP	10633	3	50967	51-670-00058	3			17.792	0.000	160.648	3.477	2.351	54.448	2.259	12	2,704,247	0.0403	0.1188	**147**	**1**	2,845,599	0.0006	0.1035		0.633	0.533	1,711,788	1,441,363	0.1188	0.0403	0.1188	0.0403	**101.69**	**34.47**	**85.63**	**29.02**
Hopewell (City)	Hopewell Power Station	RP	10771	1	51019	51-670-00063	1			77.154	0.000	303.581	27.688	27.680	162.189	3.828	12	1,847,376	0.1756	0.3287	**67**	**10**	440,050	0.0461	0.3034	Switch to biomass	1.000	1.000	1,847,376	1,847,376	0.135	0.0125	0.135	0.0125	**124.70**	**11.55**	**124.70**	**11.55**
Hopewell (City)	Hopewell Power Station	RP	10771	2	51019	51-670-00063	2			65.344	0.000	279.031	0.155	0.155	120.949	3.877	12	1,813,709	0.1334	0.3077	**70**	**8**	455,621	0.0335	0.3070	Switch to biomass	1.000	1.000	1,813,709	1,813,709	0.135	0.0125	0.135	0.0125	**122.43**	**11.34**	**122.43**	**11.34**
Richmond (City)	Spruance Genco, LLC^	RP	54081	1A&1B	51033	51-760-00399	1	1		127.379	0.060	785.260	13.480	5.876	244.840	3.600		5,406,584	0.0906	0.2905							0.963	0.967	5,206,540	5,228,166	0.2905	0.0906	0.2905	0.0906	**756.21**	**235.78**	**759.35**	**236.76**
Richmond (City)	Spruance Genco, LLC^	RP	54081	2A&2B	51033	51-760-00399	2	2		128.562	0.063	779.010	13.610	5.988	250.550	3.630		5,447,606	0.0920	0.2860							0.963	0.967	5,246,044	5,267,835	0.2860	0.0920	0.2860	0.0920	**750.19**	**241.28**	**753.30**	**242.28**
Richmond (City)	Spruance Genco, LLC^	RP	54081	3A&3B	51033	51-760-00399	3	3		125.707	0.059	789.240	13.320	5.772	237.310	3.560		5,349,656	0.0887	0.2951							0.963	0.967	5,151,719	5,173,117	0.2951	0.0887	0.2951	0.0887	**760.04**	**228.53**	**763.20**	**229.48**
Richmond (City)	Spruance Genco, LLC^	RP	54081	4A&4B	51033	51-760-00399	4	4		122.861	0.057	758.080	13.020	5.641	220.930	3.480		5,228,551	0.0845	0.2900							0.963	0.967	5,035,094	5,056,008	0.2900	0.0845	0.2900	0.0845	**730.03**	**212.76**	**733.06**	**213.64**
Richmond (City)	Spruance Genco, LLC	RP	54081	BLR01A	51033	51-760-00399						183.964					6	1,249,791	0.0000	0.2944	**348**	**104**	2,300,476	0.0902	0.3025		0.963	0.967										
Richmond (City)	Spruance Genco, LLC	RP	54081	BLR01B	51033	51-760-00399						194.706					6	1,327,686	0.0000	0.2933	**373**	**111**	2,466,502	0.0901	0.3022		0.963	0.967										
Richmond (City)	Spruance Genco, LLC	RP	54081	BLR02A	51033	51-760-00399						176.929					6	1,235,836	0.0000	0.2863	**365**	**110**	2,410,439	0.0913	0.3028		0.963	0.967										
Richmond (City)	Spruance Genco, LLC	RP	54081	BLR02B	51033	51-760-00399						181.364					6	1,271,529	0.0000	0.2853	**364**	**111**	2,404,296	0.0927	0.3026		0.963	0.967										
Richmond (City)	Spruance Genco, LLC	RP	54081	BLR03A	51033	51-760-00399						176.273					6	1,183,043	0.0000	0.2980	**350**	**126**	2,405,054	0.1046	0.2914		0.963	0.967										
Richmond (City)	Spruance Genco, LLC	RP	54081	BLR03B	51033	51-760-00399						170.341					6	1,136,145	0.0000	0.2999	**365**	**131**	2,506,982	0.1046	0.2911		0.963	0.967										
Richmond (City)	Spruance Genco, LLC	RP	54081	BLR04A	51033	51-760-00399						169.022					6	1,200,731	0.0000	0.2815	**313**	**118**	2,262,078	0.1045	0.2768		0.963	0.967										
Richmond (City)	Spruance Genco, LLC	RP	54081	BLR04B	51033	51-760-00399						178.699					6	1,271,788	0.0000	0.2810	**291**	**106**	2,112,128	0.1002	0.2753		0.963	0.967										
	Richmond Totals:									**2,313.702**	**93.493**	**17,043.194**	**1,811.280**	**760.921**	**79,531.859**	**172.414**		**159,420,556**			**9,692.040**	**19,016.882**	**138,668,372.322**						**139,578,704**	**135,764,803**					**10,546.48**	**8,427.09**	**10,401.54**	**8,439.13**
Campbell	Altavista Power Station		10773	1	30859	51-031-00156	1	1		70.581	8.500	310.892	8.076	8.076	40.638	3.674	12	2,225,231	0.0365	0.2794						Switch to Biomass	1.000	1.000	2,225,231	2,225,231	0.1350	0.0125	0.1350	0.0125	**150.20**	**13.91**	**150.20**	**13.91**
Campbell	Altavista Power Station		10773	2	30859	51-031-00156	1	2		68.173	8.210	299.700	3.020	3.020	39.308	1.568	12	2,148,592	0.0366	0.2790						Switch to Biomass	1.000	1.000	2,148,592	2,148,592	0.1350	0.0125	0.1350	0.0125	**145.03**	**13.43**	**145.03**	**13.43**
Buckingham	Dominon - Bear Garden		56807	1A	32004	51-029-00028				209.500	--	101.400	66.500	66.500	22.800	82.100					**40**	**3**	8,592,293	0.0006	0.0093	New facility; operated in 2011 but only lightly	0.633	0.533							**101.40**	**22.80**	**101.40**	**22.80**

COUNTY	FACILITY_NAME	Area	ORISPL_CODE	UNITID	Reg #	Facility #	Stack #	Point #	Seg #	2007 CO tpy	2007 NH3 tpy	2007 NOx tpy	2007 PM10 tpy	2007 PM2.5 tpy	2007 SO2 tpy	2007 VOC tpy	NUM_MONTHS_REPORTED	2007 HEAT_INPUT	2007 lbs SO2/mmbtu	2007 lbs NOx/mmbtu	2011 NOx tpy	2011 SO2 tpy	2011 HEAT_INPUT	2011 lbs SO2/mmbtu	2011 lbs NOx/mmbtu	Future Year Controls	2017 GF	2020 GF	2017 Heat Input (mmbtu)	2020 Heat Input (mmbtu)	2017 NOx lbs/mmbtu	2017 SO2 lbs/mmbtu	2020 NOx lbs/mmbtu	2020 SO2 lbs/mmbtu	2017 NOx tpy	2017 SO2 tpy	2020 NOx tpy	2020 SO2 tpy
Buckingham	Dominon - Bear Garden		56807	1B	32004	51-029-00028				209.500	--	101.400	66.500	66.500	22.800	82.100					**37**	**3**	8,379,114	0.0006	0.0088	New facility; operated in 2011 but only lightly	0.633	0.533							**101.40**	**22.80**	**101.40**	**22.80**
King George	Birchwood Power Facility		54304	1	40809	51-099-00012	1			1,220.926	0.336	550.479	110.198	24.689	552.550	61.038	12	12,361,110	0.0894	0.0891	**252**	**229**	5,258,625	0.0872	0.0960		0.963	0.967	11,903,749	11,953,193	0.0891	0.0894	0.0891	0.0894	**530.11**	**532.11**	**532.31**	**534.32**
Fluvanna	Bremo Power Station		3796	3	40199	51-065-00001	1			52.360	0.059	1,603.053	55.642	24.112	3,485.113	6.273	12	4,752,341	1.4667	0.6746	**430**	**1,048**	1,312,504	1.5972	0.6545	Switch to NG; EFs from Possum Point	0.633	0.533	3,008,232	2,532,998	0.1324	0.0006	0.1324	0.0006	**199.14**	**0.90**	**167.68**	**0.76**
Fluvanna	Bremo Power Station		3796	4	40199	51-067-00001	2			109.336	0.123	1,839.304	40.016	17.377	6,966.680	13.085	12	10,200,930	1.3659	0.3606	**1,451**	**5,433**	6,850,043	1.5862	0.4236	Switch to NG; EFs from Possum Point	0.633	0.533	6,457,189	5,437,096	0.1324	0.0006	0.1324	0.0006	**427.47**	**1.94**	**359.94**	**1.63**
Buchanan	Buchanan Units 1 & 2		55738	1	11390	51-027-00148	1	21	1	0.570		16.364	1.260	1.260	0.110	0.400	12	398,317	0.0006	0.0822	**7**	**0**	169,487	0.0006	0.0800		0.633	0.533	252,135	212,303	0.0822	0.0006	0.0822	0.0006	**10.36**	**0.07**	**8.72**	**0.06**
Buchanan	Buchanan Units 1 & 2		55738	2	11390	51-027-00148	1	21	2	0.550		15.412	1.200	1.200	0.110	0.380	12	379,173	0.0006	0.0813	**7**	**0**	157,532	0.0006	0.0846		0.633	0.533	240,017	202,099	0.0813	0.0006	0.0813	0.0006	**9.76**	**0.07**	**8.21**	**0.06**
Russell	Clinch River		3775	1	10236	51-167-00003	1	1		130.512	0.167	2,743.998	63.135	28.086	9,149.304	15.652	12	12,061,272	1.5171	0.4550	**373**	**1,340**	3,104,701	0.8630	0.2404	Retirement prior to 2017	0.963	0.967			0	0						
Russell	Clinch River		3775	2	10236	51-167-00003	1	2		128.268	0.174	2,698.444	61.840	27.508	8,996.545	15.375	12	12,248,671	1.4690	0.4406	**639**	**2,281**	5,348,586	0.8530	0.2388	Retirement prior to 2017	0.963	0.967			0	0						
Russell	Clinch River		3775	3	10236	51-167-00003	2			134.737	0.182	2,821.042	86.629	38.535	9,510.799	16.153	12	12,614,359	1.5079	0.4473	**537**	**2,300**	5,342,894	0.8611	0.2010	Switch to NG; EFs from Possum Point	0.633	0.533	7,984,889	6,723,453	0.1324	0.0006	0.1324	0.0006	**528.60**	**2.40**	**445.09**	**2.02**
Halifax	Clover Power Station		7213	1	30867	51-083-00046	1			163.862	0.444	4,879.600	49.240	49.240	814.710	16.362	12	35,026,241	0.0465	0.2786	**3,824**	**958**	28,900,000	0.0663	0.2647		0.963	0.967	33,730,271	33,870,375	0.2786	0.0465	0.2786	0.0465	**4,699.05**	**784.57**	**4,718.57**	**787.82**
Halifax	Clover Power Station		7213	2	30867	51-083-00046	2			163.520	0.436	5,036.660	65.438	65.438	814.624	81.256	12	36,710,057	0.0444	0.2744	**4,012**	**790**	27,300,000	0.0579	0.2939		0.963	0.967	35,351,785	35,498,625	0.2744	0.0444	0.2744	0.0444	**4,850.30**	**784.48**	**4,870.45**	**787.74**
Accomack	Commonwealth Chesapeake		55381	CT-001	40898	51-001-00030	1	1	1	1.230	0.047	7.534	0.637	0.637	2.249	0.020	12	106,103	0.0424	0.1420	**6**	**0**	89,150	0.0016	0.1327		0.633	0.533	67,163	56,553	0.1420	0.0424	0.1420	0.0424	**4.77**	**1.42**	**4.02**	**1.20**
Accomack	Commonwealth Chesapeake		55381	CT-002	40898	51-001-00030	1	1	2	1.200	0.000	9.135	0.792	0.792	2.797	0.022	12	131,961	0.0424	0.1384	**6**	**0**	84,347	0.0015	0.1402		0.633	0.533	83,531	70,335	0.1384	0.0424	0.1384	0.0424	**5.78**	**1.77**	**4.87**	**1.49**
Accomack	Commonwealth Chesapeake		55381	CT-003	40898	51-001-00030	1	1	3	1.820	0.000	5.831	0.462	0.462	1.632	0.030	12	77,009	0.0424	0.1514	**5**	**0**	64,228	0.0016	0.1406		0.633	0.533	48,747	41,046	0.1514	0.0424	0.1514	0.0424	**3.69**	**1.03**	**3.11**	**0.87**
Accomack	Commonwealth Chesapeake		55381	CT-004	40898	51-001-00030	1	1	4	0.870	0.000	3.084	0.261	0.261	0.922	0.015	12	43,511	0.0424	0.1418	**1**	**0**	21,207	0.0015	0.1345		0.633	0.533	27,543	23,191	0.1418	0.0424	0.1418	0.0424	**1.95**	**0.58**	**1.64**	**0.49**
Accomack	Commonwealth Chesapeake		55381	CT-005	40898	51-001-00030	1	1	5	0.510	0.000	3.031	0.266	0.266	0.939	0.010	12	44,288	0.0424	0.1369	**2**	**0**	24,276	0.0015	0.1331		0.633	0.533	28,034	23,605	0.1369	0.0424	0.1369	0.0424	**1.92**	**0.59**	**1.62**	**0.50**
Accomack	Commonwealth Chesapeake		55381	CT-006	40898	51-001-00030	1	1	6	0.430	0.000	3.415	0.290	0.290	1.025	0.000	12	48,350	0.0424	0.1413	**2**	**0**	24,804	0.0015	0.1379		0.633	0.533	30,606	25,771	0.1413	0.0424	0.1413	0.0424	**2.16**	**0.65**	**1.82**	**0.55**
Accomack	Commonwealth Chesapeake		55381	CT-007	40898	51-001-00030	1	1	7	1.230	0.000	2.825	0.256	0.256	0.905	0.000	12	42,726	0.0424	0.1322	**2**	**0**	27,421	0.0015	0.1275		0.633	0.533	27,045	22,773	0.1322	0.0424	0.1322	0.0424	**1.79**	**0.57**	**1.51**	**0.48**
Giles	Glen Lyn		3776	51	20460	51-071-00002	1	1		28.606	0.083	556.578	16.908	7.459	1,955.790	3.407	12	2,726,143	1.4348	0.4083	**44**	**140**	205,375	1.3650	0.4247	Retirement prior to 2017	0.963	0.967			0	0						
Giles	Glen Lyn		3776	52	20460	51-071-00002	1	2		28.093	0.090	548.947	32.721	14.436	1,986.947	3.342	12	2,853,362	1.3927	0.3848	**43**	**144**	207,424	1.3845	0.4160	Retirement prior to 2017	0.963	0.967			0	0						
Giles	Glen Lyn		3776	6	20460	51-071-00002	2	3		109.409	0.276	2,345.776	37.057	16.349	7,547.945	13.052	12	10,545,891	1.4314	0.4449	**433**	**1,486**	2,089,243	1.4227	0.4144	Retirement prior to 2017	0.963	0.967			0	0						
Louisa	Gordonsville Power Station		54844	1	40808	51-109-00040	1			118.100	8.491	40.162	22.818	22.818	2.391	46.347	12	1,921,513	0.0025	0.0418	**61**	**1**	3,931,231	0.0006	0.0311		0.633	0.533	1,216,318	1,024,166	0.0418	0.0025	0.0418	0.0025	**25.42**	**1.51**	**21.41**	**1.27**
Louisa	Gordonsville Power Station		54844	2	40808	51-109-00040	2			93.500	8.798	39.017	21.357	21.356	2.484	43.445	12	1,994,379	0.0025	0.0391	**42**	**1**	2,679,116	0.0006	0.0316		0.633	0.533	1,262,442	1,063,004	0.0391	0.0025	0.0391	0.0025	**24.70**	**1.57**	**20.80**	**1.32**
Surry	Gravel Neck Combustion Turbine+		7032	3 thru 6	50336	51-181-00002	4	5		14.579	0.000	123.623	4.254	4.254	59.831	1.627		1,265,444	0.0946	0.1954							0.633	0.533	801,026	674,482	0.1954	0.0946	0.1954	0.0946	**78.25**	**37.87**	**65.89**	**31.89**
Surry	Gravel Neck Combustion Turbine		7032	3	50336	51-181-00002						18.958			0.000		6	204,473	0.0000	0.1854	**12**	**2**	159,869	0.0254	0.1461		0.633	0.533										
Surry	Gravel Neck Combustion Turbine		7032	4	50336	51-181-00002						22.606			0.000		6	245,948	0.0000	0.1838	**14**	**2**	193,492	0.0206	0.1434		0.633	0.533										
Surry	Gravel Neck Combustion Turbine		7032	5	50336	51-181-00002						21.245			0.000		6	233,445	0.0000	0.1820	**25**	**4**	356,062	0.0201	0.1431		0.633	0.533										
Surry	Gravel Neck Combustion Turbine		7032	6	50336	51-181-00002						21.765			0.000		6	227,790	0.0000	0.1911	**13**	**6**	140,941	0.0809	0.1844		0.633	0.533										
Louisa	Louisa Generation Facility		7837	EU1	40989	51-109-40989	1			5.400	0.000	7.247	2.684	2.685	0.536	0.598	12	449,828	0.0024	0.0322	**3**	**0**	177,729	0.0032	0.0303		0.633	0.533	284,741	239,758	0.0322	0.0024	0.0322	0.0024	**4.59**	**0.34**	**3.86**	**0.29**
Louisa	Louisa Generation Facility		7837	EU2	40989	51-109-40989	2			10.600	0.000	7.560	2.743	2.743	0.436	0.566	12	467,943	0.0019	0.0323	**2**	**0**	190,733	0.0022	0.0213		0.633	0.533	296,208	249,413	0.0323	0.0019	0.0323	0.0019	**4.79**	**0.28**	**4.03**	**0.23**
Louisa	Louisa Generation Facility		7837	EU3	40989	51-109-40989	3			6.000	0.000	7.039	2.235	2.235	2.647	0.499	12	371,737	0.0142	0.0379	**2**	**0**	163,632	0.0030	0.0290		0.633	0.533	235,310	198,136	0.0379	0.0142	0.0379	0.0142	**4.46**	**1.68**	**3.75**	**1.41**
Louisa	Louisa Generation Facility		7837	EU4	40989	51-109-40989	4			6.000	0.000	6.456	2.310	2.310	2.730	0.518	12	380,472	0.0144	0.0339	**2**	**0**	150,350	0.0016	0.0323		0.633	0.533	240,839	202,792	0.0339	0.0144	0.0339	0.0144	**4.09**	**1.73**	**3.44**	**1.46**
Louisa	Louisa Generation Facility		7837	EU5	40989	51-109-40989	5			11.775	0.000	17.403	6.302	6.302	1.382	1.166	12	1,077,519	0.0026	0.0323	**11**	**1**	576,969	0.0028	0.0390		0.633	0.533	682,070	574,318	0.0323	0.0026	0.0323	0.0026	**11.02**	**0.87**	**9.28**	**0.74**
Fauquier	Marsh Run Generation Facility		7836	EU1	40996	51-061-00063	1			12.115	0.000	30.702	6.156	6.156	2.265	1.162	12	989,910	0.0046	0.0620	**9**	**1**	500,422	0.0022	0.0355		0.633	0.533	626,613	527,622	0.0620	0.0046	0.0620	0.0046	**19.43**	**1.43**	**16.36**	**1.21**
Fauquier	Marsh Run Generation Facility		7836	EU2	40996	51-061-00063	2			12.970	0.000	32.202	6.566	6.566	2.116	1.239	12	1,057,993	0.0040	0.0609	**10**	**1**	506,158	0.0028	0.0391		0.633	0.533	669,709	563,910	0.0609	0.0040	0.0609	0.0040	**20.38**	**1.34**	**17.16**	**1.13**
Fauquier	Marsh Run Generation Facility		7836	EU3	40996	51-061-00063	3			12.114	0.000	28.090	6.001	6.001	1.902	1.128	12	989,830	0.0038	0.0568	**9**	**0**	569,787	0.0017	0.0330		0.633	0.533	626,562	527,579	0.0568	0.0038	0.0568	0.0038	**17.78**	**1.20**	**14.97**	**1.01**
Mecklenburg	Mecklenburg Power Station		52007	1	30861	51-117-00051	1	1		42.919	0.142	595.901	13.173	13.121	252.363	5.224	12	4,342,747	0.1162	0.2744	**200**	**96**	1,405,569	0.1365	0.2843		0.963	0.967	4,182,065	4,199,436	0.2744	0.1162	0.2744	0.1162	**573.85**	**243.03**	**576.24**	**244.04**
Mecklenburg	Mecklenburg Power Station		52007	2	30861	51-117-00051	1	2		43.114	0.118	655.378	12.551	12.512	261.145	5.139	12	4,566,495	0.1144	0.2870	**191**	**84**	1,281,385	0.1314	0.2984		0.963	0.967	4,397,535	4,415,801	0.2870	0.1144	0.2870	0.1144	**631.13**	**251.48**	**633.75**	**252.53**
Fauquier	Remington Combustion Turbine Station		7839	1	40961	51-061-00061	1			0.385	0.000	9.393	1.426	1.426	1.010	0.380	12	385,803	0.0052	0.0487	**17**	**2**	763,080	0.0047	0.0456		0.633	0.533	244,214	205,633	0.0487	0.0052	0.0487	0.0052	**5.95**	**0.64**	**5.01**	**0.54**
Fauquier	Remington Combustion Turbine Station		7839	2	40961	51-061-00061	2			0.452	0.000	13.358	1.913	1.913	1.824	0.468	12	493,262	0.0074	0.0542	**14**	**1**	634,237	0.0043	0.0447		0.633	0.533	312,235	262,909	0.0542	0.0074	0.0542	0.0074	**8.46**	**1.15**	**7.12**	**0.97**

COUNTY	FACILITY_NAME	Area	ORISPL_CODE	UNITID	Reg #	Facility #	Stack #	Point #	Seg #	2007 CO tpy	2007 NH3 tpy	2007 NOx tpy	2007 PM10 tpy	2007 PM2.5 tpy	2007 SO2 tpy	2007 VOC tpy	NUM_MONTHS_REPORTED	2007 HEAT_INPUT	2007 lbs SO2/mmbtu	2007 lbs NOx/mmbtu	2011 NOx tpy	2011 SO2 tpy	2011 HEAT_INPUT	2011 lbs SO2/mmbtu	2011 lbs NOx/mmbtu	Future Year Controls	2017 GF	2020 GF	2017 Heat Input (mmbtu)	2020 Heat Input (mmbtu)	2017 NOx lbs/mmbtu	2017 SO2 lbs/mmbtu	2020 NOx lbs/mmbtu	2020 SO2 lbs/mmbtu	2017 NOx tpy	2017 SO2 tpy	2020 NOx tpy	2020 SO2 tpy
Fauquier	Remington Combustion Turbine Station		7839	3	40961	51-061-00061	3			0.407	0.000	16.875	2.083	2.083	2.578	0.462	12	520,106	0.0099	0.0649	**15**	**1**	684,458	0.0035	0.0435		0.633	0.533	329,227	277,216	0.0649	0.0099	0.0649	0.0099	**10.68**	**1.63**	**8.99**	**1.37**
Fauquier	Remington Combustion Turbine Station		7839	4	40961	51-061-00061	4			0.369	0.000	9.591	1.696	1.696	0.652	0.497	12	470,989	0.0028	0.0407	**14**	**1**	799,502	0.0015	0.0361		0.633	0.533	298,136	251,037	0.0407	0.0028	0.0407	0.0028	**6.07**	**0.41**	**5.11**	**0.35**
Southampton	Southampton Power Station		10774	1	61093	51-175-00051	1			51.536	0.036	477.330	9.504	9.504	75.023	2.101	12	2,526,561	0.0594	0.3778	**174**	**27**	902,793	0.0597	0.3859	Switch to biomass	1.000	1.000	2,526,561	2,526,561	0.135	0.0125	0.135	0.0125	**170.54**	**15.79**	**170.54**	**15.79**
Southampton	Southampton Power Station		10774	2	61093	51-175-00051	2			22.343	0.035	446.439	17.117	17.117	70.810	1.360	12	2,355,970	0.0601	0.3790	**161**	**26**	832,508	0.0617	0.3875	Switch to biomass	1.000	1.000	2,355,970	2,355,970	0.135	0.0125	0.135	0.0125	**159.03**	**14.72**	**159.03**	**14.72**
Accomack	Tasley Energy Center		3785	TA10	40304	51-001-00006	1	1	1	0.000	0.000	11.987	0.490	0.490	0.549	0.467	6	27,440	0.0400	0.8737	**16**	**0**	26,478	0.0212	1.2000		1.175	1.175	32,242	32,242	0.8737	0.0400	0.8737	0.0400	**14.08**	**0.65**	**14.08**	**0.65**
Fluvanna	Tenaska Virginia Generating Station		55439	CTGDB1	40995	51-065-00021	1			2.880	1.217	34.097	4.100	4.084	1.392	1.303	12	4,633,216	0.0006	0.0147	**44**	**3**	10,800,000	0.0006	0.0081		0.633	0.533	2,932,826	2,469,504	0.0147	0.0006	0.0147	0.0006	**21.58**	**0.88**	**18.17**	**0.74**
Fluvanna	Tenaska Virginia Generating Station		55439	CTGDB2	40995	51-065-00021	2			3.074	1.335	32.756	13.148	13.148	1.410	1.325	12	4,697,674	0.0006	0.0139	**39**	**3**	10,800,000	0.0006	0.0072		0.633	0.533	2,973,628	2,503,860	0.0139	0.0006	0.0139	0.0006	**20.73**	**0.89**	**17.46**	**0.75**
Fluvanna	Tenaska Virginia Generating Station		55439	CTGDB3	40995	51-065-00021	3			4.749	0.759	30.853	7.265	7.265	1.358	1.568	12	4,527,590	0.0006	0.0136	**37**	**3**	10,500,000	0.0006	0.0071		0.633	0.533	2,865,965	2,413,206	0.0136	0.0006	0.0136	0.0006	**19.53**	**0.86**	**16.44**	**0.72**
Washington	Wolf Hills Energy#		55285	WHO1, WHO2	11348	51-191-00180	1			1.343	0.000	21.470	1.686	1.686	0.149	0.075		494,000	0.0006	0.0869							0.633	0.533	312,702	263,302	0.0869	0.0006	0.0869	0.0006	**13.59**	**0.09**	**11.44**	**0.08**
Washington	Wolf Hills Energy#		55285	WHO3, WHO4	11348	51-191-00180	2			1.745	0.000	20.988	1.632	1.632	0.144	0.318		492,450	0.0006	0.0852							0.633	0.533	311,721	262,476	0.0852	0.0006	0.0852	0.0006	**13.29**	**0.09**	**11.19**	**0.08**
Washington	Wolf Hills Energy#		55285	WHO5, WHO6	11348	51-191-00180	3			1.892	0.000	19.581	1.551	1.551	0.145	0.667		465,150	0.0006	0.0842							0.633	0.533	294,440	247,925	0.0842	0.0006	0.0842	0.0006	**12.39**	**0.09**	**10.44**	**0.08**
Washington	Wolf Hills Energy#		55285	WHO7, WHO8	11348	51-191-00180	4			2.034	0.000	21.294	1.570	1.570	0.140	0.114		477,750	0.0006	0.0891							0.633	0.533	302,416	254,641	0.0891	0.0006	0.0891	0.0006	**13.48**	**0.09**	**11.35**	**0.07**
Washington	Wolf Hills Energy#		55285	WHO9, WHO10	11348	51-191-00180	5			2.982	0.000	19.604	1.449	1.449	0.131	0.223		441,000	0.0006	0.0889							0.633	0.533	279,153	235,053	0.0889	0.0006	0.0889	0.0006	**12.41**	**0.08**	**10.45**	**0.07**
Washington	Wolf Hills Energy		55285	WH01	11348	51-191-00180	1					6.692			0.071		12	247,811	0.0006	0.0540	**1**	**0**	49,144	0.0006	0.0563		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH02								8.676			0.072		12	251,373	0.0006	0.0690	**2**	**0**	50,319	0.0006	0.0664		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH03								6.557			0.070		12	242,832	0.0006	0.0540	**1**	**0**	51,889	0.0005	0.0532		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH04								8.605			0.072		12	249,326	0.0006	0.0690	**2**	**0**	52,648	0.0006	0.0649		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH05								6.480			0.068		12	239,950	0.0006	0.0540	**1**	**0**	47,087	0.0006	0.0571		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH06								7.758			0.065		12	224,806	0.0006	0.0690	**2**	**0**	45,990	0.0007	0.0653		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH07								6.419			0.069		12	236,330	0.0006	0.0543	**1**	**0**	48,368	0.0007	0.0543		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH08								8.317			0.070		12	240,994	0.0006	0.0690	**2**	**0**	49,294	0.0006	0.0654		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH09								5.996			0.064		12	222,056	0.0006	0.0540	**2**	**0**	57,557	0.0006	0.0550		0.633	0.533										
Washington	Wolf Hills Energy		55285	WH10								7.563			0.064		12	219,169	0.0006	0.0690	**2**	**0**	57,260	0.0006	0.0665		0.633	0.533										
Warren	Dominion - Warren			1	81391	51-187-0041				116.200		105.900	53.03	53.03	4.100	60.333											0.633	0.533							**105.90**	**4.10**	**105.90**	**4.10**
Warren	Dominion - Warren			2	81391	51-187-0041				116.200		105.900	53.03	53.03	4.100	60.333											0.633	0.533							**105.90**	**4.10**	**105.90**	**4.10**
Warren	Dominion - Warren			3	81391	51-187-0041				116.200		105.900	53.03	53.03	4.100	60.333											0.633	0.533							**105.90**	**4.10**	**105.90**	**4.10**
Wise	Dominion - Wise			1	11526					2,057.725		960.260	164.620	164.620	301.800	68.590											0.900	0.940							**960.26**	**301.80**	**960.26**	**301.80**
Wise	Dominion - Wise			2	11526					2,057.725		960.260	164.620	164.620	301.800	68.590											0.900	0.940							**960.26**	**301.80**	**960.26**	**301.80**
Brunswick	Dominion - Brunswick			1						116.200		105.900	53.03	53.03	22.800	60.333											0.633	0.533							**105.90**	**22.80**	**105.90**	**22.80**
Brunswick	Dominion - Brunswick			2						116.200		105.900	53.03	53.03	22.800	60.333											0.633	0.533							**105.90**	**22.80**	**105.90**	**22.80**
Brunswick	Dominion - Brunswick			3						116.200		105.900	53.03	53.03	22.800	60.333											0.633	0.533							**105.90**	**22.80**	**105.90**	**22.80**
					2007																																	
	VA Totals:									**7,255**	**212**	**62,309**	**3,375**	**1,812**	**187,671**	**689**					**33,855**	**68,071**													**30,649.70**	**24,546.33**	**30,270.85**	**24,600.43**

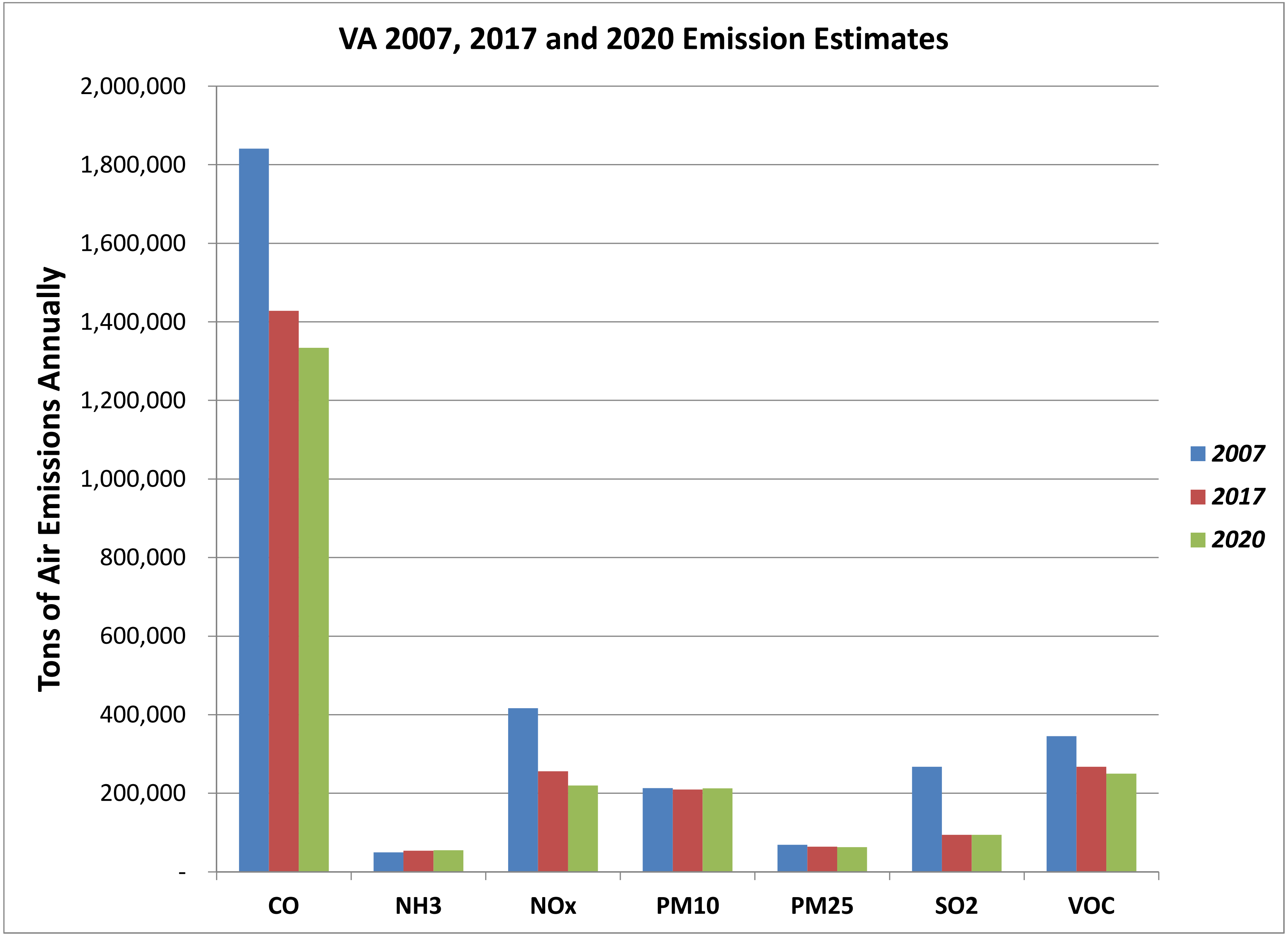
+Gravel Neck's unit are coded in CEDS under one stack/point/segment so that input and output of the units are consolidated.
*Units 3, 4, & 5 at Ladysmith did not start operating until after 2007. Values indicated are 2011 HI and EFs.
^Spruance has 8 units, coded 2 each to a stack/point combination. Values in gray are from CEDS.
#Wolf Hills has 10 units, each coded 2 to a stack/point/segment combinations. Values in gray are from CEDS.
Yellow shading indicates that values from CAMD were replaced with values from CEDS
Unless otherwise specified, all HI, SO2 and NOx data were taken from CAMD. Other data were taken from CEDS.
Blue shading indicates that permitted limits were supplied.
Orange shading indicates that values were taken from consent orders.
My best guess at what the future year emission rate for a unit might be, based on projected controls.
For all pollutants other than SO2 and NOx, future year values are estimated to be equivalent to 2007 values. If a unit did not operate in 2007, then 2011 values were used.

Growth rates are taken from AEO 2011 Tables for SERC-Virginia/Carolina

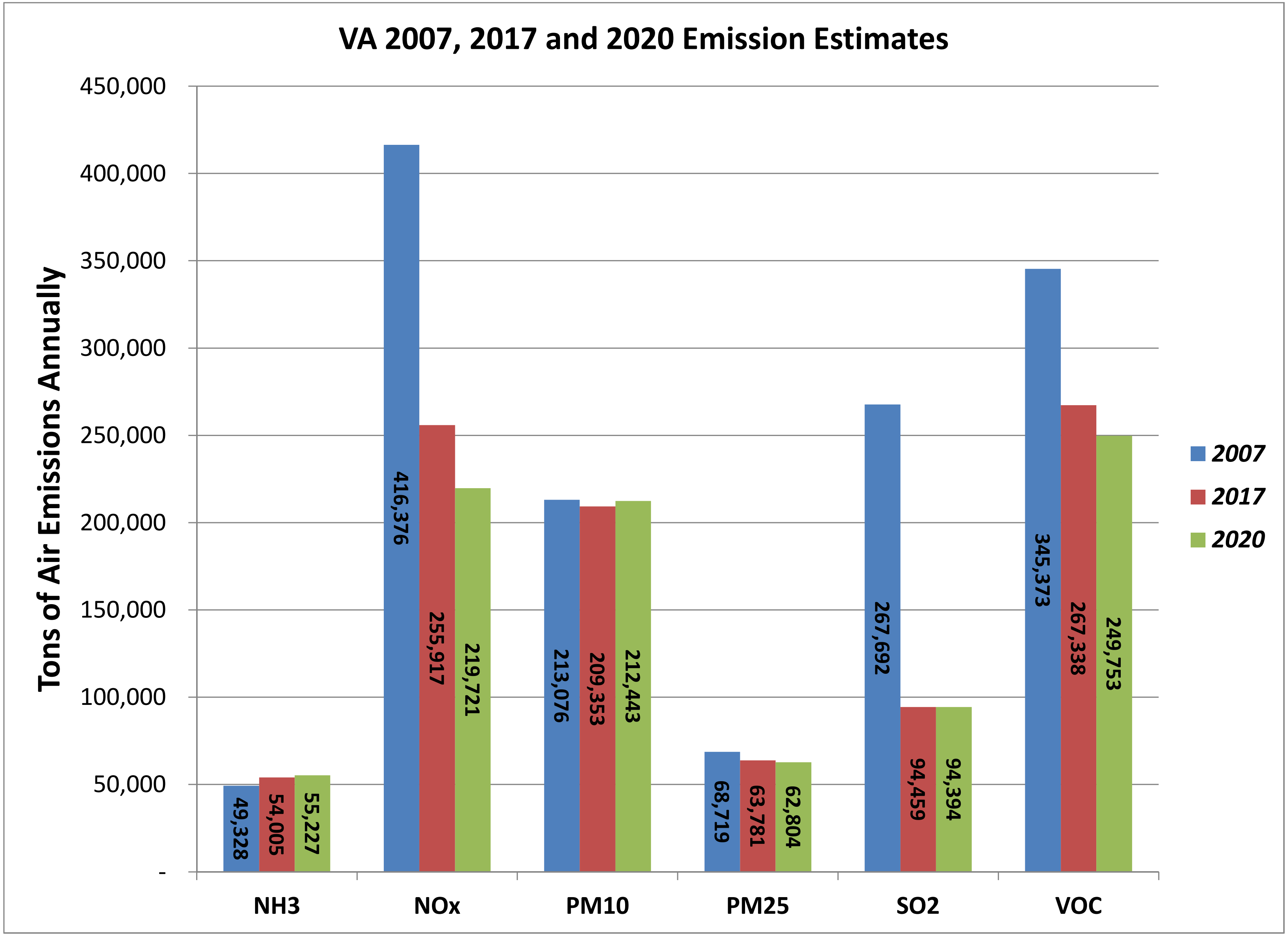
	2017	2020
Coal	0.963	0.967
Petroleum	1.175	1.175
Natural Gas	0.633	0.533

Area Summary

TPY Emission Rates	CO			NH3			NOx			PM10			PM25			SO2			VOC		
	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020
Caroline Totals:	**917.68**	**909.13**	**906.88**	**183.21**	**169.37**	**165.39**	**66.39**	**64.65**	**64.78**	**1,544.22**	**1,572.45**	**1,585.99**	**347.68**	**356.62**	**360.57**	**40.22**	**34.66**	**33.75**	**1,096.40**	**1,080.69**	**1,096.62**
Spotsylvania	2,379.13	2,336.89	2,325.90	195.49	193.59	193.04	250.95	242.87	243.64	2,362.25	2,537.50	2,607.70	646.32	684.61	700.76	180.03	154.15	149.99	2,024.33	1,758.68	1,781.70
Stafford	2,559.21	2,521.47	2,511.33	52.95	52.90	53.00	238.81	231.63	232.42	2,616.34	2,766.23	2,821.21	648.30	680.16	692.35	145.21	123.23	119.11	1,558.46	1,748.66	1,814.13
Fredericksburg	156.09	150.79	150.21	11.59	10.84	10.67	66.06	64.10	64.83	156.35	183.24	193.30	50.25	55.38	57.49	52.01	45.45	44.55	434.00	375.09	373.89
Fred Totals:	**5,094.43**	**5,009.16**	**4,987.45**	**260.03**	**257.34**	**256.71**	**555.82**	**538.60**	**540.90**	**5,134.94**	**5,486.96**	**5,622.21**	**1,344.88**	**1,420.15**	**1,450.60**	**377.26**	**322.84**	**313.64**	**4,016.79**	**3,882.43**	**3,969.72**
Charles City	175.84	174.72	174.67	88.03	93.15	94.37	20.63	19.93	20.01	990.79	945.04	932.59	184.04	177.42	175.75	20.98	18.41	18.19	159.40	137.97	134.79
Chesterfield	2,723.30	2,627.85	2,606.29	145.90	152.49	154.49	589.02	566.61	569.98	2,951.19	3,128.57	3,192.40	852.77	882.22	894.94	555.85	480.92	470.74	4,738.31	4,432.82	4,490.08
Hanover	2,889.17	2,861.43	2,857.14	264.18	266.06	266.26	304.69	295.43	297.01	2,913.08	3,031.08	3,076.32	758.71	785.04	796.06	267.29	233.83	230.56	2,090.53	1,884.34	1,890.21
Henrico	2,876.35	2,776.24	2,756.46	91.63	90.93	91.22	693.49	669.05	674.50	2,448.97	2,593.77	2,646.27	824.36	845.57	855.72	653.53	569.55	559.36	5,122.33	4,544.03	4,512.32
Prince George	606.93	602.29	601.53	60.02	58.90	58.58	77.07	74.61	74.91	1,278.59	1,275.60	1,276.72	273.84	275.03	275.99	59.65	51.49	50.28	530.88	473.48	472.34
Colonial Heights	171.43	165.23	163.91	6.07	5.84	5.80	40.42	39.03	39.34	80.51	88.21	90.96	40.43	41.62	42.16	35.41	30.74	30.11	275.63	244.78	243.61
Hopewell	162.42	158.57	158.22	5.18	5.16	5.19	51.42	49.35	49.63	122.79	134.39	138.54	45.69	47.18	47.95	59.01	51.59	50.85	664.39	607.01	600.59
Petersburg	244.36	238.70	238.52	47.07	42.81	41.67	85.31	82.04	82.61	156.01	169.26	174.21	69.94	71.94	73.09	97.27	85.15	84.09	712.50	610.40	595.13
Richmond	2,166.16	2,092.56	2,079.76	84.79	80.73	79.97	557.33	538.22	542.86	1,541.66	1,631.77	1,664.22	580.99	587.63	592.35	549.20	481.31	474.28	4,098.09	3,502.27	3,422.96
Rich-Pet Totals:	**12,015.96**	**11,697.60**	**11,636.51**	**792.87**	**796.06**	**797.55**	**2,419.38**	**2,334.29**	**2,350.86**	**12,483.58**	**12,997.69**	**13,192.24**	**3,630.78**	**3,713.66**	**3,754.01**	**2,298.19**	**2,003.00**	**1,968.45**	**18,392.06**	**16,437.09**	**16,362.04**
Gloucester	1,034.91	1,025.44	1,022.96	166.26	152.22	148.22	86.81	84.50	84.74	1,449.63	1,445.28	1,445.36	326.53	326.26	326.56	47.67	40.64	39.33	598.19	597.54	601.27
Isle of Wight	856.13	846.44	847.19	258.65	252.17	250.03	155.21	149.22	150.10	1,969.18	1,958.58	1,959.65	440.56	441.97	444.23	214.60	190.02	189.10	599.57	601.25	606.98
James City	2,404.47	2,387.94	2,384.43	51.31	52.91	53.35	183.06	178.57	179.36	1,632.10	1,684.20	1,703.34	446.11	455.10	458.83	108.99	94.23	92.10	925.48	1,017.74	1,059.27
York	408.04	388.42	383.39	157.46	142.47	138.27	101.94	97.96	98.49	957.53	993.21	1,006.30	212.43	218.53	221.07	84.17	71.90	69.78	2,133.73	1,996.13	2,006.55
Chesapeake	1,375.44	1,323.80	1,314.76	260.78	263.08	263.72	457.09	439.44	442.44	2,470.33	2,586.26	2,630.91	612.66	630.62	639.37	455.45	394.99	387.52	3,640.63	3,486.29	3,466.56
Hampton	880.42	842.23	833.56	28.49	28.39	28.58	262.52	252.25	253.70	836.71	889.06	908.31	305.26	313.84	317.80	236.81	203.51	198.49	1,970.63	1,826.36	1,787.64
Newport News	1,386.99	1,332.03	1,321.56	40.69	40.26	40.47	421.16	405.61	408.13	1,185.25	1,276.56	1,309.84	424.77	436.74	442.89	428.32	374.23	368.15	2,769.62	2,544.16	2,492.58
Norfolk	1,612.53	1,549.56	1,539.90	58.81	57.61	57.71	564.78	543.59	547.91	1,296.32	1,367.94	1,394.68	480.69	484.91	489.01	583.03	508.53	500.41	3,670.78	3,358.15	3,284.15
Poquoson	63.48	60.35	59.43	6.99	6.47	6.33	14.93	14.30	14.33	48.94	53.09	54.49	19.02	19.60	19.82	10.66	8.85	8.44	125.38	117.09	115.39
Portsmouth	695.15	667.59	662.14	21.89	21.70	21.83	208.77	200.53	201.61	616.61	634.33	642.01	223.66	224.25	225.59	217.30	188.94	185.55	1,446.81	1,340.08	1,315.78
Suffolk	1,469.23	1,449.34	1,445.44	368.18	379.12	381.12	188.10	181.74	182.55	2,116.83	2,092.60	2,090.87	501.32	500.10	501.38	163.92	142.18	139.48	1,350.57	1,421.23	1,460.90
Virginia Beach	2,869.49	2,765.18	2,741.64	292.84	293.10	293.40	784.90	755.54	760.26	2,952.50	3,143.99	3,211.07	873.69	895.85	905.77	517.79	432.83	417.30	5,684.71	5,334.49	5,255.78
Williamsburg	72.80	69.49	68.84	5.61	5.25	5.17	29.17	28.30	28.60	51.32	55.35	56.73	19.82	20.31	20.52	18.92	16.30	15.81	163.23	153.15	151.52
HR Total:	**15,129.06**	**14,707.81**	**14,625.25**	**1,717.96**	**1,694.75**	**1,688.20**	**3,458.45**	**3,331.56**	**3,352.23**	**17,583.23**	**18,180.44**	**18,413.57**	**4,886.51**	**4,968.08**	**5,012.83**	**3,087.65**	**2,667.15**	**2,611.47**	**25,079.31**	**23,793.68**	**23,604.37**
VA Total	**132,098.48**	**129,478.58**	**128,936.86**	**43,394.20**	**45,862.39**	**46,434.16**	**19,055.70**	**18,410.73**	**18,519.94**	**183,340.65**	**188,210.75**	**190,096.65**	**44,101.98**	**44,850.68**	**45,215.89**	**17,098.22**	**14,880.13**	**14,616.19**	**142,218.06**	**135,379.23**	**135,001.63**



Appendix A-2007-2017-2020 OA Summary.xlsx-All VA totals



Appendix A-2007-2017-2020 OA Summary.xlsx-All VA totals no CO

Mobile Summary

Tons/Year Emission Rates	CO			NH3			NOx			PM10			PM25			SO2			VOC		
	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020
Caroline	**10,650.50**	**8,038.51**	**7,254.91**	**41.63**	**32.29**	**29.49**	**2,738.92**	**1,315.82**	**888.89**	**104.14**	**47.86**	**30.98**	**100.09**	**45.81**	**29.53**	**19.68**	**22.30**	**23.08**	**700.09**	**394.29**	**302.54**
Spotsylvania	25,100.87	19,457.60	17,764.62	62.50	49.70	45.86	3,563.24	1,965.86	1,486.65	124.31	68.22	51.39	118.84	64.99	48.83	28.87	34.28	35.91	2,053.57	1,271.48	1,036.85
Stafford	13,666.79	11,456.45	10,793.35	73.25	58.70	54.33	3,160.43	1,462.67	953.34	130.33	68.74	50.27	125.18	65.76	47.94	20.63	23.76	24.69	1,279.88	732.23	567.94
Fredericksburg	5,606.35	4,241.97	3,832.65	18.39	13.98	12.65	973.61	496.74	353.68	34.75	17.80	12.71	33.26	16.97	12.08	8.13	9.23	9.56	414.46	238.88	186.20
Fred Totals:	**44,374.01**	**35,156.02**	**32,390.63**	**154.14**	**122.38**	**112.85**	**7,697.27**	**3,925.27**	**2,793.67**	**289.39**	**154.77**	**114.38**	**277.28**	**147.72**	**108.85**	**57.63**	**67.27**	**70.16**	**3,747.90**	**2,242.59**	**1,790.99**
Charles City	1,257.30	848.55	725.92	3.91	2.76	2.41	230.05	114.76	80.17	8.18	3.90	2.61	7.85	3.73	2.50	1.08	1.09	1.09	143.93	77.71	57.85
Chesterfield	46,284.45	33,839.50	30,106.02	163.81	118.61	105.05	6,941.72	3,401.76	2,339.77	227.22	130.83	101.92	216.95	124.62	96.92	37.30	40.81	41.87	4,794.96	2,654.43	2,012.27
Hanover	19,349.76	14,329.97	12,824.04	76.91	57.53	51.72	3,849.28	1,826.04	1,219.07	130.34	67.16	48.21	124.88	64.09	45.86	19.78	21.99	22.65	1,871.55	1,036.59	786.10
Henrico	41,186.62	29,464.57	25,947.95	146.31	102.71	89.62	6,172.77	2,953.56	1,987.80	191.89	108.37	83.31	182.99	103.06	79.08	32.86	34.86	35.46	4,301.27	2,320.48	1,726.24
Prince George	7,752.54	5,539.28	4,875.31	22.18	16.56	14.88	1,508.55	730.41	496.97	58.04	26.74	17.36	55.77	25.62	16.57	11.08	11.97	12.24	622.09	352.41	271.50
Colonial Heights	2,783.45	1,980.48	1,739.59	9.84	6.90	6.02	454.01	208.51	134.86	16.32	8.49	6.14	15.60	8.09	5.84	2.42	2.54	2.58	280.07	151.42	112.83
Hopewell	2,828.59	1,969.73	1,712.08	9.58	6.76	5.92	503.13	228.09	145.58	17.29	8.75	6.19	16.58	8.37	5.90	2.61	2.72	2.76	303.09	162.97	120.94
Petersburg	5,751.69	4,022.04	3,503.15	15.98	11.18	9.74	904.04	437.09	297.00	35.10	16.98	11.54	33.63	16.23	11.00	7.64	7.88	7.95	476.07	256.77	190.97
Richmond	25,129.61	17,276.78	14,920.93	92.93	62.09	52.84	3,837.01	1,847.22	1,250.28	120.94	66.67	50.38	115.33	63.44	47.88	20.48	20.44	20.44	2,587.73	1,336.68	961.36
Rich-Pet Totals:	**152,324.01**	**109,270.92**	**96,354.99**	**541.46**	**385.09**	**338.19**	**24,400.56**	**11,747.43**	**7,951.49**	**805.30**	**437.88**	**327.66**	**769.59**	**417.25**	**311.55**	**135.25**	**144.31**	**147.03**	**15,380.76**	**8,349.46**	**6,240.07**
Gloucester	7,661.67	5,202.73	4,465.05	15.86	11.13	9.71	741.86	418.52	321.52	20.99	12.54	10.01	19.91	11.90	9.49	6.91	7.18	7.26	657.77	375.02	290.19
Isle of Wight	9,752.76	6,549.66	5,588.73	31.18	21.76	18.93	1,403.11	704.93	495.48	50.28	26.46	19.31	48.20	25.34	18.48	13.88	14.38	14.53	798.26	427.73	316.57
James City	7,784.41	5,710.12	5,087.83	33.30	24.67	22.08	1,420.84	705.95	491.48	46.75	25.64	19.30	44.62	24.37	18.30	10.70	11.74	12.05	799.99	453.12	349.06
York	8,765.10	6,304.18	5,565.91	41.47	30.31	26.96	1,614.28	786.99	538.80	50.27	28.29	21.70	48.00	26.93	20.60	13.00	14.09	14.41	885.49	494.16	376.77
Chesapeake	28,269.93	20,473.02	18,133.94	122.94	90.19	80.36	4,636.63	2,389.15	1,714.90	136.98	82.34	65.96	130.51	78.28	62.61	37.85	41.21	42.21	3,022.28	1,699.94	1,303.24
Hampton	15,974.35	11,266.53	9,854.19	70.59	49.38	43.02	2,399.45	1,191.24	828.78	67.27	42.06	34.50	63.86	39.89	32.70	20.56	21.63	21.96	1,725.51	947.56	714.17
Newport News	21,136.54	14,941.46	13,082.93	92.28	65.31	57.21	3,237.32	1,625.15	1,141.50	92.40	57.47	46.99	87.81	54.55	44.57	27.33	29.00	29.50	2,271.79	1,259.56	955.89
Norfolk	23,885.94	16,350.98	14,090.49	104.03	70.54	60.49	3,599.87	1,783.47	1,238.54	99.99	59.28	47.06	94.87	56.13	44.51	29.74	30.06	30.16	2,596.83	1,395.08	1,034.55
Poquoson	1,209.97	800.74	677.97	2.95	1.99	1.70	133.95	69.44	50.08	3.38	2.27	1.94	3.20	2.16	1.84	0.97	0.98	0.98	153.01	83.74	62.96
Portsmouth	8,850.23	6,151.29	5,341.61	33.01	22.99	19.99	1,269.01	647.22	460.69	34.87	21.05	16.90	33.12	19.95	16.00	9.91	10.30	10.41	1,040.46	576.07	436.76
Suffolk	12,225.62	8,800.57	7,773.06	62.06	46.35	41.63	2,903.07	1,373.66	914.84	108.99	53.86	37.32	104.67	51.55	35.61	21.62	23.57	24.16	1,222.87	676.61	512.73
Virginia Beach	42,892.10	29,741.61	25,796.47	155.32	108.52	94.48	5,631.77	2,898.74	2,078.83	144.72	95.02	80.11	137.09	90.00	75.88	45.87	48.06	48.72	5,150.32	2,877.35	2,195.46
Williamsburg	1,456.15	971.93	826.66	4.74	3.14	2.67	178.78	89.99	63.35	4.48	2.85	2.36	4.24	2.69	2.23	1.40	1.40	1.40	176.32	96.43	72.47
Hampton Roads Totals:	**189,864.76**	**133,264.82**	**116,284.83**	**769.74**	**546.26**	**479.22**	**29,169.94**	**14,684.44**	**10,338.79**	**861.38**	**509.13**	**403.46**	**820.09**	**483.74**	**382.84**	**239.75**	**253.61**	**257.77**	**20,500.92**	**11,362.37**	**8,620.81**
Virginia Totals:	**1,195,237.09**	**861,199.54**	**760,988.28**	**4,041.05**	**6,162.09**	**6,798.41**	**197,822.24**	**97,694.29**	**67,655.90**	**6,798.41**	**953.63**	**2,553.17**	**6,499.27**	**3,364.56**	**2,424.15**	**1,434.42**	**1,532.75**	**1,562.25**	**108,001.04**	**59,956.54**	**45,543.19**

2017 Values are linearly interpolated from 2007 and 2020 results.

NMIM Summary

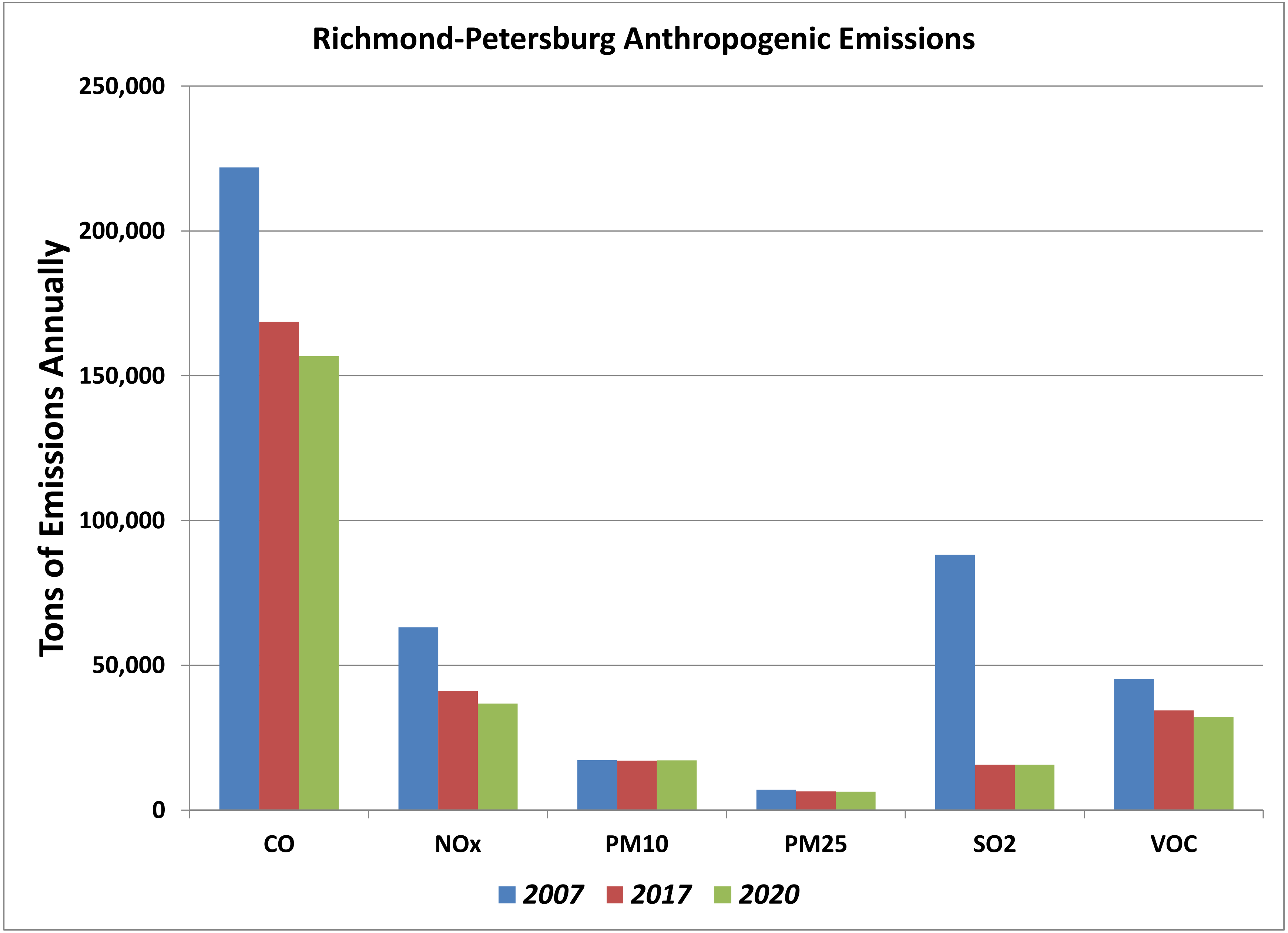
TPY Emission Rates	CO			NH3			NOx			PM10			PM25			SO2			VOC		
	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020
Caroline Totals:	**1,158.99**	**999.57**	**995.51**	**0.20**	**0.24**	**0.25**	**194.28**	**114.64**	**94.53**	**22.07**	**12.34**	**9.77**	**21.07**	**11.72**	**9.26**	**12.82**	**0.23**	**0.23**	**276.22**	**163.28**	**138.93**
Spotsylvania	3,862.74	3,127.58	3,151.45	0.66	0.79	0.83	658.01	366.97	298.95	63.79	36.91	29.17	61.21	35.24	27.75	44.46	0.74	0.76	582.07	335.40	300.27
Stafford	3,853.35	3,135.64	3,171.39	0.68	0.82	0.86	671.52	376.55	305.26	65.35	38.74	30.93	62.75	36.98	29.41	46.81	0.73	0.74	501.28	294.25	270.96
Fredericksburg	811.33	623.49	644.94	0.05	0.06	0.06	45.39	21.85	20.00	3.55	3.01	2.91	3.37	2.83	2.73	1.49	0.09	0.10	57.06	33.58	33.94
Fred Totals:	**8,527.43**	**6,886.72**	**6,967.78**	**1.38**	**1.67**	**1.75**	**1,374.92**	**765.37**	**624.20**	**132.69**	**78.66**	**63.01**	**127.33**	**75.05**	**59.89**	**92.76**	**1.57**	**1.59**	**1,140.41**	**663.23**	**605.18**
Charles City	1,060.45	844.52	828.90	0.14	0.15	0.15	101.69	78.76	71.66	11.86	5.57	4.36	11.18	5.26	4.12	4.96	0.19	0.19	373.95	169.10	133.35
Chesterfield	11,577.45	9,214.97	9,429.01	1.22	1.47	1.55	1,177.68	630.79	528.71	109.56	71.47	60.66	104.75	67.81	57.32	68.97	1.66	1.71	1,196.13	697.40	655.14
Hanover	10,918.44	9,145.98	9,483.99	0.81	0.98	1.03	623.80	362.86	317.06	74.98	60.91	57.17	70.97	57.10	53.42	32.57	1.15	1.19	912.58	607.85	604.48
Henrico	10,809.57	8,349.13	8,510.16	1.60	1.95	2.05	1,695.91	899.50	730.72	147.76	89.19	72.04	142.24	85.31	68.64	110.08	1.94	1.98	928.68	532.58	516.82
Prince George	1,621.75	1,357.18	1,350.02	0.22	0.25	0.26	186.41	116.14	100.28	21.57	11.81	9.43	20.45	11.17	8.89	10.68	0.29	0.29	444.86	238.59	197.76
Colonial Heights	556.19	404.69	415.12	0.03	0.04	0.04	31.65	13.59	12.42	2.21	1.81	1.75	2.09	1.70	1.63	0.93	0.07	0.07	47.25	25.33	24.67
Hopewell	987.52	725.90	746.78	0.05	0.06	0.07	56.62	23.65	21.58	4.25	3.70	3.63	4.01	3.46	3.38	1.63	0.12	0.12	76.79	43.99	43.85
Petersburg	846.52	563.72	573.41	0.05	0.06	0.06	68.78	26.87	23.91	3.60	2.50	2.29	3.44	2.37	2.17	2.07	0.12	0.13	67.37	33.10	31.93
Richmond	9,272.91	7,095.84	7,331.51	0.52	0.63	0.66	524.82	246.31	224.63	38.44	32.04	30.89	36.43	30.10	28.94	16.52	1.07	1.12	669.06	380.31	379.84
Rich-Pet Totals:	**47,650.82**	**37,701.95**	**38,668.91**	**4.65**	**5.58**	**5.87**	**4,467.37**	**2,398.47**	**2,030.97**	**414.22**	**278.99**	**242.21**	**395.56**	**264.28**	**228.51**	**248.40**	**6.60**	**6.81**	**4,716.67**	**2,728.24**	**2,587.85**
Gloucester	3,142.29	2,655.57	2,629.18	0.35	0.39	0.40	237.94	189.09	173.76	30.16	16.57	13.51	28.31	15.55	12.66	11.04	0.52	0.53	946.62	484.96	395.60
Isle of Wight	2,369.11	1,788.23	1,778.00	0.29	0.34	0.36	315.47	175.14	149.30	29.30	17.29	14.37	27.93	16.40	13.60	16.21	0.45	0.47	426.57	240.83	208.10
James City	8,642.63	6,908.96	6,877.76	1.17	1.37	1.43	1,145.63	657.00	556.11	116.13	68.09	55.35	110.57	64.55	52.34	64.76	1.63	1.68	1,762.27	1,003.59	857.10
York	6,715.86	5,631.52	5,755.07	0.56	0.65	0.68	380.08	260.34	235.26	47.69	36.25	33.44	44.85	33.89	31.18	18.84	0.81	0.84	966.70	558.72	506.28
Chesapeake	9,610.56	7,876.19	8,143.37	0.60	0.71	0.75	442.57	265.59	244.23	50.81	41.43	39.52	47.89	38.74	36.86	17.37	0.98	1.02	939.12	562.35	538.21
Hampton	4,257.81	3,322.15	3,358.20	0.30	0.33	0.35	235.65	145.90	137.75	21.62	14.99	13.63	20.26	14.00	12.71	7.26	0.56	0.59	672.99	358.50	312.14
Newport News	6,655.10	4,202.47	4,207.79	0.63	0.74	0.78	867.93	366.80	308.16	53.91	33.95	28.98	51.75	32.38	27.55	37.65	1.25	1.30	562.49	282.72	268.04
Norfolk	9,515.39	7,246.90	7,365.09	1.31	1.58	1.67	1,386.83	736.00	604.94	119.21	73.13	59.92	114.54	69.81	56.97	86.01	1.70	1.74	916.93	510.62	484.11
Poquoson	1,102.00	894.49	896.58	0.09	0.10	0.10	53.07	48.21	46.47	5.35	3.95	3.77	4.97	3.67	3.50	1.58	0.16	0.16	204.73	105.86	91.09
Portsmouth	2,710.26	2,170.14	2,219.67	0.17	0.20	0.20	120.87	74.23	70.44	12.54	9.38	8.71	11.75	8.75	8.12	3.92	0.30	0.31	361.23	197.22	177.20
Suffolk	3,251.92	2,589.63	2,596.03	0.51	0.60	0.62	495.29	292.02	243.61	48.34	27.25	21.79	46.31	25.99	20.72	31.39	0.61	0.62	564.19	296.59	256.72
Virginia Beach	19,667.05	16,217.20	16,493.19	2.01	2.37	2.48	1,658.55	1,031.41	896.29	174.76	115.01	98.91	165.98	108.55	93.02	94.17	2.76	2.84	2,872.19	1,613.31	1,439.38
Williamsburg	799.43	710.13	732.19	0.04	0.05	0.06	21.92	14.08	13.51	4.52	3.93	3.72	4.20	3.64	3.44	0.69	0.07	0.08	104.17	71.04	65.22
HR Total:	**78,439.42**	**62,213.57**	**63,052.11**	**8.03**	**9.44**	**9.87**	**7,361.81**	**4,255.82**	**3,679.81**	**714.35**	**461.22**	**395.61**	**679.32**	**435.93**	**372.68**	**390.91**	**11.80**	**12.18**	**11,300.22**	**6,286.31**	**5,599.18**
VA Total	**415,093.13**	**335,531.35**	**341,458.43**	**44.54**	**52.69**	**55.21**	**41,325.01**	**23,657.58**	**20,189.41**	**4,132.00**	**2,693.12**	**2,317.12**	**3,936.52**	**2,547.72**	**2,184.07**	**2,328.90**	**61.48**	**63.30**	**55,134.54**	**32,141.18**	**29,303.02**

MAR Summary

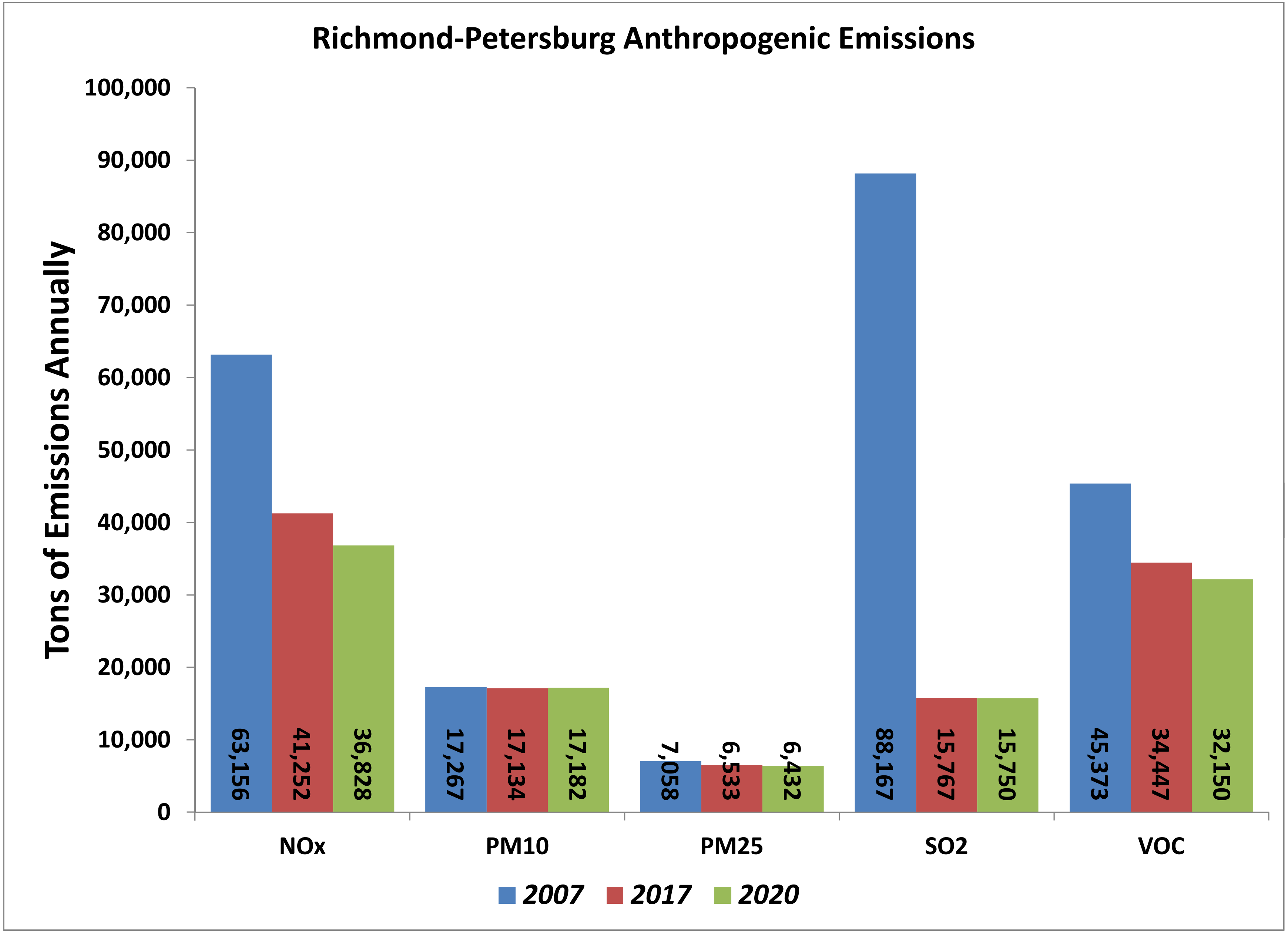
TPY Emission Rates	CO			NH3			NOx			PM10			PM25			SO2			VOC		
	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020
Caroline	**180.72**	**181.87**	**183.76**	**0.15**	**0.15**	**0.16**	**435.19**	**265.41**	**235.27**	**15.63**	**8.20**	**7.11**	**14.05**	**7.15**	**6.13**	**4.40**	**0.10**	**0.10**	**33.86**	**22.92**	**20.82**
Spotsylvania	107.87	108.29	108.94	0.05	0.05	0.05	155.38	93.37	82.56	6.56	3.92	3.53	5.70	3.24	2.87	1.62	0.08	0.08	15.78	11.90	11.13
Stafford	534.73	535.44	536.70	0.10	0.10	0.11	316.13	202.25	181.98	16.12	11.14	10.41	13.33	8.69	8.01	3.28	0.31	0.31	101.30	93.99	92.59
Fredericksburg	5.31	5.42	5.59	0.01	0.01	0.01	39.75	23.78	21.00	1.24	0.57	0.46	1.16	0.53	0.43	0.40	0.00	0.00	1.95	0.95	0.75
Fred Total:	**647.92**	**649.15**	**651.23**	**0.16**	**0.17**	**0.17**	**511.26**	**319.41**	**285.54**	**23.92**	**15.63**	**14.41**	**20.18**	**12.46**	**11.31**	**5.30**	**0.39**	**0.39**	**119.03**	**106.85**	**104.48**
Charles City	9.54	8.96	9.10	0.03	0.03	0.03	65.12	40.98	36.31	2.81	1.08	0.87	2.63	1.02	0.82	75.55	8.50	2.62	2.65	1.62	1.42
Chesterfield	370.53	370.70	372.09	0.13	0.14	0.14	329.28	206.90	183.95	17.08	11.30	10.48	14.33	8.96	8.20	14.01	1.45	0.69	45.98	37.98	36.51
Hanover	206.98	207.66	208.77	0.09	0.09	0.09	264.13	172.85	156.53	11.46	7.36	6.77	9.83	6.02	5.47	2.66	0.15	0.15	28.74	22.95	21.87
Henrico	1,047.84	999.55	1,056.39	0.17	0.18	0.18	703.44	576.83	558.10	31.12	23.27	23.21	26.92	19.88	19.68	58.13	33.34	32.35	98.44	89.38	90.96
Prince George	35.84	35.64	36.36	0.08	0.08	0.08	160.17	103.00	91.87	6.50	2.94	2.47	5.97	2.67	2.24	60.24	6.65	2.07	9.63	5.56	4.86
Colonial Heights	2.46	2.50	2.59	0.01	0.01	0.01	17.56	11.32	10.11	0.57	0.26	0.22	0.52	0.24	0.20	0.17	0.00	0.00	0.89	0.44	0.36
Hopewell	50.05	42.13	41.91	0.10	0.10	0.10	264.32	169.73	146.90	9.88	5.07	4.32	9.60	4.92	4.19	27.65	2.60	1.58	5.55	3.96	3.40
Petersburg	31.75	32.31	33.38	0.09	0.09	0.10	221.99	157.97	144.45	7.28	3.95	3.48	6.82	3.72	3.28	2.17	0.01	0.01	13.45	8.48	7.45
Richmond	87.13	80.48	81.58	0.22	0.22	0.23	538.02	352.39	312.31	19.45	9.51	8.08	17.46	8.83	7.55	34.07	3.06	1.68	21.76	13.56	11.75
Rich-Pet Total:	**1,842.11**	**1,779.93**	**1,842.17**	**0.93**	**0.94**	**0.97**	**2,564.02**	**1,791.96**	**1,640.54**	**106.16**	**64.75**	**59.91**	**94.09**	**56.27**	**51.63**	**274.67**	**55.76**	**41.16**	**227.09**	**183.92**	**178.57**
Gloucester	75.34	74.20	74.16	0.03	0.03	0.03	58.48	45.88	42.73	3.35	2.79	2.69	2.91	2.36	2.27	11.86	9.93	9.93	7.33	7.11	7.03
Isle of Wight	139.84	139.41	139.90	0.06	0.06	0.06	117.23	75.63	67.32	6.99	4.45	4.11	5.92	3.56	3.24	36.50	4.07	1.36	16.37	13.51	13.01
James City	97.92	97.68	98.26	0.07	0.07	0.07	153.91	97.29	86.55	6.99	3.86	3.44	6.13	3.23	2.84	59.43	6.63	2.10	14.36	10.94	10.32
York	60.92	60.82	60.96	0.02	0.02	0.02	92.62	77.88	75.08	4.30	3.64	3.54	3.92	3.31	3.21	22.06	21.41	21.41	7.74	6.87	6.70
Chesapeake	531.27	519.13	519.90	0.38	0.39	0.40	837.80	641.01	594.01	121.49	111.73	110.20	87.66	78.36	76.89	33.20	9.38	9.43	81.43	74.22	72.50
Hampton	775.04	763.42	763.13	0.30	0.30	0.31	1,047.05	871.10	833.35	29.44	14.21	12.37	27.81	13.50	11.76	180.15	57.82	48.58	52.27	49.86	49.11
Newport News	1,699.65	1,274.01	1,296.09	1.82	1.82	1.87	4,789.78	3,164.58	2,769.71	193.11	101.45	88.37	183.57	96.94	84.28	512.36	64.80	46.76	325.25	218.90	212.96
Norfolk	2,338.29	1,808.80	1,818.49	2.66	2.67	2.75	7,610.81	5,116.18	4,532.99	284.40	173.75	155.88	275.21	168.64	151.28	739.60	315.13	310.63	313.90	211.06	197.09
Poquoson	2.52	2.52	2.52	0.00	0.00	0.00	28.62	28.54	28.52	1.00	1.00	1.00	1.00	1.00	1.00	12.18	12.17	12.17	0.38	0.38	0.38
Portsmouth	575.60	479.96	477.14	1.31	1.32	1.36	2,993.36	1,935.85	1,670.99	107.40	59.96	51.88	104.20	58.20	50.36	182.06	20.07	20.47	65.70	46.98	40.24
Suffolk	186.33	126.14	127.09	0.08	0.09	0.09	175.90	116.50	105.10	9.53	4.96	4.50	8.05	4.11	3.69	2.04	0.09	0.09	24.36	13.72	12.90
Virginia Beach	2,037.64	2,028.25	2,028.18	0.33	0.32	0.33	1,875.68	1,642.63	1,601.37	466.76	436.48	433.37	330.99	302.82	299.91	590.09	302.91	278.40	671.09	668.87	668.39
Williamsburg	5.68	5.79	5.98	0.02	0.02	0.02	41.33	25.89	23.04	1.32	0.60	0.50	1.22	0.56	0.46	0.41	0.00	0.00	2.07	1.01	0.82
HR Total:	**8,526.04**	**7,380.12**	**7,411.79**	**7.08**	**7.08**	**7.29**	**19,822.57**	**13,838.95**	**12,430.74**	**1,236.08**	**918.89**	**871.85**	**1,038.59**	**736.58**	**691.20**	**2,381.95**	**824.40**	**761.34**	**1,582.24**	**1,323.42**	**1,291.45**
VA Total:	**28,444.15**	**28,604.86**	**29,183.40**	**17.33**	**17.43**	**17.96**	**45,599.82**	**32,268.42**	**29,494.77**	**2,402.11**	**1,602.86**	**1,498.31**	**2,073.91**	**1,321.20**	**1,221.57**	**4,673.51**	**######**	**######**	**4,311.87**	**3,710.21**	**3,622.49**

Point NonEGU Summary

TPY Emission Rates	CO			NH3			NOx			PM10			PM25			SO2			VOC		
	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020
Caroline Totals:	**15.70**	**15.87**	**15.87**	**0.12**	**0.12**	**0.12**	**16.32**	**16.63**	**16.68**	**9.71**	**9.82**	**9.83**	**7.85**	**7.94**	**7.95**	**11.14**	**11.15**	**11.16**	**42.62**	**42.80**	**42.85**
Spotsylvania	12.27	12.65	12.67	-	-	-	55.87	58.71	59.21	23.52	23.67	23.71	19.90	20.05	20.08	18.55	18.99	19.11	116.96	117.01	117.06
Stafford	138.06	151.19	156.44	-	-	-	120.46	129.60	131.73	13.03	14.82	15.42	7.46	8.16	8.40	33.27	34.16	34.41	85.08	84.04	84.31
Fredericksburg	3.34	3.91	3.89	-	-	-	3.98	4.65	4.63	1.21	1.41	1.41	1.21	1.41	1.41	0.02	0.03	0.03	105.04	105.07	105.07
Fred Totals:	**153.67**	**167.75**	**172.99**	**-**	**-**	**-**	**180.31**	**192.96**	**195.57**	**37.76**	**39.91**	**40.53**	**28.57**	**29.62**	**29.89**	**51.84**	**53.18**	**53.55**	**307.08**	**306.12**	**306.44**
Charles City	131.31	145.86	149.58	-	-	-	128.68	140.68	143.32	128.49	138.97	141.33	122.56	132.07	134.12	5.01	6.34	6.64	69.61	77.39	79.40
Chesterfield	366.75	408.02	414.30	18.53	19.07	19.06	1,168.37	1,199.06	1,200.58	331.02	320.71	321.81	311.26	308.81	309.91	2,351.48	1,792.39	1,795.80	1,651.62	1,660.92	1,663.26
Hanover	384.07	386.25	387.14	0.40	0.49	0.50	382.40	390.14	392.07	319.93	203.59	204.37	296.39	179.93	180.54	421.74	421.77	421.80	566.95	567.35	567.69
Henrico	268.21	302.41	311.47	57.85	58.25	58.30	106.71	117.71	119.10	82.08	88.39	89.71	72.62	78.44	79.60	16.97	18.04	18.37	689.48	698.39	702.41
Prince George	22.91	23.71	24.04	0.07	0.07	0.07	94.82	96.59	97.15	18.57	19.88	20.30	13.91	14.88	15.20	0.74	0.78	0.80	17.13	18.21	18.77
Colonial Heights	0.35	0.35	0.35	-	-	-	1.76	1.76	1.76	0.50	0.50	0.50	0.39	0.39	0.39	0.01	0.01	0.01	108.52	108.52	108.52
Hopewell	4,185.43	4,220.63	4,257.66	1,006.64	1,006.66	1,006.66	9,778.17	9,874.84	9,885.68	675.69	690.67	690.34	508.50	528.72	528.39	2,226.20	2,231.64	2,243.90	1,208.72	1,211.34	1,215.16
Petersburg	18.75	21.79	21.74	3.68	3.80	3.80	30.14	34.21	34.23	15.67	16.94	16.98	14.99	16.22	16.26	62.33	64.13	64.68	32.60	33.17	33.28
Richmond	367.59	373.19	374.17	241.70	242.02	242.01	570.41	578.19	578.62	74.04	63.55	63.57	66.74	61.15	61.16	594.15	594.90	595.23	2,139.84	2,200.49	2,221.06
Rich-Pet Totals:	**5,745.37**	**5,882.21**	**5,940.45**	**1,328.87**	**1,330.36**	**1,330.40**	**12,261.45**	**12,433.18**	**12,452.52**	**1,645.98**	**1,543.20**	**1,548.92**	**1,407.35**	**1,320.62**	**1,325.57**	**5,678.65**	**5,130.00**	**5,147.22**	**6,484.46**	**6,575.78**	**6,609.56**
Gloucester	6.40	7.45	7.78	-	-	-	18.43	21.45	22.41	25.24	28.53	29.57	22.28	25.09	25.97	5.40	6.29	6.57	23.61	27.48	28.72
Isle of Wight	2,426.17	2,430.32	2,431.74	0.06	0.06	0.06	2,516.11	2,521.23	2,523.38	917.10	919.45	920.53	518.11	520.10	521.07	7,278.72	7,278.77	7,278.78	1,293.55	1,293.98	1,294.00
James City	182.78	191.68	191.60	-	-	-	608.73	651.26	661.03	97.51	102.52	103.05	86.30	91.08	91.53	647.44	667.95	674.26	566.66	575.01	577.35
York	24,497.67	25,034.32	25,196.82	0.09	0.09	0.09	622.45	634.12	637.65	68.09	69.08	69.38	60.92	61.76	62.01	600.60	613.54	617.46	1,248.90	1,276.18	1,284.45
Chesapeake	156.29	160.85	161.51	-	-	-	259.78	273.05	275.85	164.00	174.25	177.44	68.35	73.37	74.80	392.83	393.91	394.14	623.79	654.20	664.04
Hampton	143.46	159.92	164.49	0.69	0.70	0.70	-	263.78	266.02	57.19	55.70	57.01	34.80	32.54	32.93	110.67	111.44	111.62	55.47	59.54	60.85
Newport News	249.98	254.69	255.89	3.47	3.49	3.49	555.67	560.98	561.87	336.98	339.77	341.34	249.11	248.15	248.55	1,184.39	1,184.44	1,184.45	415.01	413.02	415.05
Norfolk	408.07	422.80	423.86	4.35	4.73	4.72	379.33	401.56	403.19	325.22	336.53	339.94	156.05	162.09	163.87	813.66	813.86	813.89	467.52	480.58	484.90
Poquoson																					
Portsmouth	536.14	1,284.16	1,362.28	0.16	0.18	0.18	990.66	2,106.92	2,177.51	172.48	209.45	215.28	120.55	142.17	145.67	179.80	388.51	419.30	158.21	170.36	174.29
Suffolk	116.21	124.24	127.48	1.26	1.26	1.26	123.99	173.61	173.92	52.13	58.69	59.85	33.15	37.70	38.55	38.63	56.97	59.66	90.51	95.51	96.38
Virginia Beach	291.12	287.03	292.09	0.91	1.02	1.02	152.95	156.17	158.78	42.24	43.91	44.94	33.79	35.34	36.29	160.23	160.41	160.48	96.22	101.84	104.61
Williamsburg																					
HR Total:	**29,014.29**	**30,357.44**	**30,615.53**	**10.98**	**11.53**	**11.52**	**6,228.09**	**7,764.15**	**7,861.60**	**2,258.19**	**2,337.88**	**2,358.34**	**1,383.39**	**1,429.37**	**1,441.23**	**11,412.37**	**11,676.07**	**11,720.60**	**5,039.43**	**5,147.70**	**5,184.65**
VA Total	63,079.40	65,739.60	66,211.63	1,618.34	1,697.89	1,709.30	50,264.93	53,236.10	53,590.56	13,027.84	12,517.20	12,601.86	10,295.54	9,885.47	9,947.10	54,486.27	52,043.55	52,338.12	35,017.99	35,461.19	35,593.32



Appendix A-2007-2017-2020 OA Summary.xlsx-Rich-Pet Totals



Appendix A-2007-2017-2020 OA Summary.xlsx-Rich-Pet Totals wo CO

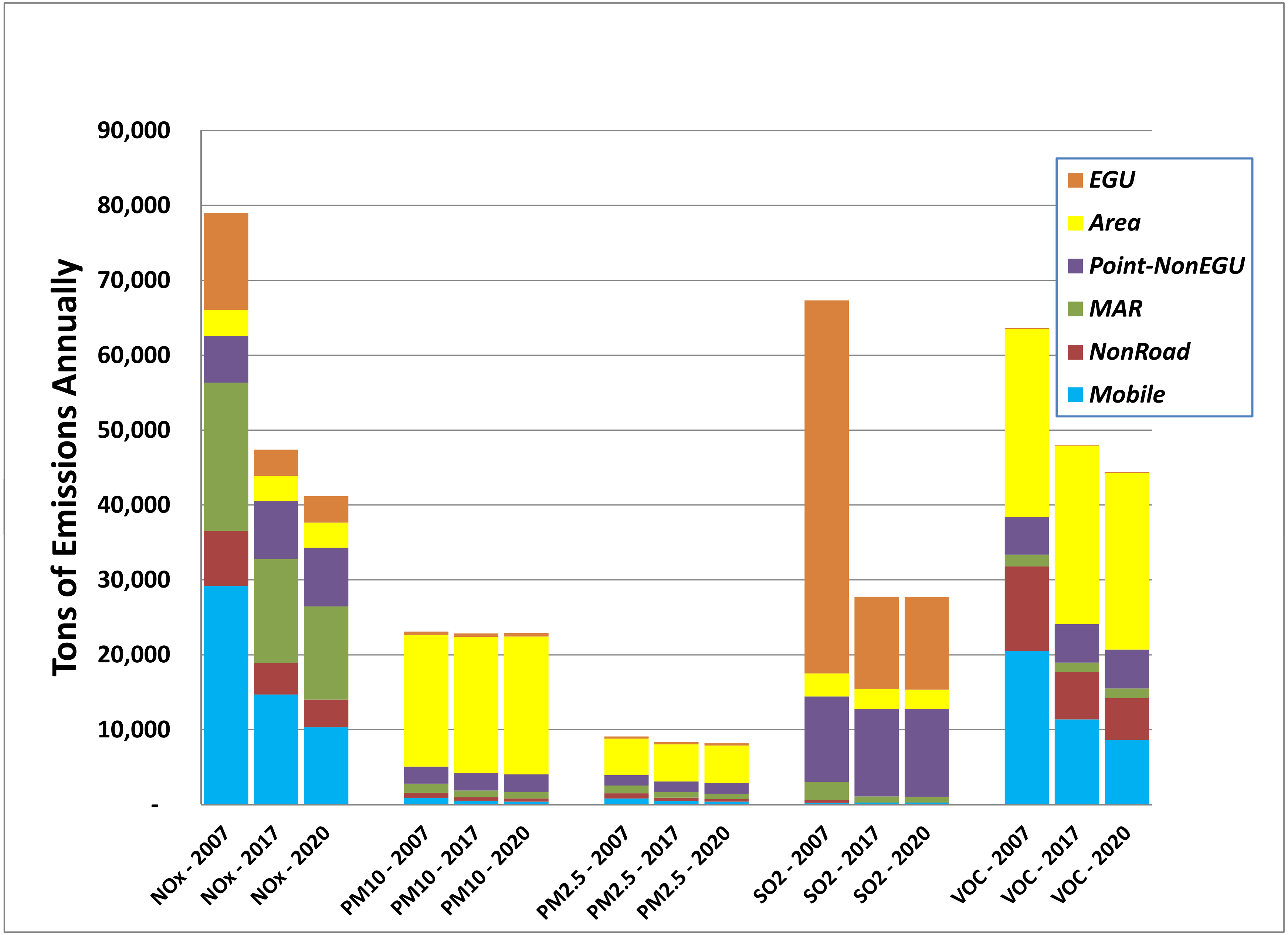
Hampton Roads

	NOx - 2007	NOx - 2017	NOx - 2020	PM10 - 2007	PM10 - 2017	PM10 - 2020	PM2.5 - 20(	PM2.5 - 20:	PM2.5 - 2020	SO2 - 2007	SO2 - 2017	SO2 - 2020	VOC - 2007	VOC - 2017	VOC - 2020
Mobile	29,170	14,684	10,339	861	509	403	820	484	383	240	254	258	20,501	11,362	8,621
NonRoad	7,362	4,256	3,680	714	461	396	679	436	373	391	12	12	11,300	6,286	5,599
MAR	19,823	13,839	12,431	1,236	919	872	1,039	737	691	2,382	824	761	1,582	1,323	1,291
Point-NonI	6,228	7,764	7,862	2,258	2,338	2,358	1,383	1,429	1,441	11,412	11,676	11,721	5,039	5,148	5,185
Area	3,458	3,332	3,352	17,583	18,180	18,414	4,887	4,968	5,013	3,088	2,667	2,611	25,079	23,794	23,604
EGU	12,974	3,530	3,533	456	456	456	290	290	290	49,815	12,325	12,369	106	106	106
Total:	79,015	47,405	41,196	23,109	22,864	22,899	9,098	8,344	8,191	67,327	27,758	27,733	63,608	48,019	44,406

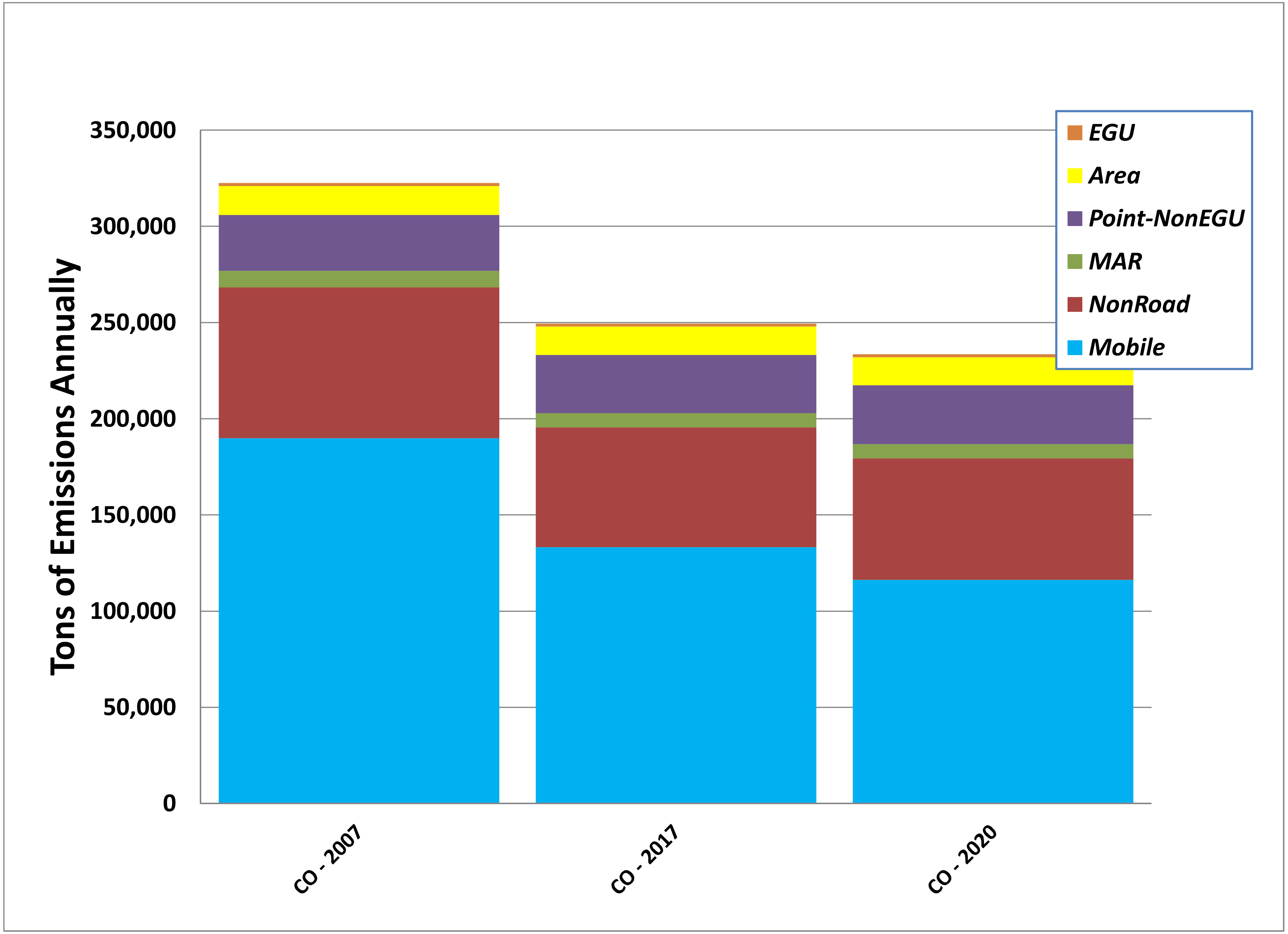
		CO	
	CO - 2007	CO - 2017	CO - 2020
Mobile	189,865	133,265	116,285
NonRoad	78,439	62,214	63,052
MAR	8,526	7,380	7,412
Point-NonI	29,014	30,357	30,616
Area	15,129	14,708	14,625
EGU	1,552	1,552	1,552
Total:	322,525	249,476	233,541

Virginia and Ozone Advance Summaries

TPY Emission Rates	CO			NH3			NOx			PM10			PM25			SO2			VOC		
	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020
Caroline																					
Mobile	10,650.50	8,038.51	7,254.91	41.63	32.29	29.49	2,738.92	1,315.82	888.89	104.14	47.86	30.98	100.09	45.81	29.53	19.68	22.30	23.08	700.09	394.29	302.54
NonRoad	1,158.99	999.57	995.51	0.20	0.24	0.25	194.28	114.64	94.53	22.07	12.34	9.77	21.07	11.72	9.26	12.82	0.23	0.23	276.22	163.28	138.93
MAR	180.72	181.87	183.76	0.15	0.15	0.16	435.19	265.41	235.27	15.63	8.20	7.11	14.05	7.15	6.13	4.40	0.10	0.10	33.86	22.92	20.82
Point-NonEGU	15.70	15.87	15.87	0.12	0.12	0.12	16.32	16.63	16.68	9.71	9.82	9.83	7.85	7.94	7.95	11.14	11.15	11.16	42.62	42.80	42.85
Area	917.68	909.13	906.88	183.21	169.37	165.39	66.39	64.65	64.78	1,544.22	1,572.45	1,585.99	347.68	356.62	360.57	40.22	34.66	33.75	1,096.40	1,080.69	1,096.62
EGU	0.92	0.92	0.92	0.00	0.00	0.00	51.70	59.17	49.82	8.12	8.12	8.12	8.12	8.12	8.12	5.66	4.19	3.53	2.17	2.17	2.17
Total:	**12,924.51**	**10,145.86**	**9,357.84**	**225.31**	**202.17**	**195.41**	**3,502.81**	**1,836.33**	**1,349.97**	**1,703.89**	**1,658.79**	**1,651.79**	**498.87**	**437.36**	**421.56**	**93.91**	**72.64**	**71.86**	**2,151.36**	**1,706.15**	**1,603.93**
Fredericksburg																					
Mobile	44,374.01	35,156.02	32,390.63	154.14	122.38	112.85	7,697.27	3,925.27	2,793.67	289.39	154.77	114.38	277.28	147.72	108.85	57.63	67.27	70.16	3,747.90	2,242.59	1,790.99
NonRoad	8,527.43	6,886.72	6,967.78	1.38	1.67	1.75	1,374.92	765.37	624.20	132.69	78.66	63.01	127.33	75.05	59.89	92.76	1.57	1.59	1,140.41	663.23	605.18
MAR	647.92	649.15	651.23	0.16	0.17	0.17	511.26	319.41	285.54	23.92	15.63	14.41	20.18	12.46	11.31	5.30	0.39	0.39	119.03	106.85	104.48
Point-NonEGU	153.67	167.75	172.99	0.00	0.00	0.00	180.31	192.96	195.57	37.76	39.91	40.53	28.57	29.62	29.89	51.84	53.18	53.55	307.08	306.12	306.44
Area	5,094.43	5,009.16	4,987.45	260.03	257.34	256.71	555.82	538.60	540.90	5,134.94	5,486.96	5,622.21	1,344.88	1,420.15	1,450.60	377.26	322.84	313.64	4,016.79	3,882.43	3,969.72
EGU	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total:	**58,797.47**	**47,868.79**	**45,170.07**	**415.71**	**381.55**	**371.48**	**10,319.58**	**5,741.60**	**4,439.88**	**5,618.71**	**5,775.93**	**5,854.53**	**1,798.23**	**1,685.00**	**1,660.55**	**584.78**	**445.25**	**439.33**	**9,331.21**	**7,201.21**	**6,776.81**
Richmond-Petersburg																					
Mobile	152,324.01	109,270.92	96,354.99	541.46	385.09	338.19	24,400.56	11,747.43	7,951.49	805.30	437.88	327.66	769.59	417.25	311.55	135.25	144.31	147.03	15,380.76	8,349.46	6,240.07
NonRoad	47,650.82	37,701.95	38,668.91	4.65	5.58	5.87	4,467.37	2,398.47	2,030.97	414.22	278.99	242.21	395.56	264.28	228.51	248.40	6.60	6.81	4,716.67	2,728.24	2,587.85
MAR	1,842.11	1,779.93	1,842.17	0.93	0.94	0.97	2,564.02	1,791.96	1,640.54	106.16	64.75	59.91	94.09	56.27	51.63	274.67	55.76	41.16	227.09	183.92	178.57
Point-NonEGU	5,745.37	5,882.21	5,940.45	1,328.87	1,330.36	1,330.40	12,261.45	12,433.18	12,452.52	1,645.98	1,543.20	1,548.92	1,407.35	1,320.62	1,325.57	5,678.65	5,130.00	5,147.22	6,484.46	6,575.78	6,609.56
Area	12,015.96	11,697.60	11,636.51	792.87	796.06	797.55	2,419.38	2,334.29	2,350.86	12,483.58	12,997.69	13,192.24	3,630.78	3,713.66	3,754.01	2,298.19	2,003.00	1,968.45	18,392.06	16,437.09	16,362.04
EGU	2,313.70	2,313.70	2,313.70	93.49	93.49	93.49	17,043.19	10,546.48	10,401.54	1,811.28	1,811.28	1,811.28	760.92	760.92	760.92	79,531.86	8,427.09	8,439.13	172.41	172.41	172.41
Total:	**221,891.97**	**168,646.30**	**156,756.72**	**2,762.26**	**2,611.52**	**2,566.47**	**63,155.98**	**41,251.81**	**36,827.93**	**17,266.52**	**17,133.80**	**17,182.21**	**7,058.29**	**6,532.99**	**6,432.20**	**88,167.02**	**15,766.76**	**15,749.80**	**45,373.45**	**34,446.90**	**32,150.50**
Hampton Roads																					
Mobile	189,864.76	133,264.82	116,284.83	769.74	546.26	479.22	29,169.94	14,684.44	10,338.79	861.38	509.13	403.46	820.09	483.74	382.84	239.75	253.61	257.77	20,500.92	11,362.37	8,620.81
NonRoad	78,439.42	62,213.57	63,052.11	8.03	9.44	9.87	7,361.81	4,255.82	3,679.81	714.35	461.22	395.61	679.32	435.93	372.68	390.91	11.80	12.18	11,300.22	6,286.31	5,599.18
MAR	8,526.04	7,380.12	7,411.79	7.08	7.08	7.29	19,822.57	13,838.95	12,430.74	1,236.08	918.89	871.85	1,038.59	736.58	691.20	2,381.95	824.40	761.34	1,582.24	1,323.42	1,291.45
Point-NonEGU	29,014.29	30,357.44	30,615.53	10.98	11.53	11.52	6,228.09	7,764.15	7,861.60	2,258.19	2,337.88	2,358.34	1,383.39	1,429.37	1,441.23	11,412.37	11,676.07	11,720.60	5,039.43	5,147.70	5,184.65
Area	15,129.06	14,707.81	14,625.25	1,717.96	1,694.75	1,688.20	3,458.45	3,331.56	3,352.23	17,583.23	18,180.44	18,413.57	4,886.51	4,968.08	5,012.83	3,087.65	2,667.15	2,611.47	25,079.31	23,793.68	23,604.37
EGU	1,551.88	1,551.88	1,551.88	28.44	28.44	28.44	12,974.37	3,529.70	3,532.77	456.07	456.07	456.07	290.10	290.10	290.10	49,814.63	12,324.57	12,369.34	105.59	105.59	105.59
Total:	**322,525.46**	**249,475.65**	**233,541.39**	**2,542.22**	**2,297.49**	**2,224.53**	**79,015.23**	**47,404.61**	**41,195.94**	**23,109.30**	**22,863.63**	**22,898.91**	**9,098.00**	**8,343.80**	**8,190.87**	**67,327.24**	**27,757.59**	**27,732.70**	**63,607.72**	**48,019.07**	**44,406.05**
Virginia-Wide																					
Mobile	1,195,237.09	861,199.54	760,988.28	4,041.05	6,162.09	6,798.41	197,822.24	97,694.29	67,655.90	6,798.41	953.63	2,553.17	6,499.27	3,364.56	2,424.15	1,434.42	1,532.75	1,562.25	108,001.04	59,956.54	45,543.19
NonRoad	415,093.13	335,531.35	341,458.43	44.54	52.69	55.21	41,325.01	23,657.58	20,189.41	4,132.00	2,693.12	2,317.12	3,936.52	2,547.72	2,184.07	2,328.90	61.48	63.30	55,134.54	32,141.18	29,303.02
MAR	28,444.15	28,604.86	29,183.40	17.33	17.43	17.96	45,599.82	32,268.42	29,494.77	2,402.11	1,602.86	1,498.31	2,073.91	1,321.20	1,221.57	4,673.51	1,394.95	1,213.75	4,311.87	3,710.21	3,622.49
Point-NonEGU	63,079.40	65,739.60	66,211.63	1,618.34	1,697.89	1,709.30	50,264.93	53,236.10	53,590.56	13,027.84	12,517.20	12,601.86	10,295.54	9,885.47	9,947.10	54,486.27	52,043.55	52,338.12	35,017.99	35,461.19	35,593.32
Area	132,098.48	129,478.58	128,936.86	43,394.20	45,862.39	46,434.16	19,055.70	18,410.73	18,519.94	183,340.65	188,210.75	190,096.65	44,101.98	44,850.68	45,215.89	17,098.22	14,880.13	14,616.19	142,218.06	135,379.23	135,001.63
EGU	7,255.41	7,255.41	7,255.41	212.24	212.24	212.24	62,308.56	30,649.70	30,270.85	3,375.41	3,375.41	3,375.41	1,811.58	1,811.58	1,811.58	187,670.64	24,546.33	24,600.43	689.43	689.43	689.43
Total:	**1,841,207.66**	**1,427,809.34**	**1,334,034.01**	**49,327.71**	**54,004.72**	**55,227.28**	**416,376.25**	**255,916.82**	**219,721.43**	**213,076.41**	**209,352.97**	**212,442.52**	**68,718.79**	**63,781.22**	**62,804.37**	**267,691.96**	**94,459.20**	**94,394.04**	**345,372.94**	**267,337.78**	**249,753.10**



Appendix A-2007-2017-2020 OA Summary.xlsx-HR Clustered Chart

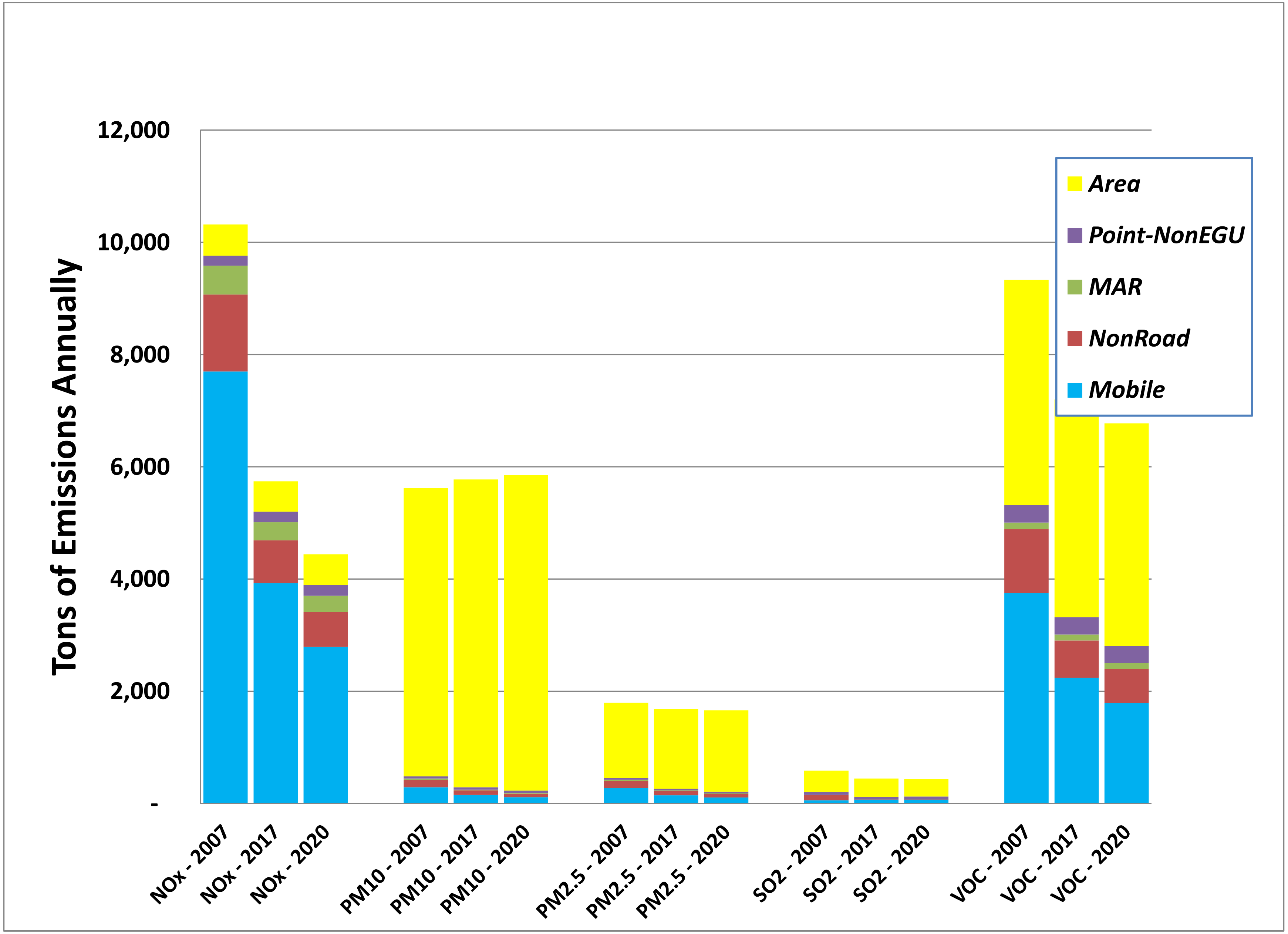


Appendix A-2007-2017-2020 OA Summary.xlsx-HR Cluster CO

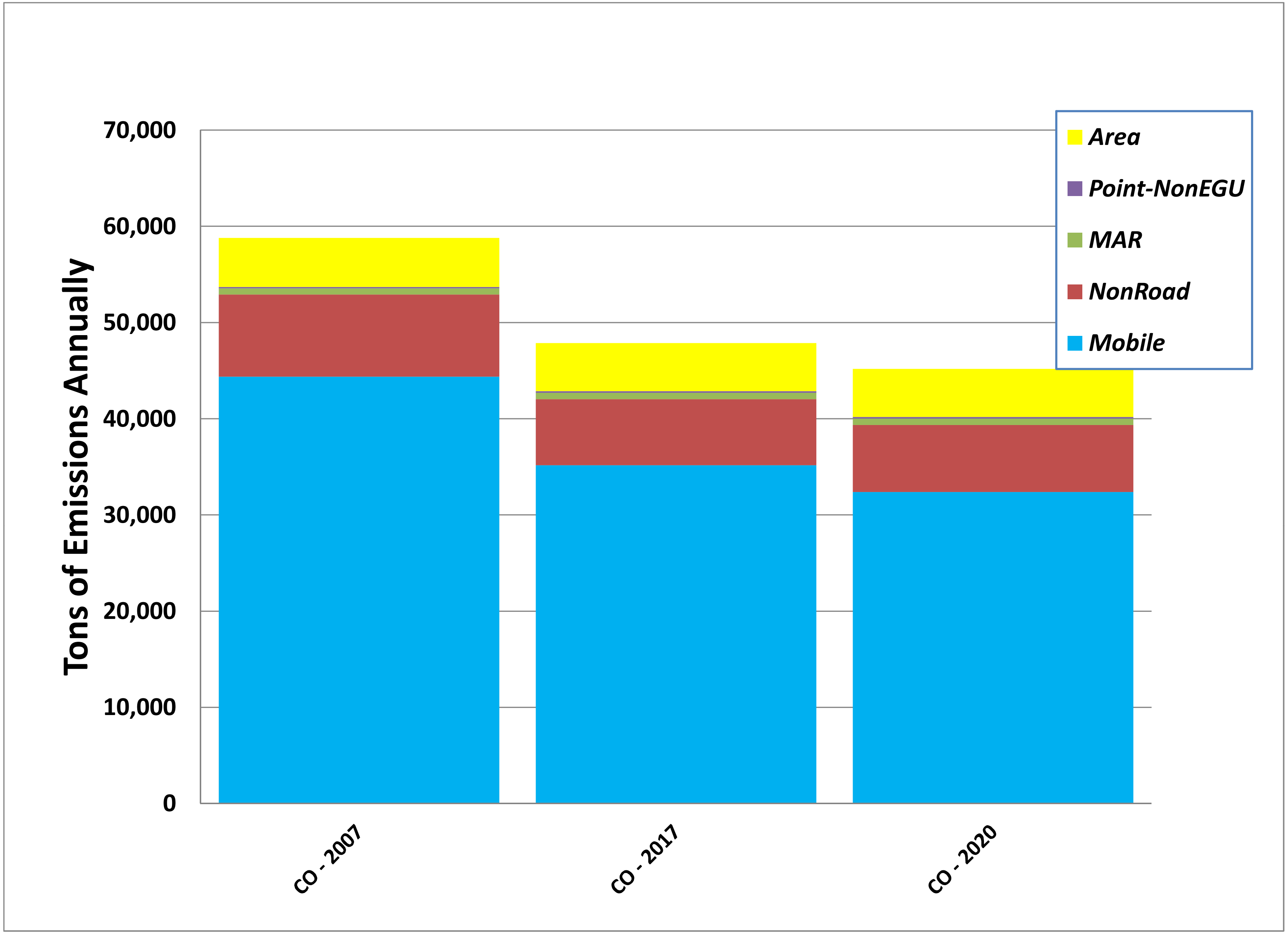
Fredericksburg Clustered Data

	NOx - 2007	NOx - 2017	NOx - 2020	PM10 - 2007	PM10 - 2017	PM10 - 2020	PM2.5 - 20(	PM2.5 - 20:	PM2.5 - 2020	SO2 - 2007	SO2 - 2017	SO2 - 2020	VOC - 2007	VOC - 2017	VOC - 2020
Mobile	7,697	3,925	2,794	289	155	114	277	148	109	58	67	70	3,748	2,243	1,791
NonRoad	1,375	765	624	133	79	63	127	75	60	93	2	2	1,140	663	605
MAR	511	319	286	24	16	14	20	12	11	5	0	0	119	107	104
Point-NonE	180	193	196	38	40	41	29	30	30	52	53	54	307	306	306
Area	556	539	541	5,135	5,487	5,622	1,345	1,420	1,451	377	323	314	4,017	3,882	3,970
EGU	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total:	10,320	5,742	4,440	5,619	5,776	5,855	1,798	1,685	1,661	585	445	439	9,331	7,201	6,777

		CO	
	CO - 2007	CO - 2017	CO - 2020
Mobile	44,374	35,156	32,391
NonRoad	8,527	6,887	6,968
MAR	648	649	651
Point-NonE	154	168	173
Area	5,094	5,009	4,987
EGU	n/a	n/a	n/a
Total:	58,797	47,869	45,170



Appendix A-2007-2017-2020 OA Summary.xlsx-Fred Cluster Chart



Appendix A-2007-2017-2020 OA Summary.xlsx-Fred Clustered CO Chart

Technical Support Document
for the
Development of the 2007
Emission Inventory
for Regional Air Quality Modeling
in the Northeast / Mid-Atlantic Region

Version 3.3

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About MARAMA

The Mid-Atlantic Regional Air Management Association, Inc. is a voluntary, non-profit association of ten state and local air pollution control agencies. MARAMA's mission is to strengthen the skills and capabilities of member agencies and to help them work together to prevent and reduce air pollution in the Mid-Atlantic Region. MARAMA provides cost-effective approaches to regional collaboration by pooling resources to develop and analyze data, share ideas, and train staff to implement common requirements.

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Acronyms and Abbreviations

Acronym	Description
CAMD	Clean Air Markets Division (USEPA)
CAP	Criteria Air Pollutant
CEM	Continuous Emission Monitoring
CMV	Commercial Marine Vessel
CO	Carbon Monoxide
EGU	Electric Generating Unit
ERTAC	Eastern Regional Technical Advisory Committee
FIPS	Federal Information Processing Standard
GSE	Ground Support Equipment
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MANE-VU+VA	MANE-VU States plus Virginia
MAR	Marine, Airport, Rail
MARAMA	Mid-Atlantic Regional Air Management Association
MOBILE6	USEPA model
MOVES	Motor Vehicle Emissions Simulator
NAICS	North American Industry Classification System code
NCD	National County Database
NEI	National Emission Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NH3	Ammonia
NIF3.0	National Emission Inventory Input Format Version 3.0
NMIM	National Mobile Input Model
NOF3.0	National Emission Inventory Output Format Version 3.0
NONROAD	USEPA model
NOx	Oxides of nitrogen
OAQPS	Office of Air Quality Planning and Standards (USEPA)
ORL	One-record-per-line (SMOKE Format)
OTAQ	Office of Transportation and Air Quality (USEPA)
PFC	Portable Fuel Container
PM-CON	Primary PM, Condensable portion only (all < 1 micron)
PM-FIL	Primary PM, Filterable portion only
PM-PRI	Primary PM, includes filterables and condensables PM-PRI= PM-FIL + PM-CON
PM10-FIL	Primary PM10, Filterable portion only
PM10-PRI	Primary PM10, includes filterables and condensables, PM10- PRI = PM0-FIL + PM-CON

Acronym	**Description**
PM25-FIL	Primary PM2.5, Filterable portion only
PM25-PRI	Primary PM2.5, includes filterables and condensables PM25-PRI= PM25-FIL + PM-CON
RWC	Residential Wood Combustion
SEMAP	Southeast Modeling, Analysis and Planning
SIC	Standard Industrial Classification code
SIP	State Implementation Plan
SCC	Source Classification Code
S/L	State/local
SMOKE	Sparse Matrix Operator Kernel Emissions
SO2	Sulfur Dioxide
USEPA	U.S Environmental Protection Agency
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

This technical support document (TSD) explains the data sources, methods, and results for preparing the 2007 criteria air pollutant (CAP) and ammonia (NH3) emission inventory for the Northeast and Mid-Atlantic/Northeast region. The region includes the Mid-Atlantic / Northeast Visibility Union (MANE-VU) area plus Virginia. In this document, this region will be referred to as the MANE-VU+VA region. The MANE-VU+VA region includes Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia. Local air planning agencies include Philadelphia and Allegheny County, Pennsylvania.

1.1 INVENTORY PURPOSE

The MANE-VU+VA regional inventory will be used to concurrently address national ambient air quality standard (NAAQS) requirements for the new ozone and fine particle ambient standards and to evaluate progress towards long-term regional haze goals. Similar pollutant emissions and atmospheric processes control chemical formation and transport of ozone, fine particles, and regional haze. Therefore, similar technical analyses are necessary to evaluate air quality benefits of emissions controls. The emissions inventory will support a single integrated, one-atmosphere air quality modeling platform to support State air quality attainment demonstrations.

The U.S. Environmental Protection Agency (USEPA) has provided guidance on developing emission inventories to be used with models and other analyses for demonstrating attainment of air quality goals for ozone, fine particles, and regional haze (USEPA 2007a). According to the USEPA guidance, there are potentially two different base year emissions inventories. One is the base case inventory which represents the actual emissions for the meteorological period that is being modeled. This inventory is generally used for model performance evaluations. The second potential base year inventory is called the baseline inventory, which is generally used as the basis for projecting emissions to the future. The base case inventory may include day specific information (e.g. hourly continuous emission monitoring data for point sources) that USEPA considers inappropriate for using in future year projections. Therefore, the baseline inventory may need to replace the day specific emissions with average or "typical" emissions (for certain types of sources). For the 2007 MANE-VU+VA inventory, the base case and baseline inventories are one in the same.

1.2 POLLUTANTS

The inventory includes annual emissions for carbon monoxide (CO), ammonia (NH3), oxides of nitrogen (NOx), particulate matter (PM), sulfur dioxide (SO2), and volatile organic compounds (VOC). The PM species in the inventory are categorized as: filterable and condensable particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., PM10-PRI and PM25-PRI); filterable particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., PM10-FIL and PM25-FIL); and condensable particles (PM-CON). Note that PM10-PRI equals the sum of PM10-FIL and PM-CON, and PM25-PRI equals the sum of PM25-FIL and PM-CON.

1.3 SOURCE CATEGORIES

Emission inventory data from five general categories are needed to support air quality modeling: stationary point-sources, stationary area-sources, on-road mobile sources, nonroad mobile sources (including aircraft, railroad, and marine vessels), and biogenic/geogenic emissions. These sectors are described as follows:

- **Point Sources** are individual facilities and are further subdivided by stack, emission unit ("point"), and emission process ("segment"). The point source data include source-specific information on the location of sources (e.g., latitude/longitude coordinates); stack parameters (stack diameter and height, exit gas temperature and velocity); type of emission process (Source Classification Code {SCC}); and annual emissions. Point sources were classified as electric generating units (EGUs) and non-electric generating units (nonEGUs). Most point source emissions data is certified by the facility and reported to the State agency or USEPA.

- **Stationary Area Sources** include sources that in and of themselves are small, but in aggregate may comprise significant emissions. Examples include emissions from small industrial/commercial facilities, residential heating furnaces, VOCs volatizing from house painting or consumer products, gasoline service stations, and agricultural fertilizer/pesticide application. Emissions were calculated using emission factors and activity data on a county and source category basis.

- **On-road Mobile Source** emissions include sources of air pollution from internal combustion engines used to propel cars, trucks, buses, and other vehicles on public roadways. Emissions were calculated by the Northeast States for Coordinated Air

Use Management (NESCAUM) using the USEPA Motor Vehicle Emission Simulator (MOVES) model in concert with vehicle miles traveled (VMT) data.

- **Non-road Mobile Sources** include internal combustion engines used to propel marine vessels, airplanes, and locomotives, or to operate equipment such as forklifts, lawn and garden equipment, portable generators, etc. For activities other than marine vessels, airplanes, and locomotives, the inventory was developed using the most current version of USEPA's NONROAD model as embedded in the National Mobile Inventory Model (NMIM). Since the NONROAD model does not include emissions from marine vessels, airplanes, and locomotives, these emissions were estimated using the latest USEPA guidance or by groups such as the Eastern Regional Technical Advisory Committee (ERTAC).

- **Biogenic** emissions are emitted by natural sources, such as plants, trees, and soils. The sharp scent of pine needles, for instance, is caused by monoterpenes, which are VOCs. The USEPA developed estimates of biogenic emissions from vegetation for natural areas, crops, and urban vegetation. The USEPA estimates take into account the geographic variations in vegetation land cover and species composition, as well as seasonal variations in leaf cover.

For all sectors, emissions data were compiled on an annual basis to represent 2007 actual emissions and meteorology. For certain large EGUs and nonEGUs, actual hourly 2007 emissions data were adapted for use in the inventory. For sources with emissions estimated by NONROAD model, emissions were compiled as monthly total emissions. For sources included in the MOVES model, emissions will be compiled on an hourly basis.

1.4 DATA FORMATS

The annual mass emissions inventory files were prepared in the National Emissions Inventory (NEI) Output Format Version 3.0 (NOF 3.0). These annual emission inventories will be converted (through the emissions modeling process) from their original resolution (e.g., annual, county level) to input files for air quality models. These input files generally require emissions to be specified by model grid cell, hour, and model chemical species. The emission modelers in the MANE-VU+VA region are using the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system and data formats. Ancillary files (holding spatial, temporal, and speciation profile data) were prepared in SMOKE compatible format. Various spreadsheets summarizing emissions by county, sector, SCC, and pollutant were also prepared.

1.5 SUMMARY OF INVENTORY DEVELOPMENT PROCESS

Work on Version 1 of the 2007 MANE-VU+VA inventory began in April 2009. Preparation of the consolidated inventory for point, area, onroad, and nonroad sources started with the inventories submitted by State and local (S/L) as well as input files needed by the NONROAD and MOVES models. For certain area and nonroad source categories, the S/L submittals were supplemented 2008 NEI data. In addition, the Carnegie Mellon Ammonia model was exercised to calculate agricultural ammonia emissions. Work products developed by ERTAC were used including the USEPA wood smoke tool and the Area Source emission factor harmonization project.

The USEPA's format and content quality assurance (QA) programs (and other QA checks not included in USEPA's QA software) were run to identify format and/or data content issues (EPA, 2004). The Contractor worked with the S/L agencies and the staff of the Mid-Atlantic Regional Air Management Association (MARAMA) to resolve QA issues and augment the inventories to fill data gaps in accordance with the Quality Assurance Project Plan prepared for this project.

Work on Version 2 began with a stakeholder review process. Version 1 inventory and summary files were provided for stakeholder review between October 2009 and August 2010. Stakeholder comments were reviewed by the S/L agencies and revisions to the inventory files were made to incorporate stakeholder comments as approved by each S/L agency. Other corrections, revisions, or updates were supplied by the S/L agencies, which resulted in the publication of Version 2 of the 2007 inventory in February 2011 (MARAMA 2011).

Further revisions to the 2007 inventory were made in late 2011. The most significant changes were to use an improved emission estimation methodology for re-entrained road dust from paved roads, incorporate vehicle refueling emissions as calculated by MOVES, amd correct errors used in the NMIM modeling of nonroad emissions. Other revisions were made to correct minor errors or revisions to selected categories as identified by the S/L agencies. These revisons resulted in the publication of Version 3 of the 2007 inventory in December 2011.

1.6 REPORT ORGANIZATION

This report documents the development of Version 1 of the 2007 inventory, as well as the revisions made during the Version 2 and Version 3 update cycles. Sections 2 and 3 of this TSD present the general and State-specific methods and data sources used to develop the MANE-VU+VA 2007 annual inventory for point sources and hourly emissions for large point sources, respectively. Sections 4 through 7 present the methods and data used to develop the inventory for area sources, nonroad marine vessel/airport/locomotive sources, nonroad sources included in the NONROAD model, and onroad sources included in the MOVES model. Section 8 documents the inventory, temporal allocation, speciation, and spatial allocation modeling input files used for the MANE-VU+VA 2007 inventory for all sectors. Section 9 identifies the file names for all final deliverable products. References for the TSD are provided in Section 10.

2.0 ANNUAL 2007 INVENTORY FOR POINT SOURCES

2.1 INITIAL DATA SOURCES AND QA REVIEW

The 2007 annual point source inventory was developed using the 2007 inventories that S/L agencies submitted to MARAMA and data from the USEPA's Clean Air Markets Division (CAMD) hourly emissions database.

2.1.1 Initial State NIF Submittals

State and local (S/L) agencies prepared and submitted emission inventory files in the National Emissions Inventory (NEI) Input Format Version 3.0 (NIF 3.0). The NIF format includes eight tables: Transmittal (TR), Site (SI), Emission Unit (EU), Emission Release Point (ER), Emission Process (EP), Emission Period (PE), Emission (EM), and Control Equipment (CE). States were requested to submitted 2007 data for those major sources that they would normally submit to USEPA during the 3-year requirements of the Consolidated Emission Reporting Rule. All 13 MANE-VU+VA agencies submitted point source inventories to MARAMA. In addition, Allegheny and Philadelphia Counties in Pennsylvania each submitted their own point source inventories.

Upon receipt of the NIF submittals, the Contractor performed an initial review of the S/L inventories with the following QA checks:

- EPA's Basic Format and Content Checker tool was used to verify format and check for referential integrity and duplicate record issues. Only very minor issues were identified and were resolved by the Contractor without the need for S/L assistance.
- Facility-level comparisons were made between the MANE-VU/VISTAS Best and Final 2002 inventories and the S/L 2007 submittals to identify facilities included in the 2002 inventory but not in the 2007 inventory. For four S/L agencies (NY, PA, Allegheny and Philadelphia Counties), the number of facilities included in the 2007 were far less than the number of facilities reported in 2002. These S/L agencies provided revised files with a lower facility emission cutoff level to ensure that all major sources were included in the 2007 inventory. S/L agencies were asked to review this list and confirmed that facilities not in the 2007 inventory were either closed or included in the area source inventory.
- Facility-level comparisons were made between the MANE-VU/VISTAS 2002 inventories and the S/L 2007 submittals to identify facilities included in the 2007 inventory but not in the 2002 inventory. S/L agencies verified the reasonableness of this list of sources.

- Facility-level comparisons were made between the MANE-VU/VISTAS 2002 inventories and the S/L 2007 submittals to identify facilities that were included in both the 2002 inventory and 2007 inventory. Facility-level emission changes were calculated, large differences between 2002 and 2007 emissions were flagged, and S/L agencies reviewed and confirmed the reasonableness of the emission changes between 2002 and 2007.

- Facility-level ammonia emissions were obtained from the USEPA 2007 Toxic Release Inventory (USEPA 2009a) and were compared to the ammonia emissions in the S/L agency submittal. S/L agencies reviewed the TRI data to ensure that large (> 100 tons per year) ammonia sources were included in the 2007 MANE-VU+VA inventory.

Following this initial QA review, these individual inventory files were consolidated into a single NIF database. S/L responses and updates to the inventory files resulting from the initial QA review are discussed later in this document.

2.1.2 EPA CAMD Hourly Emissions Data

The second source of data was the hourly emissions data reported to USEPA by facilities to comply with various provisions of the Clean Air Act. MARAMA downloaded the 2007 CAMD annual inventory containing NOx and SO2 emissions, heat input data and other information from the CAMD web site in May 2009.

MARAMA prepared an initial crosswalk file to match facilities and units in the CAMD inventory to facilities and units in the 2002 MANE-VU Version 3 inventory. In the CAMD inventory, the Office of Regulatory Information Systems (ORIS) identification (ID) code identifies unique facilities and the unit ID identifies unique boilers and internal combustion engines (i.e., turbines and reciprocating engines). MARAMA sent an Excel Workbook to each S/L agencies that contained an initial crosswalk with the ORIS ID and unit ID in the CAMD inventory matched to the state and county FIPS, state facility ID, and EU ID in the 2002 MANE-VU Version 3 inventory. The crosswalk contained the annual 2007 NOx, SO2, and heat input (except for those units that are required to report for only 6 months, wherein the data were for the 6 month period). The crosswalk also included other information from the 2002 MANVEU inventory, including stack and location coordinates.

Agencies reviewed and confirmed/corrected/supplemented the information in the crosswalk, provided annual 2007 emissions for the 6-month CAMD reporting units, and provided 2007 annual emissions for other CAPs and NH3.

The crosswalk was provided to the Contractor who updated the crosswalk as follows:

- In most of the S/L inventories, the state and county FIPS and state facility ID together identify unique facilities and the EU ID identifies unique boilers or internal combustion engines. However, in some of the S/L inventories, the emissions for multiple EUs were summed and reported under the same EU ID. To provide a better linkage between the CAMD data and the S/L inventories, the Contractor worked with States to establish the crosswalk at the EU ID / EP ID / ER ID. This effort resulted in a much better linkage between the CAMD and S/L inventories.

- In several cases, the EU ID / EP ID / ER ID identifiers in the 2002 MANVU inventory were changed in the 2007 S/L agency submittals. The Contractor worked with the S/L agencies to correct these broken linkages by updating the EU ID / EP ID /ER ID identifies as necessary.

- The Contractor downloaded the 2007 CAMD hourly inventory containing hourly NOx and SO2 emissions and heat input data from the CAMD website (USEPA 2009b). The Contractor summed the hourly emissions to the annual level (or 6-month level for 6-month reporting units) by emission unit. The summed hourly data was compared to the annual summary data, which matched in virtually all cases. This check was made because MARAMA is considering using the actual 2007 hourly data rather than average temporal profiles in the next round of regional air quality modeling.

- As another QA check, the Contractor compiled a list of sources with EGU SCCs of 1-01-xxx-xx and 2-01-xxx-xx in the State NIF tables that could not be linked to the CAMD table. States reviewed this list and verified that there are no large EGUs missing from the CAMD to NIF crosswalk.

The Contractor prepared a CAMD-to-NIF crosswalk spreadsheet for each State. Aagencies were asked to review this list and verify that (1) the linkages are correct, (2) there are no large sources missing from the CAMD-to-NIF crosswalk, and (3) there are not discrepancies between the emissions reported to CAMD and the emissions reported in the SEMAP database.

There are three types of possible linkages:

- CAMD facility has no match in NIF SI facility table. The emissions from these facilities reported to CAMD are small, and initially accounted for about 0.5% of the NOx and 0.07% of the SO2 emissions in the CAMD database.

- CAMD unit could not be matched in NIF. The emissions from these facilities reported to CAMD were small, accounting for about 0.9% of the NOx and 0.007% of the SO2 emissions in the CAMD database. Most of the units that could not be matched at the unit level are either peaking units or industrial sources such as paper mills or chemical plants. In addition, there were several instances where multiple CAMD units match to a single NIF record (i.e., units are grouped in the NIF tables but reported individually in the CAMD database).

- CAMD unit matches with a single NIF record or CAMD unit matches with multiple NIF records (in many cases, the NIF tables include multiple records for different fuel types). The emissions from these units reported to CAMD account for about 98.6% of the NOx and 99.9% of the SO2 emissions in the CAMD database. In most cases the sum of the emissions from the matching NIF records are generally very close to the CAMD unit level emissions; and S/L agencies verified that linkages were correct.

As another QA check, the Contractor compiled a list of sources with EGU SCCs of 1-01-xxx-xx and 2-01-xxx-xx in the S/L agency NIF tables that could not be linked to the CAMD CEM table to help resolve some of the linkage issues noted above. S/L agencies made significant efforts to improve the crosswalk between the CAMD identifiers and the S/L agency identifiers. Appendix A contains the current version of the crosswalk.

2.2 PM AUGMENTATION

PM compounds may be reported in several forms, as identified in Exhibit 2.1. Exhibit 2.2 provides a count of the number of annual NIF EM table records in each agency's NIF Submittal by type of PM compound. The PM augmentations process was necessary to gap-fill missing PM pollutant complements. For example, if a S/L agency provided only PM10-PRI emissions, the PM augmentation process filled in the PM25-PRI emissions.

A second aspect of the PM augmentation process was to utilize improved condensable emission factors for EGUs. Condensable emissions were not calculated uniformly across all states in the MANE-VU region in the 2002 emissions inventory. Because of the need to model the effect of condensable emissions on regional haze and fine particles, MARAMA instructed the Contractor to use recently updated emission factors for condensable emissions from EGUs.

Exhibit 2.1 – PM Compound Descriptions

Pollutant Code	Pollutant	Pollutant Description
PM-CON	Primary PM Condensable portion only (all < 1 micron)	Material that is vapor phase at stack conditions, but which condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid PM immediately after discharge from the stack.
PM-FIL	Primary PM, Filterable portion only	Particles that are directly emitted by a source as a solid or liquid at stack or release conditions and captured on the filter of a stack test train.
PM-PRI	Primary PM, includes filterables and condensables PM-PRI= PM-FIL + PM-CON	Particles that enter the atmosphere as a direct emission from a stack or an open source. It is comprised of two components: Filterable PM and Condensable PM.
PM10-FIL	Primary PM10, Filterable portion only	Particles with an aerodynamic diameter equal to or less than 10 micrometers that are directly emitted by a source as a solid or liquid at stack or release conditions and captured on the filter of a stack test train.
PM10-PRI	Primary PM10, includes filterables and condensables, PM10- PRI = PM0-FIL + PM-CON	Particles with an aerodynamic diameter equal to or less than 10 micrometers that enter the atmosphere as a direct emission from a stack or an open source. It is comprised of two components: Filterable PM and Condensable PM. (As specified in § 51.15 (a)(2), These two PM components are the components measured by a stack sampling train such as USEPA Method 5.)
PM25-FIL	Primary PM2.5, Filterable portion only	Particles with an aerodynamic diameter equal to or less than 2.5 micrometers that are directly emitted by a source as a solid or liquid at stack or release conditions and captured on the filter of a stack test train.
PM25-PRI	Primary PM2.5, includes filterables and condensables PM25-PRI= PM25-FIL + PM-CON	Particles with an aerodynamic diameter equal to or less than 2.5 micrometers that enter the atmosphere as a direct emission from a stack or an open source. It is comprised of two components: Filterable PM and Condensable PM. (As specified in § 51.15 (a)(2), These two PM components are the components measured by a stack sampling train such as USEPA Method 5.)

Exhibit 2.2 – PM Compounds Reported in State Initial Submittals

	Number of Annual EM Records in Agency's Initial NIF Submittal						
Agency	**PM-CON**	**PM-FIL**	**PM-PRI**	**PM10-FIL**	**PM10-PRI**	**PM25-FIL**	**PM25-PRI**
CT[1]	---	---	---	122	1,300	---	5
DE	449	---	---	886	756	734	699
DC	70	---	---	70	70	70	70
ME	---	9	---	1,150	---	1,053	---
MD	1,265	---	---	3,543	3,750	3,040	2,477
MA	---	---	6	6,614	---	5,930	---
NH	---	463	---	464	---	461	---
NJ	---	---	5,966	---	5,848	---	---
NY	---	---	1,220	---	1,201	---	---
PA	---	---	---	---	5,738	---	3,949
Allegheny[2]	434	881	---	881	---	836	---
Philadelphia	---	---	---	1,178	27	351	21
RI	12	12	105	12	46	12	48
VT	---	64	---	---	---	---	---
VA[3]	---	---	---	5,204	---	3,302	---

After reviewing the initial draft inventory that was posted in October, 2009, three agencies provided the following changes to their initial submittals. These changes are reflected in the record counts in the above table. The PM augmentation routine was re-executed to account for these changes.

1) Connecticut indicated that the PM records in their original submittal for oil and coal-fired boilers should have been submitted as PM10-FIL and not PM10-PRI. All natural gas-fired units and oil-fired turbines were correctly reported as PM10-PRI.
2) Allegheny County provided information on 31 additional facilities that were not included in their original submittal.
3) Virginia indicated that all of the PM records in their original submittal used incorrect pollutant codes. Records in the original submittal designated as PM10-PRI should have been submitted as PM10-FIL, and PM25-PRI should have been PM25-FIL.

The PM augmentation process was divided into two components – the first applying to EGUs and the second to all other point sources. EGUs were identified as those units that supplied hourly data to USEPA's CAMD database. Because of the differences in the augmentation process for EGUs and nonEGUs, each process is discussed separately in the following sections. The EGU process uses the updated condensable emission factors, while the nonEGU process is essentially the same process used in developing the 2002 MANE-VU Version 3 inventory.

2.2.1 EGU PM Augmentation

The EGU PM augmentation process utilized the recently updated condensable emission factors for EGUs developed for MARAMA in 2008. Appendix B contains the technical memorandum describing how the emission factors were developed. The general process is to use the emission factors and heat input to calculate the PM-CON emissions, and then to perform the gap filling for compounds missing from the S/L submittal.

2.2.1.1 EGU Condensable Emission Factors

As described in Appendix B, two sets of emission factors were developed by 6-digit SCC corresponding to equipment type (boiler or IC engine) and fuel type. The first set is based on all available source tests, while the second set includes only source tests where nitrogen purging occurred. As described in more detail in Appendix B, in measuring condensable PM from combustion of fuels containing sulfur, it has been shown by USEPA that SO2 collected in the impingers can be oxidized to sulfate and produce a variable sulfate artifact that results in overestimation of condensable emissions. In this example, if impingers are not purged with nitrogen, errors associated with the sulfate artifact may be inflated resulting in an overestimation of condensable PM emissions.

Exhibit 2.3 shows the emission factors considered for use in estimating EGU condensable PM emissions. It shows the new emission factors developed using all available test data as well as the emission factors based only on those tests that utilized a nitrogen purge. In addition, emission factors are available from USEPA's AP-42 emission factor document. The emission factors actually used in the augmentation process are **highlighted in bold** in Exhibit 2.3. Emission factors based on purged test were used where available; otherwise the emission factors based on all tests were used. Since Appendix B did not provide a condensable PM emission factors for residual oil, we used the AP-42 condensable PM emission factor for residual oil.

Exhibit 2.3 - Emission Factors Used to Estimate EGU Condensable PM Emissions

		Emission Factor (lbs/mmBtu)		
SCC (6-digit)	**SCC (6-digit) Description**	**MARAMA[1] All Tests**	**MARAMA[1] Purged Tests Only**	**AP-42[2]**
1-01-001 *1-02-001*	Boiler / EGU / Anthracite Coal *Boiler / Industrial / Anthracite Coal*	**0.0084**	---	---
1-01-002 *1-02-002* *1-03-002*	Boiler / EGU / Bituminous/Sub-butuminous Coal *Boiler / Industrial / Bituminous/Subbit. Coal* *Boiler / Commercial / Bituminous/Subbit. Coal*	0.022	**0.013**	0.04 to 0.37[3] depending on sulfur content
1-01-003 *1-02-003*	Boiler / EGU / Lignite *Boiler / Industrial / Lignite*	**0.039**	---	0.014
1-01-004 *1-02-004*	Boiler / EGU / #6 Fuel Oil *Boiler / Industrial / #6 Fuel Oil*	---	---	**0.01**
1-01-005 *1-02-005* *1-03-005*	Boiler / Industrial / #2 Fuel Oil *Boiler / Commercial / #2 Fuel Oil* *Boiler / EGU / #2 Fuel Oil*	**0.014**	---	0.00928
1-01-006 *1-02-006* *1-03-006*	Boiler / EGU / Natural Gas *Boiler / Industrial / Natural Gas* *Boiler / Commercial / Natural Gas*	**0.00249**	---	0.00559
1-01-008	Boiler / EGU / Petroleum Coke	**0.05**	---	---
2-01-001 *2-01-009* *2-02-009*	IC Engine / EGU/ Fuel Oil *IC Engine / EGU/ Kerosene* *IC Engine / Industrial / Kerosene*	0.013	**0.01**	0.0072
2-01-002 *2-02-002* *2-03-002*	IC Engine / EGU / Natural Gas *IC Engine / Industrial/ Natural Gas* *IC Engine / Commercial / Natural Gas*	0.005	**0.0015**	0.0047

1) Source: *Emissions Factors for Condensable Particulate Matter Emissions from Electric Generating Units* ; memo dated August 20, 2008, from Arthur Werner (MACTEC) to Julie McDill (MARAMA). In accordance with USEPA guidance, CPM emissions determined from Method 202 tests that apply nitrogen purging are more reliable than results from tests where purging was not used.
2) Source: *AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*.
3) Based on typical bituminous sulfur content range of 0.7 to 4.0 % by weight.
4) Based on typical lignite sulfur content of 0.4 % by weight.
5) **Bolded** numbers are the emission factors actually used to calculated condensable emissions.

SCCs associated with CAMD units for which condensable emission factors were not available in the MARAMA report:

1-01-009 Boiler / EGU / Wood or Bark Waste
1-01-010 Boiler / EGU / LPG
1-01-012 Boiler / EGU / Solid Waste
1-01-013 Boiler / EGU / Liquid Waste
1-02-009 Boiler / Industrial / Wood or Bark Waste
1-02-010 Boiler / Industrial / LPG
1-02-014 Boiler / CO Boiler / Natural or Process Gas
3-05-007 Cement Manufacturing / Kilns
3-06-002 Petroleum Refining / Catalytic Cracking Units
3-06-012 Petroleum Refining / Fluid Coking Units
3-90-001 In-process Fuel / Anthracite Coal
3-90-012 In-process Fuel / Solid Waste
3-99-999 Misc. Industrial Processes

While Appendix B only provides emission factors for electric generation SCCs (e.g., 1-01-xxx-xx or 2-01-xxx-xx), a review of the S/L agency NIF submittals showed that several other SCCs were used by EGUs. These additional SCCs are *highlighted in italics* in Exhibit 3. Since these SCCs were associated with EGUs, it was assumed that emission factors would apply to these SCCs also.

Note also that there were several other SCCs associated with EGUs for which condensable PM emission factors were not available. These SCCs are listed at the bottom of Exhibit 2.3. No special effort was made to evaluate condensable emissions for these SCCs; rather, the State-supplied PM condensable emissions were used where available.

2.2.1.2 EGU Heat Input

In addition to the emission factors, the annual heat input in mmBtu/year by unit and fuel type is also needed to calculate condensable PM emissions. Heat input was available from two sources. The CAMD hourly database provides heat input, but there are two limitations for each use in this analysis. First, the heat input is reported at the unit level and does not provide a breakout of heat input for units using multiple fuels. Second, only a 6-month heat input value is provided for those units only required to report for six months.

As an alternative to the CAMD heat input, the S/L NIF tables usually provide a fuel process annual throughput which can be used to calculate the heat input using the heating value of the fuel. By calculating the heat input using the NIF annual throughput, the annual heat input is available by fuel type for both 6-month and 12-month reporting units. Where NIF annual throughput was available, it was used to calculate the annual heat input which was then used to calculate condensable PM emissions. In cases where the S/L NIF tables do not provide an annual throughput, the CAMD heat input was assigned to the primary fuel type and used in the condensable PM emission calculations.

2.2.1.3 EGU PM Emission Calculations

In addition to calculating the condensable PM emissions, the EGU PM augmentation also gap-fills missing PM compounds. The gap-filling requires that the data be analyzed and separated into cases. The cases determine which math steps and ratios of PM terms will be applied. Exhibit 2.4 shows the various cases and the augmentation method that was applied.

Exhibit 2.4 – Cases and Required Steps to Augment EGU PM Emissions

Case	PM Reported	Augmentation Methodology
1	---	None required; all PM compounds = 0
2	PM25-PRI	PM-CON = HEAT_USED * EMIS_FACT PM25-PRI = PM-CON (only if PM-CON > PM25-PRI) PM25-FIL = PM25-PRI - PM-CON PM10-FIL = PM25-FIL * F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL
3	PM10-PRI	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON (only if PM-CON > PM10-PRI) PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
4	PM25-PRI PM10-PRI	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON (only if PM-CON > PM10-PRI) PM25-PRI = PM-CON (only if PM-CON > PM25-PRI) PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM25-PRI - PM-CON
5	PM10-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
6	PM10-FIL PM25-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
7	PM10-FIL PM10-PRI PM25-FIL PM25-PRI	PM-CON = HEAT_USED * EMIS_FACT
8	PM-PRI	PM-CON = HEAT_USED * EMIS_FACT PM-PRI = PM-CON (only if PM-CON > PM-PRI) PM-FIL = PM-PRI - PM-CON PM10-FIL = PM-FIL * F10_FIL ratio PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
9	PM-PRI PM10-PRI	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON (only if PM-CON > PM10-PRI) PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
10	PM-PRI PM10-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL

Case	PM Reported	Augmentation Methodology
11	PM-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-FIL = PM-FIL * F10_FIL ratio PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
12	PM-FIL PM10-FIL PM25-FIL	PM-CON = HEAT_USED * EMIS_FACT PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
13	PM-CON PM10-FIL PM25-FIL	PM10-PRI = PM10-FIL + PM-CON PM25-PRI = PM25-FIL + PM-CON
14	PM-CON PM10-FIL PM10-PRI	PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PMCON + PM25-FIL
15	PM-CON PM10-FIL PM10-PRI PM25-FIL PM25-PRI	None required; all PM compounds present
16	PM-CON PM-PRI	None required; only one occurrence and emissions were trivial
17	PM-CON PM-PRI PM10-FIL PM10-PRI PM25-FIL PM25-PRI	None required; all PM compounds present
18	PM-CON PM-FIL PM-PRI PM10-FIL PM10-PRI PM25-FIL PM25-PRI	None required; all PM compounds present

2.2.2 NONEGU PM Augmentation

The nonEGU PM augmentation process utilized the methodology developed for MARAMA for the 2002 MANE-VU Version 3 inventory. The steps in the PM augmentation process were as follows:

- Step 1: Initial QA and remediation of S/L provided PM pollutants;
- Step 2: Updating of PM factor ratios previously developed for MARAMA based on factors from the Factor Information and Retrieval (FIRE) Data System and the USEPA PM Calculator (Appendix C provides the PM ratio table by SCC and control device);
- Step 3: Implementation of the ratios developed in step 2.; and
- Step 4: Presentation of PM augmentation results to S/L agencies for review and comment.

2.2.2.1 Initial QA and Remediation of PM Pollutants

Before we ran the nonEGU PM augmentation process, we reviewed the data for inconsistencies. Inconsistent values were be replaced. The consistency checks and replacement actions were as follows:

1. If PM10-PRI >0 and PM25-PRI > PM10-PRI (and PM10-FIL, PM25-FIL and PM-CON are null or 0), then set PM25-PRI = PM10-PRI.
2. If PM10-FIL > 0 and PM25-FIL > PM10-FIL (and PM10-PRI, PM25-PRI and PM-CON are null or 0), then set PM25-FIL = PM10-FIL.
3. If PM10-PRI >0 and PM10-FIL > PM10-PRI (and PM25-PRI, PM25-FIL and PM-CON are null or 0), then set PM10-FIL = PM10-PRI.
4. If PM25-PRI > 0 and PM25-FIL > PM25-PRI (and PM10-PRI, PM10-FIL and PM-CON are null or 0), then set PM25-FIL = PM25-PRI.

The consistency checks revealed very few occurrences of inconsistencies, and when inconsistencies did occur, the emission values were very small. As a result, S/L agencies were not asked to review this information and provide corrections because the inconsistencies did not involve significant emission sources. The replacement actions above were appropriate for an inventory used for regional air quality modeling.

2.2.2.2 Updating of PM Factor Ratios

The augmentation steps require the use of ratios developed from available emissions and particle size distribution data. These ratios are needed when only one PM term is available, and two or more terms need to be augmented. Examples of how we used the PM ratios are shown below:

PM-FIL × RatioCON/FIL = PM-CON

PM-PRI × RatioCON/PRI = PM-CON

PM-CON × RatioFIL/CON = PM-FIL

PM-CON × RatioPRI/CON = PM-PRI

For the MANE-VU 2002 inventory, a table of PM compound ratios was developed. The development of this table is documented in the *TSD for the 2002 MANE-VU SIP Modeling Inventories, Version 3*. The primary deliverable of this step of the process was the development of a table keyed by SCC, primary control device, and secondary control device. This table is called the SCC Control Device Ratios table (Reference Tables MANE-VU_PMAugmentation.mdb). We updated this table to include SCC, primary control device, and secondary control device codes found in the 2007 inventory that were not contained in the 2002 MANE-VU inventory. Appendix C provides the PM ratio table by SCC and control device.

2.2.2.3 NonEGU PM Emission Calculations

The gap-filling requires that the data be analyzed and separated into cases. The cases determine which math steps and ratios of PM terms will be applied. Exhibit 2.5 shows the various cases and the augmentation method that was applied.

After completing the calculations, the data was QA checked to ensure that the calculations resulted in consistent values for the PM complement. On a few occasions, the mix of ratio value and the pollutants and values provided by the S/L agency resulted in negative values when FIL was back-calculated. In this case the negative FIL value was set to zero and the PRI value was readjusted. In a few cases the appropriate combination of ratios, SCC, and control efficiencies were not available to calculate the PM10-PRI and PM25-PRI values. In these cases, PM10-PRI and PM25-PRI were set equal.

Exhibit 2.5 – Cases and Required Steps to Augment nonEGU PM Emissions

Case	PM Reported	Augmentation Methodology
1	PM25-PRI	PM-CON = PM25-PRI * CON_P25 ratio PM25-FIL = PM25-PRI - PM-CON PM10-FIL = PM25-FIL * F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL
2	PM10-PRI	PM-CON = PM10-PRI * CON_P10 ratio PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
3	PM25-PRI PM10-PRI	PM-CON = PM10-PRI * CON_P10 ratio PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM25-PRI - PM-CON
4	PM10-FIL	PM-CON = PM-CON * CON_F10 ratio PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
5	PM10-FIL PM25-FIL	PM-CON = PM10-FIL * CON_F10 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
6	PM10-FIL PM10-PRI	PM-CON = PM10-PRI - PM10-FIL PM25-FIL = PM10-FIL * F25_F10 ratio PM25-PRI = PM-CON + PM25-FIL
7	PM25-FIL	PM-CON = PM25-FIL * CON_F25 ratio PM10-FIL = PM25-FIL * F10-F25 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
8	PM10-FIL PM10-PRI PM25-FIL PM25-PRI	PM-CON = PM25-PRI - PM25-FIL
9	PM-PRI	PM-CON = PM-PRI * CON_PRI ratio PM-FIL = PM-PRI - PM-CON PM10-FIL = PM-FIL * F10_FIL ratio PM10-PRI = PM-CON + PM10-FIL PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PM-CON + PM25-FIL
10	PM25-FIL PM25-PRI	PMCON = PM25-PRI - PM25-FIL PM10-FIL = PM25-FIL * F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL
11	PM-CON PM10-FIL PM25-FIL	PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL

Case	PM Reported	Augmentation Methodology
12	PM-CON	PM10-FIL = PM-CON * F10_CON ratio PM25-FIL = PM10-FIL * F25_F10 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
13	PM-CON PM10-FIL PM10-PRI	PM25-FIL = PM10-FIL / F10_F25 ratio PM25-PRI = PMCON + PM25-FIL
14	PM-CON PM10-FIL PM10-PRI PM25-FIL PM25-PRI	None required; all PM compounds present
15	PM-CON PM-FIL	PM10-FIL = PM-CON / CON_F10 ratio PM25-FIL = PM10-FIL / F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL
16	PM-CON PM10-PRI PM25-PRI	PM10-FIL = PM10-PRI - PM-CON PM25-FIL = PM25-PRI - PM-CON
17	PM-FIL	PM10-FIL = PM-FIL * F10_FIL ratio PM_CON = PM10-FIL * CON_F10 ratio PM25-FIL = PM10-FIL / F10_F25 ratio PM10-PRI = PM-CON + PM10-FIL PM25-PRI = PM-CON + PM25-FIL

2.3 EMISSION RELEASE POINT QA CHECKS

Stack parameters are an important component of an emission inventory used for regional air quality modeling. Careful QA is required to ensure that the point source emissions are properly located both horizontally and vertically on the modeling grid. This section describes the procedures used to quality assure, augment, and where necessary, revise, stack parameters using standardized procedures to identify and correct stack data errors. These procedures were implemented within the NIF file itself, and are based on the QA procedures built into SMOKE that are designed to catch missing or out-of-range stack parameters.

2.3.1 QA Checks and Gap-Filling for Location Coordinates

Because air quality modeling strives to replicate the actual physical and chemical processes that occur in an inventory domain, it is important that the physical location of emissions be determined as accurately as possible. The emission release (ER) point record is used to report the location and relevant physical attributes of the emission release point. Location coordinates must be reported to identify where emissions are released to the ambient air, via a stack or non-stack (e.g., fugitive release). For a non-stack, or fugitive release, coordinates may represent the general location where emissions are released.

In the ER record, location data may be reported as x and y coordinates (X – Y) from either of two coordinate systems - Latitude / Longitude (LATLON), or Universal TransMercator (UTM). X - Y coordinates reported as Latitude and Longitude must be reported in the decimal degree format. X - Y coordinates reported as UTM Easting and UTM Northing, must be reported in kilometers.

UTM data received from MARAMA was processed by the Contractor Team and converted to Latitude Measure and Longitude Measure in decimal degrees, as is required by the SMOKE emissions processing system. All conversions of UTM to LATLON were made using a spreadsheet[1] developed by Professor Steven Dutch, School of Natural and Applied Sciences, University of Wisconsin - Green Bay. This spreadsheet tool allowed for batch conversion of UTM data to decimal degree format and was configured for WGS 84 DATUM. While errors using this spreadsheet are typically a few meters, rarely 10 or more, the accuracy of the conversion is limited to the accuracy of the initial UTM data.

Once conversions were made to LATLON decimal degrees, reasonableness checks were conducted on each release point relative to county centroids and min/max coordinates associated with the FIPS codes assigned to each stack. If a stack was located outside the western-, eastern-, northern- or southern-most boundary of the county (based on SMOKE's county lat/lon file), the point was flagged for additional review. Flagged sources were then mapped with GIS software to determine their placement relative to the FIPS County associated with the stack. If a source was found to be outside of the county boundaries, it was identified for further review.

2.3.2 QA Checks and Gap-Filling for Emission Release Parameters

In preparing emissions for grid modeling, valid parameters for the physical characteristics of each release point (stack height, diameter, temperature, velocity, and flow) are necessary to correctly place facility release points and associated emissions into vertical layers for proper air quality modeling. The USEPA's QA guidance for diagnosing stack parameter issues was generally applied to identify QA issues in the S/L point source inventories. The QA guidance involved diagnosing the correct assignment of the ERP type (i.e., stack or

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[1] http://www.uwgb.edu/dutchs/FieldMethods/UTMSystem.htm

fugitive), parameters with zero values, parameters not within the range of values specified in the USEPA's QA procedures, and consistency checks (i.e., comparing calculated values against the values reported in the inventory). In many cases errors were caused by missing or zero values.

The first step of our quality assurance (QA) involves review of the Emission Release Point Type. Using this type code, we used a routine to assess the validity of the stack parameters, to replace values if necessary, and to fill-in missing data points. We employed a routine that compared each emission release point parameter to a minimum and maximum range of values and when that parameter was missing or was found to exist outside of that range, we augmented the parameter. We also checked non-fugitive stack parameters for internal consistency between:

- stack height and diameter, and
- stack diameter, exit gas velocity, and exit gas flow rate.

When internal consistency was not met, we provided replacement values for the parameters.

The following steps summarize the process of finding and replacing missing, out-of-range, or internally inconsistent stack parameters.

Step 1: For fugitive emission release points, replace stack parameters

For fugitive emission release points (ERPTYPE=01), we first compared the existing fugitive emission height against the following range thought to be representative of the minimum and maximum values allowable for most fugitive emission release points.

Fugitive Release Height: 0.1 to 100 ft

In all but one case, the fugitive release height was valid. For that one case, we set the fugitive release height to 100 feet. For all other cases, we kept the fugitive release height and replaced all other stack parameters with the defaulted values listed below. In some cases, the fugitive release height was blank but the S/L agency provided a stack height and we retained the S/L supplied stack height. In other cases, the S/L agency provided a temperature for the fugitive emissions and we retained the S/L supplied temperature. The following summarizes the procedure for filling in stack parameters for fugitive emission release points:

Stack Height: use fugitive release height, if valid; if fugitive release height not present and stack height provided, use the stack height; if neither fugitive release height or stack height not present, use 10 feet as the default.

Stack Temperature: use temperature provided by S/L agency, if valid; otherwise used 72 ^{o}F.

Stack Diameter: use 0.003 feet for fugitive sources

Stack Velocity: 0.0003 feet per second for fugitive sources

Stack Flow: use 0.0 cubic feet per second for fugitive sources

Step 2: For non-fugitive emission release points, find and replace out-of-range or missing stack heights and temperatures

For non-fugitive emission release points, we compared existing stack parameters against a set of the following ranges thought to be representative of the minimum and maximum values allowable for most emission release points.

Stack Height: 0.1 to 1000 feet

Stack Temperature: 50 to 1,800 ^{o}F

Stack Diameter: 0.1 to 50 feet

Missing or out-of range parameters were identified and evaluated. If not realistic, missing or out-of range parameters were replaced using the procedures described below.

Stack Height: All stack heights were less than the maximum value of 1000 feet. Numerous stack heights were zero or missing, in which case the stack height was filled in using national default sets of physical parameter data based on the SCC. The stack parameter national default database is included as Appendix D.

Stack Temperature: There were 30 records where the stack temperature exceeded 1,800 ^{o}F. We reviewed the stack description table for these records, which indicated that most of these stacks were for flares or furnaces. We deemed the S/L supplied temperature data as plausible and retained the S/L provided value. There were 100 records where the stack temperature was less than 50 ^{o}F and not equal to 0 ^{o}F or missing. We reviewed the stack description table for these records. Many of these stacks were for refrigerated tanks or other sources where the S/L supplied temperature data was deemed plausible. For example, a nylon manufacturing facility in Virginia emits thousands of tons of NOx in 2007. Most of the NOx is emitted from a handful of fairly cold stacks, with exit gas temperatures generally ranging from 40-60 degrees. Rather than replace these S/L supplied values that seemed plausible with national defaults, we retained the S/L supplied data. Where the stack temperature was reported as 0 ^{o}F or missing, we replaced the stack temperature with the national default based on the SCC.

Step 3: For non-fugitive emission release points, find and replace out-of-range or missing stack diameters, velocities, and flow rates

First, we evaluated the stack diameter to determine if it was within the valid range of 0.1 to 50 feet. There were 200 records where the stack diameter exceeded 50 feet. We reviewed the stack description table for these records. Most of these were large storage tanks, cooling towers, wastewater treatment ponds or area-type sources such as process equipment leaks. Based on this review, we deemed the S/L supplied diameter data as plausible and retained the S/L provided value.

There were 66 records with missing stack diameters where both the velocity and flow rate were provided. For these records, the stack diameter was calculated using the following equation:

Stack Diameter [ft] = SQRT (4 * Stack Flow [cu ft/sec] / (Stack Velocity [ft/sec] * π [Pi]))

For the remaining cases where the stack diameter was reported as zero or missing, we replaced the stack diameter with the national default based on the SCC.

Next, the velocity and flow rate were evaluated. If the diameter, velocity and flow rate were all non-zero, we assessed internal consistency between diameter, velocity and flow rate using the following equation:

Stack Flow [cu ft/sec] = (π [Pi] * (Stack Diameter [ft] / 2) ^ 2) * Stack Velocity [ft/sec]

If the calculated and reported flow rates are within 10 % of one another, then internal consistency was assumed and no additional steps were taken. If the internal consistency was not met for velocity and flow rate, Exhibit 2.6 below provides details on the approach taken to correct missing, out-of-range values, or internally inconsistent values for velocity and flow rate based on different scenarios. Velocity and flow rate were augmented either by calculation or the use of national defaults by SCC when necessary.

Exhibit 2.6 - Stack Parameter Data Replacement Matrix

(X = Data value present)

Diameter	Velocity	Flow Rate	Action
-	X	X	1. Calculate diameter using velocity and flow rate. 2. Check that calculated diameter is within range.
-	-	-	1. Replace diameter, velocity, and flow rate with national SCC default values.
-	-	X	1. Replace diameter, velocity, and flow rate with national SCC default values.
-	X	-	1. Replace diameter, velocity, and flow rate with national SCC default values.
X	-	-	1. Default velocity using national default sets. 2. Calculate flow rate using internal consistency formula.
X	-	X	1. Calculate velocity using internal consistency formula. 2. Check that calculated velocity is within range (less than 150 ft/sec). A. If calculated velocity is not within range, then default all 3 parameters using national default sets.
X	X	-	1. Check that velocity is within range (less than 150 ft/sec). A. If velocity is within range, then: > Calculate flow rate using internal consistency formula. B. If velocity is not within range, then: > Default all 3 parameters using national default sets.
X	X	X	1. Check that velocity is within range (less than 150 ft/sec). A. If velocity is within range and flow rate does not meet internal consistency for diameter, velocity and flow rate, then: > Calculate flow rate using internal consistency formula. B. If velocity is not within range, then: > Calculate velocity using internal consistency formula. > Check that calculated velocity is within range. If so, then default to calculated velocity. > If calculated velocity is not within range, then default all 5 parameters using national default set.

2.4 IDENTIFICATION OF EGUs AND NONEGUs

In the past, point sources have been categorized as either EGUs or nonEGUs using a variety of schemes. The SCC, standard industrial classification code (SIC), and North American Industry Classification System (NAICS) code have been used to classify sources as either EGU or nonEGU. Another scheme that has been used is to classify as EGU sources that is required to report emissions to USEPA's CAMD hourly emission database. For consistency in both reporting and projecting emissions to the future, the MANE-VU+VA inventory using the following scheme for classifying point sources:

- CAMD EGU – these are units that report emissions to the USEPA CAMD hourly emission database and have been classified by States as EGUs;
- CAMD nonEGU - these are units that report emissions to the USEPA CAMD hourly emission database and have been classified by States as nonEGUs; and
- OTHER – all other nonEGU point sources and small EGU point sources not included in the above categories.

Data elements were add to the NIF EP table to include the above classification scheme. This classification scheme was reviewed and approved by ERTAC.

2.5 VERSION 2 - STAKEHOLDER COMMENT AND RESPONSE

On October 6, 2009, MARAMA provided a notice to stakeholders of the opportunity to review the initial draft of the 2007 point source inventory data and documentation. Stakeholders were invited to review and comment on the draft 2007 inventory of air emissions from point sources to be used for regional air quality modeling. On October 20, MARAMA hosted a conference call that provided an opportunity for stakeholders to ask questions about the draft 2007 point source modeling inventory. Written comments were reviewed by the State inventory staff and MARAMA, and resulted in several changes to the draft documentation and inventory data. The changes requested by stakeholders and approved by the States are summarized in the following subsections.

2.5.1 Connecticut Response to Stakeholder Comments

Sikorsky Aircraft provided comments on roughly ten sources regarding the SO2, PM, and VOC emissions. The requested changes were very small (under a ton per year). Connecticut accepted Sikorsky Aircraft's comments.

Covanta Energy commented that the annual NOx emissions for the Covanta Bristol Unit #1 (Facility ID 09003-0902, emission unit P0026) were abnormally low because of a temporary pilot test of a NOx emission control technology. Covanta requested that 2005 emissions should be used since the 2007 actual emissions are not representative of previous or subsequent years. Since the 2007 inventory is being used for air quality modeling that will be tied to actual air quality data, Connecticut decided to use actual 2007 emission values rather than 2005 values as requested by Covanta. Connecticut will consider this comment again during the development of the future year inventories to ensure that reasonable future year emissions are estimated.

Hamilton Sundstrand commented that three emission units at its facility (Facility ID 09003-8602, emission units P0038, P0079, and R0097) were permanently shut down in 2008. Since the 2007 inventory is being used for air quality modeling that will be tied to actual air quality data, Connecticut decided to use actual 2007 emission values. Connecticut will consider this comment again during the development of the future year inventories to ensure that reasonable future year emissions are estimated.

NRG Energy provided very minor revisions to the SO2, NOx, CO, VOC, PM and NH3 emissions data for the Montville (Facility ID 09011-1505) and Norwalk (Facility ID 09001-4214) facilities. Connecticut accepted these changes.

2.5.2 Maryland Response to Stakeholder Comments

NRG Energy requested a change to the VOC emissions for the Vienna Power Generating Station (Facility ID 019-0013, emission unit 4-0065). Maryland agreed to make the change, revising the VOC emissions from 0.9455 to 0.9641 tons per year.

Transcontinental Gas Pipe Line Company commented that the inventory for its facility in Howard County (Facility ID 027-0223) has 12 internal combustion engines represented by one grouped emission unit, which gives the impression that there is one large source when there are actually 12 smaller units. Maryland did not change the inventory based on this comment since the 12 engines are nearly identical and identifying each engine individually is not needed for the 2007 modeling inventory.

Covanta Energy requested changes to the stack parameters for the three units at the Montgomery County Resource Recovery Facility (Facility ID 031-1718). Maryland agreed to make those revisions.

2.5.3 Massachusetts Response to Stakeholder Comments

Saint Gobain Containers requested minor changes to the annual emissions and stack parameters for its facility in Milford (Facility ID 25027-1200856). Massachusetts accepted the changes and the 2007 inventory was updated to reflect the stakeholder comments.

Verallia formerly (Saint Gobain Containers) also provided comments on the 2007 PM2.5 emissions for all sources and stated that they may not contain appropriate condensable emissions. The company did not provide revised estimates or suggestions for improving the estimates of condensable emissions. For facilities that did not report PM2.5 or condensable emissions, the PM2.5 or condensable emissions were calculated using the methodogy described in Section 2.2.2. MARAMA acknowledges that there is some uncertainty regarding the methodology, but lacking source-specific data the methodology is the best available technique at this time for filling in the missing PM2.5 or condensable emissions.

Verallia formerly (Saint Gobain Containers) also indicated that stack flow rate data was missing for their plants in Massachusetts. The facilities facilities did have stack velocity data. This data gap was filled by calculating the flow rate using the stack diameter and the stack exit velocity.

2.5.4 New Jersey Response to Stakeholder Comments

RRI Energy provided updated emissions and stack data for several of its facilities, mostly minor changes to PM emission values and revisions to stack parameters. New Jersey agreed to make the revisions provided by RRI Energy.

BASF identified that its plant in East Newark (Facility ID 34017-10419) was permanently shut down and did not operate in 2007. New Jersey agreed and the 2007 emissions were set to zero.

Merck & Co., Inc indicated that its facility in Rahway, NJ (Facility ID 34039-41712) emitted 3.42 tons/yr of ammonia emissions from their boilers in 2007. New Jersey agreed and the ammonia emissions were added to the inventory.

Georgia Pacific Gypsum LLC submitted updates for its Camden facility (Facility ID 34007-51611) to correct the 2007 emissions based upon recent stack test data for board dryer U7 and process emissions factors from kettles U3, U4 and U5. Total PM2.5 emissions were also updated using current AP-42 factors for the Gypsum industry. In addition, the ammonia emissions were missing from the inventory. New Jersey agreed to make the requested changes.

E.R. Squibb & Sons, LLC, requested changes to the ammonia and PM2.5 emissions for its facilities in Lawrenceville, NJ (Facility ID 34021-61052), New Brunswick, NJ (Facility ID 34023-17739), and Hopewell (Facility ID 34021-61053). New Jersey agreed to make the requested changes.

Schering Corporation supplied corrections to the ammonia emissions from its Kenilworth facility (Facility ID 34039-41806). New Jersey agreed to make the requested changes.

ConocoPhillips Company provided revisions to ammonia and VOC emissions for the Bayway Refinery (Facility ID 34039-41805). They also provided revisions to selected SCCs for certain heaters, sulfur recovery units, truck loading activities, marine vessel loading activities, and emergency flares. ConocoPhillips also requested that certain parts of the refinery be modeled as area sources rather than point sources, and provided rectangular grid coordinates to define the area sources. While this change would be appropriate for a fence line modeling study, it cannot not be accommodated in a multi-State regional air quality model since the SMOKE emission modeling system is not capable of handling area sources that are smaller than the air quality model grid cell. Therefore, this change was not made.

Covanta Energy requested minor revisions to the ammonia and PM emissions at the Union County Resource Recovery Facility (Facility ID 34039-41814) and Warren Energy Resource Facility (Facility ID 34041-85455). New Jersey agreed to make those revisions.

Air Engineering submitted comments on behalf of EF Kenilworth LLC (Facility ID 34029-41741), requesting minor changes to PM emissions and revisions to stack parameters. New Jersey agreed to make the requested changes.

Air Engineering submitted comments on behalf of Rowan University (Facility ID 34015-55779), requesting adding ammonia emissions for its sources. New Jersey agreed to make the requested changes.

Air Engineering submitted comments on behalf of The College of New Jersey (Facility ID 34021-61008), requesting adding ammonia emissions for its sources and revisions to stack parameters. New Jersey agreed to make the requested changes.

Actavis requested the addition of 0.13 tons per year of ammonia for their facility (Facility ID 34039-40295). New Jersey agreed to make the addition.

PSEG Power LLC requested changes to SCCs and stack parameters, as well as numerous minor changes to emission estimates, for its facilities in New Jersey. New Jersey agreed to make the revisions. PSEG also requested the units classified as “insignificant units” be excluded from the modeling inventory. New Jersey elected to keep the emissions from insignificant units in the inventory because the purpose of the inventory is to model all of the emissions actually emitted in 2007.

MRPC/OEC-LES requested changes SCCs, ammonia and PM emissions, and stack parameters for its facility (Facility ID 34029-78901). New Jersey agreed to make the revisions.

2.5.5 New York Response to Stakeholder Comments

Covanta Energy provided updated PM emissions and stack data for several of its facilities, mostly minor changes to PM emission values and revisions to stack parameters. New York agreed to make the revisions provided by Covanta Energy.

NRG Energy provided updated PM emissions and stack data for its facilities. NRG Energy also provided updated data for the individual turbine units at the Astoria Gas Turbine Power Plant (ORISID=55243). New York agreed to make the revisions provided by NRG Energy. NRG Energy also noted that baghouses are being installed at the Dunkirk and Huntley coal-fired plants. These changes were noted and will be accounted for in the future year inventories.

2.5.6 Pennsylvania Response to Stakeholder Comments

Covanta Energy requested changes to stack parameters at the Delaware Valley (Facility ID 420450059), Lancaster County (Facility ID 420710145), Plymouth (420910295) and Harrisburg (Facility ID 420430017) facilities. Covanta also requested minor changes to the emission estimates at the Plymouth facility. Pennsylvania agreed to make those revisions.

RRI Energy provided updated emissions and stack data for several of its facilities. The most notable change was a significant increase in PM emissions at several coal-fired units. Pennsylvania agreed to make the revisions provided by RRI Energy.

Saint Gobain Containers requested minor changes to the annual emissions and stack parameters for its facility in Port Allegheny (Facility ID 420830006). Pennsylvania accepted the changes and the 2007 inventory was updated to reflect the stakeholder comments.

Verallia formerly (Saint Gobain Containers) also provided comments on the 2007 PM2.5 emissions for all sources and stated that they may not contain appropriate condensable emissions. The company did not provide revised estimates or suggestions for improving the estimates of condensable emissions. For facilities that did not report PM2.5 or condensable emissions, the PM2.5 or condensable emissions were calculated using the methodogy described in Section 2.2.2. MARAMA acknowledges that there is some uncertainty regarding the methodology, but lacking source-specific data the methodology is the best available technique at this time for filling in the missing PM2.5 and condensable emissions.

The National Lime Association requested changes to the PM emissions for four of their member facilities: Mercer Lime & Stone (Facility ID 420190021), Graymont/Pleasant Gap (Facility ID 420270003), Carmeuse Lime/Millard Lime (Facility ID 420750016), and OWB Refractories (Facility ID 421330007). Pennsylvania accepted the changes and the 2007 inventory was updated to reflect the stakeholder comments.

Magnesita Refractories (formerly LWB Refractories) provided minor revisions to stack data and PM emission estimates for the facility. Pennsylvania determined that no changes to the 2007 inventory were needed since the PM2.5 emissions were small (about 20 tons per year) and that PM2.5 emissions of this magnitude should not adversely impact the results of regional air quality modeling analyses using these inventories.

Carmeuse Lime provided minor revisions to stack data and PM emission estimates for the facility. Pennsylvania determined that no changes to the 2007 inventory were needed since the PM2.5 emissions were small (about 10 tons per year) and that PM2.5 emissions of this magnitude should not adversely impact the results of regional air quality modeling analyses using these inventories.

2.5.7 Virginia Response to Stakeholder Comments

Virginia received comments from Covanta Energy and Transco requesting very minor changes to the emissions for their facilities (generally less than 0.1 ton change in emissions). Virginia decided not to make those changes because of the insignificant impact on the regional modeling inventory.

BASF identified that its plant in Virginia is permanently shut down. Since it did operate in 2007, the actual 2007 emissions will be used for the 2007 modeling. Emissions from the plant will be set to zero for future year inventories.

Michigan Cogen Systems requested minor changes to stack parameters for their facility. Virginia approved the requested changes.

Virginia received revised stack parameters for about 20 units at the Chemical Lime Company's Kimbalton Plant. Due to the location of this facility and the size of the emissions in 2007, Virginia determined that the recommended changes should not affect air quality modeling results for 2007.

Virginia received comments from Carmeuse Natural Chemicals regarding the PM2.5 emissions at two of its facilities in Virginia. Since the company did not provide PM2.5 emissions to Virginia, the PM2.5 emissions were calculated using the methodogy described in Section 2.2.2. Virginia acknowledged that there is some uncertainty regarding the methodology, but lacking source-specific data the methodology is the best available technique at this time for filling in the missing PM2.5 emissions. Virginia determined that no changes to the 2007 inventory were needed since the PM2.5 emissions from these two kilns were small (less than 20 tons per year) and that PM2.5 emissions of this magnitude should not adversely impact the results of regional air quality modeling analyses using these inventories.

2.6 VERSION 2 - ADDITIONAL STATE-SPECIFIC UPDATES

Several States and local agencies provided revisions and updates following their review of the initial draft of the point source inventory posted in October, 2009. These changes are summarized in the following subsections.

2.6.1 Connecticut

During the review of the initial draft 2007 inventory, Connecticut identified several emission units with unexpectedly high emission values. Connecticut determined that its original submittal had emissions adjusted for rule effectiveness. Since the 2007 inventory is being used for air quality modeling that will be tied to actual air quality data, Connecticut decided to use actual 2007 emission values rather than values that had been artificially adjusted to account for rule effectiveness. The Contractor calculated the actual emissions for all units with a non-zero rule effectiveness value by backing out the rule effectiveness value. These actual emission values were supplied to Connecticut for review and approval. Connecticut recommended that the actual emissions calculated by the Contractor be used instead of the values originally supplied by Connecticut which included rule effectiveness.

Connecticut indicated that some of the PM records in their original submittal used incorrect pollutant codes. Connecticut indicated that the PM records in their original submittal for oil and coal-fired boilers should have been submitted as PM10-FIL and not PM10-PRI. All natural gas-fired units and oil-fired turbines were correctly reported as

PM10-PRI. The PM augmentation routine described in Section 1.3 was re-executed for the coal- and oil-fired units.

2.6.2 Delaware

No revisions to the initial inventory were requested or made.

2.6.3 District of Columbia

The District of Columbia made revisions to the emission inventory for Benning Road (Facility ID 11001-0001). There are four emission units at the facility designated as Units 1, 2, 15, and 16. Units 15 and 16 report emissions to USEPA's CAMD CEM database, while units 1 and 2 do not. Units 1 and 2 were not included in the initial point source inventory. These two units were added to the inventory and increased facility-wide SO2 emissions by about 100 tons per year and NOx emissions by 50 tons per year. Smaller increases were added for the other pollutants.

2.6.4 Maine

Maine provided a small correction to the SO2 emissions for the Maine Independence Station (Facility ID 2301900115).

Maine provided small corrections to the SO2 and NOx emissions for Westbrook Energy Center (Facility ID 2300500193). Also there was an error in the cross-reference between the USEPA CAMD database and the State's NIF database, which was corrected.

2.6.5 Maryland

No additional revisions beyond those requested by stakeholder were requested or made.

2.6.6 Massachusetts

An error in the PM augmentation routine was detected that incorrectly replaced State-reported PM25-FIL values. The Contractor reviewed the PM augmentation routine and identified the error that affected "Case 5" nonEGU PM25-FIL and PM25-PRI values. This error also affected numerous small sources in Massachusetts. The error was corrected and the State-reported PM25-FIL values were retained during the PM augmentation process and that the PM25-PRI values were correctly calculated using the State-reported PM25-FIL value.

Massachusetts identified errors in the ammonia emissions for 2007 for the Stony Brook Energy Center (25013-0420001) and New Bedford Energy (25005-1200634). Massachusetts provided corrected ammonia emission estimates for these two facilities. This change reduced ammonia emissions in Massachusetts by about 2,300 tons.

2.6.7 Maine

Maine identified on error in the PM augmentation routine that incorrectly replaced State-reported PM25-FIL values. The Contractor reviewed the PM augmentation routine and identified the error that affected "Case 5" nonEGU PM25-FIL and PM25-PRI values. The error was corrected and the State-reported PM25-FIL values were retained during the PM augmentation process and that the PM25-PRI values were correctly calculated using the State-reported PM25-FIL value.

2.6.8 New Hampshire

An error in the PM augmentation routine was detected that incorrectly replaced State-reported PM25-FIL values. The Contractor reviewed the PM augmentation routine and identified the error that affected "Case 5" nonEGU PM25-FIL and PM25-PRI values. This error also affected numerous small sources in New Hampshire. The error was corrected and the State-reported PM25-FIL values were retained during the PM augmentation process and that the PM25-PRI values were correctly calculated using the State-reported PM25-FIL value.

2.6.9 New Jersey

New Jersey identified numerous emission units that were inadvertently missing from their initial submittal. Most of these units were flagged as "insignificant units" or "non-source fugitive" sources in New Jersey's data system and were excluded during the initial conversion to NIF tables. New Jersey subsequently identified these "unmatched" units and submitted pertinent data for inclusion in the 2007 modeling inventory. The Contractor added these units and emissions to the NIF database. The emissions added to the inventory from these units were about: 60 tpy of CO, 50 tpy of NOx, 672 tpy of PM10-PRI,257 tpy of PM25-PRI, 5 tpy of SO2, and 1,477 tpy of VOC.

Ammonia emissions were missing from New Jersey's initial submittal. New Jersey supplied the missing ammonia emissions, which added about 845 tpy of NH3 to the point source inventory.

2.6.10 Pennsylvania – Allegheny County

Allegheny County's initial 2007 submittal included only the five "very large" sources that were submitted to USEPA for the 2007 NEI. After the release of the initial version of the point source inventory in October, 2009, the agency provided a second submittal with an addition 31 facilities. The second submittal was subjected to the QA and PM augmentation procedures described previously in Sections 1.2 and 1.3 of this report.

2.6.11 Pennsylvania - Philadelphia

Philadelphia provided the following revisions to the initial draft inventory:

- Boiler #3 at Sunoco Chemical Frankford Plant (Facility ID 4210101551 and emission point 052) was linked to CAMD ORIS ID 880007 and boilerID 52.

- VOC emissions at Cardone Industries (Facility ID 4210103887) were increased from 75.96 to 143.98 tons per year.

2.6.12 Rhode Island

Rhode Island revised the emissions for Providence Metallizing Co. (Facility ID 44007AIR1230 and emission point 2). All emissions for this emission point were changed to zero for 2007.

2.6.13 Vermont

No revisions to the initial inventory posted in October 2009 were requested or made.

2.6.14 Virginia

After the release of the initial version of the point source inventory in October, 2009, the agency provided a second submittal with a number of additional distributed generation units. The second submittal was subjected to the QA and PM augmentation procedures described previously in Sections 1.2 and 1.3 of this report. A flag was added to the EP table to identify the distributed generation units for both the units in Virginia's original submittal as well as the new units.

Virginia indicated that all of the PM records in their original submittal used incorrect pollutant codes. Records in the original submittal designated as PM10-PRI should have been submitted as PM10-FIL, and PM25-PRI should have been PM25-FIL. The PM augmentation routine described in Section 1.3 was re-executed after changing all PM10-PRI to PM10-FIL and all PM25-PRI to PM25-FIL.

Virginia revised the PM data for the Mirant Potomac River Generating Station (SiteID: 51-510-00003) using 2007 condensable test data using the test method with the nitrogen purge to replace the emission factors previously applied by the Contractor.

Virginia requested that the plantID for the Dominion Leesburg Compressor Station be changed from 51-107-71978 to 51-107-01016.

Virginia requested that the plantID for the Transcontinental Gas Pipeline Station 175 be changed from 51-065-40789 to 51-065-00016.

Virginia's review of stack test data Greif Packaging LLC (51-009-00022) showed an incorrect emissions factor applied in 2007. The 2007 emissions factor for CO was 54 lbs CO/ton processed. The test factor was 5.6 lbs CO/ton processed. The 2007 data was corrected using the lower emissions factor.

2.7 VERSION 3 REVISIONS

2.7.1 Emission Offsets

Mulitple states (CT, MA, MD, NH and NJ) added county level records account for account emission reduction credits (ERCs) issued to stationary sources pursuant to state regulation. States provided ERCs on a county-by-county basis. Fictitious facilities with an identifier of "OFFSET99999" were created for each county using SCC 23-99-000-000 (miscellaneous industrial processes: not elsewhere classified) Stack data were developed that assumed that emissions were released at the county centroid with an assumed release height of 10 feet. For the 2007, ERC emissions were set to zero since the banked emissions were not actually emitted in 2007. The ERCs will be included in the future year inventories and air quality modeling analysis.

2.8 ANNUAL 2007 POINT SOURCE EMISSION SUMMARY

Exhibits 2.7 to 2.20 present State-level summaries of 2002 and 2007 annual point source emissions by pollutant and compare 2007 annual emissions from CAMD EGUs, CAMD nonEGUs, and OTHER point sources. The 2002 emissions are those that were developed previously for Version 3 of the MANE-VU and the VISTAS best-and-final inventory for Virginia.

For most States and pollutants, point source emissions have decreased from 2002 to 2007. Notable exceptions are substantial increases in PM10-PRI and PM25-PRI emissions in Maryland, Pennsylvania, and Virginia. These increases are primarily due to a better representation of condensable emissions in the 2007 inventory, especially for coal-fired power plants. New data provided by these States confirm that condensable emissions were underreported in the 2002 inventory.

In 2007, CAMD EGUs accounted for about 88% of SO2 emissions, 62% of NOx, 51% of PM10-PRI, and 54% of PM25-PRI emissions. Non-CAMD reporting sources accounted for 94% of VOC and 82% of CO emissions in 2007.

Exhibit 2.7 – 2002 and 2007 Point Source CO Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	4,053	3,679	-9%
Delaware	9,766	7,753	-21%
District of Columbia	248	311	25%
Maine	17,005	14,483	-15%
Maryland	99,032	81,770	-17%
Massachusetts	21,641	10,108	-53%
New Hampshire	2,725	3,164	16%
New Jersey	12,300	10,548	-14%
New York	66,427	66,357	0%
Pennsylvania	121,524	101,440	-17%
Rhode Island	2,234	1,653	-26%
Vermont	1,078	2,146	99%
Virginia	70,688	70,353	0%
	428,721	**373,765**	**-13%**

Exhibit 2.8 – EGU and nonEGU 2007 Point Source CO Emissions by State

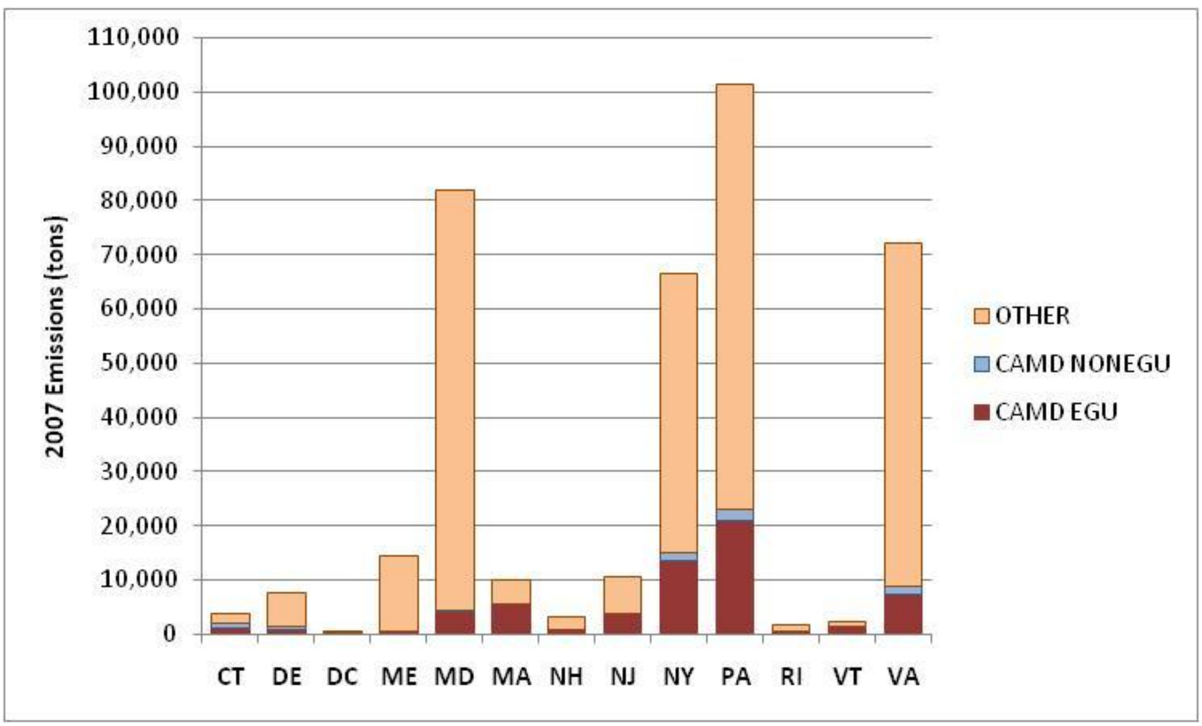


Exhibit 2.9 – 2002 and 2007 Point Source NH3 Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	0	0	
Delaware	196	94	-52%
District of Columbia	4	0	-100%
Maine	845	665	-21%
Maryland	305	137	-55%
Massachusetts	1,578	647	-59%
New Hampshire	74	128	73%
New Jersey	0	918	
New York	1,861	2,417	30%
Pennsylvania	1,388	2,379	71%
Rhode Island	58	74	28%
Vermont	0	0	
Virginia	3,230	1,830	-43%
	9,539	**9,289**	**-3%**

Exhibit 2.10 – EGU and nonEGU 2007 Point Source NH3 Emissions by State

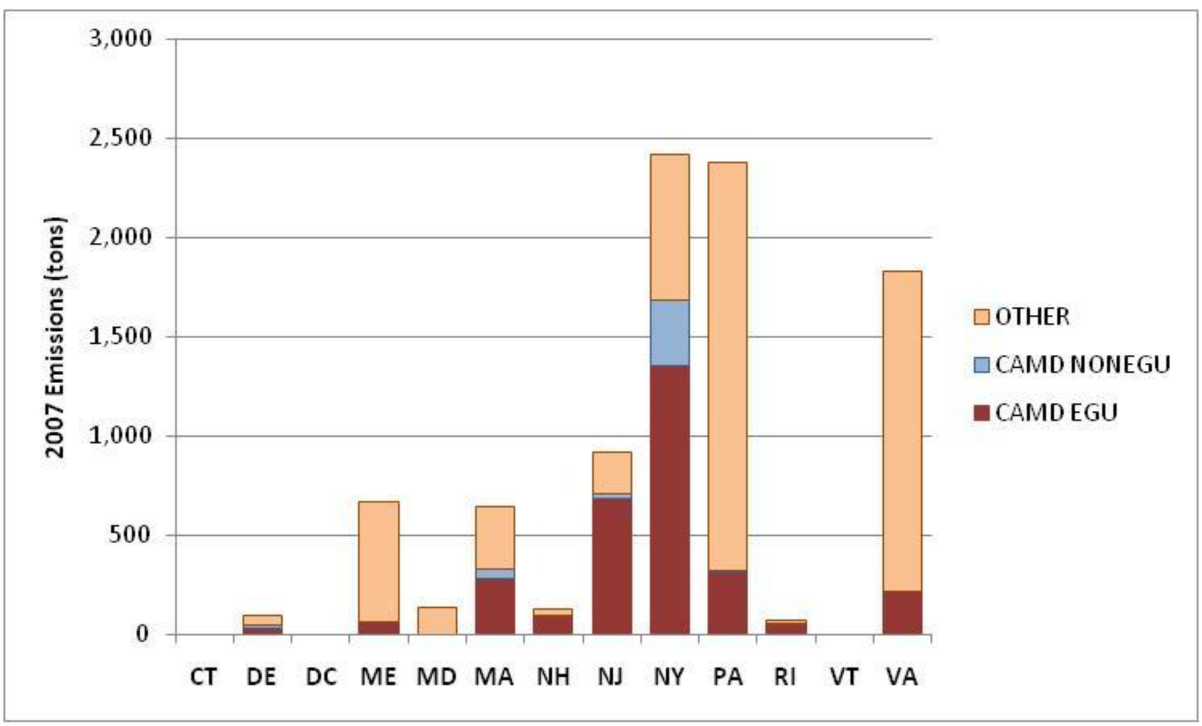


Exhibit 2.11 – 2002 and 2007 Point Source NOx Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	12,923	10,061	-22%
Delaware	16,345	15,628	-4%
District of Columbia	780	789	1%
Maine	19,939	17,746	-11%
Maryland	95,369	74,890	-21%
Massachusetts	48,607	23,628	-51%
New Hampshire	9,759	7,441	-24%
New Jersey	51,593	30,088	-42%
New York	118,978	83,033	-30%
Pennsylvania	297,379	258,379	-13%
Rhode Island	2,764	1,444	-48%
Vermont	787	811	3%
Virginia	147,300	112,938	-23%
	822,523	**636,876**	**-23%**

Exhibit 2.12 – EGU and nonEGU 2007 Point Source NOx Emissions by State

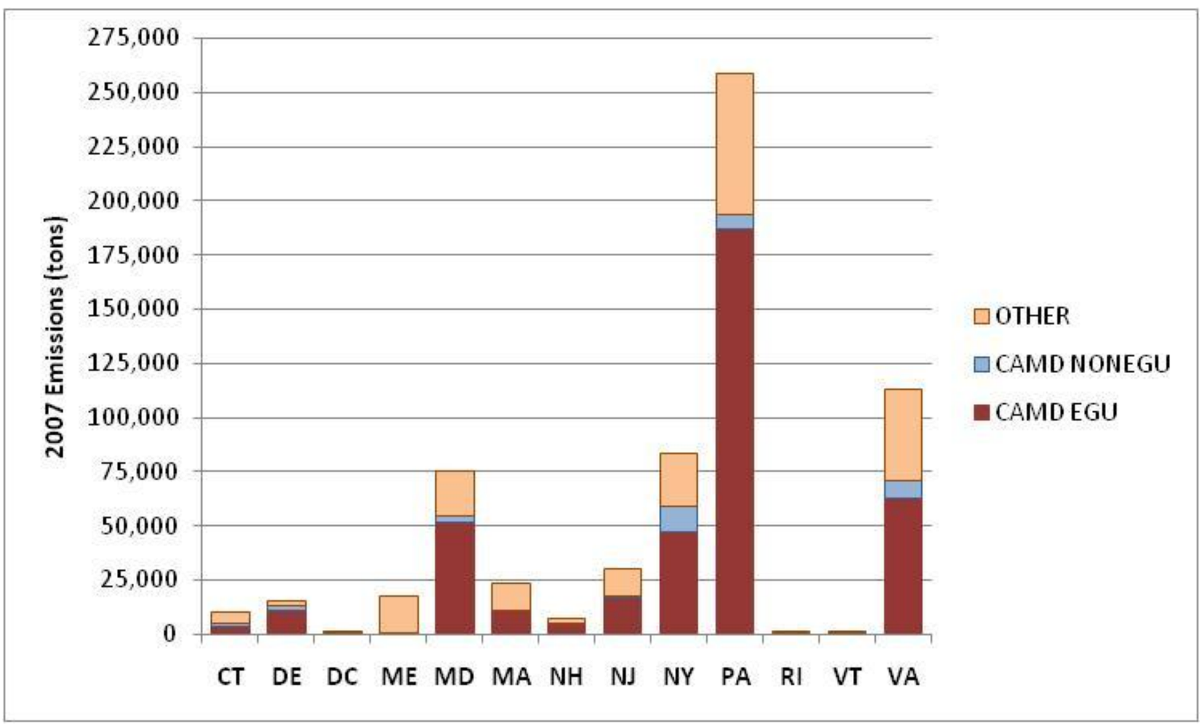


Exhibit 2.13 – 2002 and 2007 Point Source PM10-PRI Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	1,617	1,350	-17%
Delaware	4,217	3,465	-18%
District of Columbia	161	59	-63%
Maine	7,289	4,896	-33%
Maryland	9,046	19,322	114%
Massachusetts	5,852	5,604	-4%
New Hampshire	3,332	1,925	-42%
New Jersey	6,072	7,642	26%
New York	10,392	9,507	-9%
Pennsylvania	40,587	49,745	23%
Rhode Island	300	189	-37%
Vermont	304	146	-52%
Virginia	17,211	19,203	12%
	106,380	**123,053**	**16%**

Exhibit 2.14 – EGU and nonEGU2007 Point Source PM10-PRI Emissions by State

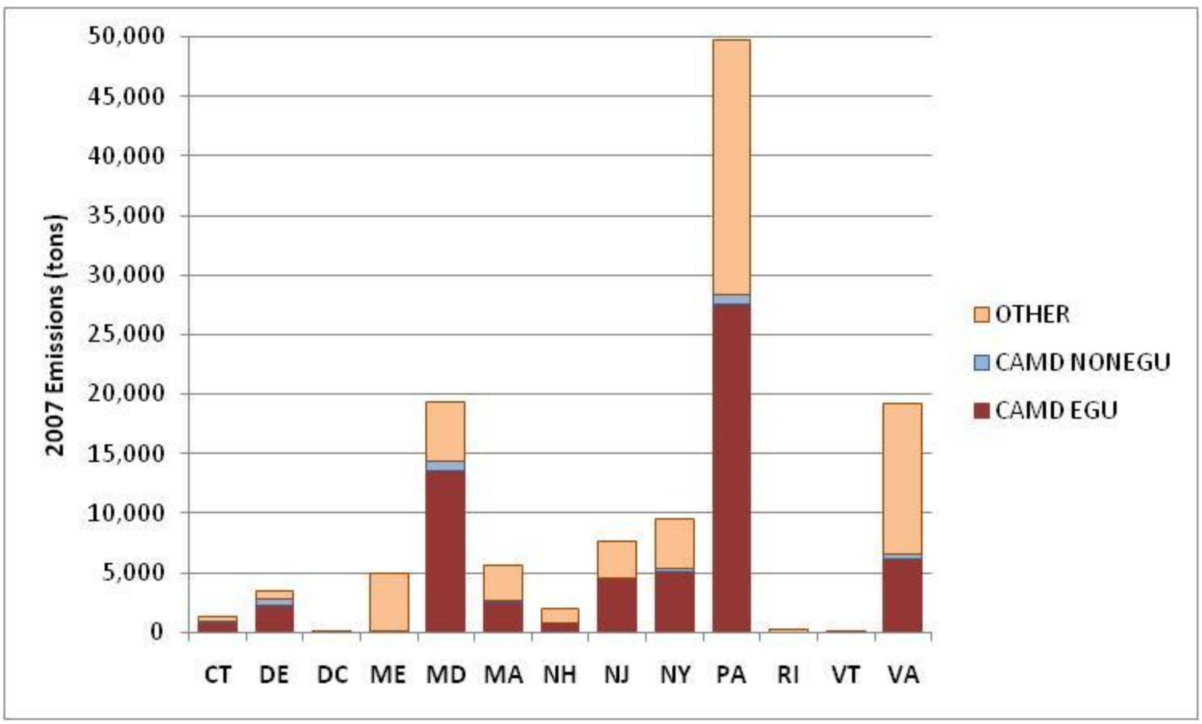


Exhibit 2.15 – 2002 and 2007 Point Source PM25-PRI Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	1,283	1,242	-3%
Delaware	3,666	3,107	-15%
District of Columbia	132	53	-60%
Maine	5,787	3,852	-33%
Maryland	5,054	15,682	210%
Massachusetts	4,161	4,864	17%
New Hampshire	2,938	1,663	-43%
New Jersey	4,779	6,821	43%
New York	7,080	5,999	-15%
Pennsylvania	20,116	32,460	61%
Rhode Island	183	140	-23%
Vermont	267	114	-57%
Virginia	12,771	14,888	17%
	68,217	**90,885**	**33%**

Exhibit 2.16 – EGU and nonEGU 2007 Point Source PM25-PRI Emissions by State

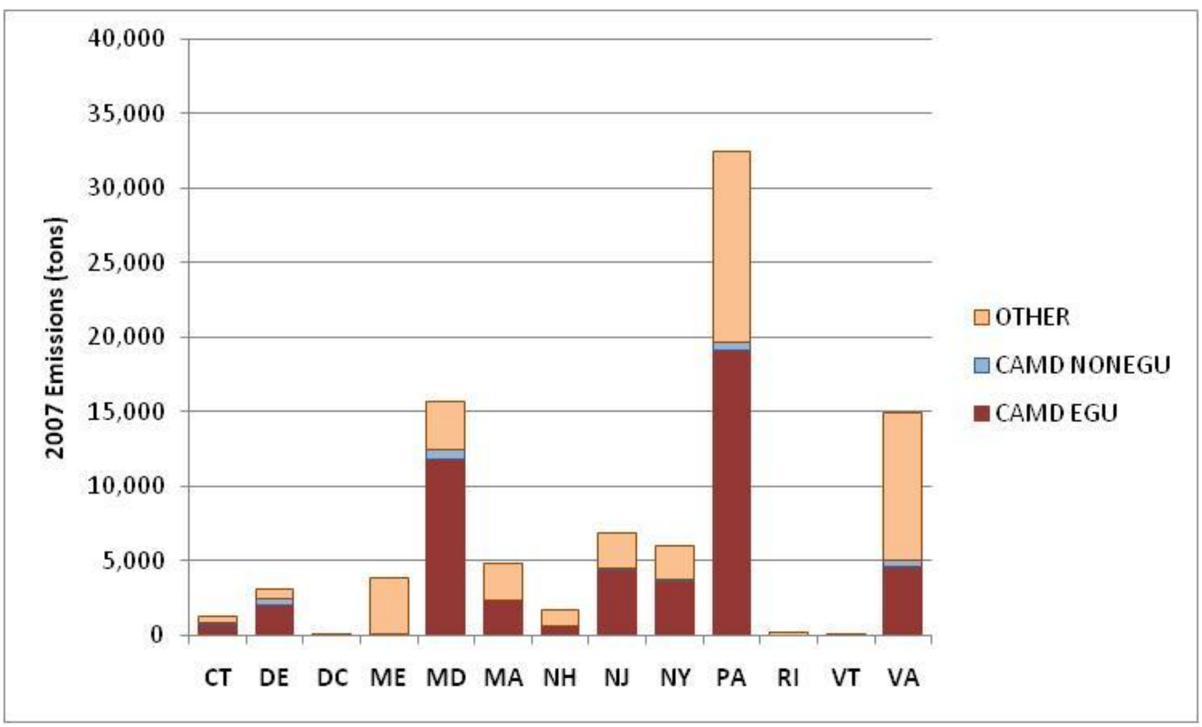


Exhibit 2.17 – 2002 and 2007 Point Source SO2 Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	15,988	7,971	-50%
Delaware	73,744	43,088	-42%
District of Columbia	963	612	-36%
Maine	23,711	17,248	-27%
Maryland	290,929	305,383	5%
Massachusetts	106,960	63,229	-41%
New Hampshire	46,560	45,258	-3%
New Jersey	61,217	40,703	-34%
New York	294,729	152,751	-48%
Pennsylvania	995,175	1,028,056	3%
Rhode Island	2,666	1,516	-43%
Vermont	905	322	-64%
Virginia	305,106	243,048	-20%
	2,218,653	**1,949,185**	**-12%**

Exhibit 2.18 – EGU and nonEGU 2007 Point Source SO2 Emissions by State

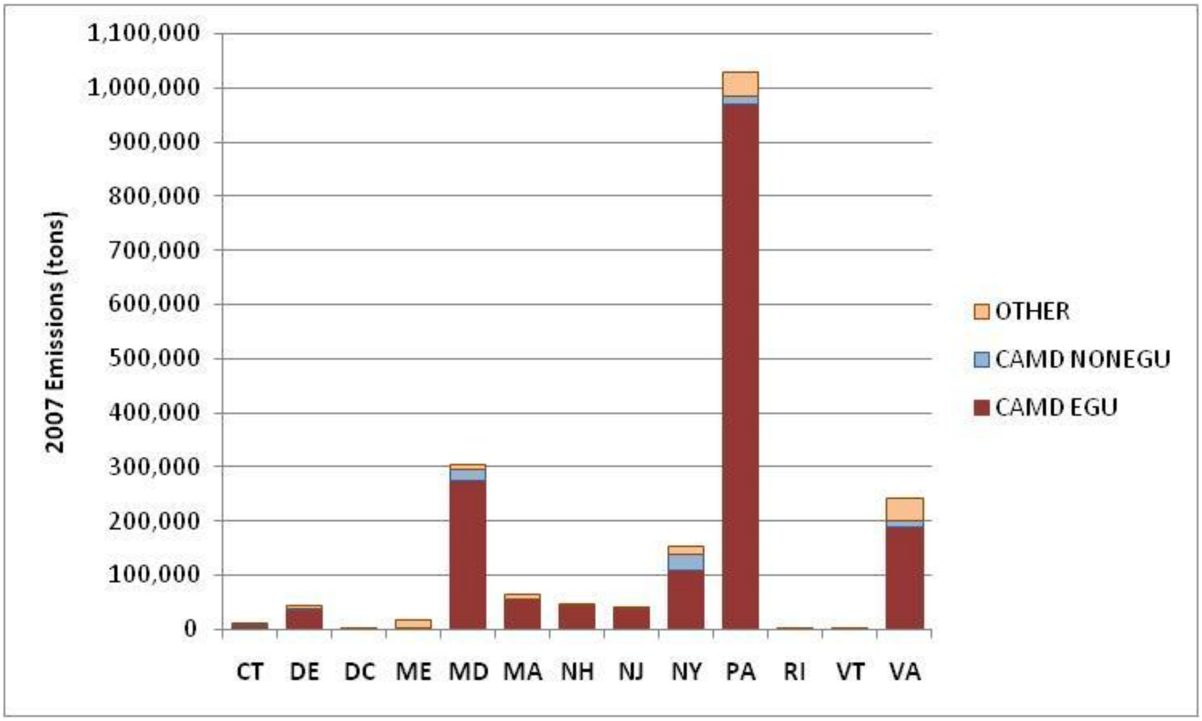
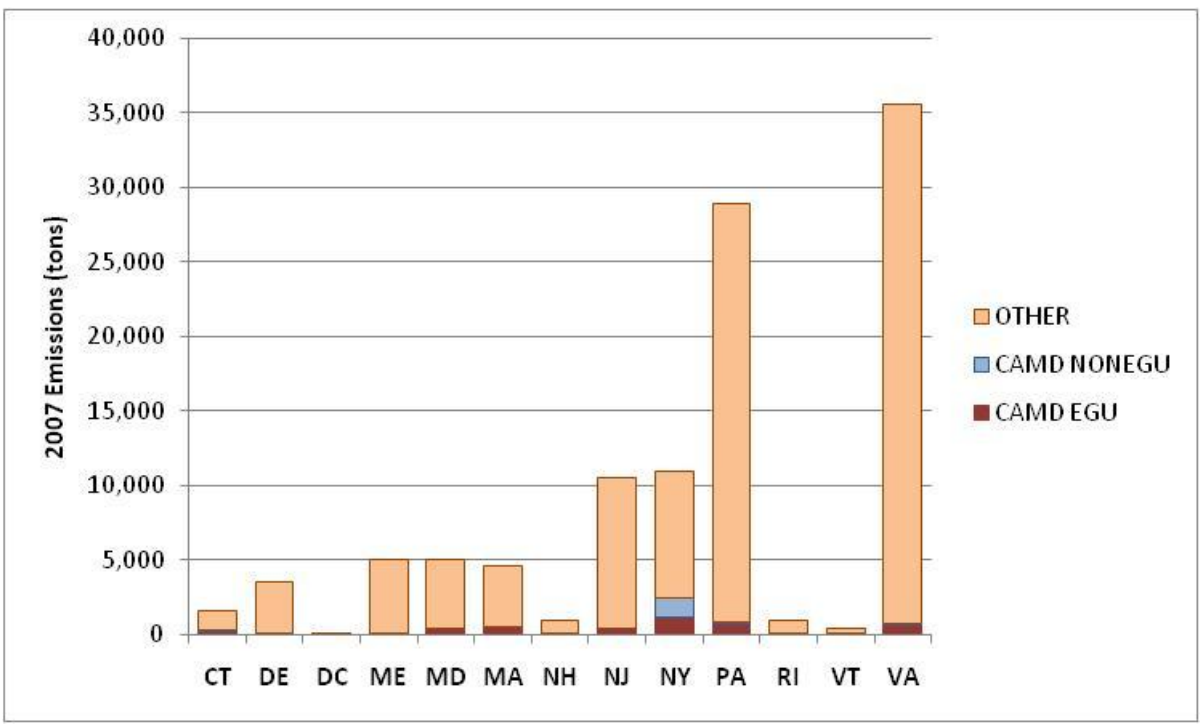


Exhibit 2.19 – 2002 and 2007 Point Source VOC Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	4,907	1,590	-68%
Delaware	4,755	3,489	-27%
District of Columbia	69	59	-14%
Maine	5,319	5,022	-6%
Maryland	6,187	4,986	-19%
Massachusetts	8,350	4,557	-45%
New Hampshire	1,599	916	-43%
New Jersey	16,547	10,526	-36%
New York	11,456	10,891	-5%
Pennsylvania	37,323	28,965	-22%
Rhode Island	1,928	970	-50%
Vermont	1,097	395	-64%
Virginia	43,906	35,618	-19%
	143,443	**107,984**	**-25%**

Exhibit 2.20 – EGU and nonEGU 2007 Point Source VOC Emissions by State



3.0 HOURLY 2007 INVENTORY FOR LARGE POINT SOURCES

The sources included in the hourly inventory include those that report hourly emissions to USEPA's CAMD database as required by market-based regulatory programs including the USEPA Acid Rain and NOx Budget Trading Programs. In Virginia, the hourly inventory also includes distributed generation (DG) units. These Virginia units are mainly internal combustion engines that participate in a demand-response program. The hourly SO2, NOx, and heat input data were used to prepare SMOKE files for modeling that used actual 2007 hourly emissions data.

3.1 DATA SOURCES FOR HOURLY EMISSIONS

The 2007 hourly point source inventory was developed using the 2007 annual emissions inventory developed as discussed in Section 2 of this report, data from the USEPA's CAMD hourly emissions database, hourly emissions data provided by the Virginia Department of Environmental Quality (VDEQ), and hourly emissions data for 6-month reporting units provided by the Maryland Department of the Environment (MDE).

3.1.1 2007 Annual Emission Inventory

As described in Section 2 of this TSD, S/L agencies prepared and submitted emission inventory files in the NIF format. A crosswalk was developed to match facilities and units in the USEPA CAMD hourly database to units in the 2007 Version 1 annual inventory. This process is necessary because the data submitted by the S/L agencies and data submitted by companies to CAMD do not use the same facility or boiler/unit identifiers to identify a particular unit. The crosswalk matched a unit in the NIF annual inventory (using the State, County, PlantID, PointID, StackID and SegmentID) with its counterpart in the USEPA CAMD hourly database (using the ORISID and BoilerID). As previously discussed in Section 2, the final version of the crosswalk is included as Appendix A in this TSD. Complete documentation of the development of the annual inventory and crosswalk table can be found in Section 2 of this report.

3.1.2 EPA CAMD Hourly Database

The second source of data was the hourly emissions data reported to USEPA by facilities to comply with various provisions of the Clean Air Act. Affected facilities are required to report hourly emissions of NOx and SO2, as well as other operational parameters such as hourly emission rate, gross load and heat input. Some units are required to submit hourly emissions data for both NOx and SO2 for the entire 12 month reporting period. Other units are required to submit hourly emissions data only for NOx for the entire 12 month reporting period. Still other units are required to submit hourly emissions data only for

NOx for the 6 month ozone season. Finally, there are a very small number of units that reported hourly emissions for a 9-month period. The USEPA CAMD hourly database is subjected to extensive QA/QC by both USEPA and the reporting facilities.

For this analysis, we used the "Part 75 Prepackaged Data Sets - hourly emissions data formatted for use with the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system". The 2007 hourly data was obtained from the USEPA Clean Air Markets web site (USEPA 2009c).

3.1.3 Virginia Hourly Data for Distributed Generation Units

The third set of data came from VDEQ. Distributed generation units are mainly internal combustion engines that participate in a demand-response program. These are small units, each usually no more than two or three megawatts in capacity, and they generally run on distillate fuel oil. These units are not required to report hourly emissions to USEPA's CAMD. Most are permitted for well below 100 tons of NOx emissions annually and do not run frequently. Annual emissions of NOx are usually not very large from these units. However, ozone season daily emissions estimates from previous ozone SIPs show that facilities that have one or more of these types of units can be quite significant NOx emitters when examined on an ozone season daily basis.

In past modeling efforts, these units were either not included in the emission inventory, or if they were included, were modeled using the SMOKE default temporal profile for the given SCC. To improve the hourly temporal allocation for these units, VADEQ undertook a substantial effort to develop hourly emission profiles using 2007 operations data obtained from utilities for their demand response programs as well as other facility-specific data. These data were used to create a 2007 profile for when these units generally operated. VDEQ used these generic profiles to prepare SMOKE PTHOUR files for each DG unit listed in the annual emissions inventory.

Complete documentation of the data sources and methods used by VDEQ is included as Appendix E - *VDEQ Conceptual Description for DG draft Feb 25, 2010.doc.*

3.1.4 Maryland Hourly Data for Six Month Reporters

The final set of data came from the Maryland Department of the Environment (MDE). MDE filled in the non-ozone season hourly emissions data for certain units that only reported ozone season hourly emissions to USEPA CAMD. MDE identified facilities which reported only 6 months worth of data to CAMD and submitted requests to these facilities for the missing 6 months of data. MDE provided the values in a CAMD-formatted table similar to the Part 75 Prepackaged Data Set format.

3.2 METHODOLOGY FOR DEVELOPING HOURLY SMOKE FILES

SMOKE requires two input files for processing hourly point source emissions:

- PTINV File. This file contains annual emissions data, stack parameters, geographic coordinates, and other information. This file can be in Inventory Data Analyzer (IDA), Emission Modeling System-95 (EMS-95), or one-line-per record (ORL) format. The ORL format from SMOKE Version 2.6 was selected for this project and is shown in Exhibit 3.1.

- PTHOUR File. This file contains the hour-specific data. This file can be in either EMS-95 format or Continuous Emissions Monitoring (CEM) format. The SMOKE Version 2.6 EMS-95 traditional format was selected for this project and is shown in Exhibit 3.2.

The following subsections describe how the PTINV ORL annual emissions file and the PTHOUR EMS-95 hour-specific emission files were created.

3.2.1 Conversion of Annual NIF Inventory to SMOKE ORL Format for PTINV

The 2007 annual inventory was developed in NIF format. Flags were added to the NIF EP table to indicate whether a unit was matched to a CAMD hourly unit or a Virginia DG unit. Matching units in the NIF file were converted to SMOKE PTINV ORL format. To facilitate QA of files and summarization of emissions, six different ORL files were created for the following types of sources:

- Annual emissions for units that reported hourly to USEPA CAMD for the entire 12 months of 2007;
- Ozone season emissions for units that reported to USEPA CAMD for either 6 or 9 months of 2007 (except for 6 month reporting units in Maryland);
- Non-ozone season emissions for units that reported to USEPA CAMD for either 6 or 9 months of 2007 (except for 6 month reporting units in Maryland);
- Units that reported hourly to USEPA CAMD for the either 6 or 9 months of 2007 in Maryland;
- Units that are classified as distributed generation units by VDEQ; and
- All other units (these are not associated with the hourly PTHOUR files); temporal allocation for these units will be accomplished using the standard SMOKE V2.6 temporal allocation profiles.

The ORL files were quality assured to conform to the SMOKE PTINV ORL format and to prevent double counting of emissions.

Exhibit 3.1 – SMOKE ORL Format for PTINV

Position	Name	Type	Description
A	FIPS	Int	Five digit FIPS code for state and county (required)
B	PLANTID	Char	Plant Identification Code (15 characters maximum) (required; this is the same as the State Facility Identifier in the NIF)
C	POINTID	Char	Point Identification Code (15 characters maximum) (required; this is the same as the Emission Unit ID in the NIF)
D	STACKID	Char	Stack Identification Code (15 characters maximum) (recommended; this is the same as the Emissions Release Point ID in the NIF)
E	SEGMENT	Char	DOE Plant ID (15 characters maximum) (recommended; this is the same as the Process ID in the NIF)
F	PLANT	Char	Plant Name (40 characters maximum) (recommended)
G	SCC	Char	Ten character SCC (required)
H	ERPTYPE	Char	Emissions release point type (2 characters maximum); indicates type of stack (not used by SMOKE) • 01 = fugitive • 02 = vertical stack • 03 = horizontal stack • 04 = goose neck • 05 = vertical with rain cap • 06 = downward-facing vent
I	SRCTYPE	Char	Source type (not used)
J	STKHGT	Real	Stack Height (ft) (required)
K	STKDIAM	Real	Stack Diameter (ft) (required)
L	STKTEMP	Real	Stack Gas Exit Temperature (°F) (required)
M	STKFLOW	Real	Stack Gas Flow Rate (ft^3/sec) (optional; automatically calculated by **Smkinven** from velocity and diameter if not given in file)
N	STKVEL	Real	Stack Gas Exit Velocity (ft/sec) (required)
O	SIC	Int	Standard Industrial Classification Code (recommended)
P	MACT	Char	Maximum Available Control Technology Code (6 characters maximum) (optional)
Q	NAICS	Char	North American Industrial Classification System Code (6 characters maximum) (optional)

Position	Name	Type	Description
R	CTYPE	Char	Coordinate system type (1 character maximum) (required) • L = Latitude/longitude
S	XLOC	Real	X location (required); Longitude (decimal degrees)
T	YLOC	Real	Y location (required); Latitude (decimal degrees)
U	UTMZ	Int	UTM zone (not used)
V	CAS	Char	Pollutant CAS number or other code (16 characters maximum) (required; this is called the pollutant code in the NIF)
W	ANN_EMIS	Real	Annual Emissions (tons/year) (required)
X	AVD_EMIS	Real	Average-day Emissions (tons/average day) (not used)
Y	CEFF	Real	Control Efficiency percentage (give value of 0-100) (recommended, if left blank, SMOKE default is 0)
Z	REFF	Real	Rule Effectiveness percentage (give value of 0-100) (recommended, if left blank, SMOKE default is 100)
AA	CPRI	Int	Primary Control Equipment Code (not used by SMOKE)
BB	CSEC	Int	Secondary Control Equipment Code (not used by SMOKE)
CC	NEI_UNIQUE_ID	Char	For units that report hourly emissions to CAMD, this field contains a code to indicate how frequently the unit operated in 2007 (i.e., <15%, 15-50%, or >50% of available hours) For Virginia DG units, this field contains the descriptor “VA DG”. For units that do not have an association in the PTHOUR file, this field contains the descriptor “NonHourly”.
DD	ORIS_FACILITY_CODE	Char	DOE Plant ID (generally recommended, and required if matching to hour-specific CEM data)
EE	ORIS_BOILER_ID	Char	Boiler Identification Code (recommended)

Fields not currently used by SMOKE Version 2.6 after field position EE have been excluded from the ORL file to reduce file size.

Exhibit 3.2 – SMOKE EMS-95 Traditional Format for Individual Hour-Specific Files

Position	Name	Type	Description
1-2	STID	Int	State FIPS Code (required)
3-5	CYID	Int	County FIPS Code (required)
6-20	FCID	Char	Facility ID (a.k.a. plant ID) (required)
21-32	SKID	Char	Point ID (required)
33-44	DVID	Char	Stack ID (required)
45-56	PRID	Char	Segment ID (required)
57-61	POLID	Char	Pollutant name (required)
62-69	DATE	Char	Date in MM/DD/YY format. Years less than 70 are treated as century 2000 (required)
70-72	TZONNAM	Char	Time zone name associated with emissions data. Valid entries are GMT, ADT, AST, EDT, EST, CDT, CST, MDT, MST, PDT, and PST. (required)
73-79	HRVAL1	Real	Hourly emissions for hour 1 (short tons/hour) (required)
80-86	HRVAL2	Real	Hourly emissions for hour 2 (short tons/hour) (required)
87-93	HRVAL3	Real	Hourly emissions for hour 3 (short tons/hour) (required)
...			
234-240	HRVAL24	Real	Hourly emissions for hour 24 (short tons/hour) (required)
241-248	DAYTOT	Real	Daily emissions total (short tons/day)
249	Blank	Blank	Blank
250-259	SCC	Char	SCC (required).
261-276	DATNAM	Char	Blank

3.2.2 PTHOUR Methodology for 12 Month Reporters

For units that reported hourly data to USEPA CAMD for the entire 12 months of 2007, the annual emissions in the PTINV ORL files were allocated to specific hours using the actual NOx, SO2, and heat input-based hour-specific data in the USEPA CAMD database. This ensured that the annual emission values provided by the S/L agencies were maintained and distributed to specific hours using actual 2007 hourly data.

The methodology for creating the PTHOUR files is as follows. First, hourly SO2 and NOx mass and heat input values in the USEPA CAMD database were summed for each unit to create annual values. Next, annual emission records in the ORL file were matched to a corresponding hourly CAMD unit using the crosswalk file. The hourly values in the PTHOUR file were calculated using the following equations, depending on the pollutant:

Hourly NOx emissions

$$\text{Hourly PTHOUR NOx emissions} = \frac{\text{annual ORL NOx emissions} * \text{hourly CAMD NOx emissions}}{\text{CAMD summed annual NOx emissions}}$$

Hourly SO2 emissions for units with non-zero SO2 emissions in the CAMD database

$$\text{Hourly PTHOUR SO2 emissions} = \frac{\text{annual ORL SO2 emissions} * \text{hourly CAMD SO2 emissions}}{\text{CAMD summed annual SO2 emissions}}$$

Hourly SO2 emissions for units with zero SO2 emissions in the CAMD database

Hourly PTHOUR SO2 emissions = annual ORL SO2 emissions * annual factor

Where annual factor = hourly CAMD heat input / annual summed CAMD heat input

Hourly emissions for other pollutants (CO, NH3, PM10-PRI, PM25-PRI, VOC)

Hourly PTHOUR POLL emissions = annual ORL POLL emissions * annual factor

Where annual factor = hourly CAMD heat input / annual summed CAMD heat input

If CAMD heat input data are not available, the steam load was used instead, if available, followed by gross load as a last resort.

3.2.3 PTHOUR Methodology for 6 Month Reporters

About 15 percent of the units in the 2007 CAMD hourly database only reported data for the ozone season, i.e., the second and third quarters, as allowed by their reporting requirements. These units are referred to as 6-months units in this document. Two separate PTINV ORL files were created – one for the 6-month ozone season and one for the 6-month non-ozone season. The CAMD hourly data for these units were used to develop ozone season PTINV and PTHOUR files. For the non-ozone season, a PTINV file was created and was used with re-adjusted SMOKE temporal profiles to develop hourly emissions for the non-ozone season.

The CAMD hourly database for 6-month units contains NOx emissions, heat input and other parameters for the 6 month period. The CAMD hourly data for April through September was used directly and was summed to calculate the ozone season NOx emissions. To calculate the non-ozone season NOx emissions, total CAMD NOx emissions for a 6-month unit was subtracted from the annual NOx emissions of the corresponding unit in the S/L supplied NIF database. In some cases, the 6-month NOx emissions in the CAMD database were greater than the annual emissions in the S/L NIF database. For those cases, non-ozone season emissions were set to zero.

Ozone season emissions of other pollutant are not available from the CAMD database. These emissions were estimated based on a ratio of ozone season NOx emissions to annual NOx emissions. This ratio was applied to the annual emissions from the NIF database. To calculate the non-ozone season emissions for the other pollutants, the total ozone season emissions for the 6-month unit was subtracted from the annual emissions reported for that unit in the S/L supplied NIF database. The PTHOUR files for the ozone season were created as follows. First, hourly NOx mass and heat input values in the USEPA CAMD database were summed for each unit to create ozone season values. Next, ozone season emission records in the ORL file were matched to the hourly CAMD unit using the crosswalk file. Hourly emissions were calculated using the following equations:

Hourly NOx emissions

$$\text{Hourly PTHOUR NOx emissions} = \frac{\text{6-month ORL NOx emissions} * \text{hourly CAMD NOx emissions}}{\text{CAMD summed 6-month NOx emissions}}$$

Hourly emissions for other pollutants (CO, NH3, PM10-PRI, PM25-PRI, SO2, VOC)

Hourly PTHOUR POLL emissions = annual ORL POLL emissions * annual factor

Where annual factor = hourly CAMD heat input / 6-month summed CAMD heat input

If CAMD heat input data are not available, the steam load was used instead, if available, followed by gross load as a last resort.

Hourly data for the non-ozone season was developed using the methodology discussed in Section 3.4 of this TSD.

3.2.4 PTHOUR Methodology for Maryland 6 Month Reporters

MDE identified facilities that only reported 6 months of data to CAMD and requested data from those facilities for the 6 months outside of the ozone season. MDE manually entered hourly values into a CAMD-formatted table similar to the Part 75 Prepackaged Data Set format for the following units.

Plant Name	ORIS	UNITS
Constellation Perryman	1556	CT1, CT2, CT3, CT4
Constellation Riverside	1559	CT6
Constellation Westport	1560	CT5
Mirant Chalk Point	1571	GT2, SMECO
Mirant Morgantown	1573	GT3, GT4, GT5, GT6

The PTHOUR files for the Maryland 6-month reporters were created as described here. First, hourly SO2 and NOx mass and heat input in the MDE hourly database were summed for each unit to create annual totals. Next, annual emission records for all pollutants in the ORL file were matched to the hourly records using the crosswalk file. Hourly emissions in the PTHOUR file were calculated using the following equations, depending on the pollutant:

Hourly NOx emissions

$$\text{Hourly PTHOUR NOx emissions} = \frac{\text{annual ORL NOx emissions} * \text{hourly MDE NOx emissions}}{\text{MDE summed annual NOx emissions}}$$

Hourly SO2 emissions for units with SO2 emissions in the MDE database

$$\text{Hourly PTHOUR SO2 emissions} = \frac{\text{annual ORL SO2 emissions} * \text{hourly MDE SO2 emissions}}{\text{MDE summed annual SO2 emissions}}$$

Hourly SO2 emissions for units without SO2 emissions in the MDE database

Hourly PTHOUR SO2 emissions = annual ORL SO2 emissions * annual factor

Where annual factor = hourly MDE heat input / annual summed MDE heat input

Hourly emissions for other pollutants (CO, NH3, PM10-PRI, PM25-PRI, VOC)

Hourly PTHOUR POLL emissions = annual ORL POLL emissions * annual factor

Where annual factor = hourly MDE heat input / annual summed MDE heat input

If MDE heat input data are not available, the steam load was used instead, if available, followed by gross load as a last resort.

3.2.5 PTHOUR Methodology for Virginia Distributed Generation Units

Complete documentation of the data sources and methods used by VDEQ is included as Appendix E - *VDEQ Conceptual Description for DG draft Feb 25, 2010.doc.*

3.2.6 QA of PTINV and PTHOUR Files

A number of QA activities were undertaken to ensure that the PTINV and PTHOUR files were complete, consistent with the 2007 NIF annual inventory, and did not double count any emission source. Specific QA steps included:

- The ORL annual emission files were quality assured to conform to the SMOKE PTINV ORL format and match the values reported in the original NIF file.
- The PTHOUR files were quality assured to conform to the SMOKE PTHOUR EMS-95 traditional format, the sum of emissions in the PTHOUR file equals the

ORL annual emissions, the number of hourly data records equals 8760, the number of days equals 365, and that all pollutants were included in the PTHOUR file.

These QA checks verified that the original NIF annual values and the annual sum of the hourly values matched.

3.3 DEVELOPMENT OF HOURLY PROFILES FOR 6-MONTH REPORTING UNITS

Since some CAMD units only report data for the ozone season, there was a need for a set of actual 2007 hourly temporal profiles to be used in simulating hourly emissions for these units in non-ozone season months. The following subsections describe the steps taken by Alpine Geophysics in preparing this file.

3.3.1 Annual Profile Preparation

The 2007 hourly CEM data was obtained from CAMD's "Data and Maps" website for each State in the MANE-VU+VA region. Using these data, we filtered the individual source list within each State to only those units reporting each hour of the year (i.e., 8,760 hours of data). This ensured that the resulting profiles are not influenced by units which only report during summertime months for ozone season programs.

For this filtered source list, we summed three variables: total NOx and SO2 mass and heat input as reported in these hourly files at both a State monthly and a State total basis. For each of the three variables, monthly distribution ratios were calculated by dividing each State's monthly sum by their total annual sum as shown in Equation 1 below.

Equation 1. Monthly ratio calculation.

$$\text{Monthly Ratio}_{\text{State, Var}} = \text{Monthly Sum}_{\text{State, Var}} / \text{Annual Sum}_{\text{State, Var}}$$

Where,

Var = CEM-based variable of SO2, NOx or heat input

Exhibit 3.3 provides an example calculation for this step, both in tabular and graphical format.

The resulting ratios were normalized for each variable to provide SMOKE with the monthly distribution factors necessary to process annual emissions into a monthly result. An example monthly profile using the data from Exhibit 3.3 is shown in Exhibit 3.4.

Exhibit 3.3 – Example Application of Calculated Ratios for Actual 2007 by Month

		Actual Reported Value Sums [2007]			Calculated Ratios		
State	**Month**	**SO2 Mass**	**NOx Mass**	**Heat Input**	**SO2**	**NOx**	**Heat Input**
NY	Jan	22,423,391	10,809,292	60,408,685	0.1046	0.0942	0.0809
NY	Feb	29,299,033	12,448,052	67,590,104	0.1366	0.1084	0.0905
NY	Mar	21,364,883	10,327,432	63,106,554	0.0996	0.0900	0.0845
NY	Apr	16,454,881	9,221,500	55,568,488	0.0767	0.0803	0.0744
NY	May	12,855,963	8,198,597	53,421,346	0.0600	0.0714	0.0715
NY	Jun	14,525,239	9,282,277	65,577,304	0.0677	0.0809	0.0878
NY	Jul	16,311,783	10,372,119	74,182,361	0.0761	0.0904	0.0993
NY	Aug	17,757,143	11,156,733	82,322,615	0.0828	0.0972	0.1102
NY	Sep	15,809,719	8,879,373	63,553,452	0.0737	0.0773	0.0851
NY	Oct	15,055,032	7,390,952	55,149,951	0.0702	0.0644	0.0738
NY	Nov	14,471,865	7,561,984	47,280,729	0.0675	0.0659	0.0633
NY	Dec	18,092,057	9,155,587	58,804,999	0.0844	0.0798	0.0787
NY	**Total**	**214,420,988**	**114,803,899**	**746,966,587**	**1.0000**	**1.0000**	**1.0000**

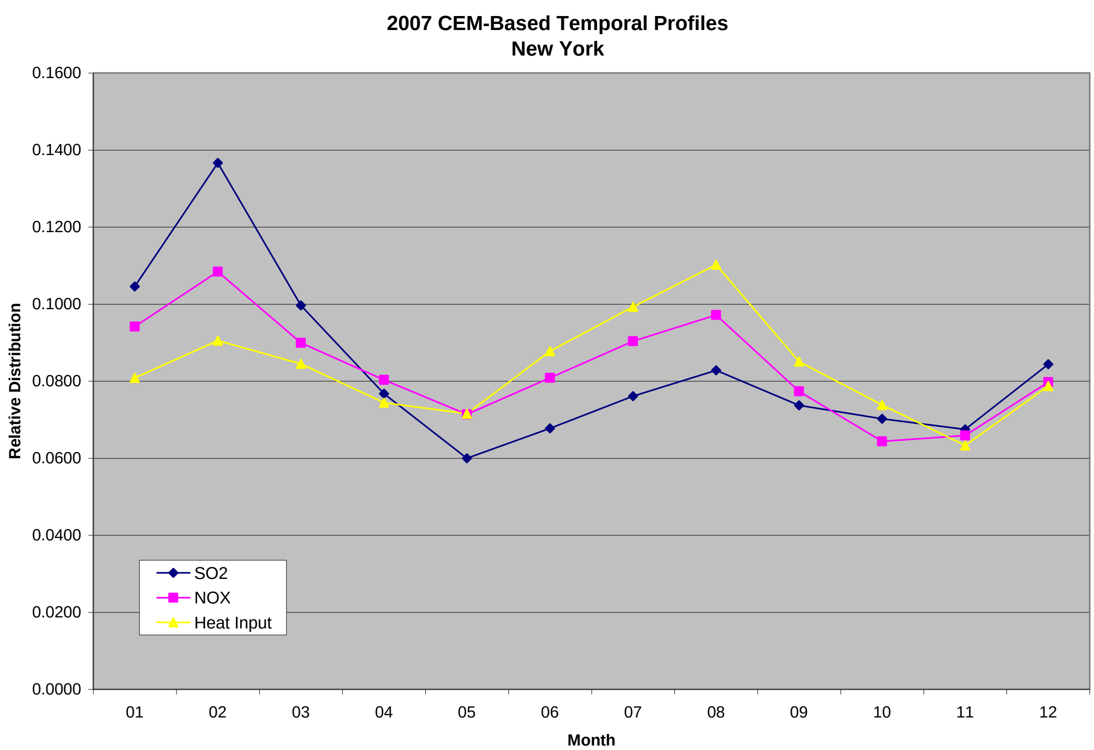


Exhibit 3.4 - Example SMOKE profile for monthly distribution of New York annual emissions using heat input.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly Ratio	0.0809	0.0905	0.0845	0.0744	0.0715	0.0878	0.0993	0.1102	0.0851	0.0738	0.0633	0.0787	1.0000
Monthly Profile	809	905	845	744	716	878	994	1103	851	739	633	788	10005

The profile in the above table can then be associated to the profile cross-reference lookup either by State, State-SCC or some other combination allowing each non-CEM (PTHOUR) reporting unit to have annual emissions allocated. Existing day of week and diurnal profiles from the EPA CHIEF website were used to allocate emissions to finer smaller time periods within each month.

3.3.2 Non-Annual Profile Development

A number of units were identified which require monthly distribution for timeframes outside of the ozone season (when these units are not required to report CEMs). The monthly profiles described in 3.3.1 were modified for use with these units. To account for emissions at these sources not included in prepared hourly (PTHOUR) SMOKE input files, the monthly profiles were zeroed out during the months when hourly CAMD emissions were reported. Concurrently, the TOTAL profile sum was adjusted to accurately reflect the ratio of month to total distribution. An example of this adjustment is shown with highlight in Exhibit 3.5.

Exhibit 3.5 - Example SMOKE profile for adjusted monthly distribution of New York seasonal emissions using heat input.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly Ratio	0.0809	0.0905	0.0845	0.0744	0.0715	0.0878	0.0993	0.1102	0.0851	0.0738	0.0633	0.0787	1.0000
Monthly Profile	809	905	845	744	716	878	994	1103	851	739	633	788	10005
Adjusted Profile	809	905	845	0	0	0	0	0	0	739	633	788	4719

3.3.3 Issue for Consideration

In the USEPA CAMD files only a few CAMD 6-month units reported emissions in April 2007. As a result, the April hourly CAMD data was not used in MARAMA's simulation. Instead, an adjusted profile for five month operation was prepared and used for these sources.

3.4 VERSION 2 - STATE AND STAKEHOLDER REVIEW

On March 15, 2010, MARAMA invited States and stakeholders to review and comment on the draft 2007 hourly inventory of air emissions from point sources. States and stakeholders were provided a 4-week comment period. Written comments were reviewed by the State inventory staff and MARAMA, and resulted in several changes to the draft documentation and inventory data. The changes requested by stakeholders and approved by the States are summarized in the following subsections.

3.4.1 Massachusetts

Massachusetts commented that the majority of the Massachusetts facilities reviewed the CAMD-to-NIF crosswalk and indicated they found no major errors. Some facilities expressed concern that several dual fuel units appeared to have their total NOx emissions doubled, reported separately for both oil and gas. The Contractor reviewed the database and verified that no double counting of emissions occurs. For multiple-fuel units, the Appendix A spreadsheet matches each CAMD record to ALL fuel records in the NIF database, making it appear that the CAMD emissions are counted more than once. MARAMA will use the NIF emissions from State database in regional modeling and the hourly data from the matching CAMD unit to allocate NIF emissions to hourly data for modeling. Emissions will not be double counted for units using multiple fuels.

3.4.2 New York

NRG Energy identified an issue with the hourly emissions for those units in the NIF database when multiple units exhaust from a common stack. In NY's database, multiple units are represented by a single emission unit, whereas in the CAMD database each unit is represented individually. That is why there is a CAMD BLR6ID with no equivalent NIF labels in Appendix A. The Contractor discussed the issue with NRG and devised a solution for the Huntley and Dunkirk Steam Generating Stations by adding emissions units to the NIF tables in cases where there are combined stacks. Annual emissions in the NIF database will be apportioned to each unit based on annual heat input from the USEPA CAMD database. This will allow a proper match to the hourly data for each Unit and ensure that the proper CAMD hourly emissions were used in developing the PTHOUR files for the units at these two facilities.

New York State also worked to improve the linkages between the NIF annual emissions and the CAMD hourly emissions. Not all cases could be resolved, and New York is continuing to review the data.

3.4.3 Pennsylvania

RRI Energy commented that they agree with the approach for calculating hourly emissions as described in Section 3.3 of this report.

3.4.4 Virginia

Virginia reviewed the data in the hourly files and provided three updates needed for the VA cross reference between NIF and CAMD information. These updates do not affect large emission units, but they were made to make the cross reference as correct as possible, as follows:

- For ORIS CODE 55439, NIF ID 51-065-00021, facility name Tenaska Virginia Generating Station was added to CAMD Boiler ID CTGDB1 with the NIF identifier Stack 1, Point 1, Segment 2. This stack point segment was left out of the cross reference and represents the emissions from the duct burner on this turbine.
- For ORIS CODE 55439, NIF ID 51-065-00021, facility name Tenaska Virginia Generating Station was added to CAMD Boiler ID CTGDB3 with the NIF identifier Stack 3, Point 9, Segment 2. This stack point segment was left out of the cross reference and represents the emissions from the duct burner on this turbine.
- For ORIS CODE 52089, NIF ID 51-071-00062, facility name Duke Energy Generation Services of Narrows was deleted for the NIF identifier Stack 1, Point 1, Segment 3 from CAMD Boiler ID BLR007. This stack point segment represents the emissions from the ash handling system for the boilers, and the emissions would be better represented by generic profiles rather than CAMD profiles.

Virginia also commented that some facilities have empty date stamps (i.e., MM/DD/YY field is listed as “xx/xx/xxEST“ where x is blank space). For example, in 12 month units files, 51-033-00040 and 51-065-00021 combined have either 21 or 39 lines with empty date stamps. Similarly, in 6 month units files, 09-009-6614 (in New Haven, Connecticut) have 6 or 12 lines without date stamps. The Contractor identified errors in the CAMD to NIF crosswalk that caused this situation to occur. Fixing the CAMD to NIF crosswalk resolved all occurrences of this problem.

3.5 VERSION 3 REVISIONS

3.5.1 Massachusetts Stony Brook Energy Center NH3 Emissions

Massachusetts identified errors in the ammonia emissions for 2007 for the Stony Brook Energy Center (25013-0420001) and New Bedford Energy (25005-1200634). Massachusetts provided corrected ammonia emission estimates for these two facilities. This change reduced ammonia emissions in Massachusetts by about 2,300 tons.

New Bedford Energy does not report hourly emissions to CAMD, so no changes to the PTHOUR files were needed for this source.

The Stony Brook Energy Center has three units that are 12-month CAMD reporters and two units that are 5-month CAMD reporters. The PTHOUR monthly files for 5-month and 12-month reporters were revised to provide corrected NH3 emissions for the Stony Brook units.

4.0 ANNUAL 2007 INVENTORY FOR AREA SOURCES

4.1 AREA SOURCE CATEGORIES

Area sources are relatively small sources of air pollutants that are diffused over a wide geographical area. They include sources that individually are insignificant, but in aggregate may comprise significant emissions. Examples are emissions from home heating systems, house painting, consumer products usage, and small industrial or commercial operations that are not permitted as point sources. There are 356 individual area source categories in the MANE-VU+VA inventory, categorized by a 10-digit SCC. Major grouping (categories at the 7-digit SCC) included in the area source inventory are shown in Exhibit 4.1.

The USEPA has develops area source emission estimation methodologies and estimates for the NEI on a three-year cycle, and inventories are available for 2002, 2005, and 2008 (USEPA 2010a).

For many categories, unless specifically instructed otherwise by the States, the Contractor used the most recent data from USEPA. These sources included ammonia emissions from livestock and fertilizers which came from a recent application of the Carnegie Mellon University (CMU) ammonia model to produce 2007 emissions and output from a version of the Residential Wood Combustion (RWC) model developed by USEPA and run with updated 2007 data to produce emission estimates for that source category. In addition, a number of States requested that the Contractor include USEPA data on wildfire emissions developed as part of USEPA's SMARTFIRE system.

In the following sections, we describe the data that was available from USEPA and that was used for categories where States did not submit data. Next we describe the State data submittals that were used to override the USEPA data. We summarize the ultimate source of the area source data that each State decided to use for each source category. Finally, we present a State-level summary of emissions by pollutant.

Exhibit 4.1 – Area Source Category Definitions

7-Digit SCC	7-Digit SCC Description
21-01-001	Stationary Fuel; Electric Utility; Anthracite Coal
21-01-002	Stationary Fuel; Electric Utility; Bituminous/Sub-butuminousSub-butuminous Coal
21-01-004	Stationary Fuel; Electric Utility; Distillate Oil
21-01-005	Stationary Fuel; Electric Utility; Residual Oil
21-01-006	Stationary Fuel; Electric Utility; Natural Gas
21-02-001	Stationary Fuel; Industrial; Anthracite Coal

7-Digit SCC	7-Digit SCC Description
21-02-002	Stationary Fuel; Industrial; Bituminous/Sub-butuminous Coal
21-02-004	Stationary Fuel; Industrial; Distillate Oil
21-02-005	Stationary Fuel; Industrial; Residual Oil
21-02-006	Stationary Fuel; Industrial; Natural Gas
21-02-007	Stationary Fuel; Industrial; Liquified Petroleum Gas (LPG)
21-02-008	Stationary Fuel; Industrial; Wood
21-02-011	Stationary Fuel; Industrial; Kerosene
21-03-001	Stationary Fuel; Commercial/Institutional; Anthracite Coal
21-03-002	Stationary Fuel; Commercial/Institutional; Bituminous/Sub-butuminous Coal
21-03-004	Stationary Fuel; Commercial/Institutional; Distillate Oil
21-03-005	Stationary Fuel; Commercial/Institutional; Residual Oil
21-03-006	Stationary Fuel; Commercial/Institutional; Natural Gas
21-03-007	Stationary Fuel; Commercial/Institutional; Liquified Petroleum Gas (LPG)
21-03-008	Stationary Fuel; Commercial/Institutional; Wood
21-03-011	Stationary Fuel; Commercial/Institutional; Kerosene
21-04-001	Stationary Fuel; Residential; Anthracite Coal
21-04-002	Stationary Fuel; Residential; Bituminous/Sub-butuminous Coal
21-04-004	Stationary Fuel; Residential; Distillate Oil
21-04-006	Stationary Fuel; Residential; Natural Gas
21-04-007	Stationary Fuel; Residential; Liquified Petroleum Gas (LPG)
21-04-008	Stationary Fuel; Residential; Wood
21-04-009	Stationary Fuel; Residential; Firelog
21-04-011	Stationary Fuel; Residential; Kerosene
22-94-000	Mobile Sources; Paved Roads; All Paved Roads
22-96-000	Mobile Sources; Unpaved Roads; All Unpaved Roads
23-01-000	Industrial Processes; Chemical Manufacturing: SIC 28; All Processes
23-01-030	Industrial Processes; Chemical Manufacturing: SIC 28; Process Emissions from Pharmaceutical
23-02-002	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking – Charbroiling
23-02-003	Industrial Processes; Food and Kindred Products: SIC 20; Commercial Cooking – Frying
23-02-040	Industrial Processes; Food and Kindred Products: SIC 20; Grain Mill Products
23-02-050	Industrial Processes; Food and Kindred Products: SIC 20; Bakery Products
23-02-070	Industrial Processes; Food and Kindred Products: SIC 20; Fermentation/Beverages
23-02-080	Industrial Processes; Food and Kindred Products: SIC 20; Miscellaneous Food and Kindred Prods
23-07-030	Industrial Processes; Wood Products: SIC 24; Millwork, Plywood, and Structural Members
23-07-060	Industrial Processes; Wood Products: SIC 24; Miscellaneous Wood Products
23-08-000	Industrial Processes; Rubber/Plastics: SIC 30; All Processes
23-09-100	Industrial Processes; Fabricated Metals: SIC 34; Coating, Engraving, and Allied Services
23-11-010	Industrial Processes; Construction: SIC 15 - 17; Residential
23-11-020	Industrial Processes; Construction: SIC 15 - 17; Industrial/Commercial/Institutional
23-11-030	Industrial Processes; Construction: SIC 15 - 17; Road Construction
23-25-000	Industrial Processes; Mining and Quarrying: SIC 14; All Processes
23-25-020	Industrial Processes; Mining and Quarrying: SIC 14; Crushed and Broken Stone

7-Digit SCC	7-Digit SCC Description
23-25-030	Industrial Processes; Mining and Quarrying: SIC 14; Sand and Gravel
23-90-008	Industrial Processes; In-process Fuel Use; Wood
23-99-000	Industrial Processes; Industrial Processes: NEC; Industrial Processes: NEC
23-99-010	Industrial Processes; Industrial Refrigeration; Refrigerant Losses
24-01-001	Solvent Utilization; Surface Coating; Architectural Coatings
24-01-002	Solvent Utilization; Surface Coating; Architectural Coatings - Solvent-based
24-01-003	Solvent Utilization; Surface Coating; Architectural Coatings - Water-based
24-01-005	Solvent Utilization; Surface Coating; Auto Refinishing: SIC 7532
24-01-008	Solvent Utilization; Surface Coating; Traffic Markings
24-01-015	Solvent Utilization; Surface Coating; Factory Finished Wood: SIC 2426 thru 242
24-01-020	Solvent Utilization; Surface Coating; Wood Furniture: SIC 25
24-01-025	Solvent Utilization; Surface Coating; Metal Furniture: SIC 25
24-01-030	Solvent Utilization; Surface Coating; Paper: SIC 26
24-01-040	Solvent Utilization; Surface Coating; Metal Cans: SIC 341
24-01-045	Solvent Utilization; Surface Coating; Metal Coils: SIC 3498
24-01-050	Solvent Utilization; Surface Coating; Miscellaneous Finished Metals: SIC 34 - (341 + 3498)
24-01-055	Solvent Utilization; Surface Coating; Machinery and Equipment: SIC 35
24-01-060	Solvent Utilization; Surface Coating; Large Appliances: SIC 363
24-01-065	Solvent Utilization; Surface Coating; Electronic and Other Electrical: SIC 36 - 363
24-01-070	Solvent Utilization; Surface Coating; Motor Vehicles: SIC 371
24-01-075	Solvent Utilization; Surface Coating; Aircraft: SIC 372
24-01-080	Solvent Utilization; Surface Coating; Marine: SIC 373
24-01-085	Solvent Utilization; Surface Coating; Railroad: SIC 374
24-01-090	Solvent Utilization; Surface Coating; Miscellaneous Manufacturing
24-01-100	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings
24-01-102	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings
24-01-103	Solvent Utilization; Surface Coating; Industrial Maintenance Coatings
24-01-200	Solvent Utilization; Surface Coating; Other Special Purpose Coatings
24-01-990	Solvent Utilization; Surface Coating; All Surface Coating Categories
24-15-000	Solvent Utilization; Degreasing; All Processes/All Industries
24-15-005	Solvent Utilization; Degreasing; Furniture and Fixtures (SIC 25): All Processes
24-15-010	Solvent Utilization; Degreasing; Primary Metal Industries (SIC 33): All Processes
24-15-020	Solvent Utilization; Degreasing; Fabricated Metal Products (SIC 34): All Processes
24-15-025	Solvent Utilization; Degreasing; Industrial Machinery and Equipment (SIC 35): All Processes
24-15-030	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): All Processes
24-15-035	Solvent Utilization; Degreasing; Transportation Equipment (SIC 37): All Processes
24-15-040	Solvent Utilization; Degreasing; Instruments and Related Products (SIC 38): All Processes
24-15-045	Solvent Utilization; Degreasing; Miscellaneous Manufacturing (SIC 39): All Processes
24-15-050	Solvent Utilization; Degreasing; Transportation Maintenance Facilities (SIC 40-45): All Processes
24-15-055	Solvent Utilization; Degreasing; Automotive Dealers (SIC 55): All Processes
24-15-060	Solvent Utilization; Degreasing; Miscellaneous Repair Services (SIC 76): All Processes
24-15-065	Solvent Utilization; Degreasing; Auto Repair Services (SIC 75): All Processes

7-Digit SCC	7-Digit SCC Description
24-15-100	Solvent Utilization; Degreasing; All Industries: Open Top Degreasing
24-15-130	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): Open Top Degreasing
24-15-200	Solvent Utilization; Degreasing; All Industries: Conveyerized Degreasing
24-15-230	Solvent Utilization; Degreasing; Electronic and Other Elec. (SIC 36): Conveyerized Degreasing
24-15-300	Solvent Utilization; Degreasing; All Industries: Cold Cleaning
24-15-360	Solvent Utilization; Degreasing; Auto Repair Services (SIC 75): Cold Cleaning
24-20-000	Solvent Utilization; Dry Cleaning; All Processes
24-20-010	Solvent Utilization; Dry Cleaning; Commercial/Industrial Cleaners
24-25-000	Solvent Utilization; Graphic Arts; All Processes
24-25-010	Solvent Utilization; Graphic Arts; Lithography
24-25-020	Solvent Utilization; Graphic Arts; Letterpress
24-25-030	Solvent Utilization; Graphic Arts; Rotogravure
24-25-040	Solvent Utilization; Graphic Arts; Flexography
24-30-000	Solvent Utilization; Rubber/Plastics; All Processes
24-40-000	Solvent Utilization; Misc. Industrial; All Processes
24-40-020	Solvent Utilization; Misc. Industrial; Adhesive (Industrial) Application
24-60-000	Solvent Utilization; Misc. Non-industrial: Consumer and Commercial; All Processes
24-60-100	Solvent Utilization; Misc. Non-industrial: Consumer and Commercial; All Personal Care Products
24-60-200	Solvent Utilization; Misc. Non-industrial: Consumer and Commercial; All Household Products
24-60-400	Solvent Utilization; Misc. Non-industrial: Consumer and Commercial; All Automotive Aftermarket
24-60-500	Solvent Utilization; Misc. Non-industrial: Consumer and Commercial; All Coatings and Related
24-60-600	Solvent Utilization; Misc. Non-industrial: Consumer and Commercial; All Adhesives and Sealants
24-60-800	Solvent Utilization; Misc. Non-industrial: Consumer and Commercial; All FIFRA Related Products
24-60-900	Solvent Utilization; Misc. Non-industrial: Consumer and Commercial; Miscellaneous Products
24-61-020	Solvent Utilization; Misc. Non-industrial: Commercial; Asphalt Application: All Processes
24-61-021	Solvent Utilization; Misc. Non-industrial: Commercial; Cutback Asphalt
24-61-022	Solvent Utilization; Misc. Non-industrial: Commercial; Emulsified Asphalt
24-61-023	Solvent Utilization; Misc. Non-industrial: Commercial; Asphalt Roofing
24-61-200	Solvent Utilization; Misc. Non-industrial: Commercial; Adhesives and Sealants
24-61-800	Solvent Utilization; Misc. Non-industrial: Commercial; Pesticide Application: All Processes
24-61-850	Solvent Utilization; Misc. Non-industrial: Commercial; Pesticide Application: Agricultural
24-61-870	Solvent Utilization; Misc. Non-industrial: Commercial; Pesticide Application: Non-Agricultural
24-65-000	Solvent Utilization; Misc. Non-industrial: Consumer; All Products/Processes
24-65-800	Solvent Utilization; Misc. Non-industrial: Consumer; Pesticide Application
25-01-011	Storage and Transport; Petroleum and Petroleum Product Storage; Residential PFCs
25-01-012	Storage and Transport; Petroleum and Petroleum Product Storage; Commercial PFCs
25-01-030	Storage and Transport; Petroleum and Petroleum Product Storage;
25-01-050	Storage and Transport; Petroleum and Petroleum Product Storage; Bulk Terminals
25-01-055	Storage and Transport; Petroleum and Petroleum Product Storage; Bulk Plants
25-01-060	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations
25-01-080	Storage and Transport; Petroleum and Petroleum Product Storage; Airports : Aviation Gasoline
25-01-090	Storage and Transport; Petroleum and Petroleum Product Storage;

7-Digit SCC	7-Digit SCC Description
25-01-995	Storage and Transport; Petroleum and Petroleum Product Storage; All Storage Types
25-05-020	Storage and Transport; Petroleum and Petroleum Product Transport; Marine Vessel
25-05-030	Storage and Transport; Petroleum and Petroleum Product Transport; Truck
25-05-040	Storage and Transport; Petroleum and Petroleum Product Transport; Pipeline
25-30-010	Storage and Transport; Bulk Materials Storage; Commercial/Industrial
26-01-000	Waste Disposal; On-site Incineration; All Categories
26-01-010	Waste Disposal; On-site Incineration; Industrial
26-01-020	Waste Disposal; On-site Incineration; Commercial/Institutional
26-01-030	Waste Disposal; On-site Incineration; Residential
26-10-000	Waste Disposal; Open Burning; All Categories
26-10-030	Waste Disposal; Open Burning; Residential
26-10-040	Waste Disposal; Open Burning; Municipal (collected from residences, parks,other for central burn)
26-20-000	Waste Disposal; Landfills; All Categories
26-20-030	Waste Disposal; Landfills; Municipal
26-30-010	Waste Disposal; Wastewater Treatment; Industrial
26-30-020	Waste Disposal; Wastewater Treatment; Public Owned
26-30-050	Waste Disposal; Wastewater Treatment; Public Owned
26-40-000	Waste Disposal; TSDFs; All TSDF Types
26-60-000	Waste Disposal; Leaking Underground Storage Tanks; Leaking Underground Storage Tanks
26-80-001	Waste Disposal; Composting; 100% Biosolids (e.g., sewage sludge, manure, mixtures)
26-80-002	Waste Disposal; Composting; Mixed Waste (e.g., a 50:50 mixture of biosolids and green wastes)
28-01-000	Misc. Area Sources; Agriculture Production - Crops; Agriculture – Crops
28-01-001	Misc. Area Sources; Agriculture Production - Crops;
28-01-002	Misc. Area Sources; Agriculture Production - Crops;
28-01-500	Misc. Area Sources; Agriculture Production - Crops; Agricultural Field Burning - whole field
28-01-700	Misc. Area Sources; Agriculture Production - Crops; Fertilizer Application
28-05-001	Misc. Area Sources; Agriculture Production - Livestock; Beef cattle - finishing / dry-lots
28-05-002	Misc. Area Sources; Agriculture Production - Livestock; Beef cattle production composite
28-05-003	Misc. Area Sources; Agriculture Production - Livestock; Beef cattle - finishing / pasture/range
28-05-007	Misc. Area Sources; Agriculture Production - Livestock; Poultry production - layers with dry mgmt
28-05-008	Misc. Area Sources; Agriculture Production - Livestock; Poultry production - layers with wet mgmt
28-05-009	Misc. Area Sources; Agriculture Production - Livestock; Poultry production – broilers
28-05-010	Misc. Area Sources; Agriculture Production - Livestock; Poultry production – turkeys
28-05-018	Misc. Area Sources; Agriculture Production - Livestock; Dairy cattle composite
28-05-019	Misc. Area Sources; Agriculture Production - Livestock; Dairy cattle - flush dairy
28-05-020	Misc. Area Sources; Agriculture Production - Livestock; Cattle and Calves Waste Emissions
28-05-021	Misc. Area Sources; Agriculture Production - Livestock; Dairy cattle - scrape dairy
28-05-022	Misc. Area Sources; Agriculture Production - Livestock; Dairy cattle - deep pit dairy
28-05-023	Misc. Area Sources; Agriculture Production - Livestock; Dairy cattle - dry-lot/pasture dairy
28-05-024	Misc. Area Sources; Agriculture Production - Livestock;
28-05-025	Misc. Area Sources; Agriculture Production - Livestock; Swine production composite
28-05-026	Misc. Area Sources; Agriculture Production - Livestock;

7-Digit SCC	7-Digit SCC Description
28-05-027	Misc. Area Sources; Agriculture Production - Livestock;
28-05-028	Misc. Area Sources; Agriculture Production - Livestock;
28-05-030	Misc. Area Sources; Agriculture Production - Livestock; Poultry Waste Emissions
28-05-035	Misc. Area Sources; Agriculture Production - Livestock; Horses and Ponies Waste Emissions
28-05-039	Misc. Area Sources; Agriculture Production - Livestock; Swine production - ops with lagoons
28-05-040	Misc. Area Sources; Agriculture Production - Livestock; Sheep and Lambs Waste Emissions
28-05-045	Misc. Area Sources; Agriculture Production - Livestock; Goats Waste Emissions
28-05-047	Misc. Area Sources; Agriculture Production - Livestock; Swine production - deep-pit house
28-05-053	Misc. Area Sources; Agriculture Production - Livestock; Swine production - outdoor
28-06-010	Misc. Area Sources; Domestic Animals Waste Emissions; Cats
28-06-015	Misc. Area Sources; Domestic Animals Waste Emissions; Dogs
28-07-020	Misc. Area Sources; Wild Animals Waste Emissions; Bears
28-07-025	Misc. Area Sources; Wild Animals Waste Emissions; Elk
28-07-030	Misc. Area Sources; Wild Animals Waste Emissions; Deer
28-07-040	Misc. Area Sources; Wild Animals Waste Emissions; Birds
28-10-001	Misc. Area Sources; Other Combustion; Forest Wildfires
28-10-003	Misc. Area Sources; Other Combustion; Cigarette Smoke
28-10-005	Misc. Area Sources; Other Combustion; Managed Burning, Slash (Logging Debris)
28-10-010	Misc. Area Sources; Other Combustion; Human Perspiration and Respiration
28-10-014	Misc. Area Sources; Other Combustion; Prescribed Burning
28-10-015	Misc. Area Sources; Other Combustion; Prescribed Forest Burning
28-10-020	Misc. Area Sources; Other Combustion; Prescribed Rangeland Burning
28-10-025	Misc. Area Sources; Other Combustion; Charcoal Grilling - Residential
28-10-030	Misc. Area Sources; Other Combustion; Structure Fires
28-10-035	Misc. Area Sources; Other Combustion; Firefighting Training
28-10-050	Misc. Area Sources; Other Combustion; Motor Vehicle Fires
28-10-060	Misc. Area Sources; Other Combustion; Cremation
28-10-090	Misc. Area Sources; Other Combustion; Open Fire
28-30-000	Misc. Area Sources; Catastrophic/Accidental Releases; All Catastrophic/Accidental Releases
28-30-010	Misc. Area Sources; Catastrophic/Accidental Releases; Transportation Accidents
28-70-000	Misc. Area Sources; ;

4.2 USEPA AREA SOURCE DATA

USEPA emissions inventories and emission estimation tools were used to create a preliminary version of the 2007 area source inventory. States reviewed the data available from USEPA and made a determination on a category by category basis of whether the USEPA data was acceptable for their State. This section describes the data and tools available from USEPA.

4.2.1 USEPA 2008 National Emission Inventory

Prior to preparation of the 2008 inventory, USEPA, in consultation with ERTAC, revised the recommended emission factors and estimation methods for many area source categories, as listed below. The goal was to provide standardized emission calculations and related documentation across states. These were used by USEPA's contractor to develop 2008 emission estimates for fifteen area source categories to support development of the 2008 National Emission Inventory (NEI). In general, county-level criteria and HAP pollutant emissions were estimated at the SCC level. In most cases, activity data was collected for 2008. In cases where 2008 activity data did not exist, data from the most recent year available was used, as reported in the documentation.

- Agriculture Production - Livestock
- Asphalt Paving
- Aviation Gasoline Distribution
- Commercial Cooking
- Construction Dust
- Commercial/Institutional Fuel Combustion
- Fertilizer Application
- Gasoline Distribution
- Industrial Fuel Combustion
- Open Burning
- Road Dust
- Publicly Owned Treatment Works (POTW)
- Residential Heating
- Solvent Usage - Surface Coatings
- Solvent Usage - Other

The emission factors from the ERTAC process and the resulting 2008 emissions developed by USEPA were available for State use in this 2007 inventory development process (USEPA 2010a).

4.2.2 EPA Residential Wood Combustion (RWC) Tool

EPA worked with a group of State, local, and regional planning organization representatives to develop a new methodology for estimating RWC emissions (USEPA 2010b). USEPA developed a Microsoft Access Tool to allow S/L agencies to calculate annual emissions from RWC sources. The new methodology: 1) accounts for appliances not included in the old methodology (e.g., outdoor hydronic heaters); 2) makes the methodology easier for States to input location-specific knowledge; and 3) updates many of the assumptions made to calculate emissions (for example, the percent conventional versus USEPA certified wood stoves).

EPA updated the RWC tool with 2007 population data and provided it to States to review the input parameters, including county populations, appliance profiles, burn rates, density of cordwood by county, appliance populations, and emission factors by SCC. The only changes that were made to the model itself were for Vermont, which provided updated burn rates and other appliance populations. The Contractor reran the revised 2007 RWC tool for all states. The results of this run are included in the inventory with the exception of New Jersey. New Jersey revised certain model inputs, re-ran the RWC tool on their own, and provided the Contractor with the resulting NIF files.

4.2.3 EPA CMU Agricultural Ammonia Model

In preparation for the 2008 NEI, USEPA used the Carnegie Mellon University (CMU) Ammonia Model to generate an ammonia emission inventory for the continental United States based on 2007 activity levels. No significant change was made to the emission factors in the model. The primary sources of ammonia are two agricultural operations:

- Livestock refers to domesticated animals intentionally reared for the production of food, fiber, or other goods or for the use of their labor. The definition of livestock in this category includes beef cattle, dairy cattle, ducks, geese, goats, horses, poultry, sheep, and swine.
- Fertilizer refers to any nitrogen-based compound, or mixture containing such a compound, that is applied to land to improve plant fitness.

The Contractor obtained from USEPA a recent run of the CMU model for 2007 and provided it to the States for their review (USEPA 2010c). The USEPA data provided to MARAMA included emissions for livestock and fertilizer application. The CMU model is also capable of estimating ammonia emissions from non-domestic animals (deer, bear, etc.) and domesticated pets (dogs and cats) as well as other things such as human perspiration. However, none of these sources were included in the runs of the CMU model that EPA provided to MARAMA. Thus, unless a State supplied emission estimates for those categories, they were not included in the 2007 inventory.

4.2.4 EPA SMARTFIRE Emissions Database

SMARTFIRE is an algorithm and database system developed and built within a geographic information system (GIS) framework that combines multiple sources of fire information and reconciles them into a unified data set (SONOMA 2009). SMARTFIRE data sources include satellite fire detects and ground reports of fire incidents for various wild land management agencies. SMARTFIRE was developed by the USDA Forest Service AirFire Team and Sonoma Technology, Inc. under a grant from NASA.

SMARTFIRE interfaces with the BlueSky framework to estimate daily, location-specific fire emissions.

The Contractor obtained from USEPA a file of 2007 annual, county-level emissions data for wild land fires as calculated using the SMARTFIRE methodology. The Contractor provided the inventory and documentation to States for their review and consideration.

4.3 STATE-SPECIFIC DATA

States reviewed the documentation and resulting emission files for each USEPA estimation methodology. Each State made a decision of whether to accept the USEPA inventory (NEI 2008, RWC tool results, CMU ammonia model results, SMARTFIRE results) or to develop their own emission estimates for these categories. Based on state choices, the Contractor initiated collection of the State supplied data. Generally states provided their data in NIF3.0 format; however some data was provided in spreadsheets in a State-specific format or in the new EIS Emissions format. Where necessary, data was converted to NIF format, filling in as many NIF fields as possible with state-supplied data.

State submitted emission files were augmented using USEPA data as directed by the States. Where 2008 NEI data were used to fill missing categories in the 2007 MANE VU+VA inventory, no growth adjustment was made to the emissions. This is because States felt that activity in 2008 to 2007 was similar due to the economic downturn.

The emissions data is housed in NOF formatted files, which provide additional fields at the end of each table to identify the data source and revision date. Those data elements provide a the data lineage for each source category, thus improving the overall inventory quality assurance (QA). The values in the DATA_SOURCE field in the EM table are shown in Exhibit 4.2. Exhibit 4.3 summarizes the data sources used for each MARAMA State and major source category.

Exhibit 4.2 – Values Contained in the DATA_SOURCE Field of the EM Table

EM Table DATA-SOURCE Value	Description of Data Source
2005NEIv2	All of the records are for CT, which used this value in their submittal to the Contractor – data taken directly by CT from the 2005 NEI version 2
2008NEI	Emissions based on USEPA's 2008 NEI using the USEPA data and methodologies described in Section 4.2.1 of this TSD
EPA	Emissions based on USEPA's 2008 NEI using the USEPA data and methodologies described in Section 4.2.1 of this TSD
EPA NEI05	Emissions based on USEPA's 2005 NEI as a gap-filling measure where 2007 data were not available from State or USEPA
EPA RWC Mo	Emissions based on USEPA's Residential Wood Combustion model
EPA/Ratio	PM emissions were generated using USEPA-supplied emission values and ratios of condensable to PM-PRI or other ratios as necessary to complete the PM spectrum of pollutants
EPA-CMU	Emissions based on USEPA's 2007 run of the CMU ammonia model
MARAMA02BY	Emissions based on MARAMA's 2002 Version 3 area source inventory as a gap-filling measure where 2007 data were not available from the State or USEPA
MARAMA2009	Emissions based on MARAMA's 2009 Version 3 area source inventory as a gap-filling measure where 2007 data not available from State or USEPA
MOVES	Vehicle refueling emissions calculated by NESCAUM using the MOVES model in the inventory mode
NEI0508INT	Emissions were linearly interpolated for 2007 based on values in the 2005 NEI and the 2008 NEI
NEI08CTMOD	All of the records are for CT, which used this value in their submittal to the Contractor – these records were based on the 2008 NEI data modified by CT air quality staff
SEMAP07	Emissions for Virginia are based on SEMAPs 2007 area source inventory
State MOVES	Vehicle refueling emissions calculated by the state using the MOVES model in the inventory mode
State RWC	Emissions for New Jersey based on NJ-specific application of USEPA's Residential Wood Combustion model
State	Emissions were provided directly by the State and represent actual 2007 emissions
StateRatio	PM emissions were generated using State-supplied emission values and ratios of condensable to PM-PRI or other ratios as necessary to complete the PM spectrum of pollutants

Exhibit 4.3 – Data Sources Generally Used by Each State for Each Area Source Category

SCC4 Description	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT	VA
2101 Fuel Comb. / Utility	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	State	n/a	n/a	n/a	n/a
2102 Fuel Comb. / Industrial	State	State	State	n/a	n/a	State	State	State	State	State	State	State	State
2103 Fuel Comb. / Commercial	State	State	State	State	State	State	State	State	State	State	State	State	State
2104 Residential Other Fuels	State	State	State	State	State	State	State	State	State	State	EPA	State / USEPA	State
2104 Residential Wood Comb.	EPA RWC	State	EPA RWC	State	State	EPA RWC	State	State RWC	State	State	EPA RWC	EPA RWC	EPA RWC
2294 Paved Road Dust	State	State	State	State	State	State	State	State	State	State	State	State	State
2296 Unpaved Road Dust	EPA	n/a	State	State	State	EPA	EPA	State	EPA	EPA	EPA	State	EPA
2302 Food & Kindred Products	EPA	State	State	State	State	State	EPA	State	State	State	EPA	EPA	State / USEPA
2311 Construction	EPA	State	State	State	State	n/a	State / USEPA	State	EPA	EPA	EPA	EPA	EPA
2325 Mining & Quarrying	State	n/a	n/a	State	n/a	EPA NEI05	EPA NEI05	State	MARAMA 09	EPA NEI05	n/a	EPA NEI05	State
2399 Industrial Refrigeration	State	n/a	n/a	n/a	n/a	n/a	n/a	State	n/a	n/a	n/a	n/a	n/a
2401 Surface Coating	EPA	State	State	State	State	State	State	State	State	State	EPA	EPA	State
2415 Degreasing	EPA	State	State	State	State	State	State	State	State	State	EPA	EPA	State
2420 Dry Cleaning	EPA	State	State	n/a	State	State	EPA	State	n/a	State	EPA	EPA	State
2425 Graphic Arts	EPA	State	State	State	State	State	State	State	State	State	EPA	EPA	State

SCC4 Description	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT	VA
2440 Industrial Adhesives	2005NEI	State	n/a	State	State	State	n/a	State	MARAMA 09	n/a	n/a	n/a	n/a
2460 Consumer/Comm Products	EPA	State	State	State	State	State	State	State	n/a	State	EPA	EPA	State
2461 Road Asphalt	2005NEI	State	State	State	State	State	State	State	State	State	State	EPA	State
2465 Consumer Products	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	State	n/a	n/a	n/a	n/a
2501 Portable Fuel Containers	NEI0508 INT	State	State	n/a	State	EPA	EPA	State	State	State	State	EPA	EPA
2501 Gas Stations Stage 1	2008NEI	State	State	State	State	State	State	State	EPA	State	State	State	State
2501 Gas Stations Stage 2	MOVES	MOVES	MOVES	MOVES	MOVES	MOVES	MOVES	MOVES	State MOVES	State MOVES	MOVES	MOVES	State MOVES
2501 Aviation Gas Stage 1/2	EPA	State	State	State	State	State	n/a	State	n/a	n/a	EPA	State	EPA
2505 Tank Truck Transport	2008NEI	State	State	State	State	State	n/a	State	EPA	State	State	State	State
2610 Open Burning	EPA	State	State	State	State	EPA	State	State	EPA	State / USEPA	EPA	EPA	EPA
2620 Landfills	State	State	n/a	State	State	State	State	State	State	n/a	n/a	n/a	n/a
2630 Wastewater Treatment	EPA	State	State	State	State	State	State	State	State	State	EPA	EPA	EPA
2660 Leaking Underground Tanks	State	State	n/a	State	State	State	State	State	n/a	n/a	n/a	n/a	State
2680 Composting	State	n/a	n/a	State	n/a	n/a	State	State	n/a	n/a	n/a	n/a	n/a
2801 Agriculture Tilling	State	State	n/a	State	State	State	State	State	n/a	EPA NEI05	EPA NEI05	State	State

SCC4 Description	CT	DE	DC	ME	MD	MA	NH	NJ	NY	PA	RI	VT	VA
2801 Agriculture Field Burning	n/a	n/a	n/a	State	n/a	n/a	n/a	State	n/a	n/a	n/a	n/a	n/a
2801 Agriculture Fertilizer	EPA CMU	State	n/a	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU
2805 Agriculture Livestock	EPA CMU	State	n/a	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU	EPA CMU
2810 Forest Wildfires	n/a	State	n/a	State	State	State	n/a	State	State	EPA	n/a	State	SEMAP 07
2810 Prescribed Fires	n/a	State	State	State	State	n/a	n/a	State	State	n/a	n/a	n/a	SEMAP 07
2810 Structure Fires	State	State	State	State	State	State	State	State	State	n/a	n/a	State	State

Note: this table provides a general indication of the data source used for each major source category. Refer to the NIF EM table for a comprehensive listing of the Data Source for each individual county/SCC/pollutant.

4.4 VERSION 2: STATE AND STAKEHOLDER REVIEW AND COMMENT

The draft MS Access area source files were provided to States and stakeholders for review and comment. Within the Access database three queries were provided to allow the States to summarize emissions by State, county, SCC and pollutant to assist with the review. States and stakeholders provided comments and changes for incorporation and/or change. The following subsections describe the comments received and other QA activities performed that were ultimately incorporated into the final area source inventory.

4.4.1 National Park Service Comments

The only comments received from outside stakeholders came from the National Park Service (NPS). The NPS requested that the documentation be updated to more clearly identify the data sources used by each State for each category. Exhibits 4.2 and 4.3 were prepared in response to this request. Note that Exhibit 4.2 provides only a general indication of the data source used for each major source category. Reviewers are directed to the NOF EM table for a comprehensive listing of the Data Source used for each individual county/SCC/pollutant record. The NPS also commented on the large differences in emissions from some categories between 2002 and 2007. These differences were evaluated and are addressed in Section 4.4.3 and 4.5 of this TSD.

4.4.2 Checks for Missing Categories, Double Counting, Outliers, and Differences between 2002 and 2007 Inventories

As shown previously in Exhibit 4.3, a variety of data sources and methods are used by States to develop the 2007 inventory. The potential exists for categories to be inadvertently omitted, double counted (for example by including both State-specific and USEPA estimates), or to have a large per-capita or per-employee variation from State-to-State.

To guard against omission or double counting, the Contractor and MARAMA prepared a series of SCC level summary reports and manually reviewed them to determine potentially missing source categories. Among the reports were the following:

- "SCC in both 2002 and 2007" compares emissions by State and SCC for SCCs contained in both the 2002 and 2007 inventories.
- "2002 SCCs NOT in 2007" contains the SCCs that were in the 2002 inventory, but not in the first draft of the 2007 inventory.
- "2007 SCCs NOT in 2002" contains the SCCs that were in the 2007 inventory, but not in the 2002 inventory.

There are both increases and decreases in emissions between 2002 and 2007 depending upon the State and pollutant. In order to better understand these differences, we also prepared charts to graphically depict the major differences between the 2002 and 2007 area source inventories. Finally 4-digit SCC summaries were prepared to identify gaps.

States were asked to review these QA reports and provide responses to fill in gaps or address potentially anomalous emission estimates. Several instances were found where a State did not have emissions for a relatively important source category in the draft 2007 inventory. Examples are several SCCs related to PM emissions from construction, agricultural tilling and mining & quarrying operations. These gaps were brought to the attention of the affected States for resolution. In some cases, States provided data for the missing categories or advised the Contractor to fill in the gap using available data from existing USEPA or MARAMA inventories. In other cases, States indicated that emissions from the missing categories were small and determined that the effort to fill the missing category gap was not justified.

We reviewed SO2 and NOx emissions by State from industrial, commercial/institutional, and residential fuel combustion. Since the OTC is considering additional control measures for the industrial/commercial/institutional fuel combustion category, these values were closely scrutinized. Pennsylvania showed a dramatic increase in emissions from 2002 to 2007 for both SO2 and NOx for the industrial fuel combustion category. New York showed a substantial decrease in both the industrial and commercial/institutional categories from 2002 to 2007. Pennsylvania provided updated estimates for Version 3 of the inventory. New York did not provide an explanation of the possible reason for the differences, and no changes to the 2007 values were made.

A comparison of 2002 and 2007 VOC emissions by State for three types of solvent evaporation categories revealed that two States – Maine and New York – appear to have double-counted VOC emissions for this category using two different SCCs (24-60-xxx-xx and 24-65-xxx-xx). Maine and New York reviewed the issue and provided updates to eliminate the double counting issue.

4.5 VERSION 3 REVISIONS

4.5.1 Use of New USEPA Road Dust Equation

In January 2011, USEPA issued a new methodology (USEPA 2011) for developing emission factors for re-entrained particulate matter from vehicles traveling over a paved surface such as a road or parking lot. The new methodology was not used in Version 2 of the MANE-VU+VA 2007 inventory as it was not finalized in time.

This January 2011 version of the paved road emission factor equation only estimates particulate emissions from suspended road surface material. Particulate emissions from vehicle exhaust, brake wear, and tire wear are now estimated separately using USEPA's MOVES model. This approach eliminates possible double counting of emissions resulting from use of the previous version of the equation in this section and MOVES to estimate particulate emissions from vehicle traffic on paved roads.

All states (except Maine) submitted revised paved road emission estimates using the new methodology for Version 3 of the 2007 MANE-VU+VA inventory. Exhibit 4.4 compares the 2007 PM10 and PM2.5 emissions using the new and previous methodology. PM10 emissions are lower using the new methodology, while PM2.5 emissions are higher.

Exhibit 4.4 –2007 Paved Road Dust PM10 and PM2.5 Emission Estimates

	PM10-PRI		PM25-PRI	
State	**Version2 (tons/yr)**	**Version 3 New Method (tons/yr)**	**Version2 (tons/yr)**	**Version 3 New Method (tons/yr)**
Connecticut	16,085	6,722	688	1,680
Delaware	10,217	4,556	724	1,143
District of Columbia	1,841	819	81	201
Maine*	16,536	16,536	1,665	1,665
Maryland**	12,813	13,798	3,160	3,387
Massachusetts	32,748	27,392	1,622	6,724
New Hampshire	8,821	7,985	524	1,960
New Jersey	38,210	19,914	1,142	4,979
New York	95,075	46,348	5,818	11,376
Pennsylvania	92,927	46,806	6,114	11,489
Rhode Island	4,387	3,833	204	941
Vermont	11,326	5,659	979	1,389
Virginia	50,827	29,637	2,966	7,275
Total	**391,814**	**230,004**	**25,690**	**54,207**

* Maine did not provide paved road emissions using the new method.

** Maryland used a draft version of the new AP-42 method for Version 2.

4.5.2 Use of MOVES Model to Estimate Stage II Emissions

States elected to use the Stage II emissions as calculated by the MOVES model, and to include those emissions in the area source sector emission summaries. Stage II emissions result from the refueling of motor vehicles at gasoline service stations. NESCAUM, PA, NY, and VA each executed the MOVES model in inventory mode to calculate vehicle refueling emissions. The MOVES estimates were used instead of the estimates provided by states for Version 2 of the inventory. The MOVES estimates are not included in the onroad sector summaries or modeling files so that the emissions will not be double counted. Exhibit 4.5 compares the Stage II VOC emissions in the 2008 NEI to the emissions calculated using the MOVES model. VOC emissions are higher using MOVES in some states, lower in others. Appendix F contains NESCAUM's documentation of the MOVES modeling. Appendix G contains the VOC control efficiencies by county used in the MOVES modeling for displacement losses and for spillage losses.

Exhibit 4.5 –Stage II Refueling VOC Emissions for 2007 Using NMIM and MOVES

State	NEI2008 (tons/yr)	2007 Version 3 Using MOVES (tons/yr)
Connecticut	483	286
Delaware	284	294
District of Columbia	71	52
Maine	809	709
Maryland	1,933	2,132
Massachusetts	980	807
New Hampshire	412	419
New Jersey	2,287	2,500
New York	7,604	8,787
Pennsylvania	5,313	6,581
Rhode Island	178	180
Vermont	128	122
Virginia	4,464	5,569
Total	**24,947**	**28,437**

4.5.3 Connecticut Changes for Fuel Combustion

Connecticut provided updated 2007 emission estimates for non-wood fuel combustion for the residential, commercial/institutional and industrial source categories. Connecticut previously relied on USEPA's 2005 NEI-v2 (commercial/institutional and industrial) and USEPA's 2008 NEI (residential) for these categories. Prompted by reviews provided by MARAMA, Connecticut subsequently discovered that USEPA's inventory assumed a 2.25% sulfur level for residual fuel oil compared to a CT regulatory maximum of 1.0% sulfur. In addition, Connecticut could not verify whether USEPA's 2005 NEI-v2 adjusted its area source estimates to avoid double counting of point sources. As a result, Connecticut has decided to use emission estimates from its draft-2005 periodic emissions inventory (PEI) for the non-wood fuel combustion portions of the three cited categories.

The draft-2005 PEI includes only CO, VOC and NOx emissions, so fuel use values were multiplied by USEPA emission factors obtained from the 2008 NEI to calculate estimates of annual SO2 and PM2.5 emissions. Emissions for 2005 are assumed to be representative of 2007, with no growth adjustments.

Connecticut identified errors in the Version 2 inventory that were corrected in Version 3. The CO emissions for residential distillate oil combustion were incorrectly reported as winter season emissions instead of annual emissions. Version 2 emissions for residential, commercial/institutional, and industrial kerosene combustion were based on NEI 2008 values. Connecticut indicated that kerosene emissions in the state are included under the distillate oil category. Emissions for the kerosene combustion SCCs were set to zero in Version 3 to avoid double counting of emissions. For a few SCCs, the sum of the PM10-FIL and PM-CON emissions did not equal the PM10-PRI emissions, and the sum of the PM25-FIL and PM-CON emissions did not equal the PM25-PRI emissions. Revisions to the PM10-PRI and PM25-PRI emissions were made to correct the error.

4.5.4 Connecticut Revisions for AIM Coatings and Auto Refinishing

Version 2 of the 2007 inventory for AIM coatings was based on USEPA 2008 NEI values, which accounted for the implementation of the OTC model rule for AIM coatings in Connecticut. Since Connecticut's AIM rule did not go into place in time to produce 2007 reductions, the 2008 NEI values for those SCCs were increased for the Version 3 inventory. The emission factor used to calculate emissions was changed from 2.41 to 3.02 lbs/person to reflect the absence of reductions from the CT AIM rule in 2007.

Version 2 of the 2007 inventory for industrial maintenance coatings was based on USEPA 2008 NEI values, which accounted for the implementation of the OTC model rule for AIM coatings in Connecticut. Since Connecticut's AIM rule did not go into place in time to produce 2007 reductions, the 2008 NEI values for those SCCs were increased for the Version 3 inventory. The emission factor used to calculate emissions was changed from 0.15 to 0.96 lbs/person to reflect the absence of reductions from the CT AIM rule in 2007.

Version 2 of the 2007 inventory for auto refinishing coatings was based on USEPA 2008 NEI values, which did not account for the implementation of the OTC model rule for mobile equipment repair and refinishing in Connecticut. A rule similar to the OTC rule was in place in Connecticut in April 2006. Since Connecticut's auto refinishing rule was in place prior to 2007, the 2008 NEI values for those SCCs were reduced for the Version 3 inventory. The emission factor used to calculate emissions was changed from 89 to 55 lbs/employee to reflect the 38 percent reduction in VOC emissions from the Connecticut auto refinishing rule in 2007.

4.5.5 District of Columbia Residential Wood Combustion

Emissions for residential wood combustion in the District of Columbia were missing from Version 2 of the 2007 MANE-VU+VA area source inventory. These emissions were originally estimated using the USEPA RWC tool, but were inadvertently left out of the 2007 inventory. The 2007 emissions calculated by the USEPA RWC tool were added.

4.5.6 Maryland Degreasing VOC Emisions

Maryland provided revised estimates for VOC emissions for the degreasing category.

4.5.7 Massachusetts NH3 Emisions

Massachusetts added NH3 emissions from humans (SCC 28-10-010-000), cats (SCC 28-06-010-000), and dogs (SCC 28-06-015-000) that were missing in Version 2.

4.5.8 New Jersey Bakeries and Auto Refinishing VOC Emisions

New Jersey revised the VOC emissions for bakeries and auto refinishing.

4.5.9 New York VOC Emisions from Residential Wood Combustion

New York revised the CO and VOC emissions for all residential wood combustion SCCs.

4.5.10 Pennsylvania Industrial Coal Combustion

Pennsylvania revised the industrial coal emissions for SCCs 2102001000 and 2102002000. This revision was accomplished using one of the two new preferred methods of point subtraction based on activity throughputs (coal usage). The revised activity method is performed by subtracting the point source coal usage from the state coal usage totals, and then calculating the area source emissions, which is a more accurate calculation estimate.

4.5.11 Pennsylvania Residential Distillate Oil Combustion

Pennsylvania’s original submittal for SO2 emissions for residential distillate oil were incorrectly underreported by a factor of 100. This error was corrected in Version 3.

4.5.12 Virginia Industrial Coal Combustion

Virginia identified an error in the Version 2 emissions from industrial coal combustion (SCC=21-02-002-000) resulting from a misinterpretation of activity data from the Energy Information Administration. Virginia now believes that all industrial coal combustion is accounted for in the point source inventory. All emissions for this SCC were zeroed out for all counties in Virginia.

4.5.13 Multiple States Open Burning and Commercial Cooking

USEPA updated their emissions estimates for the 2008 NEI in August, 2011. Several states relied on the USEPA estimates for use in the 2007 MANE-VU+VA inventory. These revisions included:

- For commercial cooking (SCCs 23-02-002-xxx and 23-02-003-xxx), USEPA added emission factors for PM-CON and emissions for PM25-PRI were recalculated.
- For open burning (26-10-000-100, 26-10-000-400, 26-10-000-500, 26-10-030-000), USEPA updated per capita waste generation and recalculated emissions.

Emissions for states using the USEPA estimates were updated to reflect these changes.

4.6 ANNUAL 2007 AREA SOURCE EMISSION SUMMARY

Overall, estimated area source emissions decreased from 2002 to 2007 in the region for all pollutants. Area source emissions are generally a product of both activity and emission factors. Changes in both activity and emission factors occurred between 2002 and 2007 for several categories resulting in changes in emission estimates.

Exhibit 4.6 summarizes 2002 and 2007 area source CO emissions by State. Exhibit 4.7 presents the 2007 CO emissions by State and major source category. Most States show a significant reduction in CO area source emissions between 2002 and 2007. The District of Columbia, Rhode Island and Vermont show increases. Regionwide, area source emissions of CO are estimated to be 33% lower in 2007 than was estimated in 2002. Most of the area source CO emissions result from residential wood combustion and open burning, and the emission estimation methods used for these categories changed between 2002 and 2007. Therefore, the substantial changes in CO emissions from 2002 to 2007 are primarily due to different emission estimation methodologies used for the 2002 and 2007 inventories.

Exhibit 4.8 summarizes 2002 and 2007 area source NH3 emissions by State. Exhibit 4.9 presents the 2007 NH3 emissions by State and major source category. Most States show a reduction in NH3 area source emissions between 2002 and 2007, except for the District of Columbia, which show substantial percentage increase. It should be noted that the magnitude of NH3 emissions in the District are very small in comparison to regional emissions, and the large percentage increase is insignificant in the context of regional air quality modeling. Regionwide, area source emissions of NH3 are estimated to be 15% lower in 2007 than was estimated in 2002. Nearly all area source NH3 emissions result from agricultural livestock and fertilizer categories which were calculated by USEPA using the CMU ammonia model. Reductions in animal populations and fertilizer usage between 2007 and 2002 are the reason for the change.

Exhibit 4.10 summarizes 2002 and 2007 area source NOx emissions by State. Exhibit 4.11 presents the 2007 NOx emissions by State and major source category. Most States show decreases between 2002 and 2007, except for Pennsylvania and Vermont, which show increases. Regionwide, area source emissions of NOx are estimated to be 28% lower in 2007 than was estimated in 2002. Nearly all area source NOx emissions are from the industrial, commercial, and residential (non-wood fuel) categories.

Exhibit 4.12 summarizes 2002 and 2007 area source PM10-PRI emissions by State. Exhibit 4.13 presents the 2007 PM10-PRI emissions by State and major source category. Regionwide, area source emissions of PM10-PRI are estimated to be 29% lower in 2007 than was estimated in 2002. PM10-PRI emissions are attributable to the paved/unpaved road dust, construction activity, mining & quarrying, and agricultural tilling categories. Changes in the emission calculation methodology for road dust from paved roads accounts for a substantial portion of the decrease.

Exhibit 4.14 summarizes 2002 and 2007 area source PM25-PRI emissions. Exhibit 4.15 presents the 2007 PM25-PRI emissions by State and major source category. Regionwide, area source emissions of PM25-PRI are estimated to be 19% lower in 2007 than was estimated in 2002. PM25-PRI emissions result from residential wood combustion, paved/unpaved road dust, construction activity, mining & quarrying, and open burning categories. Changes in the emission calculation methodology for road dust from paved roads and residential wood combustion accounts for a substantial portion of the changes.

Exhibit 4.16 summarizes 2002 and 2007 area source SO2 emissions by State. Exhibit 4.17 presents the 2007 SO2 emissions by State and major source category. Most States show decreases between 2002 and 2007, except for Connecticut and Pennsylvania, which show increases. Regionwide, area source emissions of SO2 are estimated to be 42% lower in 2007 than was estimated in 2002. Nearly all area source SO2 emissions are from the industrial, commercial, and residential (non-wood fuel) categories.

Exhibit 4.18 summarizes 2002 and 2007 area source VOC emissions by State. Exhibit 4.19 presents the 2007 VOC emissions by State and major source category. All States show substantial reductions in VOC emissions from 2002 to 2007. Regionwide, area source emissions of VOC are estimated to be 45% lower in 2007 than was estimated in 2002. Part of the difference can be explained by post-2002 control measures for architectural coatings, consumer products, degreasing and portable fuel containers. But, as was discuss for CO emissions, part of the difference is due to differences in the methodologies used to estimate emissions from residential wood combustion.

Exhibit 4.6 – 2002 and 2007 Area Source CO Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	70,198	41,496	-41%
Delaware	14,052	8,266	-41%
District of Columbia	2,300	5,488	139%
Maine	109,223	50,496	-54%
Maryland	141,179	74,188	-47%
Massachusetts	137,496	79,226	-42%
New Hampshire	79,647	39,677	-50%
New Jersey	97,657	77,687	-20%
New York	356,254	205,055	-42%
Pennsylvania	266,935	217,079	-19%
Rhode Island	8,007	15,419	93%
Vermont	43,849	51,109	17%
Virginia	155,873	132,098	-15%
	1,482,669	**997,285**	**-33%**

Exhibit 4.7 – 2007 Area Source CO Emissions by Category and State (tons/year)

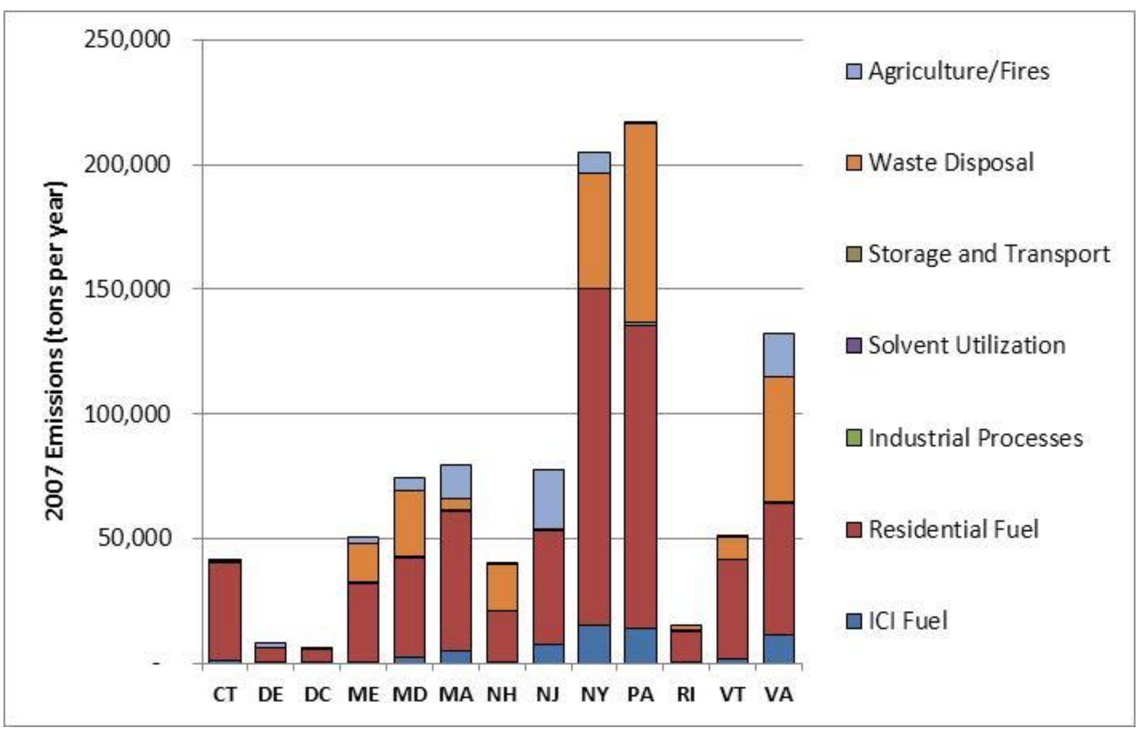


Exhibit 4.8 – 2002 and 2007 Area Source NH3 Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	5,318	4,421	-17%
Delaware	13,278	12,382	-7%
District of Columbia	14	183	1188%
Maine	8,747	5,736	-34%
Maryland	25,835	26,006	1%
Massachusetts	18,809	13,791	-27%
New Hampshire	2,158	1,500	-30%
New Jersey	17,572	15,736	-10%
New York	67,422	45,693	-32%
Pennsylvania	79,911	72,569	-9%
Rhode Island	883	625	-29%
Vermont	9,848	8,013	-19%
Virginia	43,905	43,394	-1%
	293,699	**250,049**	**-15%**

Exhibit 4.9 – 2007 Area Source NH3 Emissions by Category and State (tons/year)

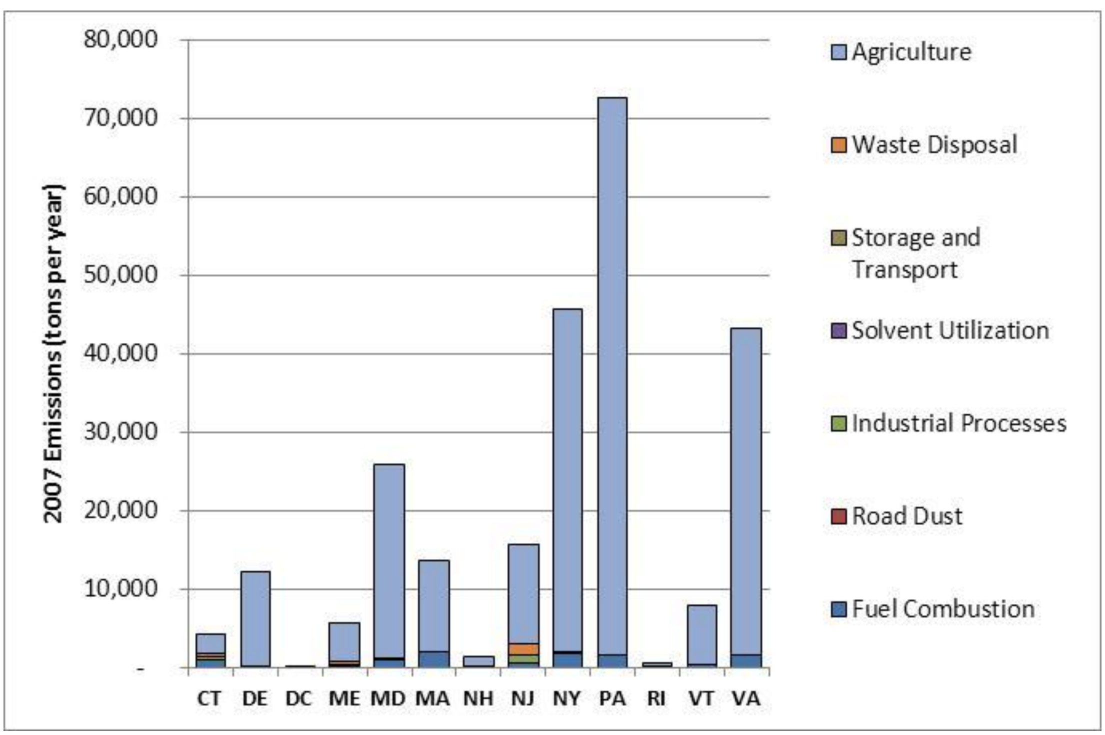


Exhibit 4.10 – 2002 and 2007 Area Source NOx Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	12,689	12,422	-2%
Delaware	2,608	2,237	-14%
District of Columbia	1,644	1,547	-6%
Maine	7,360	6,656	-10%
Maryland	15,678	10,312	-34%
Massachusetts	34,281	20,252	-41%
New Hampshire	10,960	4,737	-57%
New Jersey	26,692	24,175	-9%
New York	98,803	72,053	-27%
Pennsylvania	47,591	47,545	0%
Rhode Island	3,886	3,469	-11%
Vermont	3,208	3,996	25%
Virginia	51,418	19,056	-63%
	316,817	**228,458**	**-28%**

Exhibit 4.11 – 2007 Area Source NOx Emissions by Category and State (tons/year)

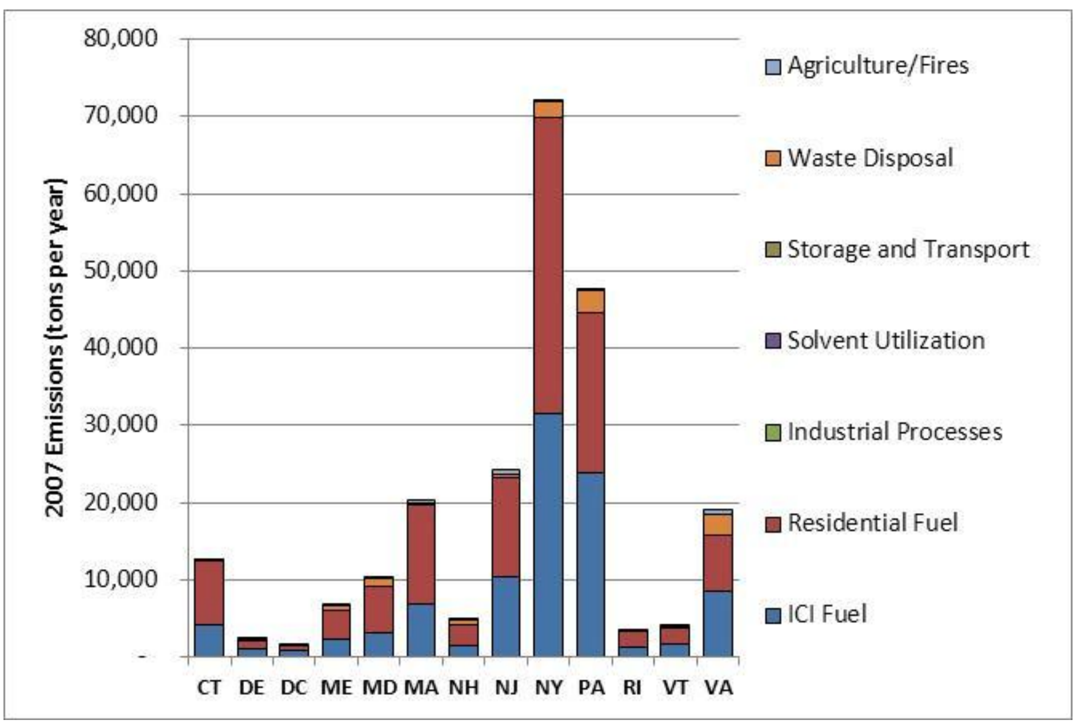


Exhibit 4.12 – 2002 and 2007 Area Source PM10-PRI Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	48,281	30,577	-37%
Delaware	13,039	10,499	-19%
District of Columbia	3,269	4,873	49%
Maine	168,953	54,445	-68%
Maryland	95,060	72,454	-24%
Massachusetts	192,860	148,756	-23%
New Hampshire	43,329	27,742	-36%
New Jersey	61,601	39,140	-36%
New York	369,595	272,674	-26%
Pennsylvania	391,897	287,998	-27%
Rhode Island	8,295	11,361	37%
Vermont	56,131	47,993	-14%
Virginia	237,577	183,341	-23%
	1,689,886	**1,191,853**	**-29%**

Exhibit 4.13 – 2007 Area Source PM10-PRI Emissions by Category and State (tons/year)

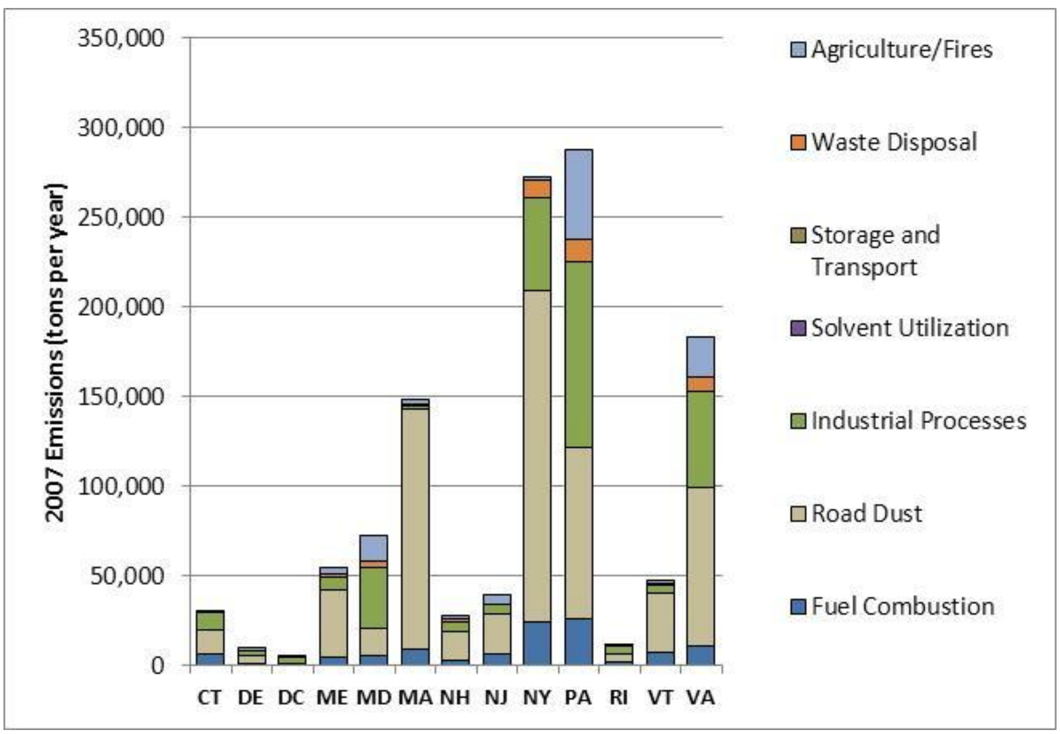


Exhibit 4.14 – 2002 and 2007 Area Source PM25-PRI Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	14,247	10,606	-26%
Delaware	3,204	3,031	-5%
District of Columbia	805	1,542	91%
Maine	32,774	12,526	-62%
Maryland	27,318	19,789	-28%
Massachusetts	42,083	30,438	-28%
New Hampshire	17,532	8,623	-51%
New Jersey	19,350	18,299	-5%
New York	87,155	63,906	-27%
Pennsylvania	74,925	73,514	-2%
Rhode Island	2,064	3,896	89%
Vermont	11,065	13,106	18%
Virginia	43,989	44,102	0%
	376,510	**303,378**	**-19%**

Exhibit 4.15 – 2007 Area Source PM25-PRI Emissions by Category and State (tons/year)

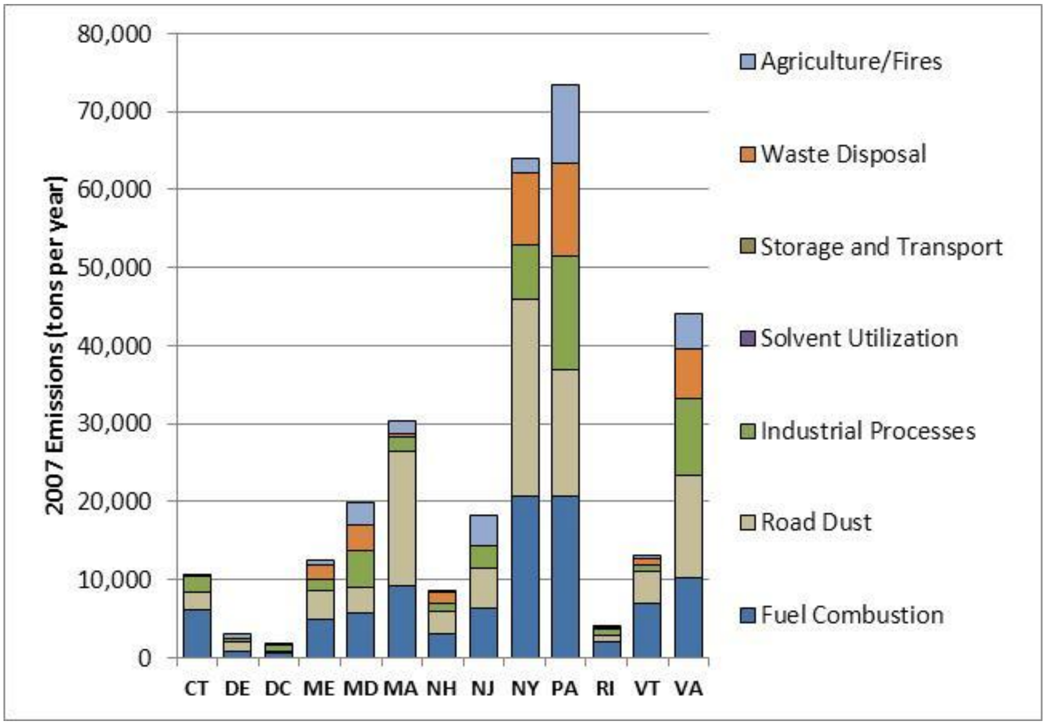


Exhibit 4.16 – 2002 and 2007 Area Source SO2 Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	12,419	16,083	30%
Delaware	1,588	1,144	-28%
District of Columbia	1,336	1,241	-7%
Maine	13,149	9,812	-25%
Maryland	12,393	5,960	-52%
Massachusetts	25,488	19,859	-22%
New Hampshire	7,072	5,283	-25%
New Jersey	10,744	8,811	-18%
New York	130,409	70,044	-46%
Pennsylvania	63,679	66,584	5%
Rhode Island	4,557	3,897	-14%
Vermont	4,088	3,752	-8%
Virginia	105,890	17,098	-84%
	392,812	**229,569**	**-42%**

Exhibit 4.17 – 2007 Area Source SO2 Emissions by Category and State (tons/year)

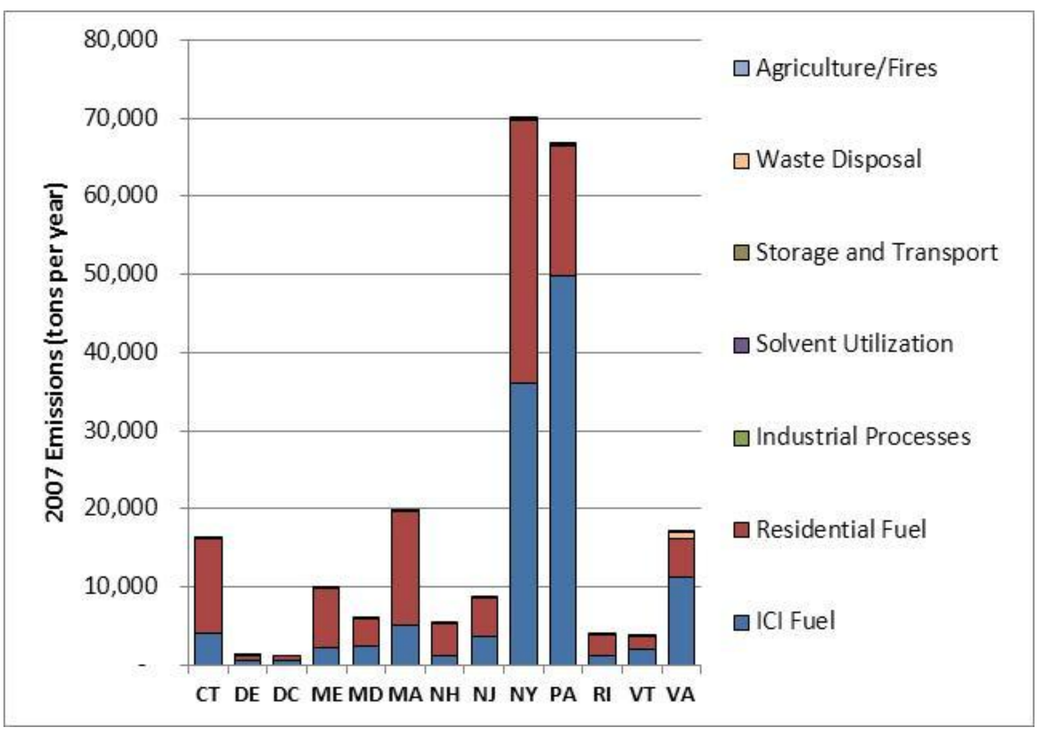
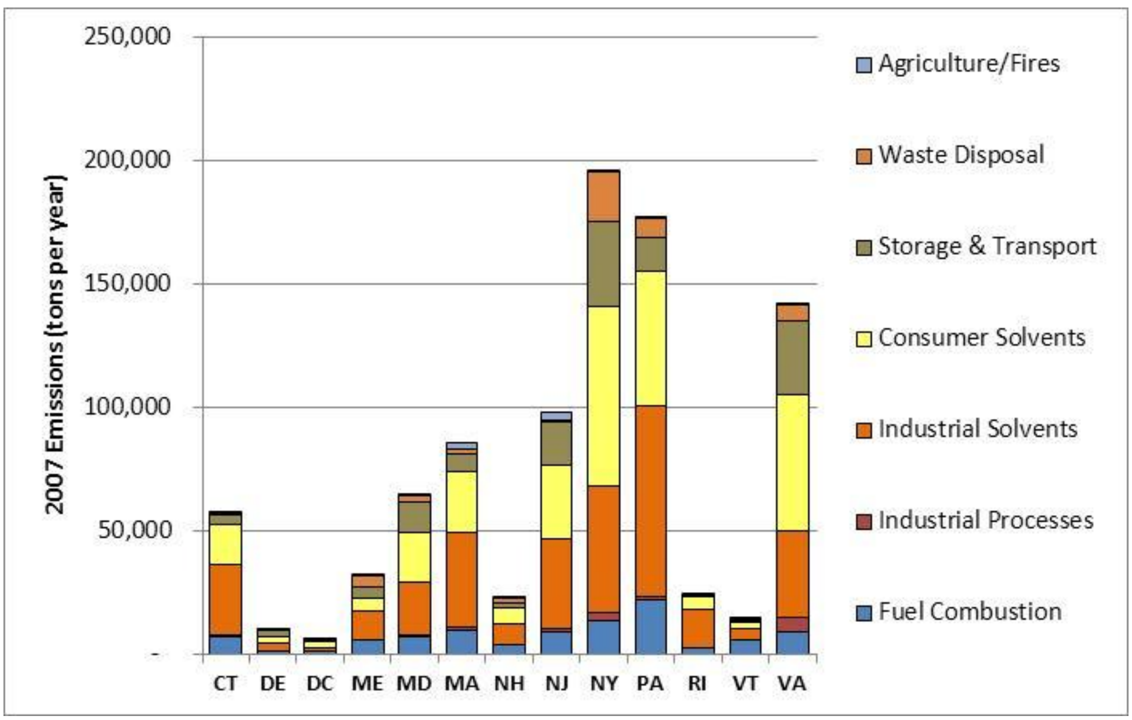


Exhibit 4.18 – 2002 and 2007 Area Source VOC Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	87,302	57,253	-34%
Delaware	15,520	9,482	-39%
District of Columbia	6,432	5,568	-13%
Maine	100,621	31,966	-68%
Maryland	120,254	64,429	-46%
Massachusetts	155,557	85,870	-45%
New Hampshire	65,371	22,343	-66%
New Jersey	167,882	98,121	-42%
New York	507,291	195,976	-61%
Pennsylvania	240,785	176,781	-27%
Rhode Island	31,402	24,214	-23%
Vermont	23,266	14,108	-39%
Virginia	172,989	142,218	-18%
	1,694,670	**928,330**	**-45%**

Exhibit 4.19 – 2007 Area Source VOC Emissions by Category and State (tons/year)



5.0 ANNUAL 2007 INVENTORY FOR NONROAD SOURCES INCLUDED IN THE NONROAD MODEL

5.1 NONROAD MODEL CATEGORIES

The USEPA's NONROAD model estimates emissions from equipment such as recreational marine vessels, recreational land-based vehicles, farm and construction machinery, lawn and garden equipment, aircraft ground support equipment (GSE) and rail maintenance equipment. This equipment is powered by diesel, gasoline, compressed natural gas or liquefied petroleum gas engines.

The National Mobile Inventory Model (NMIM) was developed by USEPA to estimate county-level emissions for certain types of nonroad equipment. NMIM uses the current version the NONROAD model. The NMIM national county database contains monthly input data to reflect county specific fuel parameters and temperatures. Most of the work associated with executing NMIM involved updating the NMIM county database with State-specific information. For this analysis, we used the NMIM2008 software (version NMIM20090504), the NMIM County Database (version NCD20090531), and NONROAD2008a (July 2009 version) as a starting point (USEPA 2009d). Changes were made to the NCD20090531 based on State review.

5.2 VERSION 2 INVENTORY DEVELOPMENT

The following subsections describe how Version 2 of the inventory was prepared.

5.2.1 State Review of NMIM Meteorology Data and Fuel Characteristics

The Contractor obtained from USEPA the National County Database (NCD20090531) for use as a starting point for preparing the modeling data sets. NCD20090531contains the 2007 year-specific meteorology data set that USEPA used to calculate 2007 emissions in addition to fuel revisions for years 2006-2011. These fuel values are updates to those in the 2007 USEPA NMIM run which used NCD20090327. It was decided to use NCD20090531 as a starting point for development of the NONROAD input files for the 2007 modeling inventory. NCD20090531 was made available for state comment.

Several States commented on fuel characteristics data and changes were made to the underlying MySQL database to incorporate those changes into the model. These included changes to Reid Vapor Pressure, sulfur and oxygenate fractions. Where changes were made, the Contractor created new gasoline types and IDs using the NMIM MySQL NCD database default entries as a starting point. Only information related to criteria pollutant emission calculations was changed. Information related to air toxics that was contained in the initial default fuel characteristic tables was not adjusted. Thus the fuel types created for the NMIM modeling should NOT be used for air toxics modeling. To further separate the data in the fuel characteristics tables from other modeling efforts, the Contractor created a separate NCD for use exclusively for this modeling effort.

Exhibit 5.1 shows the number of added gasoline fuel record types added to the "gasoline" table in the MySQL NCD database. The total number of added fuel records was 118 new gasoline types. These records were given GasolineID values of 4462 to 4479 inclusive.

Exhibit 5.1 – Gasoline Fuel Record Types Add to MySQL NCD Database

State	Number of revised gasoline records
CT	10
MD	48
NH	15
NJ	20
NY	25

Although records were added for NY, they were not used since NY performed their own NONROAD modeling (see below).

5.2.2 Update of NMIM Allocation Files for Population and Housing

Several NONROAD categories use housing unit or population data to allocate the emissions to the county level from State calculations. States identified some discrepancies in the housing and population data contained in the NONROAD model and requested that the Contractor update the allocation files for those categories. As a consequence, the Contractor obtained 1 and 2 unit housing information and updated 2007 population estimates. Data were obtained from the sources listed in Exhibit 5.2. :

Exhibit 5.2 – Data Sources for Population and Housing Data

Source Type	Data Source
2007 Population Data Source	http://www.census.gov/popest/counties/CO-EST2008-01.html
Total Housing Data Source	http://www.census.gov/popest/housing/HU-EST2007-CO.html
1 yr - 1 and 2 Unit Housing Data	2007 American Community Survey 1-Year Estimates
3 yr - 1 and 2 Unit Housing Data	B25024. UNITS IN STRUCTURE - Universe: HOUSING UNITS Data Set: 2005-2007 American Community Survey 3-Year Estimates, Survey: American Community Survey

Three sources for the housing unit data were required to evaluate all counties within the region. Census data are frequently withheld when the data reporting can lead to disclosure of confidential business information or due to incomplete survey response. For the 1 and 2 unit housing data, the predominant source was the 1 year 1 and 2 unit housing data. If that was unavailable due to either confidentiality issues or lack of survey response, then the 3 year data was used by determining an average value for the three year period. Finally if no data were available for the 3 year 1 and 2 unit housing information, total housing unit data were utilized. The revised housing unit data affected the allocation of residential lawn and garden equipment. Revised allocation files for all MARAMA States (except NY) were developed and utilized in the NMIM modeling for this category.

For the population data, the latest county estimates of population were obtained from the Census Bureau. These estimates were available for all counties within the MARAMA region. Again, revised allocation files were developed for all States within the MARAMA region with the exception of NY. These revised allocation files applied to railroad maintenance equipment and AC/refrigeration equipment.

A revised population allocation file was prepared for NH as part of this effort, but those data were not obtained from the Census Bureau. The NH population data were provided by NH and were obtained from the "2007 Population Estimates of New Hampshire Cities and Towns", New Hampshire Office of Energy and Planning, June 2008." Those data were used in lieu of the Census Bureau data.

In addition, Pennsylvania provided changes to the values for 1 and 2 unit housing for 2007. The source of these data was not cited.

5.2.3 State-Specific Data Incorporated in NMIM

In addition to the global updates to the housing and population allocation files in the MARAMA region, several States submitted additional information used to update the underlying data used to calculate emissions from nonroad sources. The data submitted and the updates resulting from these submittals are discussed below by State.

5.2.3.1 Connecticut

Connecticut only provided updated information related to the gasoline characteristics. No additional changes were submitted.

5.2.3.2 Delaware

Delaware provided revised values for several additional allocation files beyond those for population and housing units. Data for 2005 were submitted and updated files were developed for the following allocation categories: golf courses, recreational marine vessels, snow blowers, number of wholesale establishments, landscaping employees, and manufacturing employees. In addition, Delaware also submitted data on the engine populations for 2005 for the following recreational marine vessels:

2282005010	2-Str Outboard
2282005015	2-Str Personal Water Craft
2282010005	4-Str Inboard/Sterndrive
2282020005	Dsl - Inboard
2282020010	Dsl - Outboard

The updated population values for 2005 were added to the corresponding file for the NONROAD model and were used for the 2007 runs. Because of the way NONROAD handles missing data, if data for 2007 are not found, the most current data (in this case 2005) are used to assist in determining a 2007 value.

5.2.3.3 Maryland

Maryland only provided information to update the gasoline characteristics. No additional changes were submitted.

5.2.3.4 New Hampshire

As indicated above, New Hampshire provided State-specific population data from their own data source for their counties for use in preparing the population allocation files. A revised population allocation file was prepared for NH as part of this effort, but those data were not obtained from the Census Bureau. The NH population data were provided by NH and were obtained from the "2007 Population Estimates of New Hampshire Cities and Towns", New Hampshire Office of Energy and Planning, June 2008. Those data were used in lieu of the Census Bureau data.

5.2.4 New Jersey

New Jersey provided revised gasoline characteristics values as well as NONROAD equipment population data with revised data on equipment population values for Airport Ground Support Equipment. In addition, NJ provided revised human population data for 2002, 2005, 2010, 2015 and 2020. These data (along with the 2007 data generated from the Census Bureau) were added to the NJ population allocation file.

5.2.4.1 New York

New York opted to not have the Contractor calculate emissions using NMIM for their State. Instead, NY calculated their own emissions for the nonroad category and submitted the output files to the Contractor for post processing. The output files submitted by NY were monthly output runs from the NONROAD model for each county. The Contractor simply post-processed these files to combine emissions and throughput values for each county into an annual emissions number. Summary annual files were submitted to NY by the Contractor for approval. No other work on the NY emissions was performed by the Contractor.

5.2.4.2 Pennsylvania

Pennsylvania provided revised data for the 1 and 2 unit housing information for 2007. Those data were used in lieu of the Census Bureau data for 2007 in the allocation file. The source of these data was not cited.

5.2.5 NMIM Run Specification

The run specifications for each NMIM run were developed on a State-by-State basis. The settings for each specification panel within the NMIM model are detailed below.

- Description: A short descriptive term for the run was entered for each State specific run.
- Geography: The "county" option was selected for each State specific run. All counties within a State were selected for the run.
- Time: On the time panel, the year 2007 was selected in the drop down box and added to the year selections area. The Use Yearly Weather Data check box was also selected. Every month in the Months check box area was selected.
- Vehicles/Equipment: Only the nonroad vehicle/equipment area was selected. All fuels and all vehicle types were selected for each State run.
- Fleet: No selections or information was entered in this panel.
- Pollutants: All criteria pollutants (with HC reported as VOC) were selected except for CO_2. Exhaust PM10 and PM2.5 were also selected.
- Advanced features: Only the server and database were selected in this panel.
- Output: Under the Geographic Representation panel the County selection was made. In the General Output area, a new database was selected on the server for the output.

All added external files for use in each State run were placed in the external files directory of the NCD. Entries for all external files included were added to the countynrfiles table of the NCD.

5.2.6 State and Stakeholder Review of Version 2

The Contractor completed the NMIM modeling runs in October of 2009. The results were made available to States and Stakeholders for review and comment. Based on the comments received, the following issues were addressed, and in some cases, changes were made to the 2007 nonroad inventory for sources included in NMIM.

5.2.6.1 Connecticut

Connecticut requested several changes to the NMIM inputs, which were incorporated into a new 2007 NMIM run. Connecticut indicated that the RFG areas were not applied to counties correctly. RVP values were modified by a small amount to reflect USEPA RFG sample averages for the appropriate mapping of Connecticut counties to RFG areas. Connecticut identified discrepancies in the RFG average sulfur values for 2007 and provided updated values. Connecticut also provided updated values for the calculated oxygen weight percents for ethanol.

5.2.6.2 New Jersey

New Jersey identified a very minor issue with the fuels data used for the 2007 NMIM runs. After considering the insignificant impact it would have on the emission totals, they agreed the fuels data used in the original NMIM run were adequate.

5.2.7 Removal of Airport Ground Support Equipment Emissions

The NMIM/NONROAD model includes emissions from airport ground support equipment. As discussed in detail in Section 6 of this TSD, emissions from airport ground support equipment is also included in USEPA's aircraft inventory that was prepared using the Federal Aviation Administration's Emissions and Dispersion Modeling System (EDMS). Correspondence with USEPA indicated that USEPA considers the emissions calculated by EDMS to be better than those calculated by NONROAD. For this reason, all emissions calculated by NMIM/NONROAD for airport ground support equipment were removed from the inventory to avoid double counting emissions.

5.3 CHANGES MADE FOR VERSION 3

Two main modifications were made to the nonroad inventory for 2007 for version 3 of the inventory. First, Virginia and New York requested that their emissions be recalculated using the information developed for the MARAMA States. The Virginia reruns were performed for all categories except for ground support equipment and for recreational marine vessels. Those values replaced the SEMAP supplied values used in versions prior to version 3. As indicated above, New York had originally provided data from

NONROAD model runs that they performed separately. For this version of the inventory, New York emissions were calculated using NMIM runs set up using the same criteria as those for other states in earlier versions of the inventory. Both New York and Virginia were provided with the opportunity to review fuel characteristics prior to their runs. Only Virginia made changes to the fuels, however the only changes that were made were to assign alternative default fuels for gasoline powered engines to counties. The fuel characteristics were not modified from the NMIM defaults, only the fuel IDs associated with a particular county/month combination were changed to another default fuel. Those changes were instituted in the NCD developed specifically for MARAMA. Default values for diesel, LPG and CNG were maintained for Virginia. New York did not request any changes to the default values. In addition, the revisions made to the housing population allocation files were instituted for both states.

The second change was to modify the recreational marine vessel populations for all states except Vermont and Maine. A revised population file was prepared for Virginia but not utilized in the version 3 runs. Virginia used the NMIM default engine population for recreational marine vessels for version 3 runs. The revised population data were provided by the National Marine Manufacturers Association (NMMA). Total state populations for each of the three major categories contained in the NONROAD model (outboard, inboard/sterndrive and personal watercraft) were provided for each state. Because the population files used by the NONROAD model (and thus NMIM) were configured with population values for various horsepower categories, AMEC determined the fraction of the total for each marine vessel type in each horsepower category from the NONROAD default population files. These fractions were then used to allocate the total state population obtained from NMMA to the various horsepower categories.

The only exception to this was that some states added in data for sailboats to the NMMA data. The sailboat populations were split among two of the default NONROAD categories. In addition, New Hampshire provided their own revised population file. Their population data were provided by the New Hampshire DMV and is not from NMMA.

5.4 SUMMARY OF NMIM MODELING RESULTS FOR 2007

Exhibits 5.3 to 5.9 present State-level summaries that compare 2002 and 2007 annual emissions for NMIM/NONROAD sources (excluding airport ground support equipment) from Version 3 of the MARAMA inventory. The 2002 emissions are those that were developed previously for Version 3 of the MANE-VU and the VISTAS best-and-final inventory for Virginia. Note that previous versions of this document had emissions for

Virginia derived from VISTAS/SEMAP NMIM results. For this document the Virginia data is from NMIM runs made consistent with the MARAMA approach.

For most States and pollutants, emissions from NMIM/NONROAD sources decreased from 2002 to 2007.

- CO emissions generally decreased by 15-30% in all States, in part due to turnover to newer, cleaner engines.
- NH3 emissions showed increases from 2002 to 2007 for all states except Connecticut and New Jersey which showed modest decreases.
- Emissions of NO_x, PM10-PRI, and PM25-PRI generally decreased by 9-20% from 2002 to 2007, with some States showing slightly higher or slight lower decreases.
- For SO_2, emissions decreased by 40-50% in all States except New Hampshire and Rhode Island.
- VOC emissions decreased between 5-35% over the same time period.

In addition, the estimated decrease in emissions was due to differences in the versions of the NONROAD model that were used to develop the 2002 and 2007 inventories. The new version of the model (NONROAD 2008a) used for the 2007 inventory accounts for new exhaust and evaporative emission controls, and predicts substantially less HC and CO, and somewhat less NO_x and PM emissions than earlier versions of NONROAD with use of comparable scenario inputs. NH3 was relatively unaffected by the new NONROAD version.

Exhibit 5.3 – 2002 and 2007 NMIM/NONROAD CO Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	274,388	181,817	-34%
Delaware	65,954	55,173	-16%
District of Columbia	18,775	14,319	-24%
Maine	148,555	131,319	-12%
Maryland	424,777	297,832	-30%
Massachusetts	448,399	324,793	-28%
New Hampshire	128,572	90,461	-30%
New Jersey	692,548	445,302	-36%
New York	1,219,168	911,813	-25%
Pennsylvania	903,168	719,517	-20%
Rhode Island	71,573	54,028	-25%
Vermont	61,732	52,497	-15%
Virginia	582,895	415,093	-29%
	5,040,503	**3,693,965**	**-27%**

Exhibit 5.4 – 2007 NMIM CO Emissions by Category and State (tons/year)

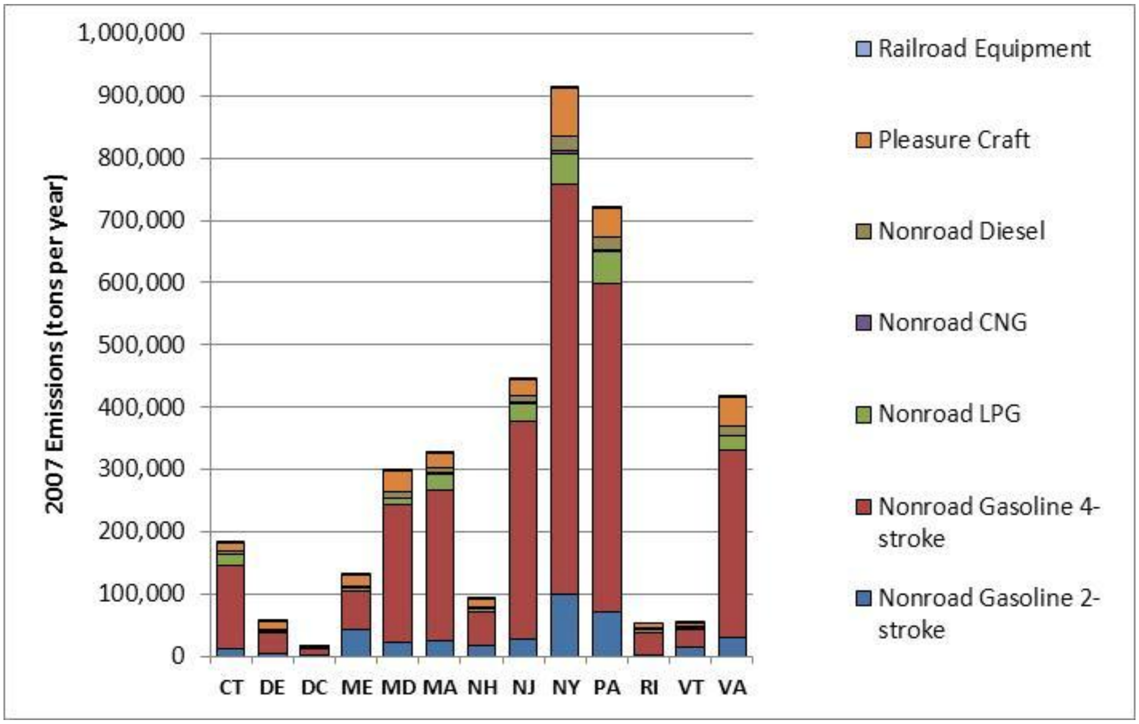


Exhibit 5.5 – 2002 and 2007 NMIM/NONROAD NH3 Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	17	16	-1%
Delaware	5	6	13%
District of Columbia	2	3	9%
Maine	11	13	11%
Maryland	28	29	4%
Massachusetts	28	28	0%
New Hampshire	9	10	11%
New Jersey	43	40	-8%
New York	79	83	5%
Pennsylvania	55	60	9%
Rhode Island	4	5	15%
Vermont	5	5	12%
Virginia	42	45	5%
	328	**342**	**4%**

Exhibit 5.6 – 2007 NMIM NH3 Emissions by Category and State (tons/year)

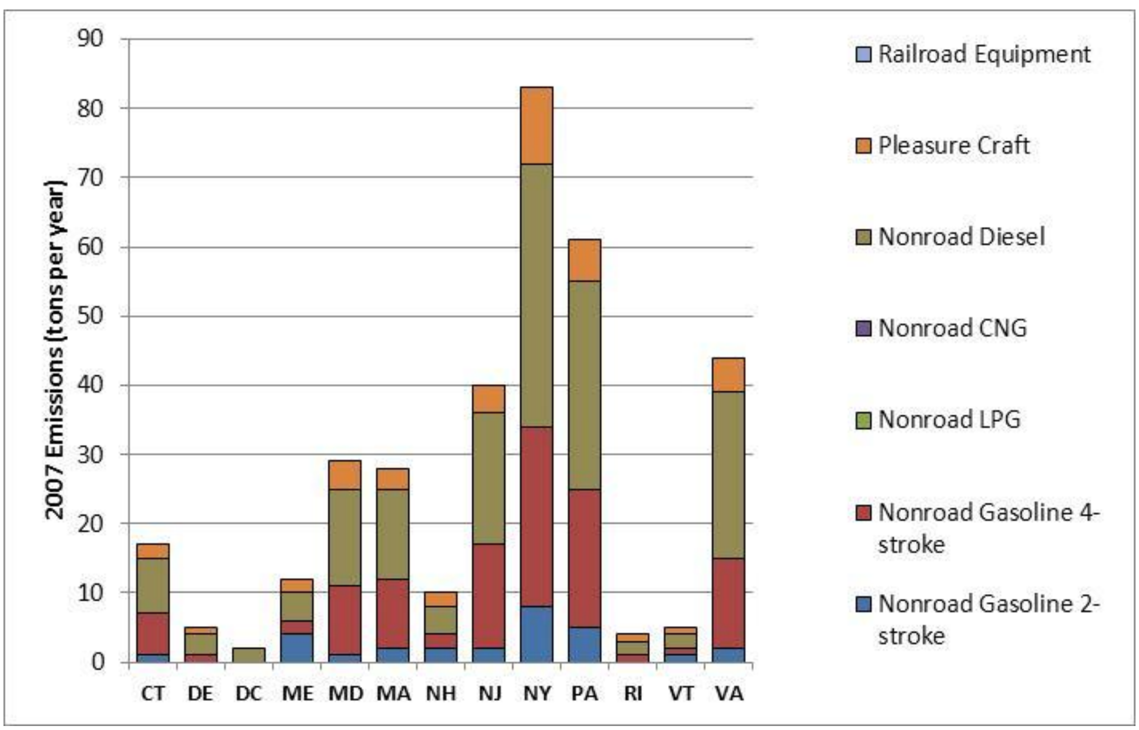


Exhibit 5.7 – 2002 and 2007 NMIM/NONROAD NOx Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	17,897	16,056	-10%
Delaware	5,798	4,998	-14%
District of Columbia	3,066	2,788	-9%
Maine	8,229	7,439	-10%
Maryland	27,789	25,726	-7%
Massachusetts	30,047	26,471	-12%
New Hampshire	8,150	8,562	5%
New Jersey	43,515	36,345	-16%
New York	78,601	72,271	-8%
Pennsylvania	62,265	55,362	-11%
Rhode Island	4,564	4,388	-4%
Vermont	4,170	3,743	-10%
Virginia	40,788	41,325	1%
	334,878	**305,475**	**-9%**

Exhibit 5.8 – 2007 NMIM NOx Emissions by Category and State (tons/year)

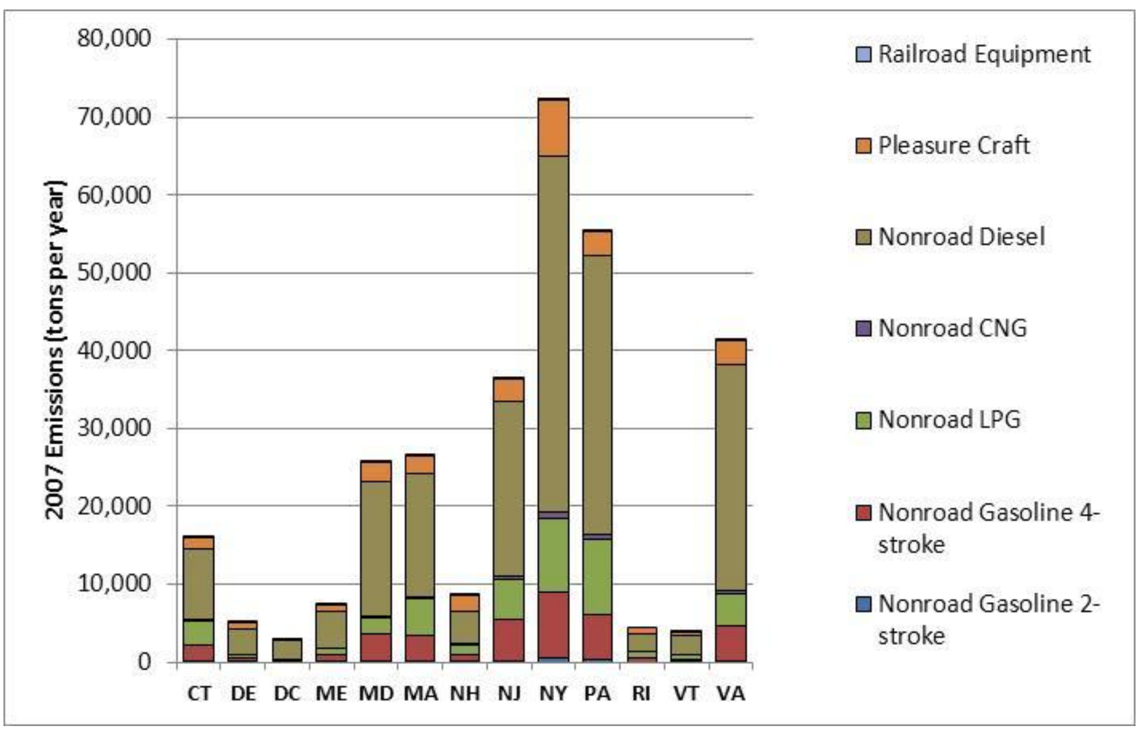


Exhibit 5.9 – 2002 and 2007 NMIM/NONROAD PM10-PRI Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	1,713	1,412	-18%
Delaware	570	476	-17%
District of Columbia	298	242	-19%
Maine	1,204	1,151	-4%
Maryland	3,119	2,600	-17%
Massachusetts	2,887	2,384	-17%
New Hampshire	947	846	-11%
New Jersey	4,285	3,377	-21%
New York	8,332	7,059	-15%
Pennsylvania	6,281	5,623	-10%
Rhode Island	403	367	-9%
Vermont	518	482	-7%
Virginia	4,901	4,128	-16%
	35,459	**30,146**	**-15%**

Exhibit 5.10 – 2007 NMIM PM10-PRI Emissions by Category and State (tons/year)

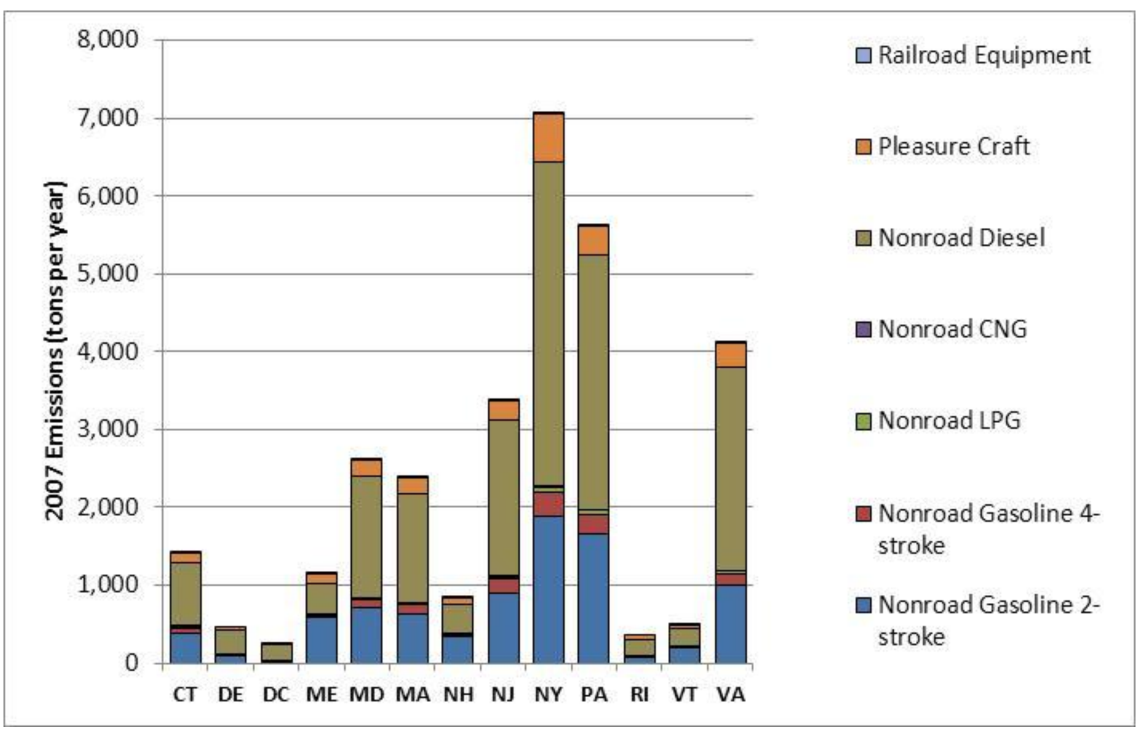


Exhibit 5.11 – 2002 and 2007 NMIM/NONROAD PM25-PRI Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	1,578	1,343	-15%
Delaware	525	453	-14%
District of Columbia	288	234	-19%
Maine	1,135	1,080	-5%
Maryland	2,870	2,473	-14%
Massachusetts	2,659	2,268	-15%
New Hampshire	872	799	-8%
New Jersey	3,951	3,213	-19%
New York	7,670	6,715	-12%
Pennsylvania	5,784	5,346	-8%
Rhode Island	371	349	-6%
Vermont	477	455	-5%
Virginia	4,665	3,933	-16%
	32,844	**28,660**	**-13%**

Exhibit 5.12 – 2007 NMIM PM25-PRI Emissions by Category and State (tons/year)

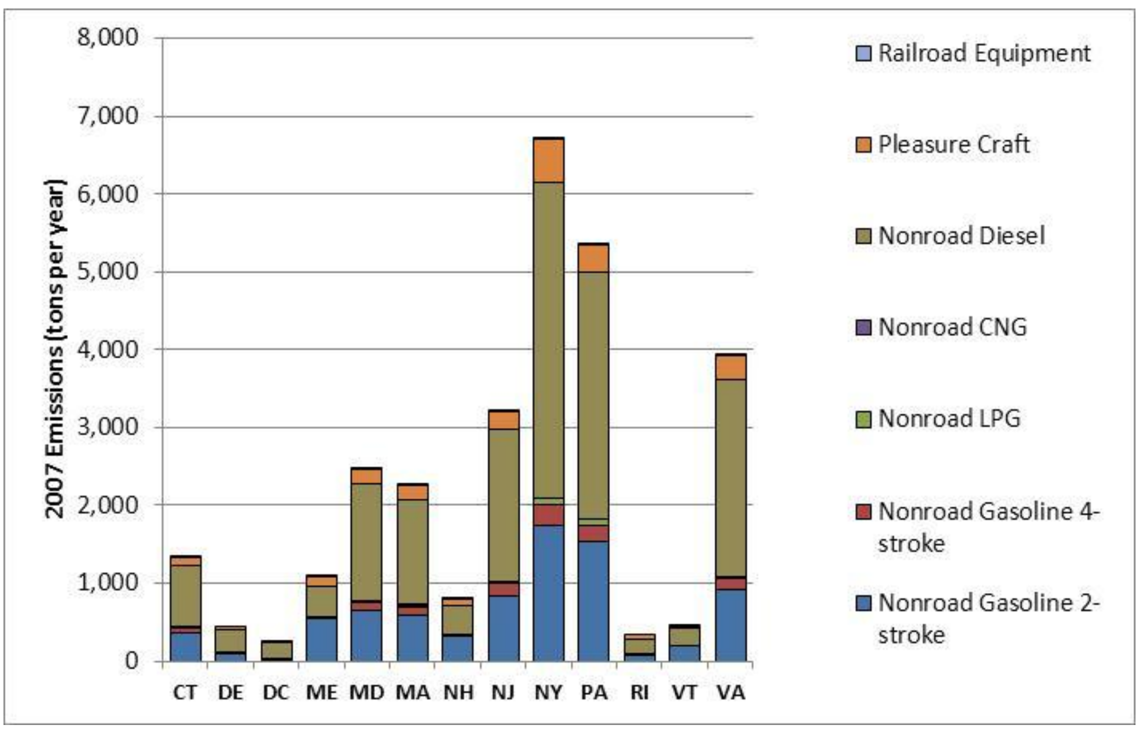


Exhibit 5.3 – 2002 and 2007 NMIM/NONROAD SO2 Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	1,377	802	-42%
Delaware	513	266	-48%
District of Columbia	341	196	-43%
Maine	772	416	-46%
Maryland	2,569	1,436	-44%
Massachusetts	2,428	1,377	-43%
New Hampshire	673	441	-34%
New Jersey	3,525	1,905	-46%
New York	6,961	3,957	-43%
Pennsylvania	5,292	2,972	-44%
Rhode Island	335	211	-37%
Vermont	368	202	-45%
Virginia	3,982	2,284	-43%
	29,136	**16,464**	**-43%**

Exhibit 5.14 – 2007 NMIM SO2 Emissions by Category and State (tons/year)

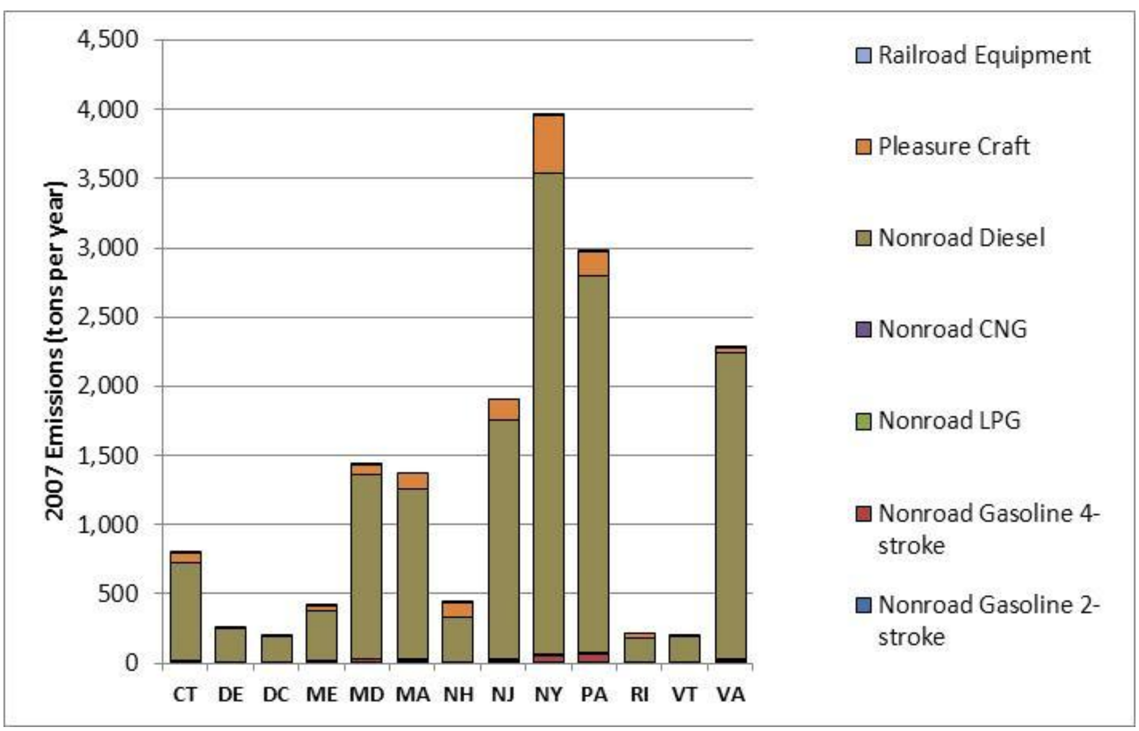
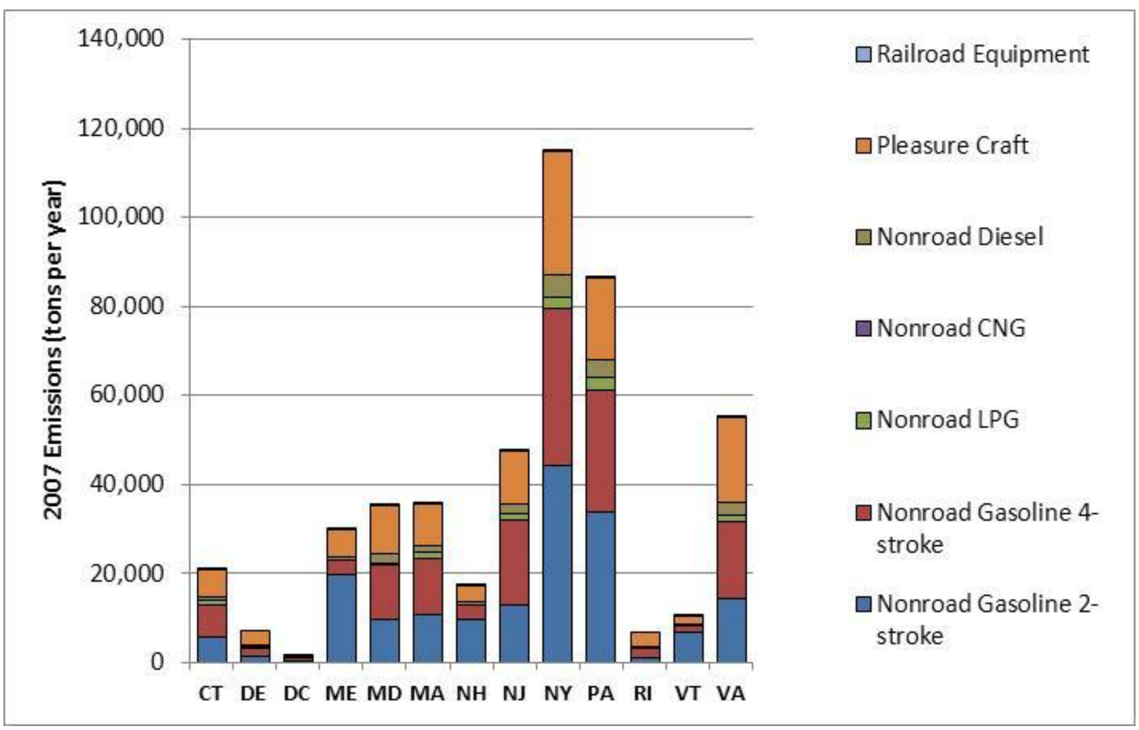


Exhibit 5.15 – 2002 and 2007 NMIM/NONROAD VOC Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	33,519	20,721	-38%
Delaware	7,531	7,157	-5%
District of Columbia	2,053	1,324	-36%
Maine	30,741	29,880	-3%
Maryland	53,035	35,160	-34%
Massachusetts	54,836	35,676	-35%
New Hampshire	22,238	17,108	-23%
New Jersey	81,900	47,521	-42%
New York	155,463	114,935	-26%
Pennsylvania	99,241	86,397	-13%
Rhode Island	7,699	6,721	-13%
Vermont	10,520	10,339	-2%
Virginia	53,487	55,135	3%
	612,262	**468,074**	**-24%**

Exhibit 5.16 – 2007 NMIM VOC Emissions by Category and State (tons/year)



6.0 ANNUAL 2007 INVENTORY FOR NONROAD SOURCES – MARINE VESSELS, AIRPORTS, AND RAIL

The Contractor estimated 2007 base year emissions for the Marine Vessel, Airports, and Rail (MAR) categories using USEPA/ERTAC data, USEPA/ERTAC data revised or augmented with state supplied data; or State supplied data. Data for each MAR category was obtained from USEPA and ERTAC for use as a default data set. The USEPA and ERTAC data, developed to support the 2008 inventory, was provided to states for review. State inventory personnel determined which of the above approaches was appropriate for their state. MARAMA coordinated the collection of supplemental or replacement data from states. The sections below describe the default data sources as well as the modifications received from states for each inventory segment.

6.1 COMMERCIAL MARINE VESSELS

For commercial marine vessels, data was obtained from USEPA 2008 NEI (USEPA 2010d). Initial draft database files were provided to the Contractor by USEPA for Category 1 and 2 CMV and for Category 3 CMV. The Category 1 and 2 database contained emissions for both ports and underway vessels.

The Category 3 database included tables containing emissions from approach, interport, port and RSZ. This database includes emissions from CMV operation within 12 nautical miles of shore. Emissions beyond the 12 nautical mile boundaries are not included in this inventory, but will be provided by USEPA to emission modelers in SMOKE format for inclusion in air quality modeling. These tables were matched to GIS ArcInfo shape files for use in plotting emissions.

Several MARAMA States indicated that they had CMV emissions that they preferred over those provided by USEPA. However, these emissions were only available in NIF area source file format (county/SCC summary level) and not spatially allocated. Thus for consistency, the Contractor summarized the emissions from USEPA to the county/SCC level and input that data into a database format. In late December 2009, USEPA provided the Contractor with a final version of the CMV emissions summarized at the county/SCC level. The file was a Microsoft Access database (2008CMVCntySummary.mdb). That database contained a summary table containing the State/county FIPS code, the SCC, pollutant code and 2008 annual emissions (in tons). The Contractor used that database to update the NIF format database for those MARAMA States that had indicated that they wished to use the USEPA data. The USEPA 2008 NEI data was used directly for 2007.

No changes were made to the 2008 data for 2007 (i.e., the 2007 emissions were assumed to be equal to 2008).

Four States (CT, DC, RI, VA) used the USEPA NEI data for all CMV categories. Virginia supplemented the USEPA CMV data by adding military vessels to the inventory. VT indicated that they wanted to use USEPA data but no CMV emissions were in the USEPA database for VT. Six States (DE, ME, MA, NH, NJ and PA) supplied State specific data for all categories. Maryland used USEPA NEI data for diesel CMV and State-specific data for residual CMV. New York used State-specific data for diesel CMV and upstate residual CMV, and USEPA NEI data for seven counties in the New York City metro area.

Note that NY included VOC emissions from lightering operations in the CMV inventory using SCC 22-80-002-000. Delaware included VOC emissions from lightering operations in the point source inventory. No other State has significant lightering operations.

Exhibit 6.1 indicates the data source by State and SCC for the emissions in the MARAMA 2007 base year inventory for CMV.

Exhibit 6.1 – Data Sources for Commercial Marine Vessel Inventory

State	22-80-002-100 Diesel Port	22-80-002-200 Diesel Underway	22-80-003-100 Residual Port	22-80-003-200 Residual Underway	22-83-000-000 All Fuels Military
CT	EPA	EPA	EPA	EPA	n/a
DE	State	State	State	State	n/a
DC	n/a	EPA	n/a	EPA	n/a
ME	State	State	State	State	n/a
MD	EPA	EPA	State	State	n/a
MA	State*	State*	State	State	n/a
NH	State	State	State	State	n/a
NJ	State	State	State	State	n/a
NY	State	State	State / EPA	State / EPA	n/a
PA	State	State	State	State	n/a
RI	EPA	EPA	EPA	EPA	n/a
VT	n/a	n/a	n/a	n/a	n/a
VA	EPA	EPA	EPA	EPA	State

* MA used different SCCs that the other States for diesel CMV to identify Harbor vessels, fishing vessels, military vessels, port operations, and underway operation.

6.2 AIRPORTS (AIRCRAFT AND GROUND SUPPORT EQUIPMENT)

For airport emissions, states either used their own data or a database developed by USEPA to support the 2008 NEI (USEPA2010e). The USEPA database was developed on an airport by airport basis. Data files provided included:

- EIS facility site ID
- State facility site ID Facility site name
- State and county FIPS code Source classification code
- Pollutant code
- Airport emissions and
- The sum of landing and take offs (LTOs).

In addition, a database containing geographic information on each facility (latitude and longitude) along with operational information related to LTOs but contained no emissions data.

For States that used the USEPA inventory the USEPA 2008 NEI airport data was summarized at the county/SCC level to provide a starting point. The remaining States provided NIF format county/SCC level files. Once the initial inventory was compiled it was formatted in NIF format and the resultant database was provided to the States for review and comment. Changes resulting from States comments were made to the initial inventory.

Exhibit 6.2 indicates by State and SCC which components of the inventory came from different data sources. In those instances where the data source is listed as "EPA", the data are taken directly from the 2008 NEI. 2008 data were used directly to represent 2007 emissions. No changes to the 2008 data were applied for the 2007 base year inventory. Exhibit 6.2 also indicates that for a number of States, the emission estimates represent blended sources. For example, several of the States providing their own data only provided emission estimates for aircraft emissions but not emissions for ground support equipment (GSE) or auxiliary power units (APUs). For those States, 2008 USEPA NEI data were added to the inventory to provide those estimates. Those States were DE and ME. MD provided State supplied GSE/APU emissions but without a break down of the GSE emissions by fuel type. In addition, NY provided EDMS output files for all aircraft and GSE/APU emissions from each individual airport. Those emissions also had GSE emissions as a single value without an indication of the fuel type of the equipment. In both cases (NY and MD), the fuel type ratios used in the USEPA NEI were used to divide GSE emissions by fuel type. Those ratios were:

SCC	SCC Level Two	Fraction
2265008005	Off-highway Vehicle Gasoline, 4-Stroke	0.1686
2267008005	LPG	0.0165
2268008005	CNG	0.0131
2270008005	Off-highway Vehicle Diesel	0.8017

Finally, while Exhibit 6.2 indicates that most of VA's emissions were derived from USEPA data, military aircraft operations emissions were provided by VA and were added to the USEPA data. However because these data were added as individual airports in counties where there were already emissions, when the data were summarized the data source was maintained as USEPA since the majority of emissions were derived from the USEPA inventory.

For Version 3, the only changes were to use a revised airport inventory for New Jersey.

Exhibit 6.2 – Data Sources for Airport Operations Inventory

State	2265, 2267, 2268, 2270 GSE	2275001xxx Military	2275020xxx Commercial	2275050xxx General Aviation	2275060xxx Air Taxi	2275070xxx APUs
CT	State	State	State	State	State	State
DE	EPA	State	State	State	State	EPA
DC	n/a	n/a	n/a	State	n/a	n/a
ME	EPA	State	State	State	State	EPA
MD	State and EPA	State	State	State	State	State and EPA
MA	EPA	EPA	EPA	EPA	EPA	EPA
NH	State	State	State	State	State	n/a
NJ	State	State	State	State	State	State
NY	State	n/a	State	State	n/a	State
PA	EPA	EPA	EPA	EPA	EPA	EPA
RI	EPA	EPA	EPA	EPA	EPA	EPA
VT	EPA	EPA	EPA	EPA	EPA	EPA
VA	EPA	EPA	EPA	EPA	EPA	EPA

6.3 RAILROAD LOCOMOTIVES AND RAILYARDS

The ERTAC 2008 inventory for railroad locomotives and rail yards was provided to MANEVU+VA States for review to determine if the inventory should be included in the 2007 base year emission inventory (ERTAC 2010a, ERTAC 2010b). The ERTAC rail inventory included three categories of locomotive emissions: Class I line-haul, Class I rail yard switchers, and Class II/III short line and regional railroads. The original files provided to the Contractor for the ERTAC inventory included several spreadsheets. There spreadsheets were:

1. EmissionsByCounty_Round61.xls (county level Class I line haul emissions)
2. EmissionsByState_Round61.xls (State level Class I line haul emissions)
3. R-1 Fuel Use Data Summary 20072.xls (line haul fuel use data for 2007)
4. Rail-Class_II_III_revised 4-20-2010.xls (Class II and III county level emissions by rail line, along with link, mileage, and fuel usage information)

The data in the Class II and III spreadsheet was summarized by county and converted into NIF format. The Class I emissions were also converted into NIF format. Both Class I and Class II/III emissions were reported as hydrocarbons (HC). These emissions were converted to VOC emissions by multiplying the HC emissions by a factor of 1.053 (USEPA 2009e) for all states except Maryland, where a factor of 1.0478 was used. In addition, all 2008 emissions were assumed to equal 2007 emissions.

Three States (PA, VA and VT) used the ERTAC data directly without modification for the three categories included in the ERTAC inventory (Class I Line Haul, Class II/III Line Haul, Yard/Switcher Locomotives). New Jersey used the ERTAC Class I data and State-supplied data for Class II/III and Yard locomotives. New York used the ERTAC yard locomotive data and State-supplied data for Class I and Class II/III. All other States made changes to the 2008 ERTAC inventory, either to add/modify included sources or to revise emission values to 2007 values.

ERTAC did not develop emission estimates for Line Haul Passenger (AMTRAK) or Line Haul Commuter locomotives. Six States (CT, DC, MD, NY, PA, and VA) provided emission estimates for AMTRAK diesel locomotives. Note that the AMTRAK northeast corridor line uses electric powered locomotives, so there are no emissions from diesel AMTRAK locomotives in DE, NJ, RI, and MA. Seven States (CT, DC, MD, MA, NJ, NY, and PA) provided emission estimates for diesel commuter locomotives in their State.

Exhibit 6.3 provides a breakdown by State and SCC of the data sources for emissions from railroads and rail yards. Once the draft inventory was prepared the NIF database was provided to the MARAMA States for review. Only minor corrections were made to the database prior to submittal for stakeholder review and comments.

Exhibit 6.3 – Data Sources for Railroad Locomotive and Railyard Inventory

State	2285002006 Line Haul Class I Ops	2285002007 Line Haul Class II/III Ops	2285002008 Line Haul Passenger	2285002009 Line Haul Commuter	2285002010 Yard Locomotives
CT	State	State	State	State	State
DE	State	State	n/a	n/a	State
DC	State	n/a	State	State	State
ME	n/a	State	n/a	n/a	State
MD	State	State	State	State	State
MA	State	State	n/a	State	State
NH	n/a	State	n/a	n/a	n/a
NJ	EPA / ERTAC	State	n/a	State	State
NY	State	State	State	State	EPA / ERTAC
PA	EPA / ERTAC	EPA / ERTAC	State	State	EPA / ERTAC
RI	State	State	n/a	n/a	State
VT	EPA / ERTAC	EPA / ERTAC	n/a	n/a	n/a
VA	EPA / ERTAC	EPA / ERTAC	State	n/a	EPA / ERTAC

6.4 STAKEHOLDER REVIEW AND COMMENT

Draft inventory data files and documentation for MAR sources was posted on the MARAMA website in August 2010 for stakeholder review. No comments on the MAR inventory were received.

6.5 VERSION 3 REVISIONS

6.5.1 New Jersey MAR Revisions

Following the completion of Version 2 of the 2007 MANE-VU+VA inventory in February 2011, New Jersey provided several revisions to the MAR inventory, as follows:

- developed a new airport inventory using the FAA's EDMS;
- provided revised emission estimates for all commercial marine vessel categories;
- allocated GSE emissions calculated by EDMS to four fuel types (gasoline, LPG, CNG, and diesel) using the apportionment factors listed in Section 6.2. Previously in Version 2, all GSE fuel use was assigned to diesel engines. The revisions did not change the total GSE emissions, simply distributes the EDMS emissions over the four GSE fuel types.

6.5.2 Adjustment of Rail VOC Emissions

It was discovered that the ERTAC-reported rail emissions for VOC were actually hydrocarbon emissions. For locomotive engines, USEPA estimated that VOC emissions can be assumed to be equal to 1.053 times the hydrocarbon emissions (USEPA2009e). This adjustment was not made to the rail inventory developed by ERTAC. The ERTAC inventory assumed that VOC emissions equal hydrocarbon emissions. Some states (DE, NH, RI) made this adjustment in the rail inventories that were used in Version 2. The remaining states did not make the adjustment and the Version 2 VOC emissions were multiplied by 1.053 to generated revised emissions for Version 3. Maryland made a partial adjustment in Version 2, and specified that a factor of 1.0478 should be used to adjust

6.6 SUMMARY OF MAR INVENTORY FOR 2007

Exhibits 6.4 to 6.10 compare the 2002 and 2007 emissions by State and pollutant for MAR sources. The 2002 emissions are those that were developed previously for Version 3 of the MANE-VU and the VISTAS best-and-final inventory for Virginia. It is likely that many of the differences between the 2002 and 2007 emissions are due to changes in the emission estimation methodologies for CMV, airports, and railroads.

CO emissions are primarily from aircraft and GSE engines used at airports. CMV is the largest sector for NOx emissions, but there are also substantial NOx emissions from airports and railroad locomotives. SO2 emissions are primarily from the CMV category. All three sectors also generate PM and VOC emissions.

Exhibit 6.4 – 2002 and 2007 MAR CO Emissions by State (tons/year)

	Marine Vessels			Airports			Rail Locomotives		
STATE	2002	2007	Change	2002	2007	Change	2002	2007	Change
CT	603	1,077	79%	1,565	4,659	198%	362	184	-49%
DE	1,138	554	-51%	1,575	1,625	3%	144	75	-48%
DC	1	1	1%	0	14	n/a	73	73	0%
ME	376	522	39%	4,487	32,879	633%	69	188	173%
MD	431	2,795	548%	11,575	10,265	-11%	789	700	-11%
MA	1,231	1,473	20%	11,294	15,495	37%	748	646	-14%
NH	169	89	-47%	2,031	2,089	3%	71	88	24%
NJ	1,424	1,619	14%	29,375	21,878	-26%	580	665	15%
NY	1,790	3,475	94%	11,895	17,403	46%	1,551	3,061	97%
PA	1,111	1,294	16%	24,799	26,540	7%	3,359	2,987	-11%
RI	0	522	n/a	1,424	1,739	22%	55	15	-73%
VT	0	0	n/a	521	2,420	365%	20	72	262%
VA	1,082	3,735	245%	11,873	22,009	85%	1,186	2,701	128%
	9,356	**17,155**	**83%**	**112,414**	**159,016**	**41%**	**9,007**	**11,456**	**27%**

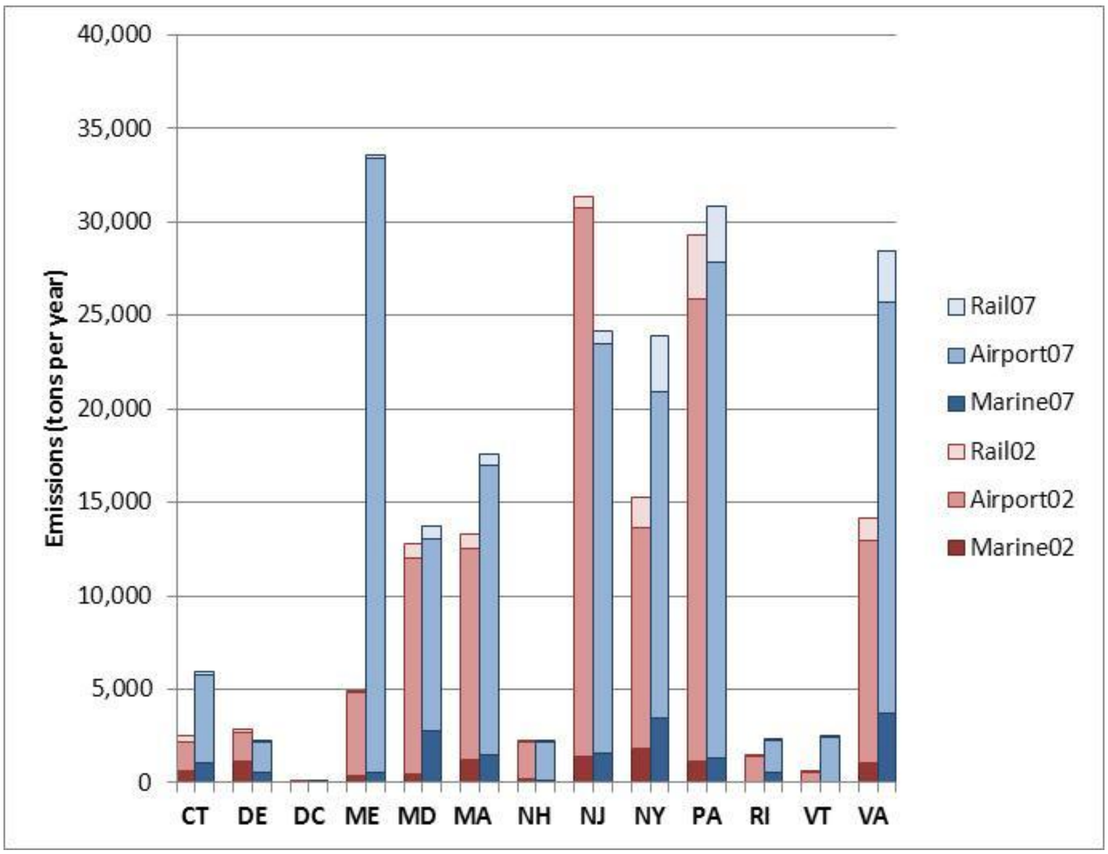


Exhibit 6.5 – 2002 and 2007 MAR NH3 Emissions by State (tons/year)

	Marine Vessels			Airports			Rail Locomotives		
STATE	2002	2007	Change	2002	2007	Change	2002	2007	Change
CT	0	3	n/a	0	0	n/a	0	1	n/a
DE	0	0	n/a	0	0	n/a	0	0	n/a
DC	0	0	n/a	0	0	n/a	0	0	n/a
ME	0	0	n/a	0	0	n/a	0	0	n/a
MD	0	8	n/a	0	0	n/a	0	0	n/a
MA	0	0	n/a	0	0	n/a	0	2	n/a
NH	0	0	n/a	0	0	n/a	0	0	n/a
NJ	0	8	n/a	0	0	n/a	0	2	n/a
NY	0	2	n/a	0	0	n/a	0	0	n/a
PA	0	13	n/a	0	0	n/a	0	9	n/a
RI	0	1	n/a	0	0	n/a	0	0	n/a
VT	0	0	n/a	0	0	n/a	0	0	n/a
VA	0	9	n/a	0	0	n/a	0	8	n/a
	0	**44**	**n/a**	**0**	**0**	**n/a**	**0**	**23**	**n/a**

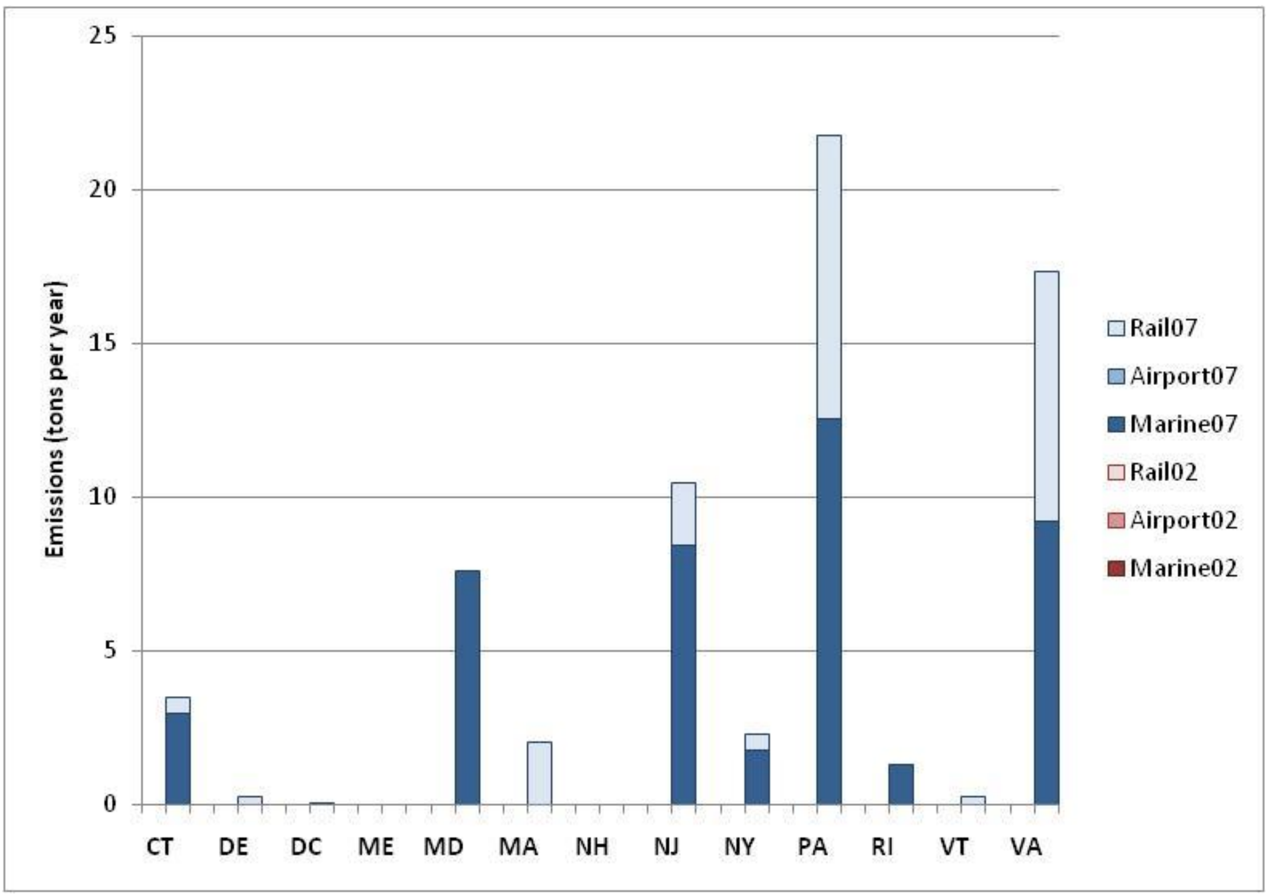


Exhibit 6.6 – 2002 and 2007 MAR NOx Emissions by State (tons/year)

	Marine Vessels			Airports			Rail Locomotives		
STATE	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**
CT	4,577	6,528	43%	415	713	72%	2,612	1,723	-34%
DE	8,362	5,094	-39%	970	805	-17%	1,105	384	-65%
DC	4	6	56%	0	0	n/a	502	505	1%
ME	1,154	1,659	44%	184	134	-27%	269	1,369	409%
MD	2,531	16,027	533%	2,038	1,910	-6%	5,145	4,767	-7%
MA	2,590	3,246	25%	2,988	3,190	7%	7,161	6,133	-14%
NH	1,284	271	-79%	162	278	72%	332	891	169%
NJ	10,981	11,197	2%	4,739	5,105	8%	5,721	5,957	4%
NY	12,266	28,180	130%	4,880	6,998	43%	14,162	20,675	46%
PA	8,217	11,378	38%	4,131	3,738	-10%	29,292	20,675	-29%
RI	1	2,829	n/a	263	289	10%	186	144	-22%
VT	0	0	n/a	48	103	114%	7	736	10416%
VA	3,088	21,760	605%	3,885	5,520	42%	11,882	18,319	54%
	55,055	**108,174**	**96%**	**24,703**	**28,783**	**17%**	**78,376**	**82,279**	**5%**

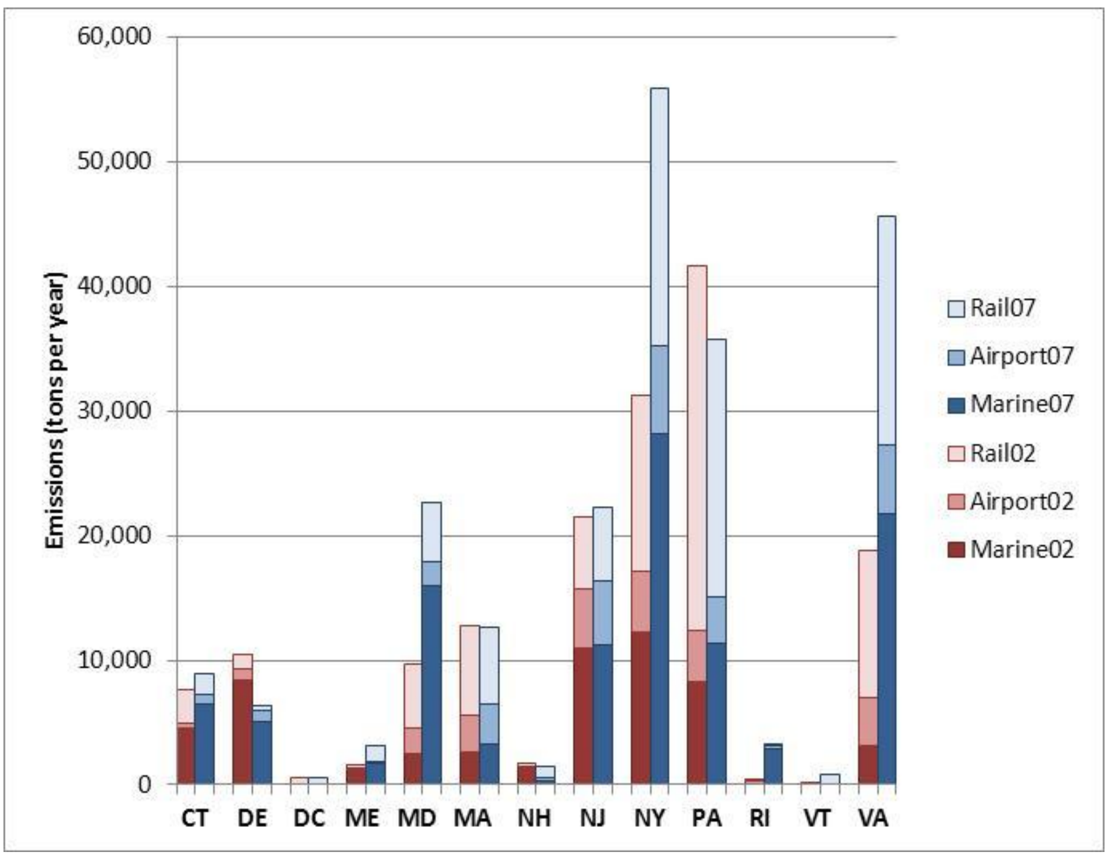


Exhibit 6.7 – 2002 and 2007 MAR PM10-PRI Emissions by State (tons/year)

	Marine Vessels			Airports			Rail Locomotives		
STATE	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**
CT	194	311	61%	45	66	46%	5	46	812%
DE	393	327	-17%	28	27	-5%	31	15	-50%
DC	0	0	n/a	0	0	n/a	12	12	-2%
ME	129	395	206%	97	83	-15%	8	28	246%
MD	637	657	3%	1,012	74	-93%	172	166	-3%
MA	217	316	45%	246	295	20%	183	159	-13%
NH	54	13	-76%	49	37	-24%	10	22	120%
NJ	796	622	-22%	280	170	-39%	143	160	12%
NY	506	1,671	230%	409	140	-66%	358	608	70%
PA	253	524	107%	2,421	396	-84%	792	704	-11%
RI	0	112	n/a	93	22	-76%	6	4	-40%
VT	0	0	n/a	12	46	282%	1	18	1712%
VA	359	946	164%	2,010	821	-59%	1,529	634	-59%
	3,538	**5,895**	**67%**	**6,702**	**2,176**	**-68%**	**3,250**	**2,574**	**-21%**

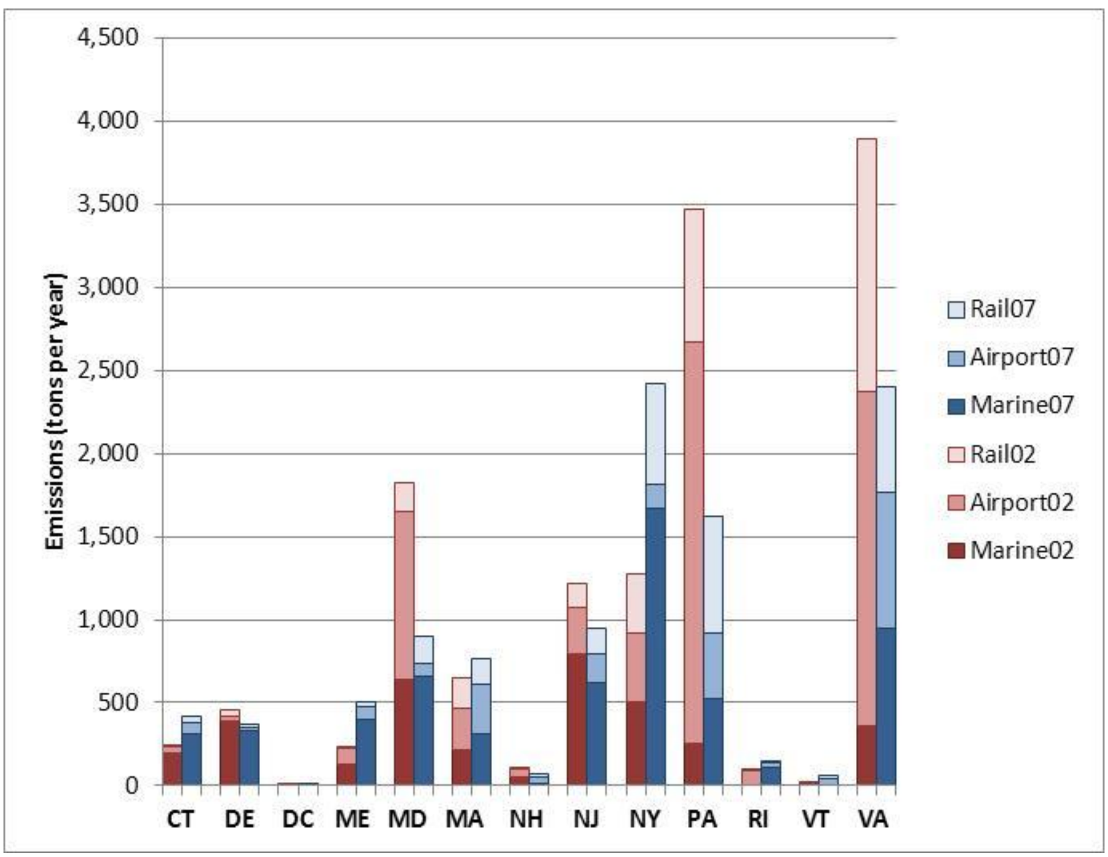


Exhibit 6.8 – 2002 and 2007 MAR PM25-PRI Emissions by State (tons/year)

	Marine Vessels			Airports			Rail Locomotives		
STATE	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**
CT	178	296	66%	38	51	35%	5	39	686%
DE	354	305	-14%	20	19	-7%	28	15	-47%
DC	0	0	n/a	0	0	n/a	11	11	4%
ME	119	364	205%	69	61	-11%	8	25	218%
MD	637	606	-5%	698	16	-98%	155	161	4%
MA	200	290	45%	226	215	-5%	143	145	2%
NH	50	12	-76%	36	27	-24%	9	21	132%
NJ	732	575	-21%	195	143	-27%	128	147	15%
NY	466	1,541	231%	362	139	-62%	323	572	77%
PA	232	484	109%	1,718	294	-83%	713	650	-9%
RI	0	108	n/a	68	17	-75%	5	3	-34%
VT	0	0	n/a	9	32	259%	1	17	1567%
VA	330	908	175%	1,970	580	-71%	1,375	586	-57%
	3,298	**5,489**	**66%**	**5,409**	**1,595**	**-71%**	**2,904**	**2,395**	**-18%**

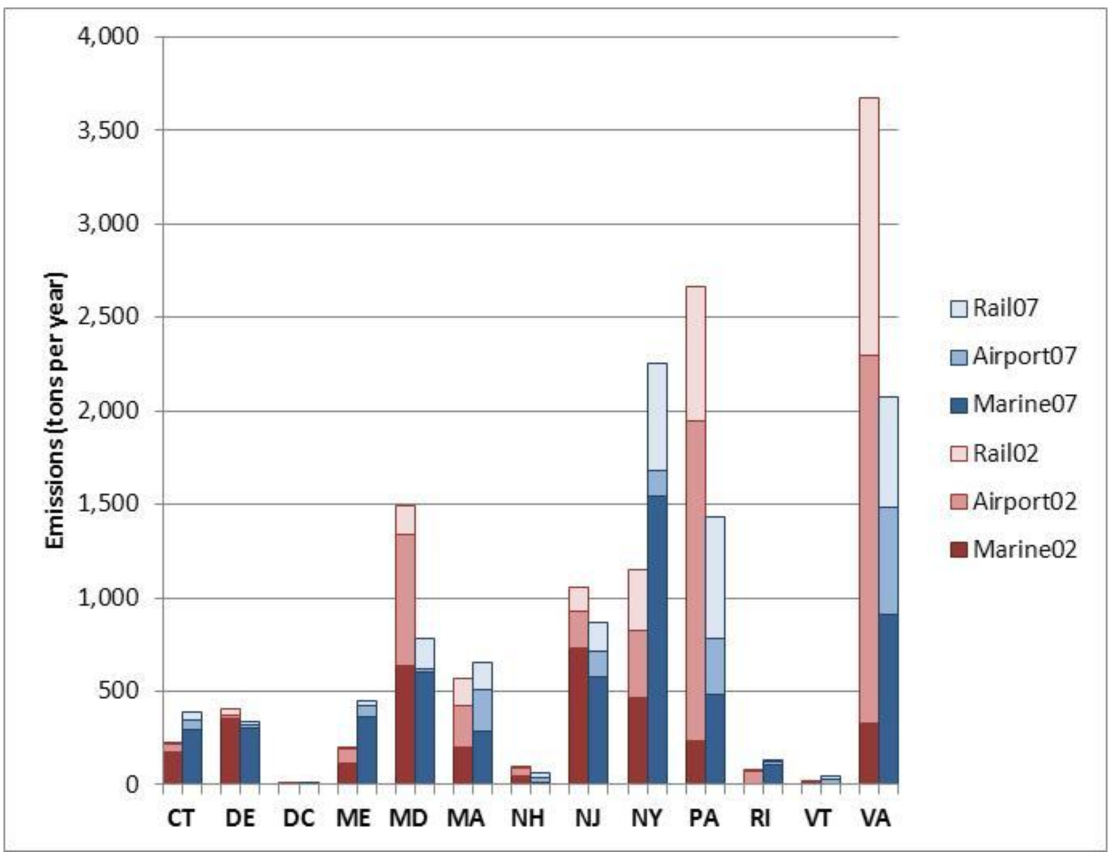


Exhibit 6.9 – 2002 and 2007 MAR SO2 Emissions by State (tons/year)

	Marine Vessels			Airports			Rail Locomotives		
STATE	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**
CT	671	1,386	107%	39	96	145%	4	57	1323%
DE	3,377	2,079	-38%	30	55	84%	64	5	-92%
DC	1	1	30%	0	0	n/a	33	37	11%
ME	128	189	47%	3	14	376%	15	92	514%
MD	4,739	2,170	-54%	262	247	-6%	374	64	-83%
MA	489	698	43%	284	218	-23%	591	66	-89%
NH	188	506	169%	15	28	86%	16	10	-36%
NJ	11,444	6,712	-41%	374	507	35%	352	55	-84%
NY	4,753	9,321	96%	440	699	59%	765	616	-19%
PA	297	3,067	933%	399	416	4%	1,934	211	-89%
RI	0	632	n/a	29	30	3%	14	5	-61%
VT	0	0	n/a	5	12	134%	1	5	412%
VA	386	4,058	951%	272	424	56%	3,641	192	-95%
	26,473	**30,819**	**16%**	**2,152**	**2,746**	**28%**	**7,804**	**1,416**	**-82%**

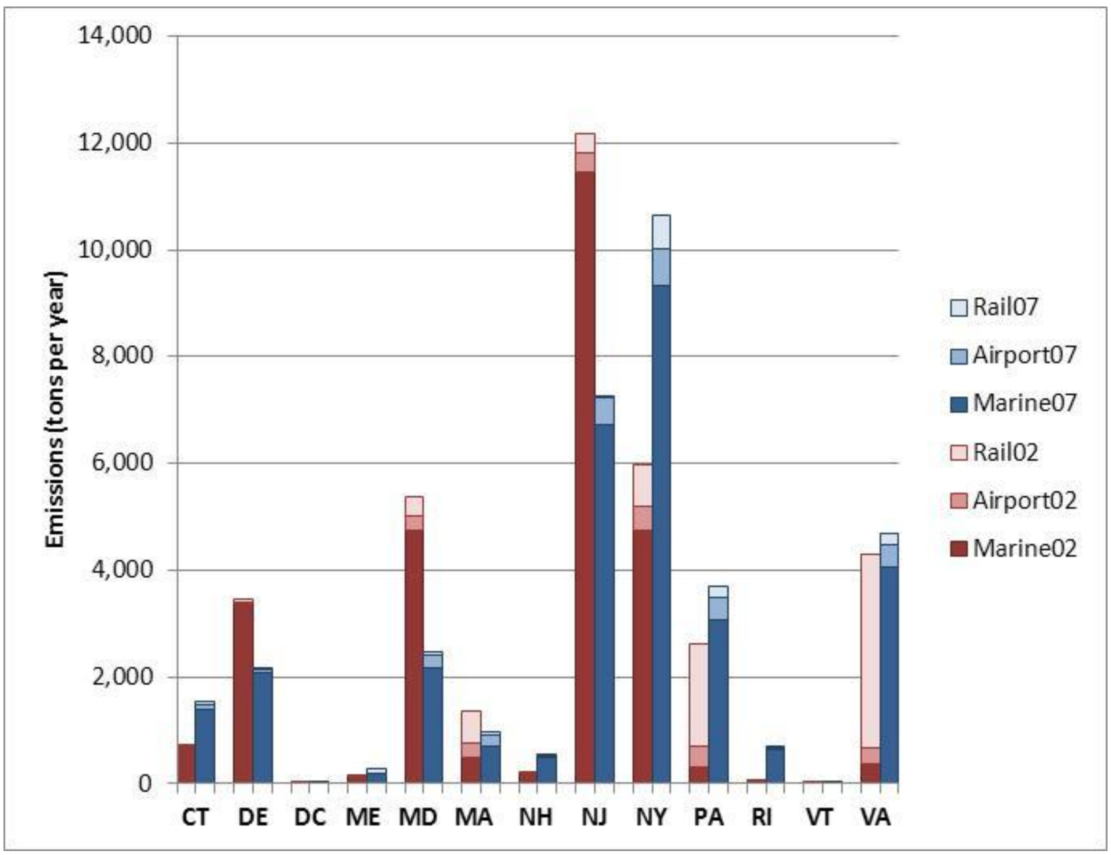
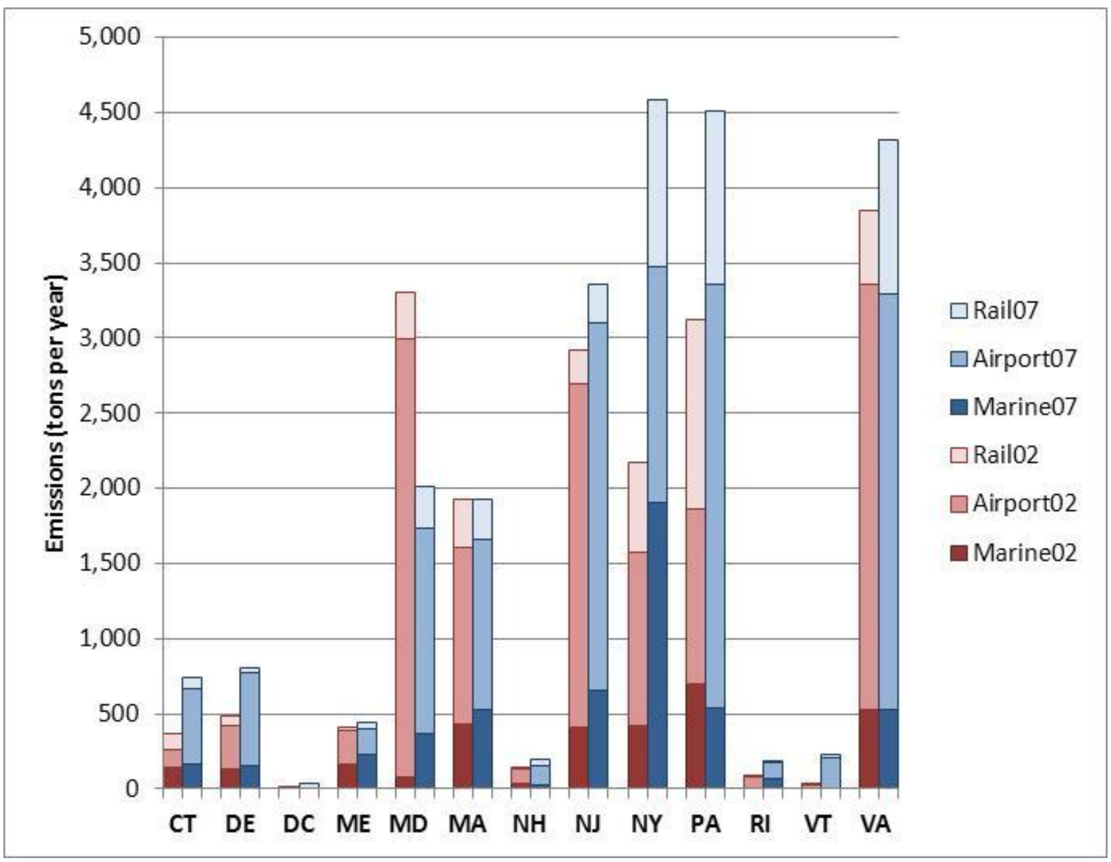


Exhibit 6.10 – 2002 and 2007 MAR VOC Emissions by State (tons/year)

	Marine Vessels			Airports			Rail Locomotives		
STATE	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**	**2002**	**2007**	**Change**
CT	143	161	13%	115	509	343%	114	73	-36%
DE	132	158	20%	290	620	114%	60	28	-53%
DC	0	0	n/a	0	1	n/a	20	34	70%
ME	166	233	41%	222	161	-27%	19	51	166%
MD	74	371	401%	2,920	1,365	-53%	312	271	-13%
MA	433	528	22%	1,177	1,129	-4%	312	267	-15%
NH	40	23	-43%	88	134	53%	15	35	136%
NJ	413	658	59%	2,281	2,438	7%	221	258	17%
NY	424	1,905	349%	1,145	1,571	37%	600	1,112	85%
PA	703	538	-23%	1,155	2,813	144%	1,260	1,153	-8%
RI	0	64	n/a	74	112	51%	10	8	-22%
VT	0	0	n/a	27	204	655%	2	29	1331%
VA	531	522	-2%	2,825	2,764	-2%	492	1,025	108%
	3,059	**5,163**	**69%**	**12,319**	**13,822**	**12%**	**3,437**	**4,343**	**26%**



7.0 ANNUAL 2007 INVENTORY FOR ONROAD SOURCES

7.1 OVERALL PROCESS TO DEVELOP THE ONROAD INVENTORY

EPA's recently released MOVES2010 (**MO**tor **V**ehicle **E**mission **S**imulator) is now the official model for estimating air pollution emissions from onroad mobile sources including buses, cars, trucks and motorcycles. MOVES2010 replaces MOBILE6.2, the previous mobile source model. MOVES input files are somewhat more detailed than the MOBILE6.2 input files. To assist in the transition to the new model, USEPA developed software tools to convert MOBILE6.2 inputs for MOVES. In addition, the MOVES model includes a preprocessing tool called the County Data Manager (CDM) to convert spreadsheet based information to MySQL database files required by MOVES.

States were offered the option of having NESCAUM perform the MOVES modeling using input data provided by and/or reviewed by the state. Three states elected to perform the MOVES modeling for their state using in-house resources. Exhibit 7.1 shows the approach selected by each state:

Exhibit 7.1 – MOVES Modeling Approach by State

States Providing MOBILE6.2 Input Files to NESCAUM	States Providing MOVES Input Files to NESCAUM	States Performing MOVES Modeling Themselves
DC, ME, NH, RI	CT, DE, MD, MA, NJ, VT	NY, PA, VA

7.2 MOVES MODEL RUN SPECIFICATIONS AND DOCUMENTATION

Appendix F contains NESCAUM's documentation of the MOVES modeling.

7.3 SUMMARY OF ONROAD INVENTORY

Exhibits 7.2 to 7.8 compare the 2002 and 2007 onroad emissions by state for each pollutant. The 2002 emissions were estimated using MOBILE6, while the 2007 emissions were estimated using MOVES. Differences between 2002 and 2007 results from the change in emission estimation methodologies (MOBILE6 vs. MOVES), VMT growth, and turnover of the vehicle fleet to newer, cleaner fuels and engines.

Exhibit 7.2 – 2002 and 2007 OnroadCO Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	562,124	365,925	-35%
Delaware	160,760	124,893	-22%
District of Columbia	66,018	36,379	-45%
Maine	410,958	215,689	-48%
Maryland	1,000,763	598,180	-40%
Massachusetts	1,039,100	583,234	-44%
New Hampshire	306,793	195,916	-36%
New Jersey	1,273,513	719,402	-44%
New York	3,711,150	2,024,775	-45%
Pennsylvania	2,784,197	1,962,326	-30%
Rhode Island	186,197	115,532	-38%
Vermont	248,248	115,532	-53%
Virginia	1,858,598	1,195,237	-36%
	13,608,417	**8,253,020**	**-39%**

2002 emissions were estimated using MOBILE6; 2007 emissions were estimated using MOVES

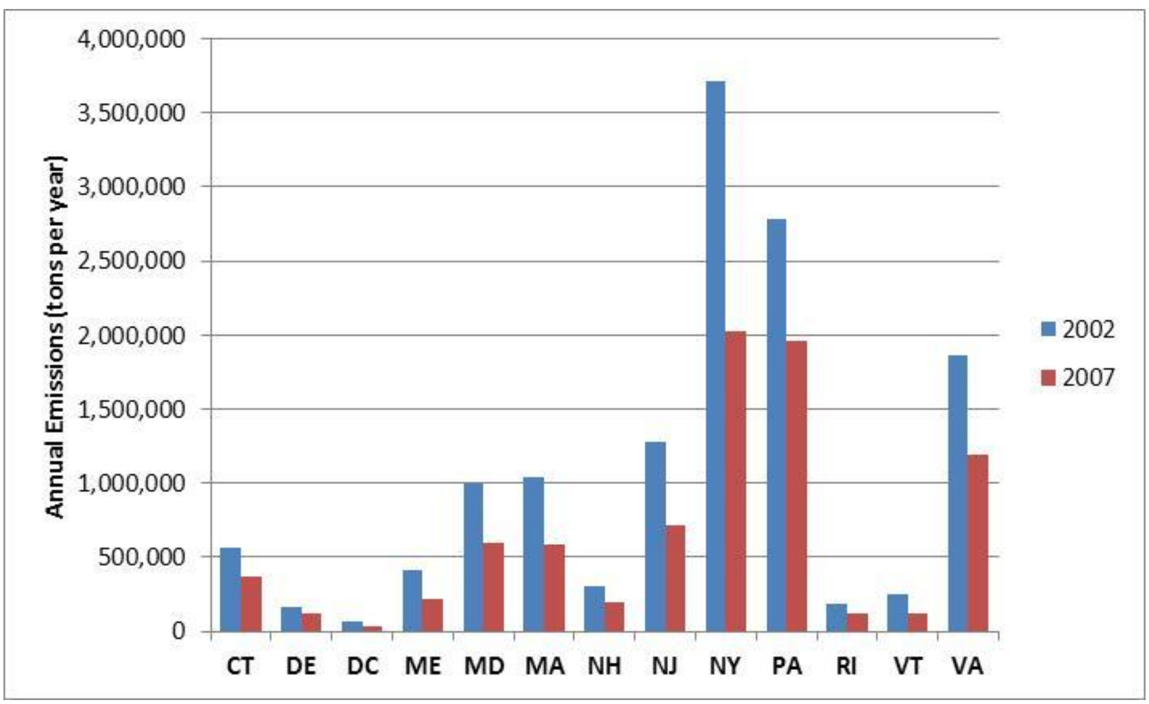


Exhibit 7.3 – 2002 and 2007 Onroad NH3 Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	3,294	1,309	-60%
Delaware	903	406	-55%
District of Columbia	398	158	-60%
Maine	1,468	605	-59%
Maryland	5,594	2,335	-58%
Massachusetts	5,499	2,194	-60%
New Hampshire	1,447	511	-65%
New Jersey	7,382	3,216	-56%
New York	14,681	6,831	-53%
Pennsylvania	10,532	5,278	-50%
Rhode Island	853	356	-58%
Vermont	934	356	-62%
Virginia	7,918	4,041	-49%
	60,902	**27,597**	**-55%**

2002 emissions were estimated using MOBILE6; 2007 emissions were estimated using MOVES

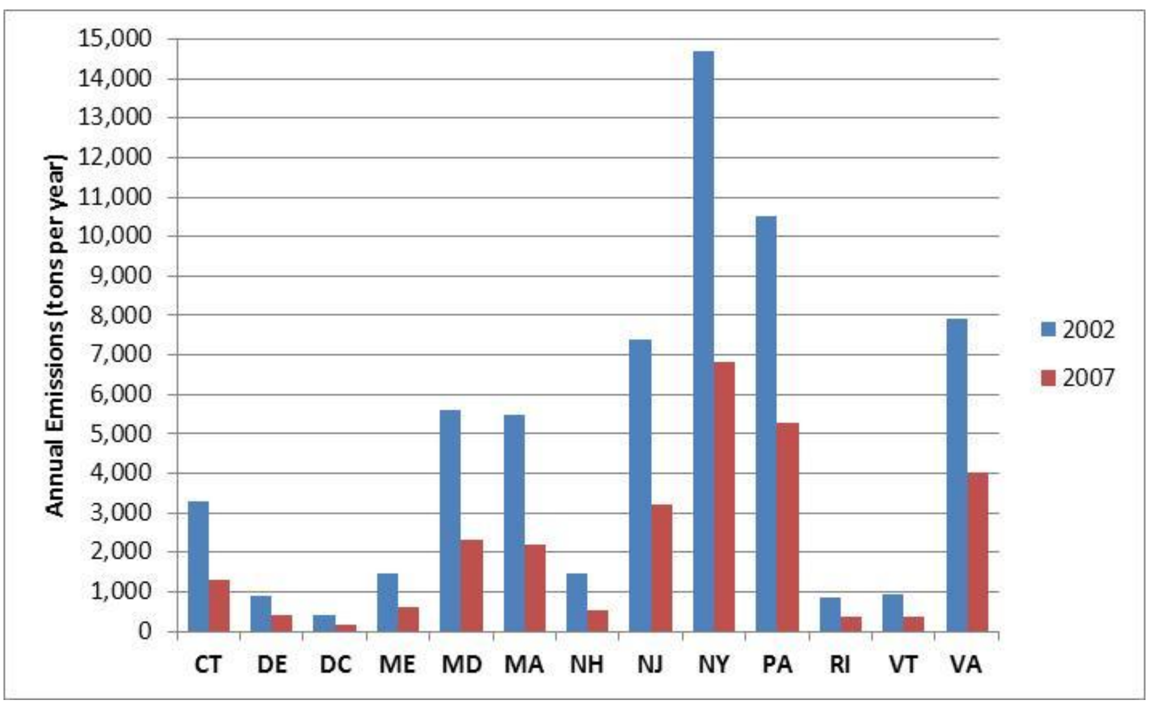


Exhibit 7.4 – 2002 and 2007 Onroad NOx Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	68,816	53,814	-22%
Delaware	21,341	24,456	15%
District of Columbia	8,902	8,714	-2%
Maine	54,687	36,844	-33%
Maryland	122,210	114,792	-6%
Massachusetts	143,368	73,328	-49%
New Hampshire	33,283	33,858	2%
New Jersey	152,076	135,139	-11%
New York	319,733	305,617	-4%
Pennsylvania	346,472	353,083	2%
Rhode Island	16,677	18,055	8%
Vermont	20,670	18,055	-13%
Virginia	182,482	197,822	8%
	1,490,716	**1,373,575**	**-8%**

2002 emissions were estimated using MOBILE6; 2007 emissions were estimated using MOVES

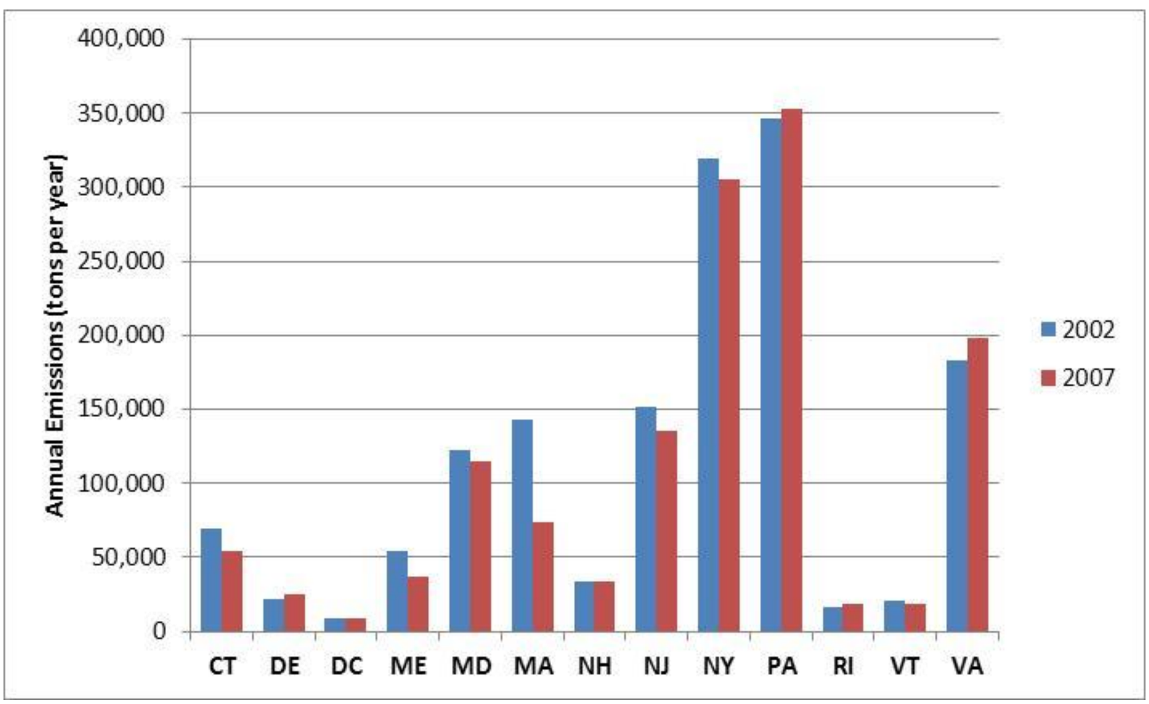


Exhibit 7.5 – 2002 and 2007 Onroad PM10-PRI Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	1,580	2,057	30%
Delaware	581	828	42%
District of Columbia	222	387	74%
Maine	1,239	1,507	22%
Maryland	3,168	4,103	29%
Massachusetts	3,408	2,915	-14%
New Hampshire	814	1,479	82%
New Jersey	3,725	5,013	35%
New York	8,457	14,765	75%
Pennsylvania	7,351	12,947	76%
Rhode Island	345	754	118%
Vermont	670	754	13%
Virginia	4,358	6,799	56%
	35,920	**54,307**	**51%**

2002 emissions were estimated using MOBILE6; 2007 emissions were estimated using MOVES

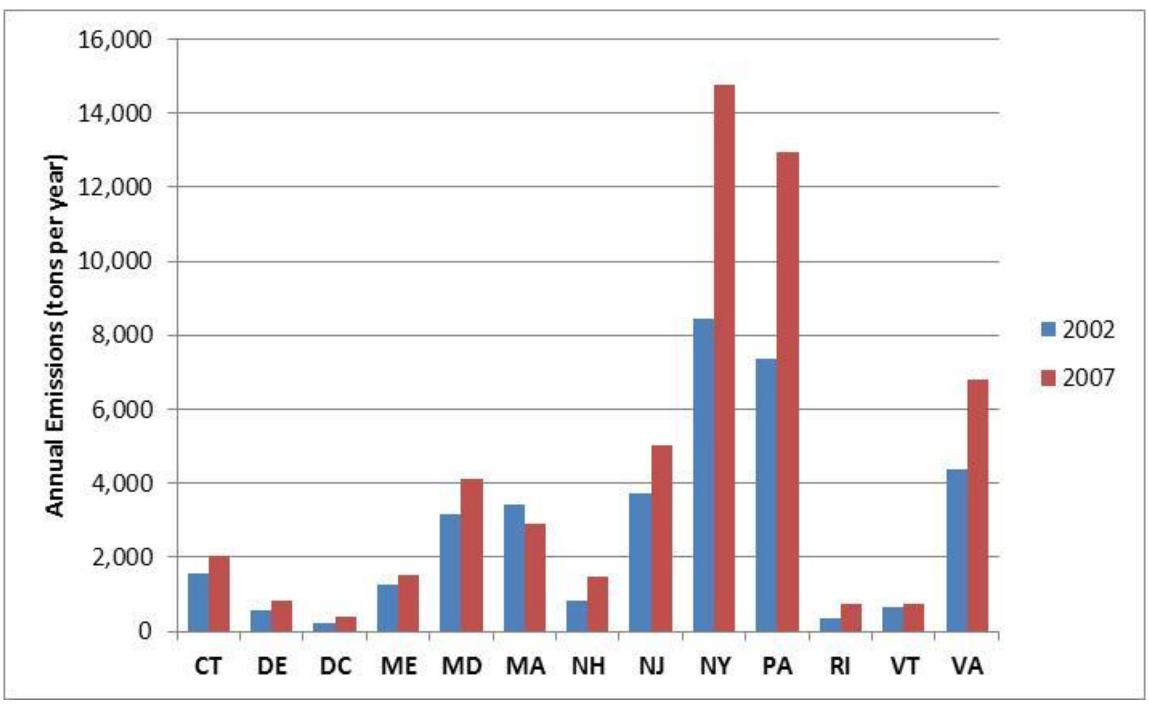


Exhibit 7.6 – 2002 and 2007 Onroad PM25-PRI Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	1,042	1,949	87%
Delaware	415	795	91%
District of Columbia	153	373	144%
Maine	934	1,443	54%
Maryland	2,200	3,924	78%
Massachusetts	2,410	2,768	15%
New Hampshire	562	1,418	152%
New Jersey	2,469	4,789	94%
New York	5,898	14,115	139%
Pennsylvania	5,331	12,393	132%
Rhode Island	211	719	241%
Vermont	483	719	49%
Virginia	2,987	6,499	118%
	25,095	**51,903**	**107%**

2002 emissions were estimated using MOBILE6; 2007 emissions were estimated using MOVES

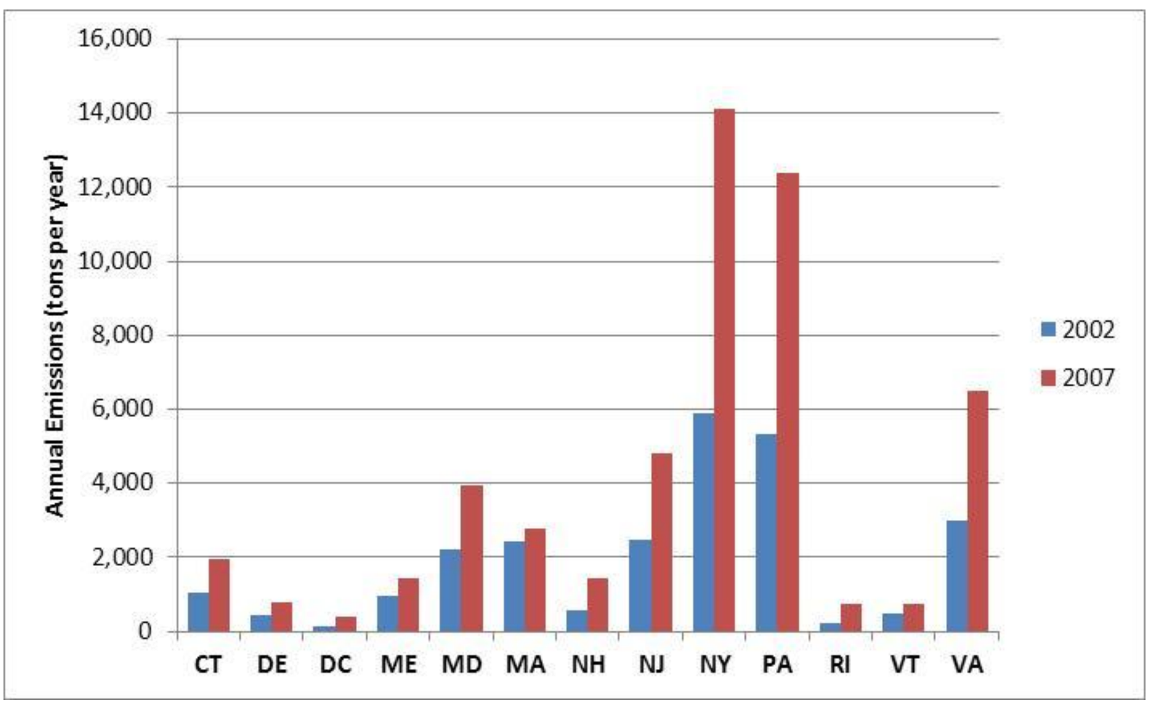


Exhibit 7.7 – 2002 and 2007 NMIM/NONROAD SO2 Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	1,667	402	-76%
Delaware	584	202	-65%
District of Columbia	271	89	-67%
Maine	1,804	377	-79%
Maryland	4,058	936	-77%
Massachusetts	4,399	769	-83%
New Hampshire	777	275	-65%
New Jersey	3,649	921	-75%
New York	10,640	2,187	-79%
Pennsylvania	10,924	2,518	-77%
Rhode Island	425	179	-58%
Vermont	894	179	-80%
Virginia	6,086	1,435	-76%
	46,176	**10,468**	**-77%**

2002 emissions were estimated using MOBILE6; 2007 emissions were estimated using MOVES

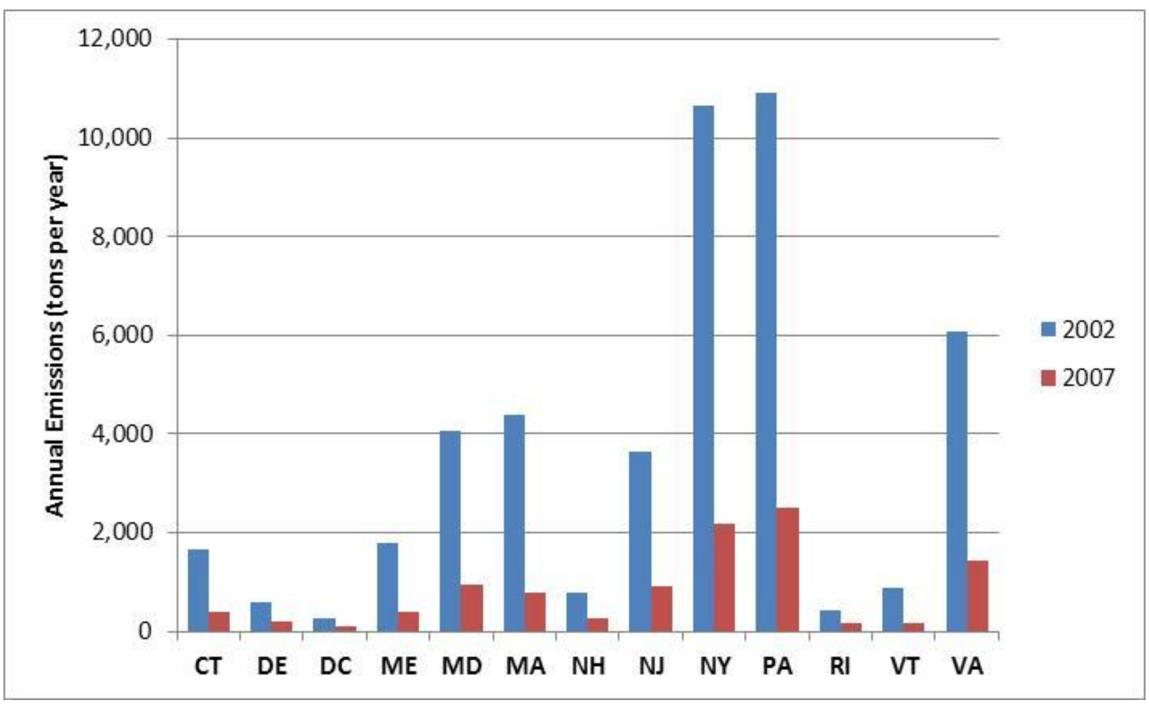
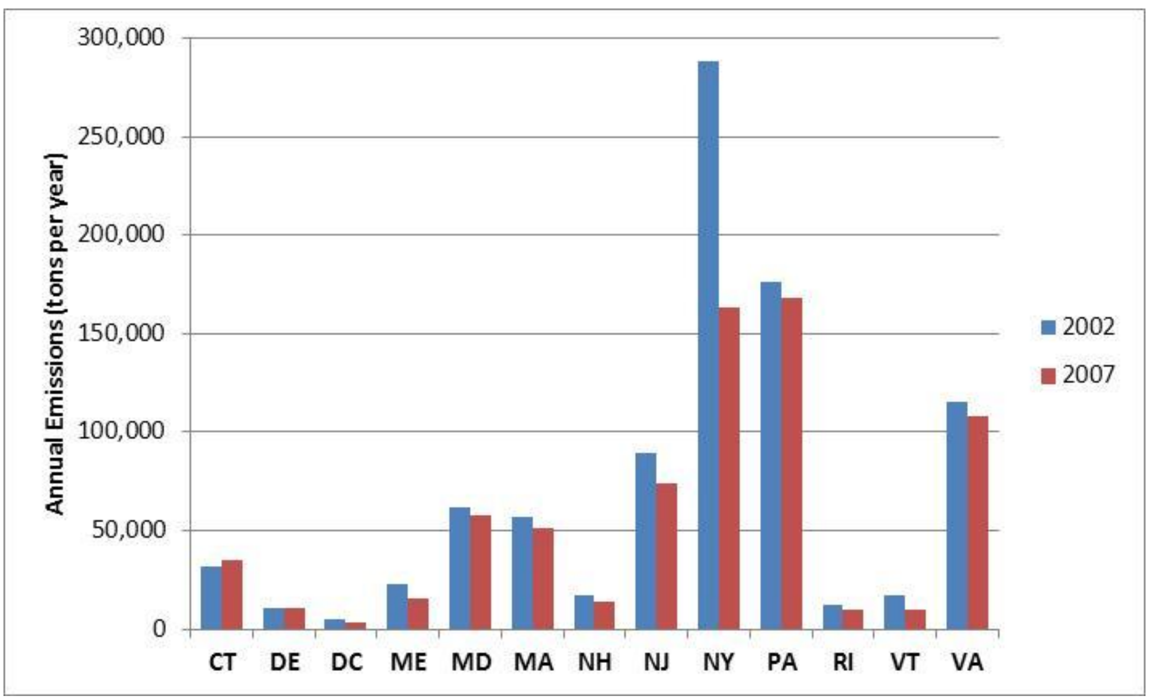


Exhibit 7.8 – 2002 and 2007 Onroad VOC Emissions by State (tons/year)

STATE	2002	2007	Change
Connecticut	31,755	35,363	11%
Delaware	10,564	10,771	2%
District of Columbia	4,895	3,598	-27%
Maine	23,037	15,382	-33%
Maryland	61,847	57,789	-7%
Massachusetts	57,186	51,149	-11%
New Hampshire	16,762	13,650	-19%
New Jersey	89,753	73,624	-18%
New York	287,845	163,290	-43%
Pennsylvania	176,090	168,289	-4%
Rhode Island	12,538	9,780	-22%
Vermont	17,288	9,780	-43%
Virginia	114,994	108,001	-6%
	904,554	**720,465**	**-20%**

2002 emissions were estimated using MOBILE6; 2007 emissions were estimated using MOVES



8.0 PREPARATION OF SMOKE MODEL FILES

Air quality modelers in the Mid-Atlantic and Northeastern States use the SMOKE Modeling System to create gridded, speciated, hourly emissions for input into a variety of air quality models. This section describes how the SMOKE inventory files were developed. It also describes how the SMOKE the temporal allocation, speciation, and spatial allocation profiles, respectively, were developed.

8.1 PREPARATION OF SMOKE EMISSION FILES

8.1.1 Point Source SMOKE Emission Files

Annual point source inventories were prepared in SMOKE PTINV ORL format. As previously discussed in Section 3.2.1, PTINV files were created for the following types of sources:

- Annual emissions for units that reported hourly data to USEPA CAMD for the entire 12 months of 2007;
- Ozone season emissions for units that reported hourly emissions to USEPA CAMD for either 6 or 9 months of 2007 (except for 6 month reporting units in Maryland);
- Non-ozone season emissions for units that reported hourly emissions to USEPA CAMD for either 6 or 9 months of 2007 (except for 6 month reporting units in Maryland);
- Units that reported hourly emissions to USEPA CAMD for either 6 or 9 months of 2007 in Maryland;
- Units that are classified as distributed generation units by VDEQ; and
- All other units (these are not associated with the hourly PTHOUR files; temporal allocation for these units will be accomplished using the standard SMOKE V2.6 temporal allocation profiles).

The ORL were quality assured to conform to the SMOKE PTINV ORL format and to prevent double counting of emissions in the ORL files.

EPA has developed a methodology to reduce fugitive dust emissions for use in air quality modeling analyses (USEPA 2007b). It is considered a logical step to account for the removal of particles near their emission source by vegetation and surface features. For the MANEVU+VA 2007 inventory the transport factors were NOT applied to the point source inventory because of the very small amount of fugitive particulate emissions in the point source inventory.

Hourly point source inventories were prepared for units that report hourly emissions to USEPA's Clean Air Markets Division in SMOKE PTHOUR EMS-95 format. Because of the large size of the PTHOUR files, separate files were prepared by month. As previously discussed in Section 3.2.1, the following PTHOUR files were created:

- 12 monthly PTHOUR files for units that reported hourly emissions to USEPA CAMD for the entire 12 months of 2007;
- 5 monthly PTHOUR files (May-September) for units that reported hourly emissions to USEPA CAMD only for the ozone season 2007;
- 12 monthly PTHOUR files for units in Maryland that reported hourly emissions to USEPA CAMD for the either 6 or 9 months of 2007; and
- 12 monthly PTHOUR files for units in Virginia that are classified as distributed generations units

Since some CAMD units only report hourly emissions data for the ozone season, there was a need for a set of actual 2007 hourly temporal profiles to be used in simulating hourly emissions for these units in non-ozone season months. Section 3.4 of this TSD discusses the development of the SMOKE temporal profiles for the non-ozone season months for these units.

8.1.2 Area Source SMOKE Emission Files

Annual area source inventories were prepared in SMOKE ARINV ORL format. In developing the SMOKE ARINV ORL files for area sources, the USEPA "transport factor" was applied to reduce fugitive dust emissions to account for the removal of particles near their emission source by vegetation and surface features. The transport factor was NOT applied to the NIF-formatted annual emissions, but only to the SMOKE ARINV ORL-formatted file.

The standard transport fractions and SCC assignments from the USEPA CHIEF website were used to reduce the PM10-PRI and PM25-PRI emissions in the MANEVU+VA 2007 area source inventory. Two files were used. The first file contains a list of SCCs for which the transport factor was applied. The major source categories included paved and unpaved roads, construction activity, agricultural crop land tilling, and agricultural livestock operations. The second file contains the transport factor which varies by county. For example, in Connecticut the transport factors ranges from 0.21 in Tolland County to 0.44 in New Haven County.

Applying the transport factor to area source fugitive dust emissions significantly reduces that amount of particulate matter included in the air quality modeling. Exhibit 8.1 compares the 2007 area source PM10-PRI and PM25-PRI emissions before and after the application of the transport fraction. Region wide, PM10-PRI emissions are reduced by 53 percent and PM25-PRI emissions are reduced by 29 percent by applying the transport fraction. The percent reduction varies by State due to the relative importance of the area source fugitive dust emissions compared to non-fugitive dust source emissions. The bottom part of Exhibit 8.1 shows the key area source fugitive dust categories and the reductions applied by using the transport fraction.

Exhibit 8.1 – Comparison of 2007 Area Source Emissions With and Without the Application of the Fugitive Dust Transport Factor (tons/year)

	PM10-PRI			PM25-PRI		
State/SCC	Without Transport Factor	With Transport Factor	Percent Reduction	Without Transport Factor	With Transport Factor	Percent Reduction
Emissions by State for All Area Source SCCs						
CT	30,577	15,591	49	10,606	8,396	21
DE	10,499	7,208	31	3,031	2,407	21
DC	4,873	2,445	50	1,542	1,120	27
ME	54,445	20,227	63	12,526	8,744	30
MD	72,454	38,520	47	19,789	14,710	26
MA	148,756	58,380	61	30,438	18,621	39
NH	27,742	10,650	62	8,623	5,832	32
NJ	39,140	24,801	37	18,299	14,944	18
NY	272,674	140,760	48	63,906	47,023	26
PA	287,998	138,571	52	73,514	50,855	31
RI	11,361	5,553	51	3,896	2,957	24
VT	47,993	19,097	60	13,106	9,434	28
VA	183,341	78,204	57	44,102	29,533	33
All States and SCCs	**1,191,853**	**560,007**	**53**	**303,378**	**214,576**	**29**
MANE-VU+VA Emissions for Selected SCCs						
2294000000 Paved Roads	230,004	78,795	66	54,207	18,727	65
2296000000 Unpaved Roads	417,951	129,150	69	41,525	12,837	69
2311xxxxxxx Construction	205,811	74,598	64	20,934	7,585	64
2801000003 Ag. Tilling	94,443	33,949	64	17,789	6,511	64

8.1.3 Nonroad NMIM SMOKE Emission Files

As discussed in Section 5, the NMIM/NONROAD model was executed using specifications to generate monthly emission files. Monthly SMOKE ARINV ORL files were created. Average day emissions were calculated by dividing the NONROAD generated monthly emissions by the number of days in each month. Various summary reports were prepared to verify agreement between the average day, monthly, and annual emissions.

8.1.4 Nonroad MAR SMOKE Emission Files

Annual inventories for marine vessels, airport operations and railroad locomotives were prepared in SMOKE ARINV ORL format for each county in the region. Average day emissions were calculated by dividing the annual emissions by 365 days. The ORL files for Category 3 commercial marine vessels include only the emissions that occur in State waters (generally from the shoreline to 3–10 nautical miles from shore).

8.1.5 Onroad SMOKE Emission Files

Smoke emission files for the onroad sector are being developed by NESCAUM under a separate contract. Please contact NESCAUM for documentation and data files.

8.1.1 Biogenic SMOKE Emission Files

Smoke emission files for the biogenic sector are being developed by New Jersey and New York under separate efforts. Please contact MARAMA to obtain documentation and data files for biogenic sources.

8.1.1 SMOKE Emission Files for Areas Outside of the MANE-VU+VA Region

Smoke emission files for areas outside of the MANE-VU+VA are currently under development. Contact MARAMA for further information.

8.2 REVIEW OF SMOKE AUXILIARY FILES

The following activities were performed to quality assure and improve the SMOKE speciation, spatial and temporal profiles:

- QA checks were made to ensure that all SCCs in the annual emission inventory files are cross-referenced to SCCs in the SMOKE profiles. In cases where a proper cross-reference does not exist, the SMOKE files were updated using data for similar SCCs or as otherwise determined on a case-by-case basis.

- SMOKE temporal profiles were reviewed and documented for key categories. Recommendations for improving SMOKE temporal profiles were made for categories where improved data is available and are reasonable feasible to use.

- SMOKE spatial profiles were reviewed and documented for selected categories. Recommendations for improving SMOKE spatial profiles were made for categories where improved data is available and are reasonable feasible to use.

Each of these activities is documented in Appendix F of this TSD.

8.2.1 SMOKE Speciation Files

Based upon the review of Appendix F by SMOKE emission modelers in the Northeast / Mid-Atlantic region, MARAMA directed the Contractor to make the following changes to the SMOKE auxiliary files as recommended in Appendix F.

GSREF Speciation Cross-Reference File

- Added records for SCC/pollutant code combinations in the 2007 inventory that needed to be added to the GSREF file

GSPRO Speciation Profiles

- No changes were needed

8.2.2 SMOKE Spatial Allocation Files

Based upon the review of Appendix F by SMOKE emission modelers in the Northeast / Mid-Atlantic region, MARAMA directed the Contractor to make the following changes to the SMOKE auxiliary files as recommended in Appendix F.

AMGREF Spatial Allocation Cross-Reference File

- Added records for SCCs in the 2007 inventory that needed to be added to the AMGREF file

SRGDESC Spatial Surrogate Code Descriptions

- No changes were needed

To spatially allocate county-level emissions from airports, SMOKE modelers will use the SMOKE ARTOPNT file to allocate county-level to specific point source airport locations instead of being assigned spatial surrogates. We reviewed this SMOKE file and confirmed the county-level commercial aircraft emissions are being allocated to the location of the large airport in the county. The only adjustment to the SMOKE ARTOPNT file was as follows:

- Changed the allocation factors for commercial aircraft (SCCs 2275000000, 2275020000, and 2275070000) in Queens County NY to allocate county-level commercial aircraft emissions to JFK Airport and LaGuardia airport based on the 2008 LTO data from USEPA's 2008 emission inventory

Emissions for Category 3 commercial marine vessels will be spatially allocated using the following procedures:

- For operations from shoreline to roughly 3-10 nautical miles from the shore, the county-level Category 3 emissions prepared by States will be allocated to grid cells using the SMOKE spatial allocation files (profile 800 {Marine Ports} for port emissions, profile 810 {Navigable Waterway Activity} for underway emissions);

- For operations outside of State waters (generally 10-200 nautical miles from shore) Northeast / Mid-Atlantic emission modelers will use a Category C3 ORL files (ptinv_eca_imo_fixFIPS_US_caps_2005_19OCT2010_orl.txt) generated by EPA for 2005. The SMOKE modelers will zero out the emissions that have been assigned to counties to avoid double counting of emissions with the State-provided emissions discussed in the previous bullet.

See Appendix F for a further discussion of the Category 3 spatial allocation issue.

8.2.3 SMOKE Temporal Allocation Files

Based upon the review of Appendix F by SMOKE emission modelers in the Northeast / Mid-Atlantic region, MARAMA directed the Contractor to make the following changes to the SMOKE auxiliary files as recommended in Appendix F.

<u>AMPTREF Temporal Cross-Reference File</u>

- Added records for SCCs in the 2007 inventory that needed to be added to the AMPTREF file

- Changed the monthly allocation code for commercial aircraft (SCC 2275000000) and auxiliary power units (SCC 2275070000) from 246 to 99246 (the new profile code that uses the Bureau of Transportation Statistics {BLS} monthly air travel data for 2007)

- Changed the day-of-week allocation code for commercial aircraft (SCC 2275000000) and auxiliary power units (SCC 2275070000) from 7 to 99007 (the new profile code that uses the BLS day-of-week air travel data for 2007)
- Changed the hour-of-day allocation code for commercial aircraft (SCC 2275000000) and auxiliary power units (SCC 2275070000) from 26 to 99026 (the new profile code that uses the BLS hour-of-day air travel data for 2007)
- Changed the monthly allocation code for SCCs 22-80-003-100 (CMV/Residual/ Port) and 22-80-003-200 (CMV/Residual/Underway) from 262 to 19531, which is the code the EPA recently developed for their C3 inventory

AMPTPRO Temporal Allocation Profiles

- Added the monthly allocation code of 99246 (the new profile code that uses the Bureau of Transportation Statistics {BLS} monthly air travel data for 2007)
- Added the day-of-week allocation code of 99007 (the new profile code that uses the BLS day-of-week air travel data for 2007)
- Added the hour-of-day allocation code of 99026 (the new profile code that uses the BLS hour-of-day air travel data for 2007)

9.0 FINAL DELIVERABLES

Exhibits 9.1 and 9.2 identify all of the deliverable products for the 2007 MANE-VU+VA emission inventory developed by the Contractor under this contract. The exhibit also identifies deliverables associated with the 2007 MANE-VU+VA under development by other agencies.

All files are stored on MARAMA ftp site:

Address: ftp.marama.org

Login ID: regionalei

Password: marama2007

Files are stored in the following directories:

\MARAMA 07-17-20 Version 3\Final 2007 (Version 3_3)\NIF

\MARAMA 07-17-20 Version 3\Final 2007 (Version 3_3)\SMOKE

\MARAMA 07-17-20 Version 3\Final 2007 (Version 3_3)\TSD

\MARAMA 07-17-20 Version 3\Final 2007 (Version 3_3)\XLS

The deliverables are described in 9.1 and 9.2.

Exhibit 9.1 – NIF Data and Emission Summary Files for the 2007 MANE-VU+VA Emission Inventory

File Description	File Name	Format	Notes
2007 Annual Point Source Emission Inventory in NOF format	MANEVU+VA_V3_3_Point_2007_NOF.mdb	NOF ACCESS	EP table modified to include fields to (1) identify units as CAMD-EGU, CAMD-nonEGU, and OTHER; (2) include the CAMD ORIS and UNITID for CAMD units; and (3) identify the percent operating time classification for CAMD units. See file for Field Definitions
2007 Annual Area Source Emission Inventory in NOF format	MANEVU+VA_V3_3_Area_2007_NOF.mdb	NOF ACCESS	See file for Field Definitions
2007 Annual NMIM/NONROAD Source Emission Inventory in NOF format	2007MARAMANRNMIMv3.mdb	NOF ACCESS	See file for Field Definitions.
2007 Annual Commercial Marine Vessel, Airport, and Rail (MAR) Emission Inventory in NOF format	MANEVU+VA_V3_3_MAR_2007.mdb	NOF ACCESS	See file for Field Definitions
2007 Annual Point Source Emission Inventory in a spreadsheet format to facilitate State and Stakeholder review	MANEVU+VA_V3_3_Point_2007_Process_Emissions.xls	MS Excel	See file for Column Definitions
2007 Annual Point Source Emission Inventory summaries by State and Source Classification Code (SCC)	MANEVU+VA_V3_3_Point_2007_State_SCC_Summary.xls	MS Excel	See file for Column Definitions
2007 Annual Area Source Emission Inventory summaries by State/SCC	MANEVU+VA_V3_3_Area_2007_State_SCC_Summary.xls	MS Excel	See file for Column Definitions
2007 Annual NMIM/NONROAD Emission Inventory summaries by State and SCC	MANEVU+VA_V3_3_NMIM_2007_State_SCC_Summary.xls	MS Excel	See file for Column Definitions.
2007 Annual MAR Emission Inventory summaries by State and SCC	MANEVU+VA_V3_3_MAR_2007StateSCCSummaries.xls	MS Excel	See file for Column Definitions

Exhibit 9.2 – SMOKE Files for the 2007 MANE-VU+VA Emission Inventory

File Description	File Name	Format	Notes
2007 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2007_NonHourly_jan2012.orl PTINV_2007_12MonthUnits_feb2011.orl PTINV_2007_Ozone_5MonthUnits_feb2011.orl PTINV_2007_NonOzone_5MonthUnits_feb2011.orl PTINV_2007_VADGUnits_march2010.orl PTINV_2007_MD6MonthUnits_march2010.orl	SMOKE PTINV ORL	One file for all non-hourly units and five separate files for units with hourly emissions. See Section 3.2.1 for the TSD for discussion of the files and Exhibit 3.1 for the file format.
SMOKE PTHOUR EMS-95 zip files with hourly emissions for each month of 2007 for units that report hourly emissions to CAMD for the entire 12 months in 2007. The zip file contains 12 monthly files.	pthour_2007_jan_12MonthUnits_nov2011.ems pthour_2007_feb_12MonthUnits_nov2011.ems pthour_2007_mar_12MonthUnits_nov2011.ems pthour_2007_apr_12MonthUnits_nov2011.ems pthour_2007_may_12MonthUnits_nov2011.ems pthour_2007_jun_12MonthUnits_nov2011.ems pthour_2007_jul_12MonthUnits_nov2011.ems pthour_2007_aug_12MonthUnits_nov2011.ems pthour_2007_sep_12MonthUnits_nov2011.ems pthour_2007_oct_12MonthUnits_nov2011.ems pthour_2007_nov_12MonthUnits_nov2011.ems pthour_2007_dec_12MonthUnits_nov2011.ems	SMOKE PTHOUR EMS-95	See Exhibit 3.2 for file format
SMOKE PTHOUR EMS-95 files with hourly emissions for 5 months of 2007 for units classified as "5-month reporters" in all States except MD. The zip file contains 5 monthly files.	pthour_2007_may_5MonthUnits_Jan2012.ems pthour_2007_jun_5MonthUnits_Jan2012.ems pthour_2007_jul_5MonthUnits_Jan2012.ems pthour_2007_aug_5MonthUnits_Jan2012.ems pthour_2007_sep_5MonthUnits_Jan2012.ems	SMOKE PTHOUR EMS-95	See Exhibit 3.2 for file format
SMOKE PTHOUR EMS-95 files with hourly emissions for each month of 2007 for units classified as "6-month reporters" in MD. The zip file contains 12 monthly files.	pthour_2007_jan_MD6MonthUnits_march2010.ems pthour_2007_feb_MD6MonthUnits_march2010.ems pthour_2007_mar_MD6MonthUnits_march2010.ems pthour_2007_apr_MD6MonthUnits_march2010.ems pthour_2007_may_MD6MonthUnits_march2010.ems pthour_2007_jun_MD6MonthUnits_march2010.ems pthour_2007_jul_MD6MonthUnits_march2010.ems pthour_2007_aug_MD6MonthUnits_march2010.ems pthour_2007_sep_MD6MonthUnits_march2010.ems	SMOKE PTHOUR EMS-95	See Exhibit 3.2 for file format

File Description	File Name	Format	Notes
	pthour_2007_oct_MD6MonthUnits_march2010.ems pthour_2007_nov_MD6MonthUnits_march2010.ems pthour_2007_dec_MD6MonthUnits_march2010.ems		
SMOKE PTHOUR EMS-95 files with hourly emissions for each month of 2007 for units classified as "distributed generation units" by the Virginia DEQ. The zip file contains 12 monthly files.	pthours_2007_jan_VADGunits_march2010.ems pthours_2007_feb_VADGunits_march2010.ems pthours_2007_mar_VADGunits_march2010.ems pthours_2007_apr_VADGunits_march2010.ems pthours_2007_may_VADGunits_march2010.ems pthours_2007_jun_VADGunits_march2010.ems pthours_2007_jul_VADGunits_march2010.ems pthours_2007_aug_VADGunits_march2010.ems pthours_2007_sep_VADGunits_march2010.ems pthours_2007_oct_VADGunits_march2010.ems pthours_2007_nov_VADGunits_march2010.ems pthours_2007_dec_VADGunits_march2010.ems	SMOKE PTHOUR EMS-95	See Exhibit 3.2 for file format
2007 Annual Area Source Emission Inventory in SMOKE ORL format	arinv_marama_2007_jan2012_w_tf_orl.txt.gz	SMOKE ARINV ORL	This file has the PM transport factors by county applied to the NOF emissions. See section 8.1.2 for discussion. See http://www.smoke-model.org/version2.6/html/ for file format
2007 Annual MAR Emission Inventory in SMOKE ORL format	ARINV_2007_MAR_Jan2012.txt	SMOKE ARINV ORL	See http://www.smoke-model.org/version2.6/html/ for file format; includes commercial marine vessels, airports (including GSE), and railroad locomotives
2007 Monthly NMIM/NONROAD Emission Inventory in SMOKE ORL format	arinv_nonroad_2007_jan_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_feb_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_mar_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_apr_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_may_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_jun_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_jul_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_aug_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_sep_29sep2010_v1_orl.txt.gz	SMOKE ARINV ORL	See http://www.smoke-model.org/version2.6/html/ for file format

File Description	File Name	Format	Notes
	arinv_nonroad_2007_oct_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_nov_29sep2010_v1_orl.txt.gz arinv_nonroad_2007_dec_29sep2010_v1_orl.txt.gz		
SMOKE formatted temporal profiles for units that report to CAMD for only part of 2007.	ptpro_2007_marama_egu_13apr2010.txt	SMOKE PTPRO	See http://www.smoke-model.org/version2.6/html/ for file format and Section 3.4 of this TSD for discussion of these files
SMOKE formatted temporal cross-reference tables for annual time periods	ptref_2007_marama_egu_annual_13apr2010.txt	SMOKE PTREF	
SMOKE formatted temporal cross-reference tables for nonozone time periods	ptref_2007_marama_egu_nonozone_13apr2010.txt	SMOKE PTREF	
SMOKE formatted temporal profiles	MARAMA_amptref_v3_3_revised_10feb2011_v1.txt	SMOKE AMPTREF	Updated SMOKE temporal files based on EPA's 2005v4 modeling platform. See Section 8.2.3 of this TSD for discussion of the updates made.
SMOKE formatted temporal cross-reference tables	MARAMA_amptpro_2005_us_can_revised_10feb2011_v0.txt	SMOKE AMPTPRO	
SMOKE formatted spatial fridding cross-reference file	MARAMA_amgref_us_can_mex_revised_17feb20110_v8.txt	SMOKE AMGREF	Updated SMOKE spatial files based on EPA's 2005v4 modeling platform. See Section 8.2.2 of this TSD for discussion of the updates made.
SMOKE formatted spatial surrogate designation file	MARAMA_srgdesc_36km_revised_10feb2011_v1.txt	SMOKE SRGDESC	
SMOKE formatted area to point file for airports	MARAMA_artopnt_2002detroit_10feb2011_v0.txt	SMOKE ARTOPNT	
SMOKE formatted speciation profile	MARAMA_gspro_cmaq_cb05_soa_2005ck_05b_10feb2011.txt	SMOKE GSPRO	Updated SMOKE speciation files based on EPA's 2005v4 modeling platform. See Section 8.2.1 of this TSD for discussion of the updates made.
SMOKE formatted speciation cross-reference file	MARAMA_gsref_cmaq_cb05_soa_2005ck_05b_17feb2011.txt	SMOKE GSREF	

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Technical Support Document for the Development of the 2017 / 2020 Emission Inventories for Regional Air Quality Modeling in the Northeast / Mid-Atlantic Region Version 3.3

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About MARAMA

The Mid-Atlantic Regional Air Management Association, Inc. is a voluntary, non-profit association of ten state and local air pollution control agencies. MARAMA's mission is to strengthen the skills and capabilities of member agencies and to help them work together to prevent and reduce air pollution in the Mid-Atlantic Region. MARAMA provides cost-effective approaches to regional collaboration by pooling resources to develop and analyze data, share ideas, and train staff to implement common requirements.

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Acronyms and Abbreviations

Acronym	Description
CAMD	Clean Air Markets Division (USEPA)
CAP	Criteria Air Pollutant
CEM	Continuous Emission Monitoring
CMV	Commercial Marine Vessel
CO	Carbon Monoxide
CTG	Control Technique Guideline
EGU	Electric Generating Unit
ERTAC	Eastern Regional Technical Advisory Committee
FIPS	Federal Information Processing Standard
GACT	Generally available control technology
GSE	Ground Support Equipment
MACT	Maximum Achievable Control Technology
MANE-VU	Mid-Atlantic/Northeast Visibility Union
MANE-VU+VA	MANE-VU States plus Virginia
MAR	Marine, Airport, Rail
MARAMA	Mid-Atlantic Regional Air Management Association
MOBILE6	USEPA model
MOVES	Motor Vehicle Emissions Simulator
NAICS	North American Industry Classification System code
NCD	National County Database
NEI	National Emission Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NH3	Ammonia
NIF3.0	National Emission Inventory Input Format Version 3.0
NMIM	National Mobile Input Model
NOF3.0	National Emission Inventory Output Format Version 3.0
NONROAD	USEPA model
NOx	Oxides of nitrogen
OAQPS	Office of Air Quality Planning and Standards (USEPA)
ORL	One-record-per-line (SMOKE Format)
OTAQ	Office of Transportation and Air Quality (USEPA)
PFC	Portable Fuel Container
PM-CON	Primary PM, Condensable portion only (< 1 micron)
PM-FIL	Primary PM, Filterable portion only
PM-PRI	Primary PM, includes filterables and condensables PM-PRI= PM-FIL + PM-CON

Acronym	Description
PM10-FIL	Primary PM10, Filterable portion only
PM10-PRI	Primary PM10, includes filterables and condensables, PM10- PRI = PM0-FIL + PM-CON
PM25-FIL	Primary PM2.5, Filterable portion only
PM25-PRI	Primary PM2.5, includes filterables and condensables PM25-PRI= PM25-FIL + PM-CON
RWC	Residential Wood Combustion
SEMAP	Southeast Modeling, Analysis and Planning
SIC	Standard Industrial Classification code
SIP	State Implementation Plan
SCC	Source Classification Code
S/L	State/local
SMOKE	Sparse Matrix Operator Kernel Emissions
SO2	Sulfur Dioxide
USEPA	U.S Environmental Protection Agency
VISTAS	Visibility Improvement State and Tribal Association of the Southeast
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

1.0 INTRODUCTION

This technical support document (TSD) explains the data sources and methods used to prepare criteria air pollutant (CAP) and ammonia (NH3) emission projections for 2017 and 2020 for the Northeast and Mid-Atlantic/Northeast region. The region includes the jurisdictions in the Mid-Atlantic / Northeast Visibility Union (MANE-VU) area plus Virginia. In this document, these jurisdictions will be referred to as the MANE-VU+VA region. The MANE-VU+VA region includes Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.

1.1 INVENTORY PURPOSE

The MANE-VU+VA regional inventories will be used to concurrently address national ambient air quality standard (NAAQS) requirements for the new ozone and fine particle ambient standards and to evaluate progress towards long-term regional haze goals. The emission inventories will support a single integrated, one-atmosphere air quality modeling platform, state air quality attainment demonstrations, and other state air quality technical analyses.

The future year inventories account for emissions growth associated with changes in population, fuel use, and economic activity. The future year inventories also refect the emission changes between 2007 and the two future years that are projected under two emission control scenarios:

- Existing Controls – this scenario represents the best estimates for the future year, accounting for all in-place controls that are fully adopted into federal or individual state regulations or State Implementation Plans (SIPs). In the past, this inventory is also referred to as the "on-the-books (OTB)" inventory. Air quality modelers often refer to this scenario as the "future base case."

- Potential New OTC Controls – this scenario accounts for all of the emission reductions from the existing control scenario plus new state or regional measures that are under consideration by the Ozone Transport Commission (OTC) or individual states. This is a "what if" scenario that assumes that all states in the MANE-VU+VA region except Virginia will adopt all new OTC control measures under consideration by 2017. Air quality modelers sometimes call this the "future control case." It does not include any potential new federal control measures that are under consideration.

The U.S. Environmental Protection Agency (USEPA) has provided guidance on developing emission projections to be used with models and other analyses for demonstrating attainment of air quality goals for ozone, fine particles, and regional haze (USEPA 1999, USEPA 2005a, USEPA 2007a). In addition, the USEPA has recently developed its own emission projections that provide data on growth and future controls that were useful in developing the MANE-VU+VA future year emission inventories (USEPA 2010a). The guidance and information available from USEPA was followed and used, as appropriate, in developing the future year emission projections.

1.2 POLLUTANTS

The inventory includes annual emissions for carbon monoxide (CO), ammonia (NH3), oxides of nitrogen (NOx), particulate matter (PM), sulfur dioxide (SO2), and volatile organic compounds (VOC). The PM species in the inventory are categorized as: filterable and condensable particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., PM10-PRI and PM25-PRI); filterable particles with an aerodynamic diameter less than or equal to a nominal 10 and 2.5 micrometers (i.e., PM10-FIL and PM25-FIL); and condensable particles (PM-CON). Note that PM10-PRI equals the sum of PM10-FIL and PM-CON, and PM25-PRI equals the sum of PM25-FIL and PM-CON.

1.3 SOURCE CATEGORIES

Emission inventory data from six general categories are needed to support air quality modeling: electric generating units (EGUs), stationary nonEGU point-sources, stationary area-sources, on-road mobile sources, nonroad mobile sources, and biogenic/geogenic emissions. This report documents the development of emission projections for three of these sectors, as follows:

- **NonEGU Point Sources** are individual facilities and are further subdivided by stack, emission unit (“point”), and emission process (“segment”). Point source data include source-specific information on source location (e.g., latitude/longitude coordinates); stack parameters (stack diameter and height, exit gas temperature and velocity); type of process (source classification code {SCC}); and annual emissions.
- **Stationary Area Sources** include sources that in and of themselves are quite small, but in aggregate may contribute significant emissions. Examples include small industrial/commercial facilities, residential heating furnaces, VOCs volatizing from

house painting or consumer products, gasoline service stations, and agricultural fertilizer/pesticide application.

- **Non-road Mobile Sources** include internal combustion engines used to propel marine vessels, airplanes, and locomotives, or to operate equipment such as forklifts, lawn and garden equipment, portable generators, etc. For activities other than marine vessels, airplanes, and railroad locomotives (MAR), the inventory was developed using the most current version of USEPA's NONROAD model as embedded in the National Mobile Inventory Model (NMIM). Since the NONROAD model does not include emissions from MAR sources, these emissions were estimated based on data and methodologies used in recent USEPA regulatory impact analyses.

For these three sectors, emissions projections were compiled on an annual basis to represent conditions in 2017 and 2020.

Emission projections for the three other sectors are being developed by the OTC under separate efforts:

- **EGU Point Sources** are units that generate electric power and sell most of that power to the electrical grid. Emission projections for EGUs are being developed as part of an inter-RPO coordination effort under the direction of the Eastern Regional Technical Advisory Committee (ERTAC).

- **On-road Mobile Sources** are sources of air pollution from internal combustion engines used to propel cars, trucks, buses, and other vehicles on public roadways. Emission projections for on-road mobile sources are being developed under a separate effort by the OTC that will use the USEPA Motor Vehicle Emission Simulator (MOVES) model.

- **Biogenic** emissions are emitted by natural sources, such as plants, trees, and soils. The sharp scent of pine needles, for instance, is caused by monoterpenes, which are VOCs. The USEPA developed estimates of biogenic emissions from vegetation for natural areas, crops, and urban vegetation. The USEPA estimates take into account the geographic variations in vegetation land cover and species composition, as well as seasonal variations in leaf cover. Emission projections for biogenic sources will be developed under a separate effort by the OTC modeling team.

Documentation of the emission projections for these three sectors will be available from the OTC.

1.4 DATA FORMATS

The annual mass emissions inventory files were prepared in the National Emissions Inventory (NEI) Output Format Version 3.0 (NOF 3.0). Spreadsheets summarizing emissions by county, sector, source classification code, and pollutant were also prepared.

These annual emission inventories will be converted (through the emissions modeling process) from their original resolution (e.g., annual, county level) to input files for air quality models. These input files require emissions to be specified by model grid cell, hour, and model chemical species. The emission modelers in the MANE-VU+VA region are using the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system and data formats. Emission inventory files were prepared in SMOKE compatible format.

1.5 INVENTORY VERSIONS

1.5.1 Version 1 Modeling Inventory

Work commenced in 2009 to assemble comprehensive 2007 and future year emission inventories to support air quality modeling. Using data available from state agencies and the USEPA, detailed point and area source emission inventories were compiled. The NONROAD model was used to estimate emissions for the nonroad equipment categories included in the model. State and USEPA data were used to assemble the inventory for nonroad sources not included in the NONROAD model (marine vessels, aircraft, and railroad locomotives, collectively referred to as the MAR sector).

For the point, area, and MAR sectors, growth factors are applied to account for changes in population, fuel use and economic activity. Next, control factors are applied to account for future emission reductions from post-2007 control measures. The NONROAD model was used to project emissions for the nonroad equipment included in the model. The control scenario developed accounted for post-2007 emission reductions from promulgated federal, State, local, and site-specific control programs and proposed control programs that are reasonably anticipated to result in post-2007 emission reductions. A series of quality assurance steps are conducted to ensure the development of complete, accurate, and consistent emission inventories. The inventories are provided in two formats – SMOKE One-Record-Per-Line (ORL) format and a spreadsheet format suitable for SIP submittals. Finally, emission summary tables by state and pollutant were developed.

Version 1 of the 2007 base year inventory and the emission projections for 2013/2017/2020 were released for state and stakeholder review in late 2009 and early 2010.

1.5.2 Version 2 Modeling Inventory

Following the review of Version 1, significant efforts were made to improve the inventory by using more state-specific data and correcting errors or omissions that were uncovered. These improvements were completed in February of 2011 and are referred to as Version 2 of the MANE-VU+VA 2007 and 2013/2017/2020 inventories. The inventories were documented in two TSDs (MARAMA 2011a, MARAMA 2011b).

1.5.3 Version 3 Modeling Inventories with Existing and Potential Controls

Beginning in the fall of 2011, MARAMA sponsored development of Version 3 of the 2007 base year modeling inventory to incorporate new paved road emission estimates, revised modeling of nonroad and onroad sources, and other state-specific changes (MARAMA2012).

This report documents the development of Version 3 of the future year inventories for the area source, nonEGU, and nonroad sectors. The future year modeling inventories for EGU) are currently being developed under a separate effort lead by ERTAC. The future year modeling inventories for onroad sources are currently being developed by NESCAUM, MARAMA or individual states.

In Version 3, the state Air Directors issued guidance on the future year emission control scenarios to be developed, as follows:

- “A special meeting of the Air Directors was convened to discuss the controlled inventory. During that call many Air Directors indicated that they would not be able to clearly identify which of the control measures their states would adopt because of the uncertainty surrounding the ozone standard. Therefore, all states, except Virginia, requested that the contractor be instructed to calculate the effect of all measures being fully adopted by both 2017 and 2020. This will allow modelers to assess the potential effect of the measures if they were fully implemented on air quality. We can also then test the assumptions that we have been making about the cumulative percent reduction from the measures.”

Thus, these TSD discusses two future control scenarios: an “existing controls” scenario scenario intended to include all 2017/2020 control measaures included in an individual state’s regulations or SIP, and a "what if" scenario that assumes that all states adopt certain new control measures by 2017.

1.6 REPORT ORGANIZATION

Section 2 describes how point source emission units were classified into the EGU or nonEGU point source categories. Section 3 discusses the growth projection factors assembled for area and nonEGU point sources. Sections 4 and 5 describe the control factors used for area and nonEGU point sources, respectively. Section 6 describes the NONROAD model runs made for the future years. Section 7 documents how emissions for marine vessels, aircraft, and railroad equipment were projected. Section 8 provides state level emission pollutant summaries for area, nonEGU point, NONROAD, and MAR sectors. Section 9 documents the creation of SMOKE inventory modeling input files. Section 10 identifies the file names for final deliverable products. References for the TSD are provided in Section 11.

2.0 IDENTIFICATION OF EGU AND NONEGU POINT SOURCES

Only the emissions from point sources classified as nonEGUs are being projected using the methods and data contained in this report. Emissions from EGU point sources are being developed by ERTAC.

States were asked to classify units in the 2007 MANE-VU+VA emissions inventory as either EGU or nonEGU. Most, but not all, of the units that are required to report hourly emissions to USEPA's Clean Air Markets Division (CAMD) are classified as EGUs. CAMD implements USEPA's rule found in Volume 40 Part 75 of the Code of Federal Regulations (CFR), which requires an hourly accounting of emissions from each affected unit - i.e., sources participating in an emissions cap and trade program under the Acid Rain Control Program, the NOx Budget Trading Program, or the Clean Air Interstate Rule.

For the ERTAC projection methodology, the following guidance was provided to states to classify a unit as an EGU if it meets the following criteria:

- An EGU sells most of the power generated to the electrical grid;
- An EGU burns mostly commercial fuel. Commercial fuel in this case means natural gas, oil, and coal. Wood is not considered a commercial fuel because some states identify wood as renewable. Therefore, to avoid double counting, units that burn wood and other renewable sources (depending on each state's own definition) should not be considered as an EGU (unless it is already in the CAMD database).

The following are units were <u>not</u> considered as EGU for emission projections: (1) a unit that generates power for a facility but occasionally sells to the grid; (2) emergency generators; or (3) distributed generation units.

States were provided with a list of units that report to CAMD (USEPA 2009a) and a list of units with an electric generating unit SCC (1-01-xxx-xx or 2-01-xxx-xx). States identified which units should be classified as EGUs and which should be classified as nonEGUs. Appendix A identifies the units that report emissions to CAMD and whether they are classified as EGUs or nonEGUs for emission projection purposes. A few states also identified units with SCCs beginning with 1-01 or 2-01 that do not report to CAMD but which should be classified as EGUs; however, for emission projection purposes these units will be processed using the nonEGU projection methodology described in this report.

Exhibits 2.1 to 2.7 summarize EGU and nonEGU emissions for 2007. For these exhibits, EGUs are defined as units that report emissions to CAMD and have been classified as EGUs by the states for emission projection purposes.

Exhibit 2.1 2007 EGU and NonEGU Point Source CO Emissions (tons per year)

State	EGU	NonEGU	Total
CT	1,095	2,584	3,679
DE	726	7,027	7,753
DC	10	301	311
ME	460	14,023	14,483
MD	4,196	77,574	81,770
MA	5,516	4,592	10,108
NH	910	2,254	3,164
NJ	3,640	6,932	10,572
NY	13,480	52,877	66,357
PA	20,900	80,540	101,440
RI	602	1,051	1,653
VT	1,444	702	2,146
VA	7,273	63,080	70,353
TOTAL	**60,252**	**313,537**	**373,789**

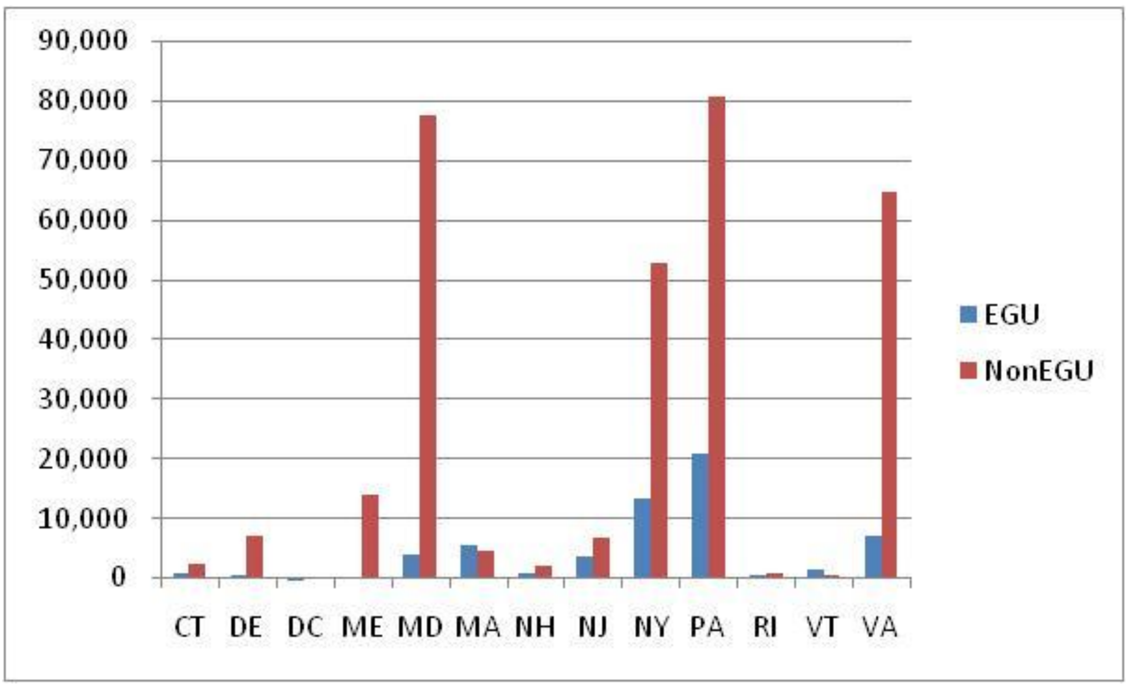


Exhibit 2.2 2007 EGU and NonEGU Point Source NH3 Emissions (tons per year)

State	EGU	NonEGU	Total
CT	0	0	0
DE	32	62	94
DC	0	0	0
ME	59	606	665
MD	0	137	137
MA	283	365	648
NH	98	30	128
NJ	708	210	918
NY	1,354	1,063	2,417
PA	309	2,070	2,379
RI	58	16	74
VT	0	0	0
VA	212	1,618	1,830
TOTAL	**3,113**	**6,177**	**9,290**

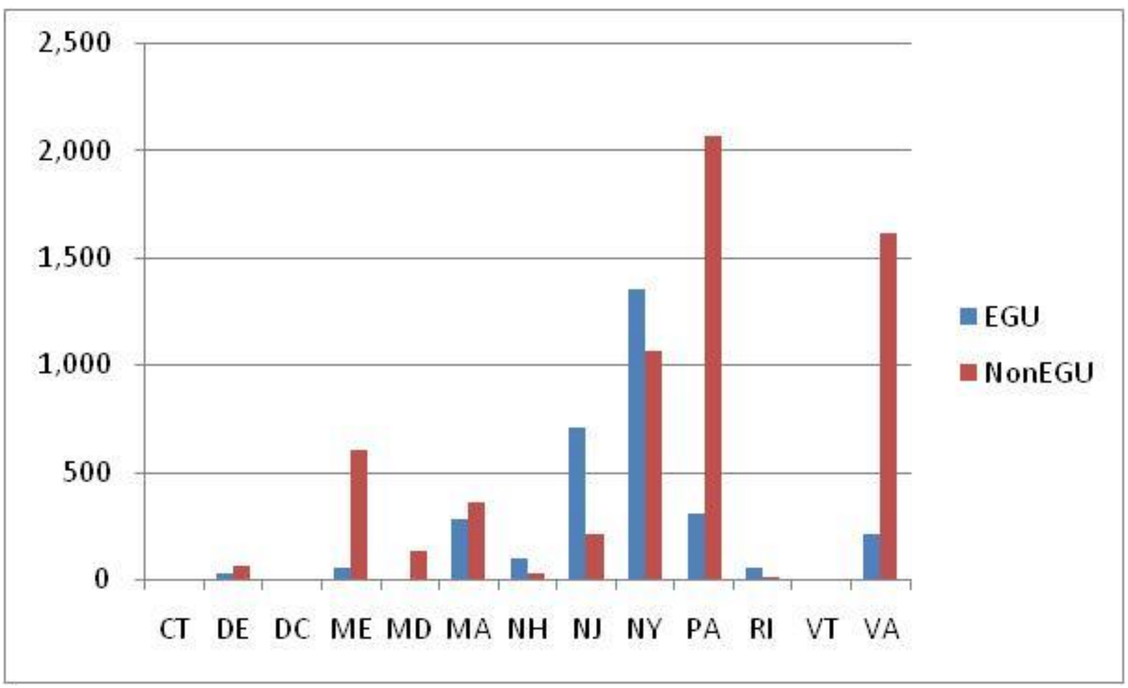


Exhibit 2.3 2007 EGU and NonEGU Point Source NOx Emissions (tons per year)

State	EGU	NonEGU	Total
CT	3,760	6,301	10,061
DE	10,507	5,121	15,628
DC	55	734	789
ME	696	17,050	17,746
MD	51,418	23,472	74,890
MA	10,755	12,873	23,628
NH	4,754	2,687	7,441
NJ	16,571	14,030	30,601
NY	47,450	35,583	83,033
PA	186,997	71,382	258,379
RI	494	950	1,444
VT	370	441	811
VA	62,673	50,265	112,938
TOTAL	**396,500**	**240,889**	**637,389**

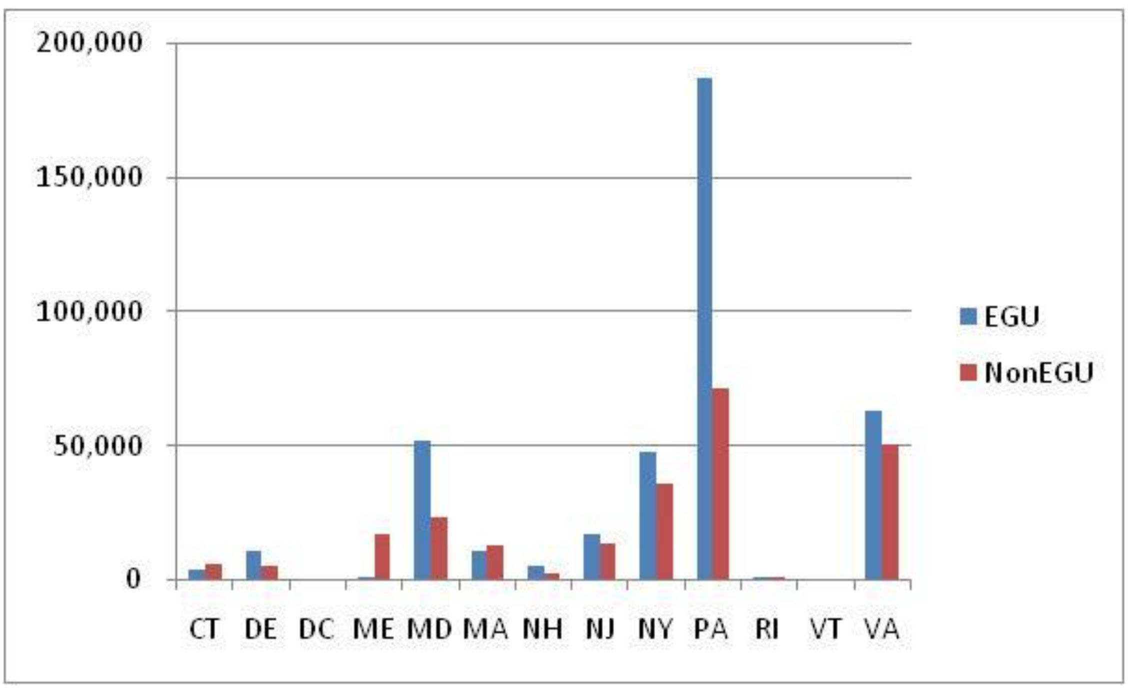


Exhibit 2.4 2007 EGU and NonEGU Point Source PM10 Emissions (tons per year)

State	EGU	NonEGU	Total
CT	705	645	1,350
DE	2,268	1,197	3,465
DC	13	46	59
ME	148	4,748	4,896
MD	13,611	5,711	19,322
MA	2,575	3,029	5,604
NH	784	1,141	1,925
NJ	4,496	3,188	7,684
NY	5,044	4,463	9,507
PA	27,470	22,275	49,745
RI	16	173	189
VT	0	146	146
VA	6,175	13,028	19,203
TOTAL	**63,305**	**59,790**	**123,095**

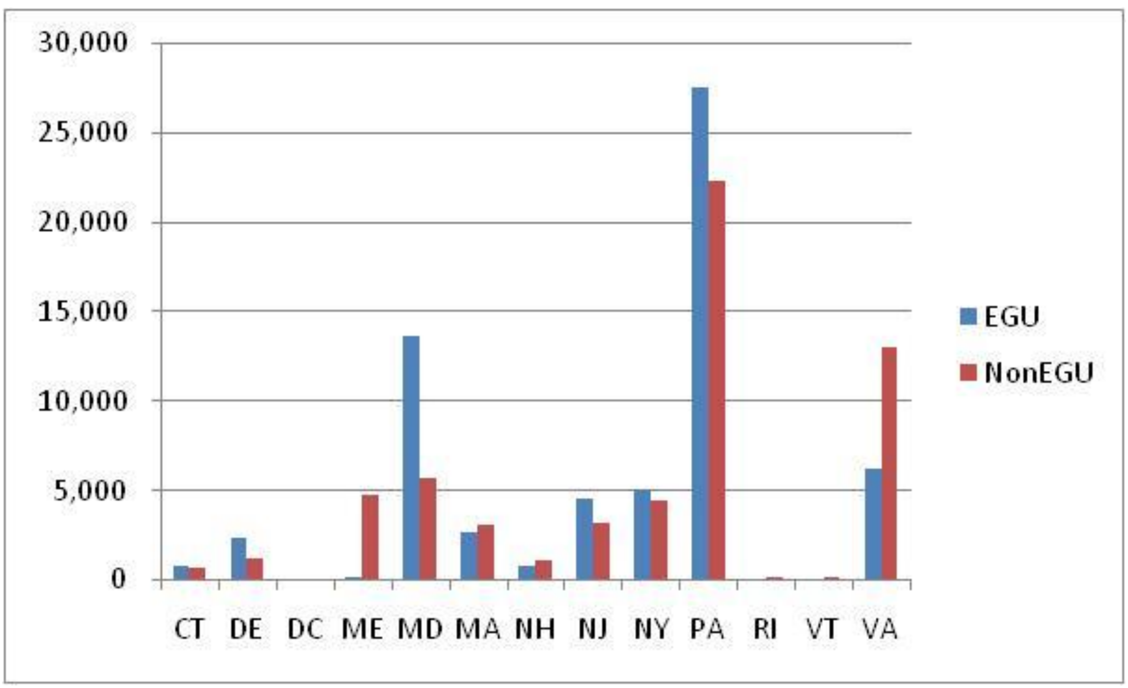


Exhibit 2.5 2007 EGU and NonEGU Point Source PM2.5 Emissions (tons per year)

State	EGU	NonEGU	Total
CT	669	573	1,242
DE	2,024	1,083	3,107
DC	10	43	53
ME	125	3,727	3,852
MD	11,805	3,877	15,682
MA	2,292	2,572	4,864
NH	602	1,061	1,663
NJ	4,410	2,453	6,863
NY	3,585	2,414	5,999
PA	19,071	13,389	32,460
RI	16	124	140
VT	0	114	114
VA	4,593	10,295	14,888
TOTAL	**49,202**	**41,725**	**90,927**

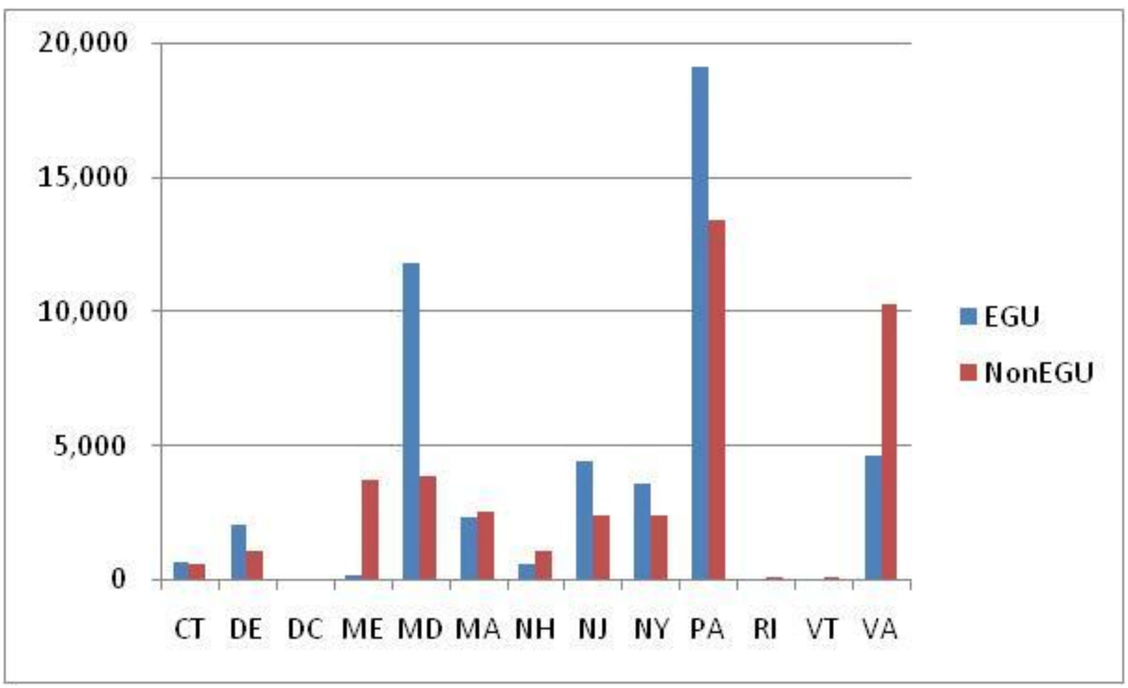


Exhibit 2.6 2007 EGU and NonEGU Point Source SO2 Emissions (tons per year)

State	EGU	NonEGU	Total
CT	4,786	3,185	7,971
DE	34,882	8,206	43,088
DC	141	471	612
ME	1,677	15,571	17,248
MD	274,207	31,176	305,383
MA	54,172	9,057	63,229
NH	42,524	2,734	45,258
NJ	37,302	3,490	40,792
NY	108,444	44,307	152,751
PA	970,726	57,330	1,028,056
RI	16	1,500	1,516
VT	6	316	322
VA	188,562	54,486	243,048
TOTAL	**1,717,445**	**231,829**	**1,949,274**

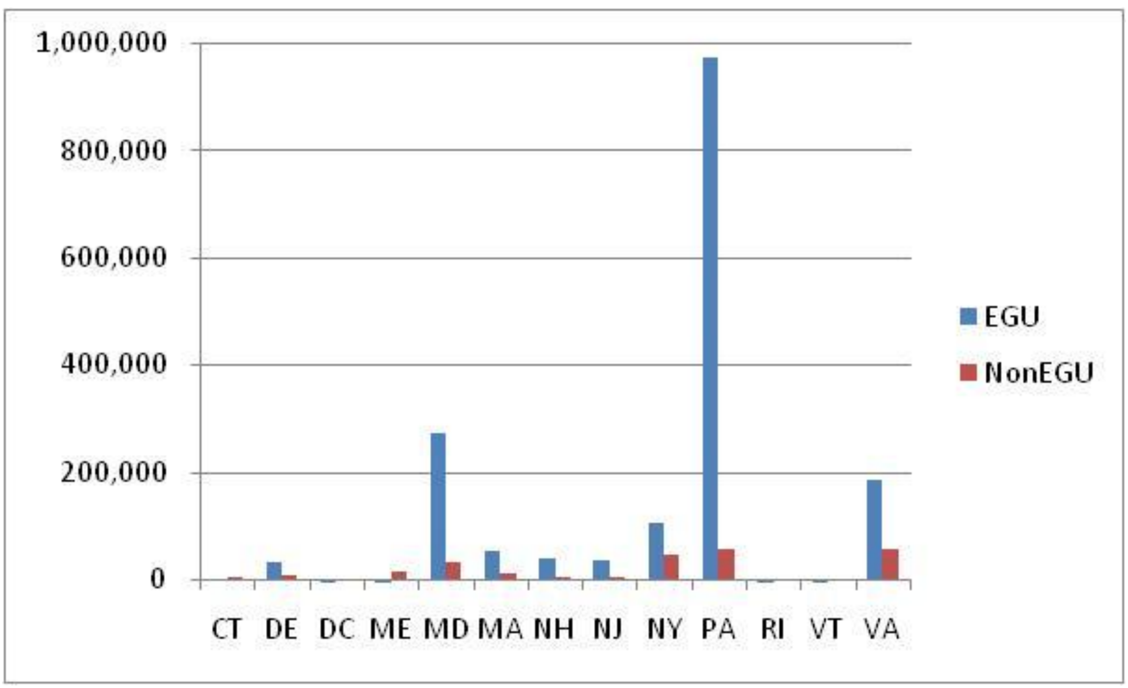
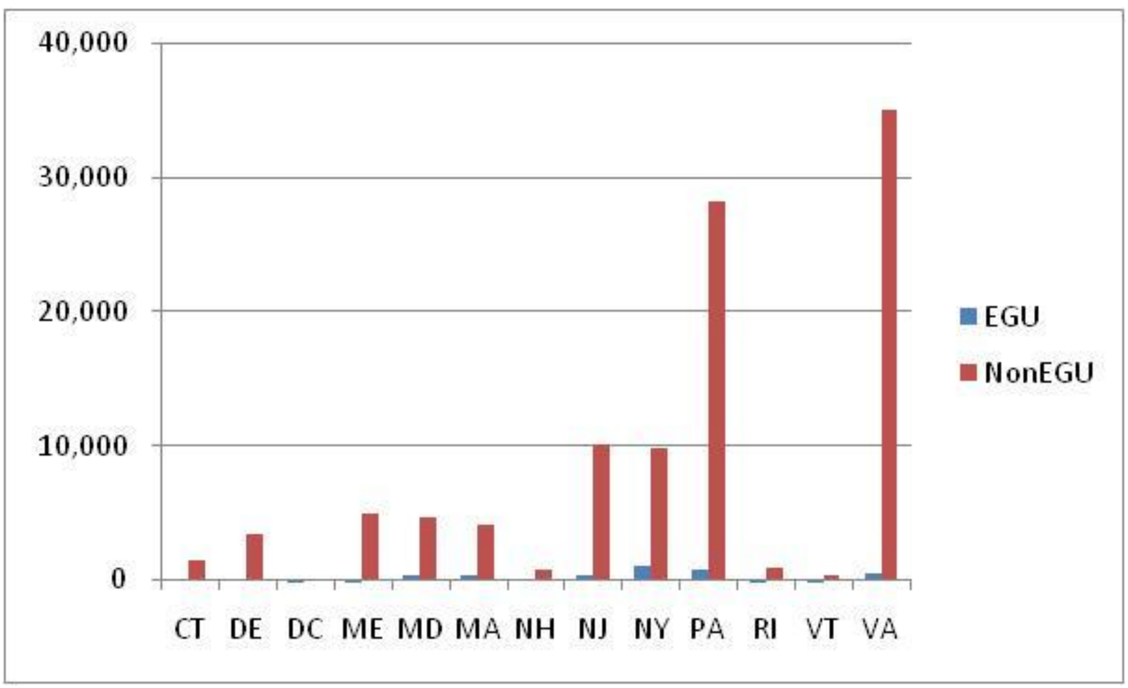


Exhibit 2.7 2007 EGU and NonEGU Point Source VOC Emissions (tons per year)

State	EGU	NonEGU	Total
CT	143	1,447	1,590
DE	83	3,406	3,489
DC	2	57	59
ME	35	4,987	5,022
MD	389	4,597	4,986
MA	463	4,094	4,557
NH	110	806	916
NJ	420	10,620	11,040
NY	1,119	9,772	10,891
PA	770	28,195	28,965
RI	49	921	970
VT	22	373	395
VA	600	35,018	35,618
TOTAL	**4,205**	**104,293**	**108,498**



3.0 GROWTH PROJECTION FACTORS FOR NONEGUs AND AREA SOURCES

The area and nonEGU point source growth factors were developed using six sets of data:

- The Annual Energy Outlook (AEO) fuel consumption forecasts;
- County-level population projections;
- State-level employment projections by NAICS code;
- County-level vehicle miles travelled (VMT) projections;
- USEPA projections for livestock and residential wood combustion; and
- Other state-specific emission projection data.

The priority for applying these growth factors was to first use the state-supplied projection data (if available). If state-supplied data were not provided, then the AEO projection factors were used for fuel consumption sources, and the population/employment/VMT data were used for other source categories.

3.1 AEO FUEL USE PROJECTIONS

The AEO is published annually by the U.S. Energy Information Administration (EIA). It presents long-term projections of energy supply, demand, and prices through 2035, based on results from EIA's National Energy Modeling System (NEMS). NEMS projects the production, imports, conversion, consumption, and prices of energy, subject to assumptions on macroeconomic and financial factors, world energy markets, resource availability and costs, behavioral and technological choice criteria, energy technology cost and performance characteristics, and demographics.

AEO provides regional fuel-use forecasts for various fuel types (e.g., coal, residual oil, distillate oil, natural gas) by end use sector (e.g., residential, commercial, industrial, transportation, and electric power). Energy use projections are reported at the Census division level. The census divisions grouped states as follows:

- South Atlantic - DE, DC, MD, VA
- Middle Atlantic – NJ, NY, PA
- New England – CT, ME, MA, NH, RI, VT

Appendices B1, B2, and B3 contain the AEO2010 fuel use projections for each of these three regions. Appendices B4, B5, and B6 contain the AEO2011 fuel use projections

Version 2 of the MANE-VU+VA future year inventories was developed using AEO2010 (EIA2010). After the release of Version 2, AEO2011 was published (EIA2011). MARAMA reviewed the updated fuel forecasts and compared the AEO2010 and AEO2011 projections. Appendix B7 documents MARAMA's analysis. MARAMA calculated the difference in projected fuel usage between AEO2010 and AEO2011 for the residential, commercial, industrial, transportation, and electric power sector for the distillate fuel oil, residual fuel oil, coal, natural gas, and renewable fuel types. MARAMA identified thresholds for what constitutes a major change as follows:

- An increase or decrease of 1% or less is considered to be no change and did not warrant a change in the growth factors between Versions 2 and 3 of the inventory;
- An increase or decrease of between 1% and 5% is considered to be a minor change, and states agreed that these differences between AEO2010 and AEO2011 did not warrant a change in the growth factors between Versions 2 and 3 of the inventory;
- An increase or decrease above 5% is considered a major change, and warrants a change in the growth factors used in Version 3.

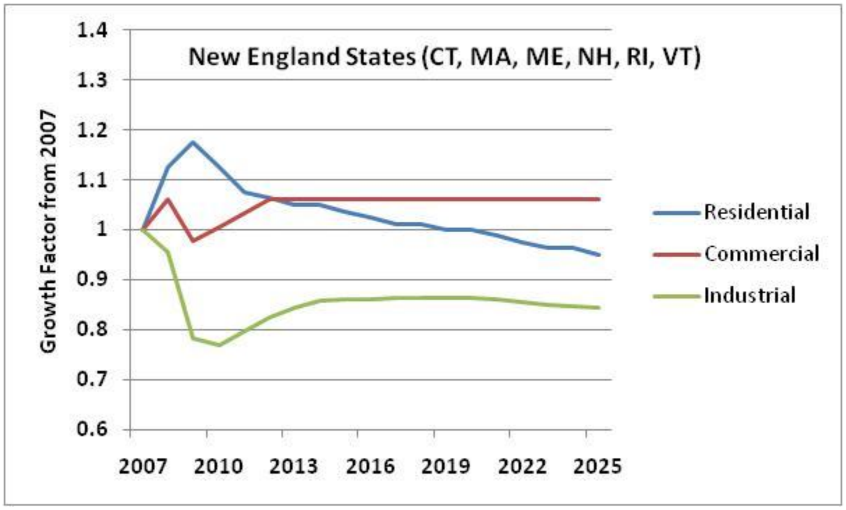
MARAMA recommended that the AEO2010 projections be retained for all residential, commercial, and industrial sector fuel use, except for industrial natural gas usage, where the AEO2011 projections will be used for Version 3 of the future year modeling inventory. New Jersey elected to use the more recent growth factors from AEO2011 instead of the AEO2010 growth factors for all area source fossil fuel use categories.

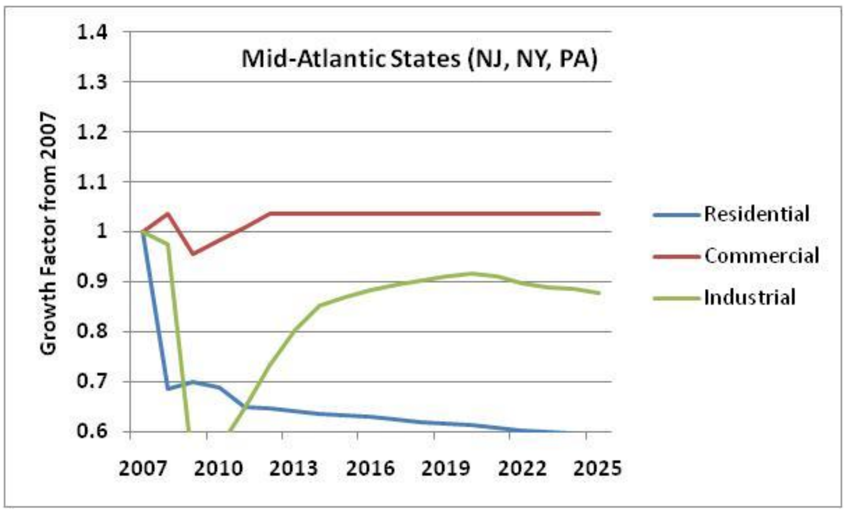
Exhibits 3.1 to 3.5 summarize the projected fuel use rates by source sector (residential, commercial, industrial, transportation) , AEO region, and fuel type for the years 2007 to 2025. The unusual growth in commercial residual oil use in the South Atlantic region could not be explained; Maryland elected to use manufacturing employment instead of the AEO2010 growth factor for commercial residual oil combustion, while Virginia and the District chose to assume flat growth in this sector.

3.2 POPULATION PROJECTIONS

States provided county-level 2007 populations and projections for future years. The historical and projection years varied from state-to-state, so values were interpolated, when necessary, to create population estimates for each year from 2007 to 2025. The population data were normalized to create growth factors from 2007 for each future year. For example, Delaware had a population of 861,087 in 2007 and the projected population in 2017 is 953,204, then the growth factor for 2017 is 953,204 / 861,087 = 1.107.

Population projections are provided in Appendix C. Exhibit 3.6 summarizes the population growth factors by state and AEO2010 region. Population is projected to grow in every state between 2007 and 2025. The population growth in the New England states varies significantly by state. Population growth in the South Atlantic states is projected to be much higher than in the New England and Mid-Atlantic states.





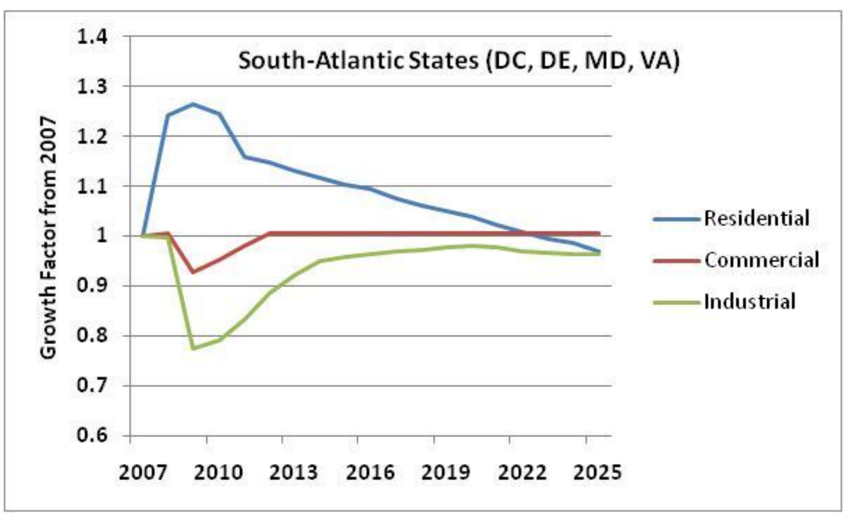


Exhibit 3.1 AEO2010 Growth Factors for Coal by AEO Region 2007 – 2025

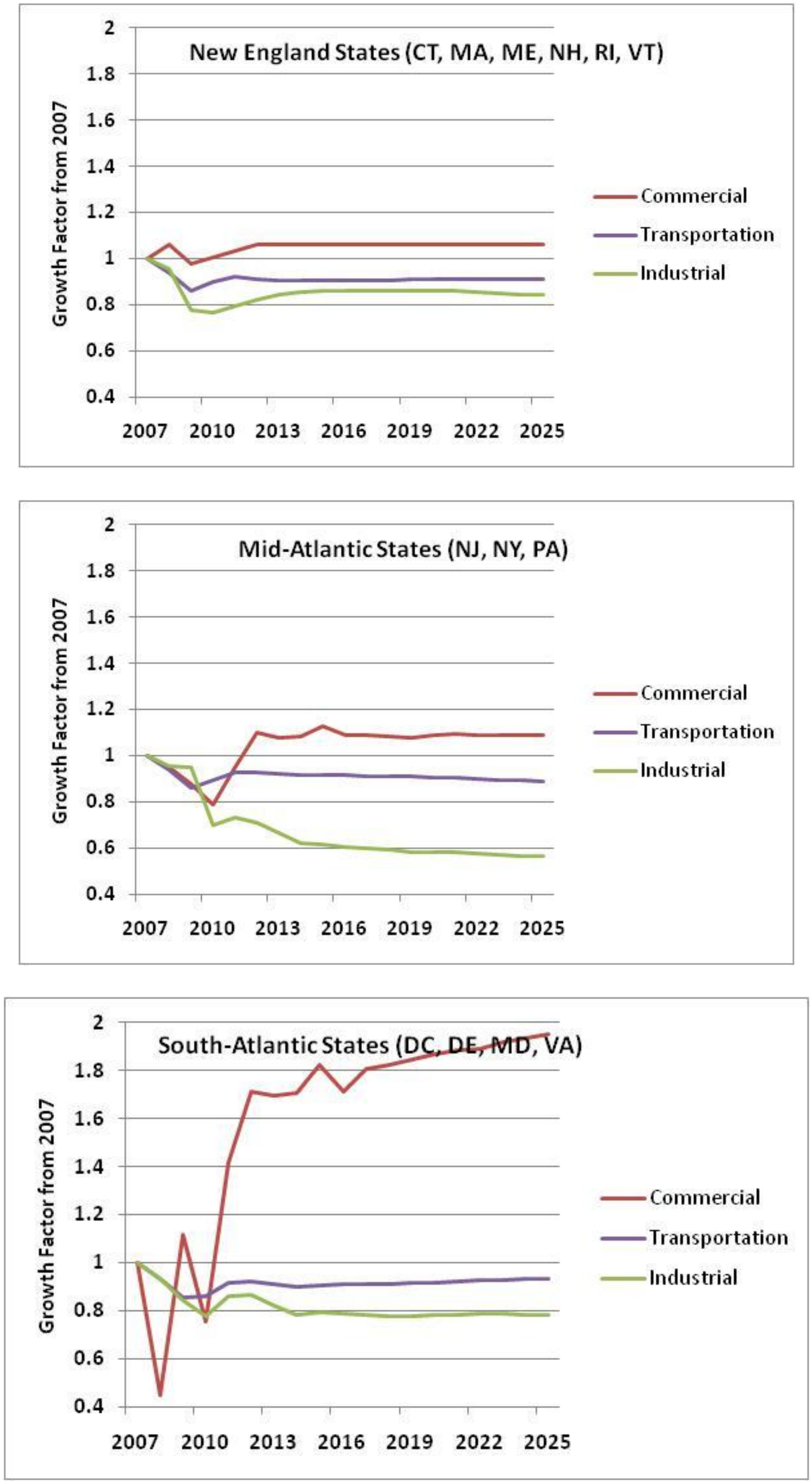
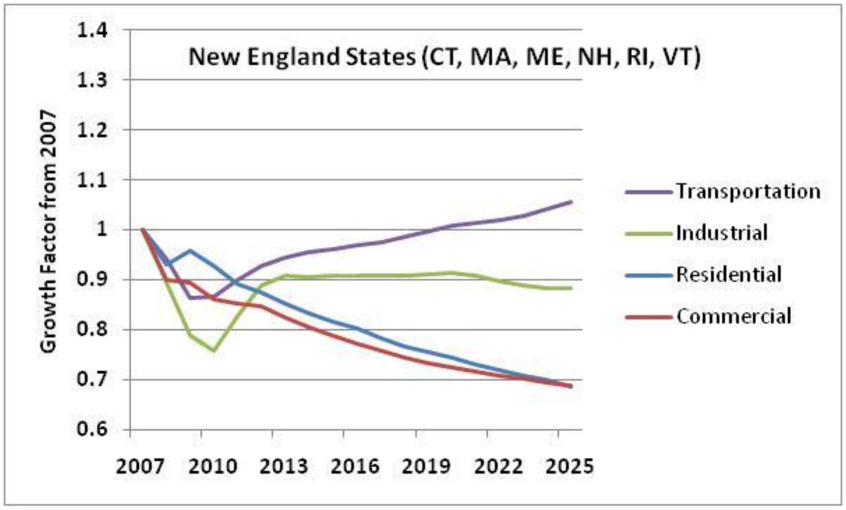
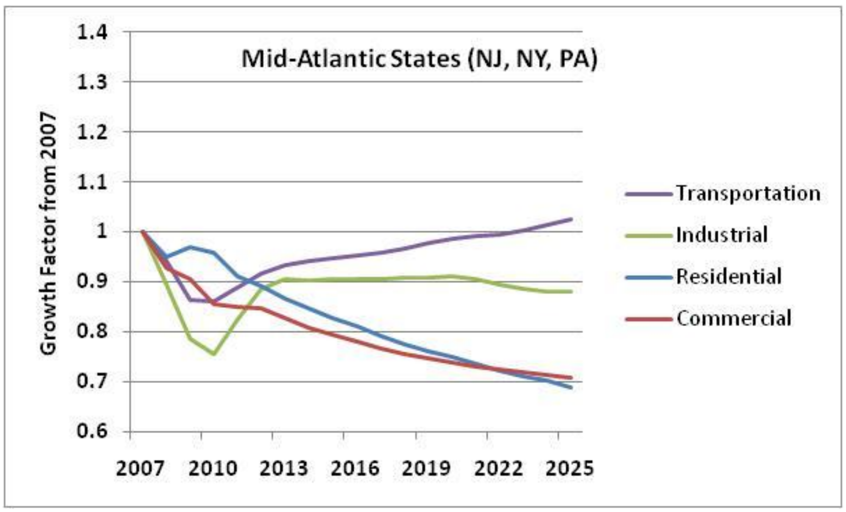


Exhibit 3.2 Growth Factors for Residual Oil by AEO Region 2007 – 2025





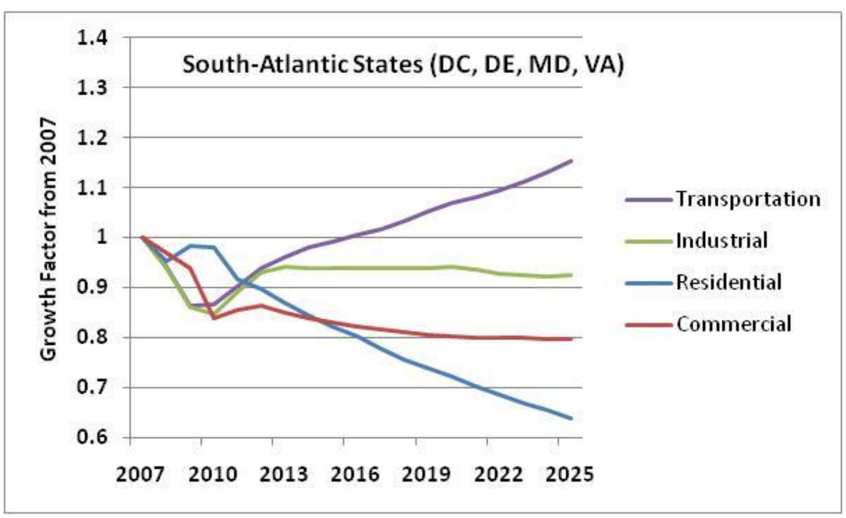
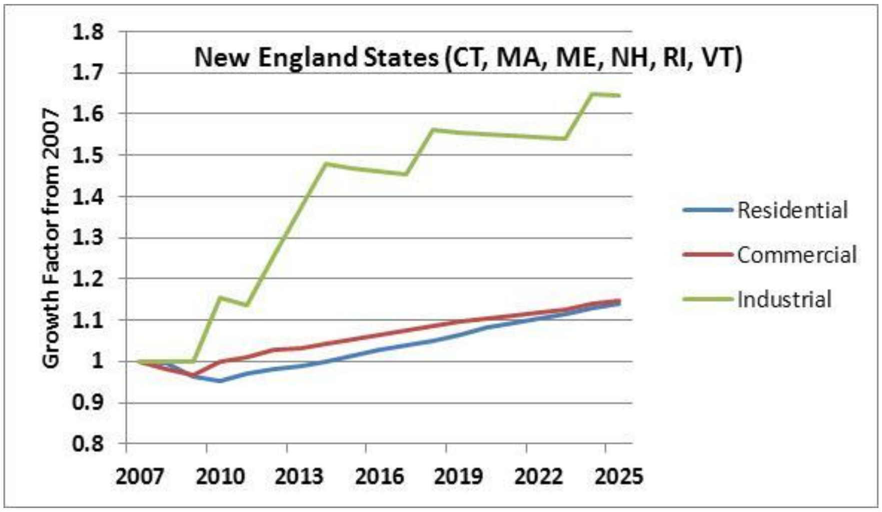
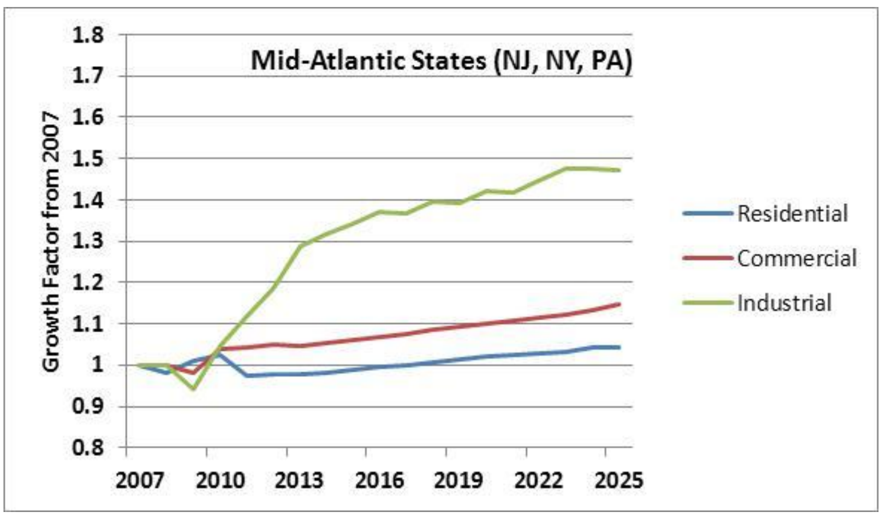


Exhibit 3.3 AEO2010 Growth Factors for Distillate Oil by AEO Region 2007 – 2025





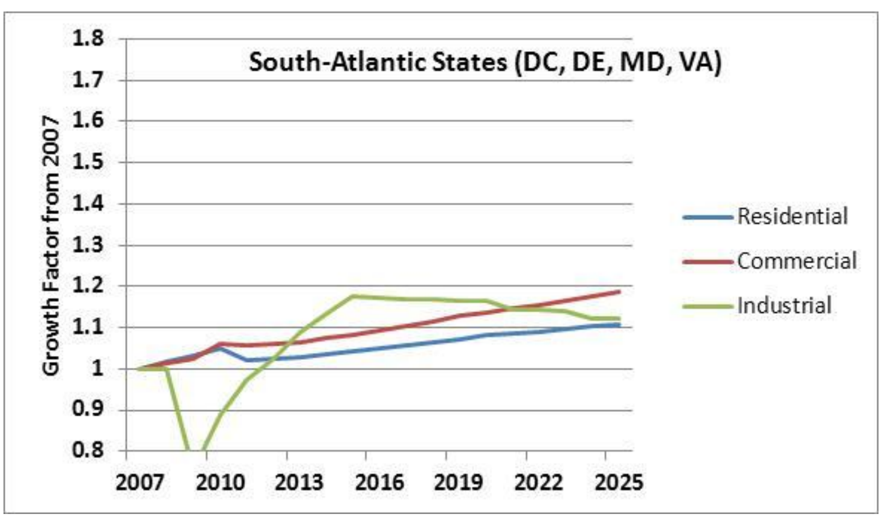
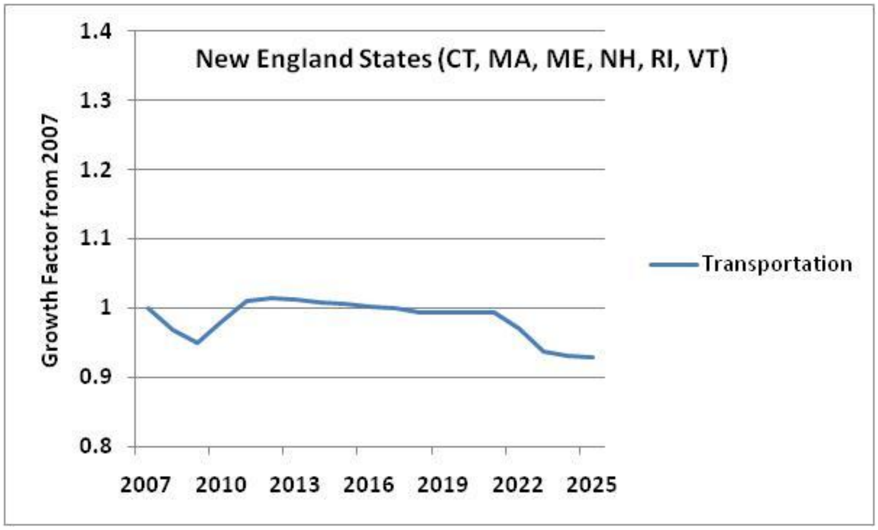
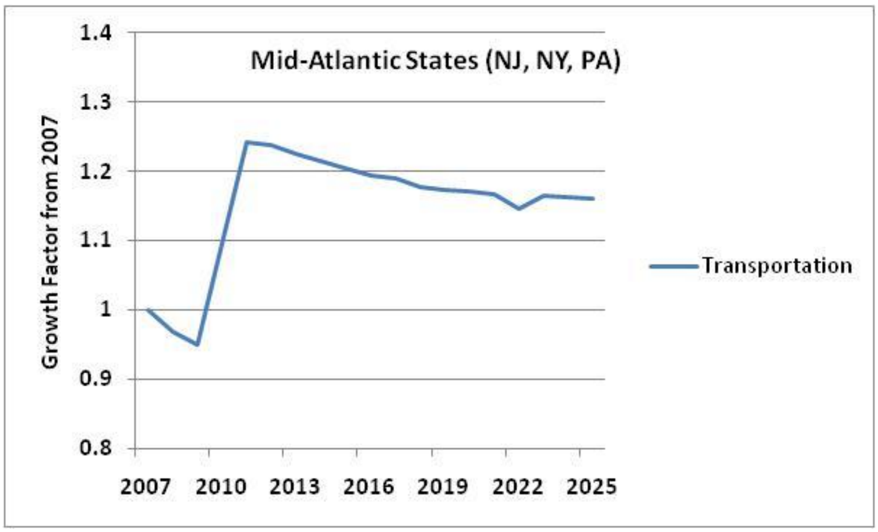


Exhibit 3.4 Growth Factors for Natural Gas by AEO Region 2007 – 2025
AEO2010 for Residential/Commercial, AEO2011 for Industrial





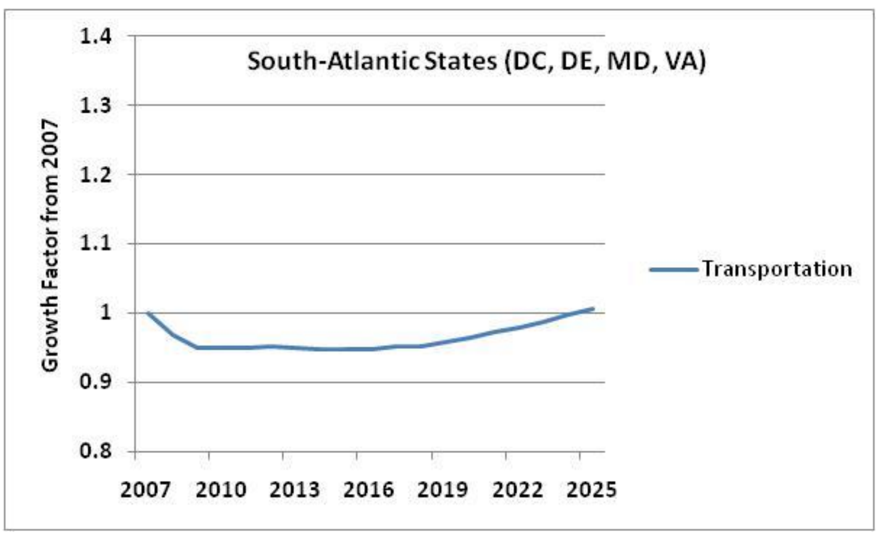


Exhibit 3.5 AEO2010 Growth Factors for Gasoline by AEO Region 2007 – 2025

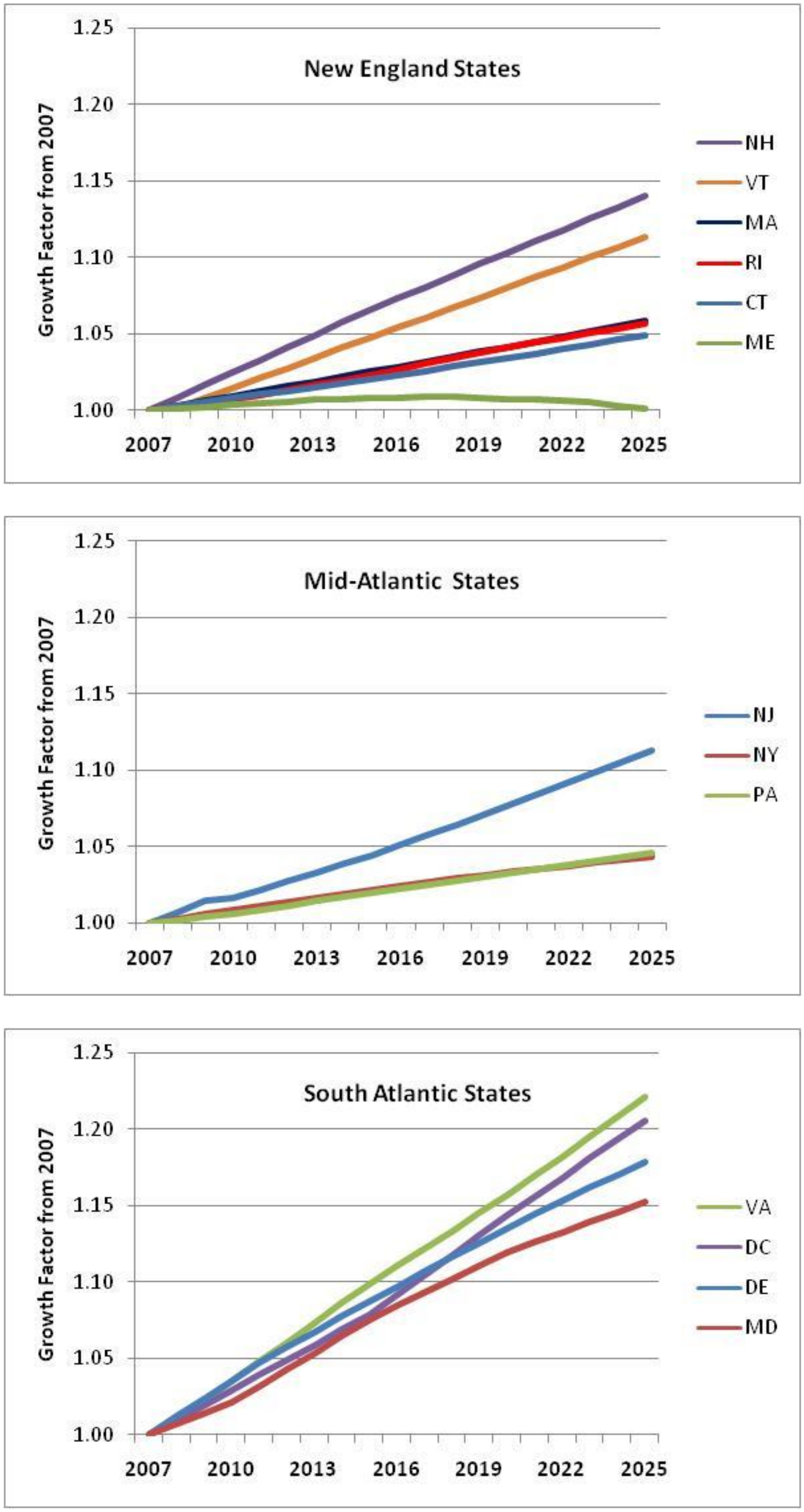


Exhibit 3.6 Population Growth Factors by AEO Region 2007 – 2025

3.3 EMPLOYMENT PROJECTIONS

Every two years, the federal Bureau of Labor Statistics produces long-term industry and occupation forecasts for ten future years and states are asked to do the same for their respective economies. The most recent projections from state Department's of Labor of for the period 2006 to 2016, most of which were published in 2008. These 10-year forecasts are updated every other year. The next set of state-specific projections will be for the period 2008 to 2018. Only the District of Columbia and Delaware were able to provide employment projections for 2008 to 2018; the 2008 to 2018 projections were not available for other states in time for use on this project. The employment projections are state-wide by 3-digit NAICS code. Employment projections are provided in Appendix D. Exhibit 3.7 summarizes the manufacturing employment (NAICS sector 31-33) growth factors by state and AEO2010 region. States in the Northeast / Mid-Atlantic region show a marked decrease in manufacturing employment from 2007 forward.

3.4 VEHICLE MILES TRAVELED PROJECTIONS

States developed projections of vehicle miles traveled (VMT) for 2007, 2017 and 2020 which were used as the growth factor for projecting emissions from re-entrained road dust from travel on paved roads (SCC 22-94-000-000). The 2007 and future year VMT are identical to those used in the MOVES modeling. Exhibit 3.8 shows the state level VMT growth between 2007 and 2020. Growth factors for years where VMT were not directly provided by states were estimated by a linear interpolation of available data. County-specific VMT projections are provided in Appendix E.

3.5 NO GROWTH ASSIGNMENT FOR CERTAIN AREA SOURCE CATEGORIES

For several area source categories, it seems reasonable that emissions would not change from the 2007 values. No growth was applied to the 2007 emissions for the area source categories shown in Exhibit 3.9.

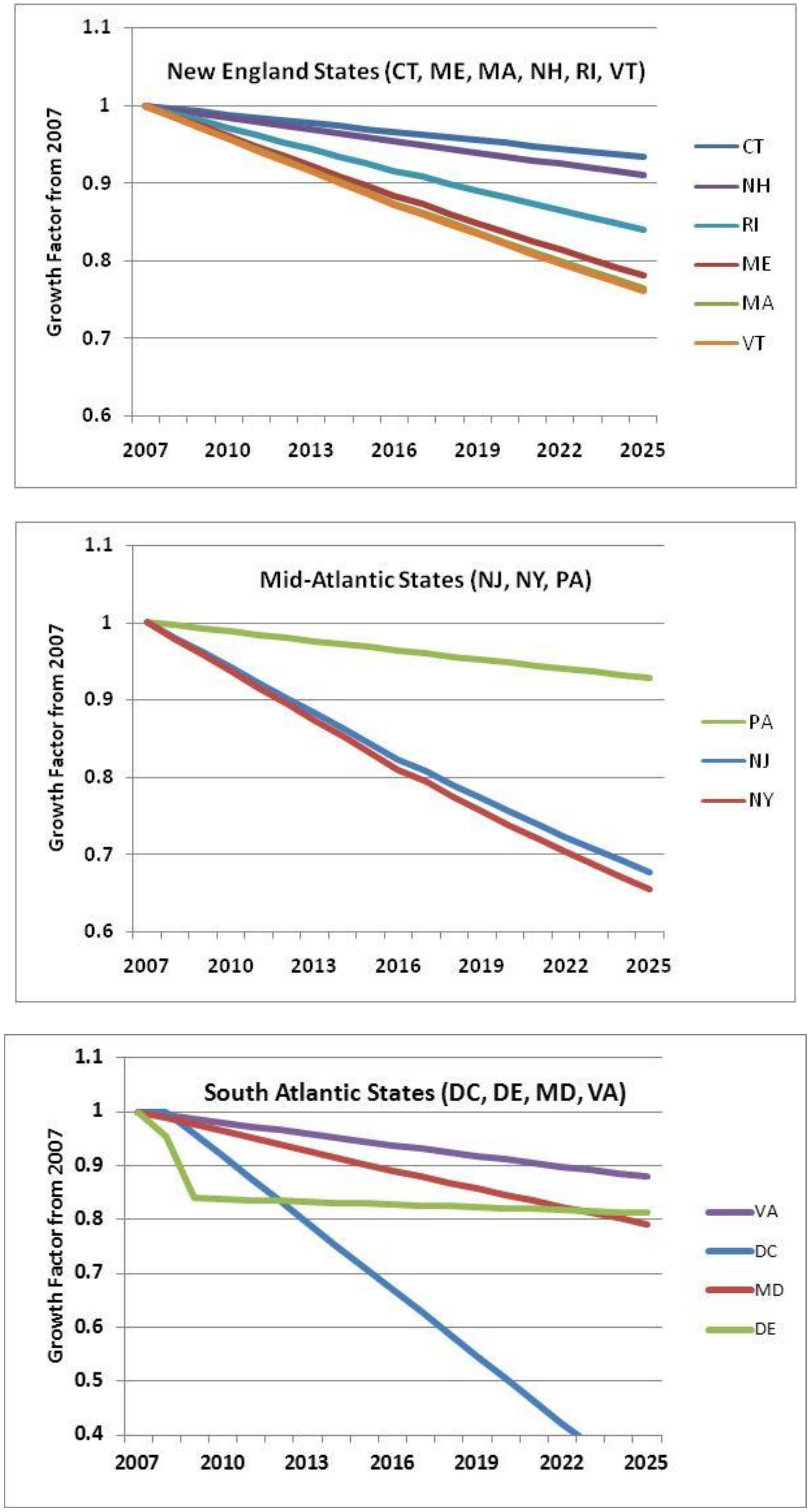


Exhibit 3.7. Manufacturing Employment Growth Factors by AEO Region 2007 - 2025

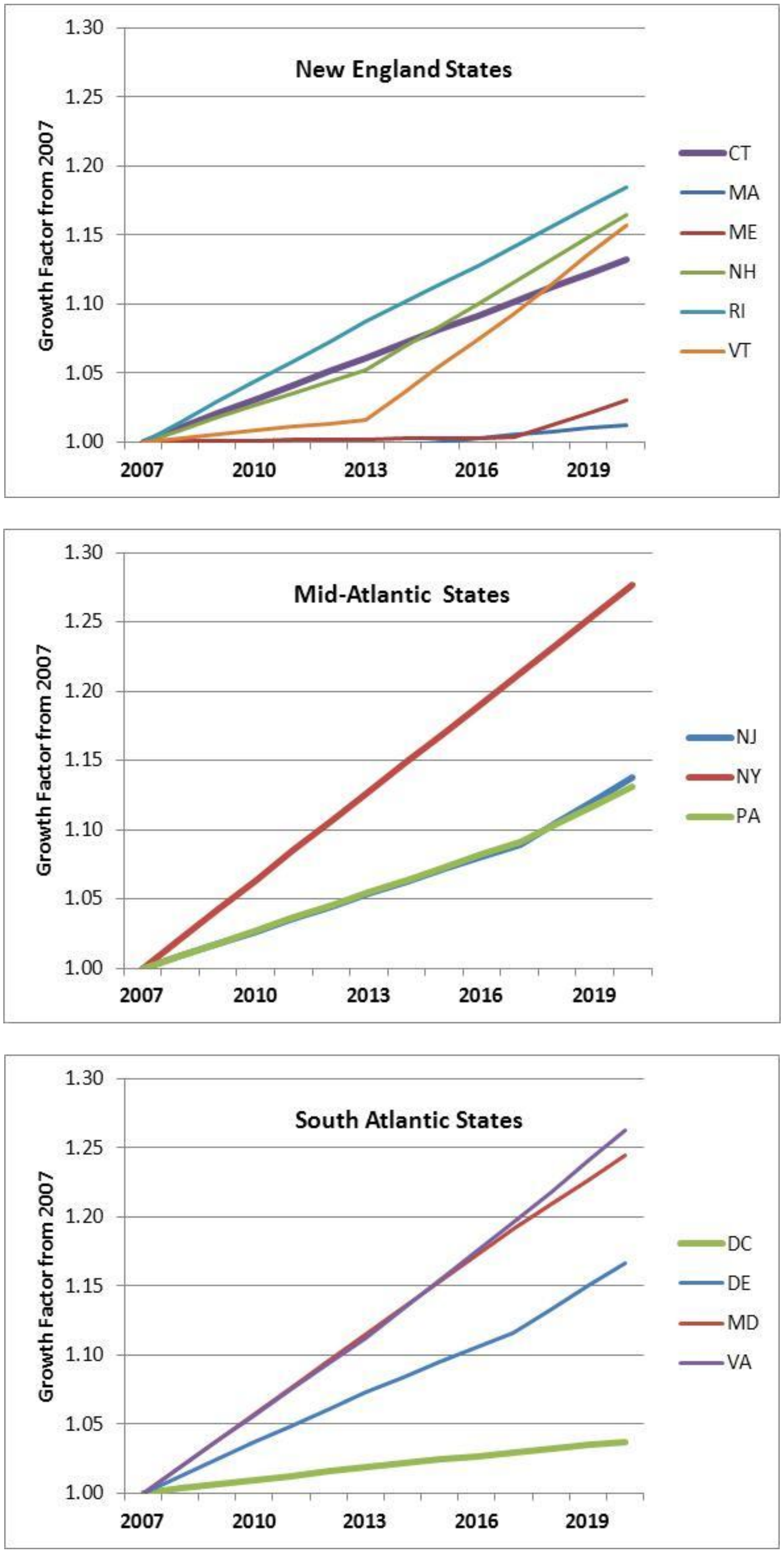


Exhibit 3.8 State VMT Growth Factors 2007 – 2020

Exhibit 3.9 Area Source Categories with No Growth Assignment

SCC	SCC Description
2296000000	Unpaved Roads /All Unpaved Roads /Total: Fugitives
2401008000	Surface Coating /Traffic Markings /Total: All Solvent Types
2461020000	Misc Non-industrial: Commercial /Asphalt Application: All Processes /Total: All
2461021000	Misc Non-industrial: Commercial /Cutback Asphalt /Total: All Solvent Types
2461022000	Misc Non-industrial: Commercial /Emulsified Asphalt /Total: All Solvent Types
2461023000	Misc Non-industrial: Commercial /Asphalt Roofing /Total: All Solvent Types
2601000000	On-site Incineration /All Categories /Total
2601010000	On-site Incineration /Industrial /Total
2601010000	On-site Incineration /Industrial /Total
2601020000	On-site Incineration /Commercial/Institutional /Total
2601020000	On-site Incineration /Commercial/Institutional /Total
2601030000	On-site Incineration /Residential /Total
2610000100	Open Burning /All Categories /Yard Waste - Leaf Species Unspecified
2610000400	Open Burning /All Categories /Yard Waste - Brush Species Unspecified
2610000500	Open Burning /All Categories /Land Clearing Debris (use 28-10-005-000 for Loggin
2610030000	Open Burning /Residential /Household Waste (use 26-10-000-xxx for Yard Wastes)
2610040400	Open Burning /Municipal (from residences, parks,other for central burn)
2660000000	Leaking Underground Storage Tanks /Leaking Underground Storage Tanks /Total: All
2680001000	Composting /100% Biosolids (e.g., sewage sludge, manure, mixtures of these matls
2680002000	Composting /Mixed Waste (e.g., a 50:50 mixture of biosolids and green wastes)
2806010000	Domestic Animals Waste Emissions /Cats /Total
2806015000	Domestic Animals Waste Emissions /Dogs /Total
2807020001	Wild Animals Waste Emissions /Bears /Black Bears
2807020002	Wild Animals Waste Emissions /Bears /Grizzly Bears
2807025000	Wild Animals Waste Emissions /Elk /Total
2807030000	Wild Animals Waste Emissions /Deer /Total
2807040000	Wild Animals Waste Emissions /Birds /Total
2810001000	Forest Wildfires - Wildfires – Unspecified
2810005000	Managed Burning, Slash (Logging Debris) /Unspecified Burn Method
2810010000	Human Perspiration and Respiration /Total
2810014000	Prescribed Burning /Generic - Unspecified land cover, ownership, class/purpose
2810015000	Prescribed Forest Burning /Unspecified
2810020000	Prescribed Rangeland Burning /Unspecified
2810030000	Structure Fires /Unspecified
2810035000	Firefighting Training /Total
2810050000	Motor Vehicle Fires /Unspecified
2810060200	Cremation /Animals
2810090000	Open Fire /Not categorized
2820010000	Cooling Towers /Process Cooling Towers /Total
2830000000	Catastrophic/Accidental Releases /All Catastrophic/Accidental Releases /Total
2830010000	Catastrophic/Accidental Releases /Transportation Accidents /Total

3.6 EPA 2020 PROJECTIONS FOR RESIDENTIAL WOOD AND LIVESTOCK

EPA's Office of Air Quality Planning and Standards (OAQPS) made available its 2020 emissions projections associated with its 2005-based v4 modeling platform. MARAMA used the OAQPS emission projection parameters for two area source sectors –livestock and residential wood combustion. OAQPS's methodology and data sources are summarized below (USEPA 2008a).

OAQPS projected residential wood combustion emissions are based on the expected increase in the number of low-emitting wood stoves and the corresponding decrease in other types of wood stoves. As newer, cleaner woodstoves replace older, more polluting stoves, there will be an overall reduction of emissions from this category. The approach used by OAQPS was developed as part of a modeling exercise to estimate the expected benefits of the woodstove changeout program. This methodology uses a combination of growth and control factors and is based on activity not pollutant. The growth and control are accounted for in a single factor for each residential wood SCC (certain SCCs represent controlled equipment, while other SCCs represent uncontrolled equipment). Control factors are indirectly incorporated based on which stove is used. The specific assumptions OAQPS made were:

- Fireplaces, SCC=2104008001: increase 1%/year;
- Old woodstoves, SCC=2104008002, 2104008010, 2104008051: decrease 2%/year;
- New woodstoves, SCC=2104008003, 2104008004, 2104008030, 2104008050, 2104008052 or 2104008053: increase 2%/year.

For the general woodstoves and fireplaces category (SCC 2104008000) OAQPS computed a weighted average distribution based on 19.4% fireplaces, 71.6% old woodstoves, 9.1% new woodstoves using 2002 Platform emissions for PM2.5. These fractions are based on the fraction of emissions from these processes in states that did not have the "general woodstoves and fireplaces" SCC in the 2002 NEI. This approach results in an overall decrease of 1.056% per year for this source category. Appendix F contains the residential wood projection data from OAQPS.

OAQPS based growth in emissions from livestock on projections of growth in animal population. Except for dairy cows and turkeys, the animal projection factors are derived from national-level animal population projections from the U.S. Department of Agriculture (USDA) and the Food and Agriculture Policy and Research Institute (FAPRI).

For dairy cows and turkeys OAQPS assumed that there would be no growth in emissions. This assumption was based on an analysis of historical trends in the number of such animals compared to production rates. While productions rates have increased, the number of animals has declined. In particular, the dairy cow population is projected to decrease in the future as it has for the past few decades; however, milk production is expected to increase over the same period. Thus, OAQPS does not believe that production forecasts provide representative estimates of the future number of cows and turkeys. Therefore, OAQPS did not use these forecasts for estimating future-year emissions from these animals. Note that the ammonia emissions from dairies are related to both animal population and nitrogen excretion. Appendix G contains the livestock projection data from OAQPS.

3.7 SCC, SIC, NAICS AND GROWTH PARAMETER CROSSWALK

Since the employment projections were based on 3-digit NAICS code, it was necessary to map NAICS codes to SCCs and SIC codes that were used by states. Employment projections at the more specific 4-digit or 6-digit NAICS codes were not available.

The first step for developing a comprehensive crosswalk between the different source classification codes (SCC, SIC, and NAICS codes) and emission activity growth indicators was to compile a complete list of the NAICS codes in the 2007 point source inventory. Some states use the SIC code while other use the NAICS code. Still other states use both the SIC and NAICS codes. When the NAICS code was not available SIC codes were converted to NAICS codes. The 6-digit NAICS code was truncated to a 3-digit code, which represents major industry subsectors of the economy. A U.S. Census Bureau document was used to perform this conversion (CENSUS 2000).

The next step was to review parameters that could be used as the emission activity growth indicator for each SCC or NAICS. We initially relied on two USEPA crosswalks (USEPA 2004a, USEPA 2004b) to match area and nonEGU point source SCCs to AEO2010 categories, employment NAICS codes, and population. The sector specific spreadsheets identify the growth parameter used to project emissions for each SCC.

3.8 FINAL GROWTH FACTORS FOR NONEGU / AREA SOURCES

The previous section described the growth factors initially recommended to project future year emissions inventories for area and non-EGU sources. Draft growth and control factors, and a draft technical support document, were circulated for review by MARAMA and state agencies. During the review, it was noted that several emissions categories show negative growth into the future, particularly categories related to fossil fuel combustion and manufacturing employment.

Many of the growth factors used to project emissions for area and non-EGU sources were based on the AEO2010 fuel consumption forecasts and state-level employment projections. The AEO2010 forecasts show declining trends for many fuel consumption sectors, especially industrial, residential, and commercial distillate fuel oil use. Similarly, the employment projections show declines in the predicted number of employees for many sectors of the economy. This is particularly true for the manufacturing sector, which is of interest because this sector is often associated with higher emissions than those for other sectors. By contrast, the employment projections show increasing trends in retail and service-related sectors. However, these sectors are not typically associated with significant emissions.

Predicted declines in fuel use and employment resulted in growth factors less than unity (i.e., represent negative growth) for many area and non-EGU point source categories. Consequently, for some categories, emissions are lower for the projected future years than for the base year, even before the application of control assumptions (i.e. the future "growth only" emissions are lower than the base year emissions). The MARAMA emissions inventory workgroup met on several occasions via conference calls and email exchanges to discuss whether the negative growth projections were realistic, and what additional assumptions should be made. A topic of particular concern is negative growth for non-EGU point sources versus the treatment of Emissions Reduction Credits (ERCs) in the future year inventories (see Section 3.9 for a discussion of how ERCs were handled).

One conclusion the workgroup reached is that growth methods and assumptions for area sources and non-EGUs should be as consistent as possible with those that are being used by the Eastern Regional Technical Advisory Committee (ERTAC) for the projection of emissions from EGUs. ERTAC is using AEO2010 as a starting point for estimating projected future year emissions, and their preliminary analysis shows some indications of negative growth. But their analysis is still on-going, and it is too early in the process to draw firm conclusions or make solid recommendations at this time regarding their work and its relationship to the area and non-EGU projections.

A few states cited the importance of the negative growth issue for non-EGUs and how it relates to their ERC programs which are critical to new businesses being able to locate in those states. Because businesses could apply for and sell ERCs at the level of the base year inventory, it would not be realistic to show negative growth for non-EGU point sources. During an economic downturn, a facility could shut down and sell its ERCs, making the effective level of future year emissions equal to (i.e. no lower than) the base year. Therefore, a recommended conservative approach for addressing negative growth for non-EGU point sources is to set a minimum growth rate of 1 (no growth).

During the July 23, 2010 conference call held to discuss the negative growth issue, state and agency representatives on the call were polled as to whether or not they felt that the current set of proposed growth factors - including the negative growth factors - were realistic for their state or district. In reply, some representatives mentioned that they have observed historic state-specific data that supports the trends displayed by the proposed growth factors. Other representatives mentioned that they feel comfortable with the growth factors and don't have a technical basis to change them or suggest others.

As a result of these discussions, each state provided guidance on how to handle projections when negative growth is indicated. Exhibit 3.10 shows the state recommendations for nonEGU point source, and Exhibit 3.11 shows the state recommendations for area sources. The sector specific spreadsheets identify the growth parameter used to project emissions for each SCC.

3.9 EMISSION REDUCTION CREDITS

Mulitple states (Connecticut, Maryland, Massachesetts, New Hampshire and New Jersey) added county level records account for account emission reduction credits (ERCs) issued to stationary sources pursuant to state regulations. States provided ERCs on a county-by-county basis. Fictitious facilities with an identifier of “OFFSET99999” were created for each county using SCC 23-99-000-000 (miscellaneous industrial processes: not elsewhere classified). Stack data were developed that assumed that emissions were released at the county centroid with an assumed release height of 10 feet. For the 2017 and 2020 inventories, ERC emissions were set to the amount of banked emissions available in 2007.

Delaware included the banked credits at the specific locations that they were generated.

Virginia does not have a formal banking and trading program. Virginia used growth rates of 1 for those SCCs in the point source emissions inventory that showed a negative growth. In addition, for units that have or are projected to have shut down, Virginia preserved the 2007 emissions in the inventory to account for potential use as offsets or credits.

Other states did not provide any additional information on how to account for ERCs.

Exhibit 3.10 State Recommendations to Address Negative Growth for the NonEGU Point Source Sector

State	AEO Growth Factors	Employment Growth Factors
CT	Use no growth (growth factor=1) when AEO growth is negative; otherwise use AEO2010 if positive growth	Use state DOL employment projections by 3-digit NAICS
DE	Use AEO2010 growth rates	For 2013, use state DOL employment projections by 3-digit NAICS; For 2017 and 2020, use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth
DC	Use AEO2010 growth rates	Use 2008-2018 employment projections; use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth
ME	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
MD	Do not use AEO growth factors Use MD DOL employment projections for industrial and commercial fuel use SCCs, unless employment growth rate is negative, in which case use no growth (growth factor=1)	Use updated state DOL employment projections by 3-digit NAICS; For DoD facilities, account for impacts of Base Realignment and Closure; For source that have closed, account for emission reduction credits
MA	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
NH	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
NJ	New Jersey submitted state specific growth factors. Used either state specific growth factors, no growth (growth factor=1) when state AEO growth is negative or AEO if positive growth	NJ submitted state specific growth factors. Used either state specific factors, no growth (growth factor=1) when state DOL employment growth is negative or employment if positive growth
NY	Use no growth (growth factor=1) when AEO growth is negative; otherwise use AEO2010 if positive growth	Use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth
PA	Use no growth (growth factor=1) when AEO growth is negative; otherwise use AEO2010 if positive growth	Use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth
RI	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
VT	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS
VA	Use no growth (growth factor=1) when AEO growth is negative; otherwise use AEO2010 if positive growth	Use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth

Exhibit 3.11 State Recommendations to Address Negative Growth and Other Growth Factors for the Area Source Sector

State	AEO Growth Factors	Employment Growth Factors	Population Growth Factors
CT	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
DE	Use AEO2010 growth rates; no growth for suspect AEO2010 projection for commercial / institutional residual oil	For 2013, use state DOL employment projections by 3-digit NAICS; For 2017 and 2020, use no growth (growth factor=1) when employment growth is negative; otherwise use employment if positive growth	Use county-level population projections
DC	Use AEO2010 growth rates; no growth for suspect AEO2010 projection for commercial / institutional residual oil	Use DOL employment growth for NAICS 722 for food and kindred product SCC; otherwise use orginial estimates	For dry cleaning, use employment growth for NAICS 812 instead of population
ME	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
MD	Not using AEO2010; used employment for commercial & insititurional fuel; used housing units for residential fuel	Provided updated employment projections; changed xwalk between NAICS code and SCC for selected source categories	Provided updated population projections by county
MA	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
NH	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
NJ	NJ submitted state specific growth factors. For fuel combustion categories only, used AEO2011 growth rates except for residual oil (use no growth)	NJ submitted state specific growth factors.	NJ submitted state specific growth factors and provided population projections by county
NY	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
PA	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
RI	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
VT	Use AEO2010 growth rates	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections
VA	Use AEO2010 growth rates; no growth for suspect AEO2010 projection for commercial / institutional residual oil	Use state DOL employment projections by 3-digit NAICS	Use county-level population projections

4.0 AREA SOURCE CONTROL FACTORS

Control factors were developed to estimate post-2007 emission reductions resulting from on-the-books regulations and proposed regulations/actions. Control factors were developed for the following national and regional measures:

- Federal Rules Affecting Area Sources
- Federal MACT Rules
- Control Technique Guidelines
- OTC Model Rules

These control programs are discussed in the following subsections. The control factors used for area sources are provided in V3_3 Area_07_17_20.xlsx

4.1 FEDERAL RULES AFFECTING AREA SOURCES

USEPA made available its 2020 emissions projections associated with its 2005-based v4 modeling platform (USEPA 2010b). USEPA accounted for control strategies for four area source categories. These categories, and their treatment in the emission projection inventories, are described below:

- <u>Woodstoves</u> - As noted in Section 3.6, USEPA developed projection factors to account for the replacement of retired woodstoves that emit at pre-new source performance standard (NSPS) levels with lower-emitting woodstoves. We used USEPA's latest methodology which uses a combination growth and control factor and is based on activity and not pollutant. The growth and control are accounted for in a single factor for specific SCCs that account for the turnover from pre-NSPS to post-NSPS woodstove.
- <u>Landfills</u>: USEPA estimated a 75% reduction in VOC emissions from municipal solid waste landfills. However, since the compliance date for this standard was January 2004, no post-2007 reductions were applied to the MANE-VU+VA projection inventory since the emission reductions from this MACT standard should be reflected in the 2007 inventory and not as an additional post-2007 credit.
- <u>Vehicle Refueling (Stage II):</u> VOC emissions from the gasoline Stage II (vehicle refueling) are affected by two emission control programs. Many areas in the region have Stage II vapor recovery rules that were in effect prior to 2007 that require the capture of gasoline vapors generated when a motor vehicle fuel tank is filled at a gasoline station. The vapors are transferred from the fuel tank in the vehicle to the storage tank at the station as the vehicle fuel tank is filled. Beginning with the 1998 model year, USEPA established a phase-in schedule requiring vehicles to

incorporate on-board equipment to capture the gasoline vapor emissions from refueling. These controls, referred to as on-board refueling vapor recovery (ORVR), have been required on the vast majority of gasoline powered motor vehicles since the 2006 model year. VOC emissions for 2020 from vehicle refueling were estimated by NESCAUM using the MOVES model (NESCAUM2011). VOC emissions for 2017 were estimated by interpolating between the MOVES 2007 and 2020 results. Appendix H contains the VOC control efficiencies by county used in the MOVES modeling for displacement losses and for spillage losses.

- Portable fuel containers (PFCs): VOC emissions from PFCs will be reduced due to the federal regulation controlling air toxic emissions from mobile sources promulgated in 2007. Most northeastern and mid-Atlantic states had already adopted similar regulations prior to the federal rule. Refer to the OTC 2006 model rules subsection later in this document (Section 4.4.6) for a discussion of the approach for accounting for VOC emission reductions from PFCs.

4.2 FEDERAL MACT RULES

USEPA developed guidance for estimating VOC and NOx emission changes from MACT Rules (USEPA 2007b). We reviewed the guidance to identify possible area source controls associated with the federal maximum achievable control technology (MACT) standards for controlling hazardous air pollutants (HAPs). Although designed to reduce HAPs, many of the MACT standards also provide a reduction in criteria air pollutants. The USEPA document provides an estimate of the percent reduction in VOC and NOx from each standard, and the compliance date for the standard. This information was used to determine whether the MACT standard provided post-2007 emission reductions. For example, if a compliance period of a MACT standard was 2007 or earlier, then we assumed that the emission reductions from the MACT standard should be reflected in the baseline year and not as an additional post- 2007 credit.

Only one area source category was listed in the USEPA guidance document - municipal solid waste landfills. Since the compliance date for this standard was January 2004, no post-2007 reductions were applied since the emission reductions from the MACT standard should be reflected in the 2007 inventory and not as an additional post-2007 credit.

USEPA has or will soon develop MACT standards for about 70 area source categories. We reviewed USEPA’s 2020 emissions projections described in the previous section and found that USEPA did not include emission reductions from recent area source MACT standards. We conducted a review of USEPA’s air toxic website and found that USEPA determined that many area source MACT standards would result in nationwide reductions in criteria air pollutants in addition to the reductions in HAP emissions. However, many states in the MANE-VU+VA region already have emission standards for many categories that are as stringent as the Federal area source MACT standards. For example, many states in the MANE-VU+VA region already have requirements as stringent as the Gasoline Distribution MACT and GACT (generally achievable control technology) standards, and little additional VOC reductions would be realized in the region. Given the resources allocated to this project, it was beyond the scope to conduct an analysis of the area source MACT requirements and state-by-state emission regulations to determine whether there would be emission reductions resulting from the area source MACT standards.

The only exception to the above discussion of area source MACT standards pertains to the recently promulgated rules for reciprocating internal combustion engines (RICE). USEPA made available an estimate of the percent reduction in emissions attributable to the RICE MACT rule in 2012 and 2014 (USEPA 2010c). The USEPA 2014 estimates shown in Exhibit 4.1 were used for the MANE-VU+VA 2017 and 2020 inventories.

4.3 RECENT CONTROL TECHNIQUE GUIDELINES

Control Techniques Guidelines (CTGs) are documents issued by USEPA to provide states with recommendation on VOC controls from a specific product or source category in an ozone nonattainment area. USEPA issued new or updated CTGs for 13 VOC categories in 3 groups during 2006, 2007 and 2008 (USEPA 2008b). The categories are:

- 2006 CTGs
    - Flat Wood Paneling Coatings
    - Industrial Cleaning Solvents
    - Flexible Package, Lithographic and Letterpress Printing
- 2007 CTGs
    - Large Appliance Surface Coating
    - Metal Furniture Coatings
    - Paper Film and Foil Coatings
- 2008 CTGs
    - Miscellaneous Metal Parts Coatings
    - Plastic Parts Coatings
    - Auto and Light-duty Truck Assembly Coatings
    - Fiberglass Boat Manufacturing
    - Miscellaneous Industrial Adhesives

States indicated that they expected very littleadditional reductions from these new or amended CTGs. Therefore, no emission reductions were included in the inventory.

Exhibit 4.1 USEPA Estimated Percent Reductions for RICE MACT Standard by 2014

SCC	CO	NOx	PM10	PM2.5	VOC	SCC Description
2101004000	12.42		7.57	7.57	30.85	Electric Utility;Distillate Oil;Total: Boilers and IC Engines
2101004002	16.9		11.81	11.81	33.78	Electric Utility;Distillate Oil;All IC Engine Types
2101006000	11.07	7.97			16.71	Electric Utility;Natural Gas;Total: Boilers and IC Engines
2101006002	15.47	9.87			21.24	Electric Utility;Natural Gas;All IC Engine Types
2102004000	12.42		7.57	7.57	30.85	Industrial;Distillate Oil;Total: Boilers and IC Engines
2102006000	11.07	7.97			16.71	Industrial;Natural Gas;Total: Boilers and IC Engines
2102006002	15.47	9.87			21.24	Industrial;Natural Gas;All IC Engine Types
2103004000	12.42		7.57	7.57	30.85	Commercial/Institutional;Distillate Oil;Total: Boilers and IC Engines
2103006000	11.07	7.97			16.71	Commercial/Institutional;Natural Gas;Total: Boilers and IC Engines
2199004000	12.42		7.57	7.57	30.85	Area Source Fuel Combustion;Distillate Oil;Total: Boilers and IC Engines
2199004002	16.9		11.81	11.81	33.78	Area Source Fuel Combustion;Distillate Oil;All IC Engine Types
2199006000	11.07	7.97			16.71	Area Source Fuel Combustion;Natural Gas;Total: Boilers and IC Engines
2310000000	19.86	12.53			23.87	Oil and Gas Production: All Processes;Total: All Processes
2310000220	19.86	12.53			23.87	Oil and Gas Exploration/Production; Drill Rigs
2310000440	19.86	12.53			23.87	Oil and Gas Exploration/Production; Saltwater Disposal Engines
2310001000	19.86	12.53			23.87	Oil and Gas Production: SIC 13; On-shore;Total: All Processes
2310002000	19.86	12.53			23.87	Oil and Gas Production: SIC 13; Off-shore;Total: All Processes
2310020000	19.86	12.53			23.87	Oil and Gas Production: SIC 13;Natural Gas;Total: All Processes
2310020600	19.86	12.53			23.87	Oil and Gas Exploration and Production;Natural Gas;Compressor Engines
2310023000	19.86	12.53			23.87	Oil and Gas Exploration and Production;Natural Gas;Cbm Gas Well - Dewatering Pump Engines

4.4 OTC MODEL RULES FOR AREA SOURCES

The Ozone Transport Commission (OTC) developed model rules for member states in 2001 for several area source categories: consumer products, architectural and industrial maintenance (AIM) coatings, portable fuel containers (PFCs), mobile equipment repair and refinishing, solvent cleaning, and industrial boilers. In 2006 the OTC introduced model rules for two additional area source categories (adhesives/sealants and asphalt paving), more stringent requirements for consumer products, portable fuel containers, and industrial boilers. In 2009/2010, the OTC recommended additional controls for autobody refinishing operations, consumer products, AIM coatings, and small new natural gas-fired boilers. In addition, MANE-VU states committed to the use of low sulfur home heating, distillate and residual fuel oil. Exhibit 4-2 briefly describes the OTC and MANE-VU control measures affecting area sources that have been recommended for adoption by the states in the OTR.

Individual states are in various stages of adopting the OTC recommendations into their rules and SIPs. OTC's status reports were reviewed to identify each state's adoption status (OTC 2009, OTC 2011a, OTC2011b). To obtain further clarification, states were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the OTC model rule or recommendation and whether credit for each rule was already accounted for in the 2007 inventory.

To evaluate the impact of the rules currently in place as well as the potential adoption of all control measures by all states except Virginia, the state Air Directors specified that two emission control scenarios should be developed as follows:

- Existing Controls - this scenario represents the best estimates for the future year, accounting for all in-place controls that are fully adopted into federal or individual state regulations or SIPs.
- Potential New OTC Controls – this scenario accounts for all of the emission reductions from the existing control scenario plus new state or regional measures that are under consideration by the OTC or individual states. This is a "what if" scenario that assumes that all states in the MANE-VU+VA region except Virginia will adopt all new OTC control measures under consideration by 2017. It does not include any potential new federal control measures that are under consideration.

The following paragraphs describe the control factors applied for each control measure by state and future year.

Exhibit 4.2 Summary of Area Source OTC Control Measures

Source Category	Pollutants	Description
Consumer Products	VOC	OTC 2001. Specified VOC content limits for certain categories that are more stringent than Federal limits OTC 2006. Included additional products and more restrictive VOC limits for certain products OTC 2009/2010. Specified more restrictive VOC limits for 14 existing consumer product categories and three new categories
Architectural and Industrial Maintenance Coatings	VOC	OTC 2001. Specified VOC content limits for certain categories that are more stringent than Federal limits OTC 2009/2010. Eliminated 15 categories (replaced by new categories or deemed unnecessary), added 10 new categories, and specified stricter VOC limits for 19 categories
Portable Fuel Containers	VOC	OTC 2001. Provided container design specifications to reduce emissions from spillage and evaporation OTC 2006. Revised and clarified design specifications and added kerosene containers and utility jugs.
Mobile Equipment Repair and Refinishing	VOC	OTC 2001. Required use of high efficiency coating application equipment, spray gun cleaning equipment that minimizes solvent loss, and enclosed spray gun cleaning. OTC 2009/2010. Limited the VOC content of coatings more stringent than the Federal limits and the VOC content of cleaning solvents
Solvent Cleaning	VOC	OTC 2001. Established hardware and operating requirements for specified vapor cleaning machines, and solvent volatility limits and operating practices for cold cleaners
Adhesives and Sealants	VOC	OTC 2006. Provided VOC content limits and other restrictions on adhesives used primarily by commercial and industrial users.
Asphalt Paving	VOC	OTC 2006. Suggested VOC content limits for emulsified and cutback asphalts use for road paving
NOx ICI Boiler Controls	NOx	OTC 2001. Recommended NOx emission rate limits for industrial boilers greater than 5 mmBtu/hour OTC 2006. Recommended lower NOx emission rate limits for industrial, commercial, and institutional boilers OTC 2010. Recommended national NOx controls for ICI boilers
Small Natural Gas-Fired Boilers	NOx	OTC 2009/2010. Recommended NOx emission rate limits for new boilers less than 5 mmBtu/hr
Low Sulfur Fuel Oil	SO2	MANE-VU 2006. Recommends sulfur content limits for home heating oil, distillate oil, and residual oil

4.4.1 OTC Model Rule for Adhesives/Sealants

VOC emissions in this category are primarily from commercial applications such as floor covering installation (carpet and wood flooring), roof installations and repair and upholstery shops. The category also includes industrial applications such as wood product manufacturers. Adhesives in small containers are not included in this category but are regulated under the consumer products regulations.

The OTC 2006 model rule for industrial adhesives and sealants is based on the reasonably available control technology (RACT) and best available retrofit control technology (BARCT) determination by the California Air Resources Board (CARB) developed in 1998. The OTC model rule regulates the application of adhesives, sealants, adhesive primers and sealant primers by providing options for appliers to either use a product with a VOC content equal to or less than a specified limit or to use add-on controls to achieve an equivalent reduction. The emission reduction benefit estimation methodology for area sources is based on information developed and used by CARB as discussed in their 1998 RACT report. A 64.4 percent reduction in VOC emissions was estimated for SCC 24-40-020-000.

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. State-by-state recommendations are shown in Exhibit 4.3.

It should be noted that not all states account for emissions from this category in a separate area source inventory. Some states, based on information received from USEPA, excluded this category because the emissions to some extent may be accounted for in the area source commercial and consumer products category or in the nonEGU point source inventory.

Exhibit 4.3 State Recommendations for OTC Industrial Adhesives/Sealants Rule

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	64.4	0	64.4	0
DE	No	64.4	0	64.4	0
DC	No	n/a	n/a	n/a	n/a
ME	No	64.4	0	64.4	0
MD	No	64.4	0	64.4	0

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
MA	No	64.4	0	64.4	0
NH	No	n/a	n/a	n/a	n/a
NJ	No	64.4	0	64.4	0
NY	No	64.4	0	64.4	0
PA	No	64.4	0	64.4	0
RI	No	n/a	n/a	n/a	n/a
VT	n/a	n/a	n/a	n/a	n/a
VA	No	n/a	n/a	n/a	n/a

* n/a means SCC 24-40-020-000 not included in 2007 inventory; see text for further discussion

4.4.2 OTC Model Rules for Architectural and Industrial Maintenance Coatings

On August 14, 1998, USEPA issued the final version of their National Volatile Organic Compound Emission Standards for Architectural Coatings under Section 183(e) of the Clean Air Act. This final rule applied only to manufacturers and importers of architectural coatings, and set VOC content limits for 61 coating categories. This rule specifically allowed states or local governments to adopt more stringent coating limits.

The OTC adopted an AIM model rule more stringent than the national rule, and based primarily on the 2000 CARB suggested control measure (SCM) for AIM coatings. The 2001 OTC model rule was estimated to provide a 31 percent incremental reduction in VOC emissions compared to the Federal Part 59 rule and was applied to the following SCCs:

- 24-01-001-000 All Architectural Coatings
- 24-01-002-000 Architectural Coatings Solvent Based
- 24-01-003-000 Architectural Coatings Water Based
- 24-01-008-000 Traffic Markings
- 24-01-100-000 Industrial Maintenance Coatings
- 24-01-200-000 Other Special Purpose Coatings

The OTC 2009/2010 model rule is an update of the 2001 model rule. It is based the 2007 CARB suggested control measure. The OTC 2009/2010 rule includes new categories which were defined in the 2007 CARB measure and revised limits for several coating categories In addition to the revised limits in the 2007 CARB SCM, the OTC model rule also includes a more stringent VOC limit for the Industrial Maintenance (IM) coating category that was included in the 2000 CARB SCM. The 2000 CARB SCM proposed a limit of 250 g/L with an optional limit of 340 g/L for colder climates. The 2002 OTC model rule included the 340 g/l due to concerns about the ability to comply in the colder northeast. Because of the success of implementing the revised limit throughout California and the advent of t-butyl acetate as a delisted solvent, OTC believes a 250 g/L VOC limit is now feasible and has included this new lowered limit in the 2010 model rule.

The CARB SCM data was used to estimate a 34.4 percent reduction for architectural coatings and a 9.7 percent reduction for traffic markings. For industrial maintenance coatings, a 26.5 percent reduction was estimated based on lowering the VOC content limit from 340 g/L to 250 g/L. Other specialty coatings are another form of industrial high performance maintenance coatings (IM), so the IM control factor was also used for the other specialty coatings SCC.

States were polled to determine whether they had adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. Many states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the rule was not accounted for in their 2007 inventory. State-by-state recommendations to account for the AIM rule are shown in Exhibit 4.4.

Exhibit 4.4 State Recommendations for OTC AIM Rule

State	Is OTC 2001 Rule Accounted for in 2007 Inventory*	Incremental VOC Percent Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	31 AIM	34.4 ARCH 9.7 TM 26.5 IM	31 AIM	34.4 ARCH 9.7 TM 26.5 IM
DE	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
DC	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
ME	No	31 AIM	34.4 ARCH 9.7 TM	31 AIM	34.4 ARCH 9.7 TM

State	Is OTC 2001 Rule Accounted for in 2007 Inventory*	Incremental VOC Percent Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
			26.5 IM		26.5 IM
MD	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
MA	No	31 AIM	34.4 ARCH 9.7 TM 26.5 IM	31 AIM	34.4 ARCH 9.7 TM 26.5 IM
NH	No	0 AIM	55.5 ARCH 37.7 TM 49.4 IM	0 AIM	55.5 ARCH 37.7 TM 49.4 IM
NJ	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
NY	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
PA	Yes	0 AIM	34.4 ARCH 9.7 TM 26.5 IM	0 AIM	34.4 ARCH 9.7 TM 26.5 IM
RI	No	31 AIM	34.4 ARCH 9.7 TM 26.5 IM	31 AIM	34.4 ARCH 9.7 TM 26.5 IM
VT	No	0 AIM	55.5 ARCH 37.7 TM 49.4 IM	0 AIM	55.5 ARCH 37.7 TM 49.4 IM
VA-NVA	Yes	0 AIM	0 AIM	0 AIM	0 AIM
VA-FRD	No	31 AIM	0 AIM	31 AIM	0 AIM
VA-Other	No	0 AIM	0 AIM	0 AIM	0 AIM

AIM – includes all AIM coatings listed below:
ARCH – architectural
TM - traffic markings
IM - industrial maintenance

VA-NVA includes the cities/counties in the Northern Virginia emission control area
VA-FRD includes the cities/counties in the Fredericksburg emission control area
VA-Other includes cities/counties in Virginia not listed above

4.4.3 OTC Model Rule for Asphalt Paving

OTC Resolution 06-02 recommends that states establish rules to achieve a 20 percent reduction in VOC emissions from the application and use of emulsified and cutback asphalt. The reductions apply to the following SCCs:

- 24-61-021-000 Cutback Asphalt
- 24-61-022-000 Emulsified Asphalt

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. Some states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the rule was not accounted for in their 2007 inventory. State recommendations to account for the asphalt paving recommendation are shown in Exhibit 4.5.

Exhibit 4.5 State Recommendations for OTC Cutback and Emulsified Asphalt Paving Recommendation

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Percent Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	20	0	20	0
DE	Yes	0	0	0	0
DC	No	0	20	0	20
ME	No emissions in inventory	0	0	0	0
MD	No	0	20	0	20
MA	No	20	0	20	0
NH	No	0	20	0	20
NJ	No	56% Cutback 25% Emulsified	0	56% Cutback 25% Emulsified	0
NY	No	20	0	20	0
PA	No	0	20	0	20
RI	No	20	0	20	0
VT	No emissions in inventory	0	0	0	0
VA-NVA	No	0	0	0	0
VA-Other	No	0	0	0	0

4.4.4 OTC Model Rules for Consumer Products

Several states began regulating the VOC content of consumer products in the early 1990s. The USEPA promulgated a national rule in 1998 (40CFR, Part 59, Subpart C). Both the California Air Resources Board (CARB) and the OTC states have periodically updated their state rules to obtain VOC reductions beyond those required by the federal rule. Following the lead of CARB, the OTC 2001 model rule for consumer products adopted more stringent VOC content limits for certain categories. The OTC 2006 model rule modified the OTC 2001 model rule based on amendments adopted by CARB in July 2005 to include additional products and more stringent VOC limits for certain products. CARB amended their rules again in 2006 and the OTC 2010 model rule is based on those amendments.

The OTC 2010 model amendments have more restrictive VOC limits for 14 existing consumer product categories (15 including subcategories) and three new categories (five including subcategories) will be regulated for the first time with VOC limits. The OTC 2010 model rule amendments also clarify or modify previously defined or regulated categories. The model rules also contained optional prohibitions on the use of chlorinated toxic compounds in certain consumer product categories. CARB adopted these provisions simultaneous with their VOC limits to address the use of non-VOC chlorinated solvent use increasing as they are used as replacement compounds.

The VOC percentage reduction from the various rules and amendments are summarized in Exhibit 4.6. The emissions reductions from the latest OTC consumer products rule update used information developed by CARB for its 2006 amendments. The OTC estimated a 4.8 percent reduction of the total consumer products inventory for states that included CARB's ban of chlorinated toxic compounds in brake cleaners, and an estimated 3.3 percent reduction of the total consumer products inventory for states that did not include this ban.

States reported VOC emissions from consumer products inventory in two different manners – using an aggregated SCC or subcategory SCCs, as follows:

Aggregated SCC:	24-60-000-000 Consumer Products, All Products
	24-65-000-000 Consumer Products, All Products
Disaggregated SCCs:	24-60-100-000 Consumer Products, Personal Care Products
	24-60-200-000 Consumer Products, Household Products
	24-60-400-000 Consumer Products, Auto Aftermarket Products
	24-60-500-000 Consumer Products, Coatings
	24-60-600-000 Consumer Products, Adhesives and Sealants
	24-60-800-000 Consumer Products, FIFRA Products
	24-60-900-000 Consumer Products, Misc. Products

Exhibit 4.6 VOC Emission Factors for Consumer Products

Uncontrolled Emission Factor:	=	7.84 lbs/capita
Emission Factor after 1998 Federal Rule:	=	7.06 lbs/capita
Percent Reduction from 1998 Federal Rule compared to uncontrolled	=	100%* (7.84 - 7.06) / 7.84
	=	9.95%
Emission Factor after 2001 OTC Rule	=	6.06 lbs/capita
Percent Reduction from 2001 OTC Rule compared to Federal Rule	=	100%* (7.06 - 6.06) / 7.06
	=	14.2%
Emission Factor after 2006 OTC Rule	=	5.94 lbs/capita
Percent Reduction from 2006 OTC Rule compared to OTC 2001 Rule	=	100%* (6.06 -5.94) / 6.06
	=	2.0%
Emission Factor after 2010 OTC Rule (without brake cleaner chlorinated toxic ban)	=	5.745 lbs/capita
Percent Reduction from 2010 OTC Rule compared to OTC 2006 Rule	=	100%* (5.94 – 5.745) / 5.94
	=	3.3%
Emission Factor after 2010 OTC Rule (with brake cleaner chlorinated toxic ban)	=	5.655 lbs/capita
Percent Reduction from 2010 OTC Rule compared to OTC 2006 Rule	=	100%* (5.94 – 5.655) / 5.94
	=	4.8%

The reductions shown above were applied to the above SCCs based on each state's adoption of the various rules and amendments as well as the decision with respect to the ban on chlorinated toxic compounds used in brake cleaners. States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the OTC 2006 recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. For the 2001 OTC rule, some states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the OTC 2001 rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the OTC 2001 rule was not accounted for in their 2007 inventory. None of the states have accounted for the OTC 2006 rule in their 2007 inventories. State-by-state recommendations to account for both the OTC 2001 and 2006 consumer products rules are shown in Exhibit 4.7.

Exhibit 4.7 State Recommendations for OTC 2001 and 2006 Consumer Products Rules

State	Is 2001 Rule Accounted for in 2007 Inventory	Is 2006 Rule Accounted for in 2007 Inventory	VOC Percent Reduction to use in:			
			2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	No	15.9	4.8	15.9	4.8
DE	Yes	No	2.0	4.8	2.0	4.8
DC	No	No	2.0	4.8	2.0	4.8
ME	No	No	15.9	4.8	15.9	4.8
MD	Yes	No	2.0	4.8	2.0	4.8
MA	No	No	15.9	4.8	15.9	4.8
NH	No	No	14.2	5.2	14.2	5.2
NJ	Yes	No	2.0	4.8	2.0	4.8
NY	Yes	No	2.0	4.8	2.0	4.8
PA	Yes	No	2.0	4.8	2.0	4.8
RI	No	No	15.9	4.8	15.9	4.8
VT	No	No	0	18.6	0	18.6
VA-NVA	Yes	No	2.0	0	2.0	0
VA-FRD	No	No	15.9	0	15.9	0
VA-RCH	No	No	15.9	0	15.9	0
VA-Other	No	No	0	0	0	0

NH indicated that their amendments to include the OTC 2006 recommendations won't be completed in time to include in the OTB/OTW inventory

4.4.5 OTC Model Rules for Mobile Equipment Repair and Refinishing

The USEPA promulgated a national rule in 1998 (40CFR, Part 59, Subpart B) to limit the VOC content of coatings usedin the refinishing of automobiles. The federal standards were estimated to reduce nationwide emissions of VOC by about 37 percent compared to uncontrolled 1998 emissions. The 2002 OTC model rule established requirements for using higher efficiency coating application equipment, such as high volume-low pressure paint guns, using spray gun cleaning equipment that minimizes solvent loss, and enclosed spray gun cleaning. The Federal VOC limits on the paints was maintained in the model rule. An incremental control effectiveness of 38 percent was estimated for the OTC 2001 model rule (post-1998 federal standard emissions).

The 2009 OTC model rule for Motor Vehicle and Mobile Equipment Non-assembly Line Coating Operations (2009 OTC MVME model rule) seeks to limit the VOC content in coatings and cleaning solvents used in motor vehicle and mobile equipment non-assembly line coating operations. The 2009 OTC MVME model rule is an update of the 2002 OTC MERR model rule. The OTC developed the 2009 OTC MVME Model Rule using the CARB 2005 Suggested Control Measure (SCM) for Automotive Coatings as a guideline. The CARB 2005 SCM estimated a 65 percent reduction in VOC emissions from 2002 CARB baseline emissions, which are post-1998 federal standard emissions. Similar reductions of 65 percent are expected from implementation of the 2009 OTC MVME Model Rule.

A few OTC states adopted the 2002 OTC model rule and accounted for the 38 percent reduction in the 2007 MANEVU+VA inventory. Other states adopted the 2002 OTC model rules after 2007, so the reduction was not included in 2007 but was included in the 2017/2020 "on-the-books" inventory. Still other states have not yet adopted the 2002 OTC model rule. Exhibit 4.8 summarizes the percent reductions that will be applied based on the adoption status of each state:

Exhibit 4.8 VOC Emission Reductions for Auto Refinishing

State Rule Adoption Status	VOC Reduction:	
	2017/2020 Existing	2017/2020 Potential
Accounted for 2002 OTC rule in 2007 inventory Will adopt 2009 OTC rule by 2017	0 %	65 %
Did not account for 2002 OTC rule in 2007 inventory Did account for 2002 OTC rule in 2017/2020 OTB inventory Will adopt 2009 OTC rule by 2017	38 %	65 %
Did not account for 2002 OTC rule in 2007 inventory Did not account for it in 2017/2020 OTB inventory Will adopt 2009 OTC rule by 2017	0 %	78.3 %

The reductions have traditionally been applied to the following area source SCCs:

24-01-005-000 Auto Refinishing / All Solvent Types

24-01-005-500 Auto Refinishing / Surface Preparation Solvents

24-01-005-600 Auto Refinishing / Primers

24-01-005-700 Auto Refinishing / Top Coats

24-01-005-800 Auto Refinishing / Clean-up Solvents

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. Many states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the rule was not accounted for in their 2007 inventory. State-by-state recommendations to account for the auto refinishing rule are shown in Exhibit 4.9.

Exhibit 4.9 State Recommendations for OTC Auto Refinishing Rule

State	Is OTC 2001 Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	Yes	0	65	0	65
DE	Yes	0	65	0	65
DC	No	38	65	38	65
ME	No	38	65	38	65
MD	Yes	Yes	0	65	0
MA	No	0	78.3	0	78.3
NH	No	0	78.3	0	78.3
NJ	Yes	0	65	0	65
NY	Yes	0	65	0	65
PA	Yes	0	65	0	65
RI	Yes	0	65	0	65
VT	No emissions in inventory	0	0	0	0
VA-NVA	Yes	0	0	0	0
VA-FRD	No	38	0	38	0
VA-Other	No	0	0	0	0

4.4.6 OTC Model Rules for Portable Fuel Containers

In 2001, the OTC developed a model rule to control VOC emissions from portable fuel containers. The 2001 model rule was based on the technical work conducted by California Air Resources Board (CARB) for developing California's 2000 fuel container rule. Several, but not all, of the MANEVU+VA states adopted regulations which became effective prior to 2007.

After OTC developed its model rule in 2001, CARB realized that its original study and rule had some defects and decided to conduct further studies and research on fuel containers. Based on its new studies, CARB revised its rule twice. In 2006, the OTC developed a second model rule for PFCs to reflect the CARB revisions. Thereafter, USEPA developed a federal rule in 2007 which included, among other things, requirements for portable fuel containers equivalent to OTC's 2006 requirements.

The federal requirements became effective on January 1, 2009. States have analyzed the federal rule and determined that the federal rule has requirements that are essentially equivalent to the OTC 2006 model rule. These new federal requirements will reduce hydrocarbon emissions from uncontrolled fuel containers by approximately 75 percent. Assuming a 10-year turnover to compliant cans, only 10 percent of the existing inventory of PFCs will comply with the new requirements in 2010. Therefore, only 10 percent of the full emission benefit estimated by USEPA will occur by 2010 – the incremental reduction will be about 7.5 percent in 2010. In 2013, there will be a 40 percent turnover to compliant cans, resulting in an incremental reduction of about 60 percent. By 2017, the will be 80 percent penetration to compliant PFCs, resulting in an incremental reduction of 58 percent in 2018. By 2020, there will be 100 percent penetration to compliant PFCs, resulting in an incremental reduction of 75 percent in 2020.

The reductions apply to the following SCCs:

- 25-01-011-xxx Residential PFCs
- 24-01-012-xxx Commercial PFCs

States were polled to determine the status of PFC regulations in each state. Some states have adopted a rule that would achieve reductions equivalent to the 2001 or 2006 OTC rules. Other states will rely exclusively on the Federal rule. State-by-state recommendations to account for the OTC and federal PFC rules are shown in Exhibit 4.10.

Exhibit 4.10 State Recommendations for OTC and Federal Portable Fuel Container Rules

State	Compliance Date for OTC 2001 Rule	Compliance Date for OTC 2006 Rule	Rely on Federal Rule?	VOC Percent Reduction to use in:			
				2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	May 2004	Jun 2008	No	81	0	81	0
DE	Jan 2003	Apr 2010	Yes	75	0	78	0
DC	Dec 2004	Feb 2012	Yes	79	0	81	0
ME	Jan 2004	n/a	Yes	77	0	80	0
MD	May 2003	Jan 2009	No	76	0	79	0
MA	n/a	n/a	Yes	77	0	85	0
NH	n/a	Jan 2008	No	85	0	85	0
NJ	Jan 2005	Jan 2009	No	83	0	83	0
NY	Jan 2005	Jan 2010	Yes	79	0	82	0
PA	Jan 2005	n/a	Yes	75	0	78	0
RI	n/a	n/a	Yes	77	0	85	0
VT	n/a	n/a	Yes	77	0	85	0
VA-NVA	Jan 2005	Aug 2010	Yes	79	0	82	0
VA-FRD	Jan 2008	Aug 2010	Yes	83	0	85	0
VA-RCH	n/a	n/a	Yes	77	0	85	0
VA-Oth	n/a	n/a	Yes	77	0	85	0

4.4.7 OTC Model Rule for Solvent Cleaning

The OTC model rule establishes hardware and operating requirements for specified vapor cleaning machines, and solvent volatility limits and operating practices for cold cleaners. An incremental control effectiveness of 66 percent was estimated for the OTC model rule relative to the base case. The reductions apply SCCs in the 24-15-xxx-xxx series (Degreasing All Industries and Processes). States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2001 OTC recommendations and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. Many states adopted the rule prior to 2007 and have already accounted for the reductions attributable to the rule in their 2007 inventories. Other states had compliance dates after 2007 and the effect of the rule was not accounted for in their 2007 inventory. State-by-state recommendations to account for the solvent cleaning rule are shown in Exhibit 4.11.

Exhibit 4.11 State Recommendations for 2001 OTC Solvent Cleaning Rule

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	66	0	66	0
DE	Yes	0	0	0	0
DC	No	66	0	66	0
ME	No	66	0	66	0
MD	Partially	30	0	30	0
MA	No	66	0	66	0
NH	No	0	66	0	66
NJ	Yes	0	0	0	0
NY	Yes	0	0	0	0
PA	Yes	0	0	0	0
RI	No	66	0	66	0
VT	n/a	0	66	0	66
VA-NVA	Yes	0	0	0	0
VA-Other	No	0	0	0	0

4.4.8 OTC Model Rules for ICI Boilers

In Resolution 06-02, the OTC Commissioners recommended that OTC member states pursue as necessary and appropriate state-specific rulemakings or other implementation methods to establish emission reduction percentages, emission rates or technologies for ICI boilers based on guidelines that varied by boiler size and fuel type.

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in NOx emissions should be applied in 2017 and 2020. All but one state indicated that they have not adopted rules for area sources equivalent to the 2006 OTC recommendations. New Jersey specified that they have post-2007 ICI boiler rules that reduce NOx emissions and provided the estimates of the reductions in NOx emissions by SCC resulting from boiler tuneup requirements, as shown in Exhibit 4.12:

Exhibit 4.12 Area Source Emission Reductions from New Jersey ICI Boiler NOx Rules

SCC	Source Category	Percent Reduction from Tuneups 2007-2017	Rule Effectiveness	Rule Penetration	Overall Percent Reduction 2007-2017
2102004000	Industrial Distillate	25%	80%	30%	6%
2102005000	Industrial Residual	25%	80%	30%	6%
2102006000	Industrial Natural Gas	25%	80%	30%	6%
2102007000	Industrial LPG	25%	80%	30%	6%
2103004000	Commercial Distillate	25%	80%	30%	6%
2103005000	Commercial Residual	25%	80%	30%	6%
2103006000	Commercial Natural Gas	25%	80%	30%	6%
2103007000	Commercial LPG	25%	80%	30%	6%

Other states indicated that they will likely depend on USEPA national rule for possible inclusion in the BOTW inventory. OTC Resolution 10-01 (June, 2010) called on USEPA for national regulations for ICI boilers. The guidelines from OTC Resolution 06-02 shown in Exhibit 4.13 were used to estimate potential area source NOx reductions for the "what if" control scenario for all states in the MANE-VU+VA inventory except New Jersey and Virginia.

Exhibit 4.13 OTC Resolution 06-02 Guidelines for ICI Boiler NOx Rules

Boiler Size (mmBtu/hr)	NOx Percent Reduction from Base Emissions by Fuel Type			
	Natural Gas	#2 Fuel Oil	#4/#6 Fuel Oil	Coal
<25	10	10	10	10
25 to 50	50	50	50	50*
50 to 100	10	10	10	10*
100 to 250	76	40	40	40*
>250	**	**	**	**

* Resolution 06-02 did not specify a percent reduction for coal; for modeling purposes, the same percent reduction specified for #4/#6 fuel oil was used for coal.

** Resolution 06-02 specified the reduction for > 250mmBtu/hour boilers to be the "same as EGUs of similar size." The OTC Commissioners have not yet recommended an emission rate or percent reduction for EGUs. As a result, no reductions for ICI boilers > 250 mmBtu/hour were included in the potential controls inventory.

Since the above guidelines vary by boiler size and fuel type, the specific percent reduction applied to an area source category depends on the SCC and design capacity of the source. The SCC identifies the fuel type (for example, SCC 21-02-004-xxx describes distillate oilfired industrial boilers, SCC 21-02-006-xxx describes natural gas-fired industrial boilers). The area source inventory does not contain any information on the sizes of the units included in the inventories. To apportion area source emissions to the boiler size ranges listed above, we used data from an Oak Ridge National Laboratory study (EEA 2005). We used the national estimates of boiler capacity by size range to calculate the percentage of total boiler capacity in each size range. Since the Oak Ridge report distinguished between industrial boilers and commercial/institutional boilers, we developed separate profiles for industrial boilers and for commercial/institutional boilers. We used these boiler size profiles to calculate weighted average percent reductions industrial boilers by fuel type and commercial/institutional boilers by fuel type, as follows:

- 34.5 percent reduction in NOx emissions from industrial boilers, all fuel types
- 28.1 percent reduction in NOx emissions from commercial/institutional boilers, all fuel types

Appendix I contains the data used to develop the NOx control factors for area source ICI boilers.

4.4.9 OTC Model Rule for New, Small, Natural Gas-fired Boilers

The provisions of this model rule limit NOx emissions from new natural gas-fired ICI and residential boilers, steam generators, process heaters, and water heaters greater than 75,000 BTUs and less than 5.0 million BTUs. This model rule may be implemented as a manufacturing restriction, a sales restriction, a use restriction, or a combination of these restrictions. Each implementing state agency will choose the entities to regulate after consideration of the agency's compliance assurance and enforcement practices and policies.

The emission limits of this model rule were developed from requirements now in effect in certain jurisdictions, including: (1) San Joaquin Valley Air Pollution Control District Rule 4308 for boilers, steam generators, process heaters and water heaters with maximum rated heat input capacity equal to or greater than 75,000 Btu/hr and up to but less than 2.0 million Btu/hr; (2) San Joaquin Valley Air Pollution Control District Rule 4307 for gas-fired and liquid fuel-fired boilers, steam generators, and process heaters with maximum rated capacity of 2.0 million Btu/hr up to and including 5.0 million Btu/hr; and (3) similar rules adopted by other California Air Pollution Control Districts and the State of Texas.

Since the OTC model rule is based on SJVAPCD Rules 4307 and 4308, one method for estimating potential NOx reductions for the OTC states from both Rule 4307 and Rule 4308 is to compare the natural gas usage in the San Joaquin Valley to the natural gas usage in the OTC states and calculate the proportional NOx reductions.

The SJV 4308 Rule, Final Staff Report estimated NOx reductions of 2.0 annual average tons per day (730 tons per year), and the 2008 SJV 4307 Rule Proposal estimated NOx reductions of 1.15 annual average tons per day (420 tons per year). The total reduction from both rules was estimated to be 3.15 tons per day (1,150 tons per year) after a 15-year period for complete turnover to compliant equipment. These SJV data were used to calculate a ton per year emission reduction, assuming implementation begins in 2014, as summarized in Exhibit 4.14 and further documented in Appendix J.

Exhibit 4.14 NOx Control Factors for the OTC Rule for New, Small, Natural Gas-fired Units

State	Percent Reduction in NOx Emissions from Residential and Commercial Natural Gas Use	
	2017	2020
CT	5.0%	8.4%
DE	6.1%	10.1%
DC	2.3%	3.9%
ME	0.0%	0.0%
MD	3.2%	5.4%
MA	5.3%	8.8%
NH	7.1%	11.8%
NJ	3.5%	5.9%
NY	5.1%	8.5%
PA	4.7%	7.8%
RI	7.0%	11.7%
VT	3.1%	5.1%
VA	0%	0%

4.4.10 MANE-VU Low Sulfur Fuel Oil Strategy

MANE-VU developed a low sulfur fuel oil strategy to help states develop Regional Haze SIPs (MANE_VU 2007). The sulfur in fuel oil recommendations are shown in Exhibit 4.15 and vary by state, type of fuel oil, and year of implementation.

Exhibit 4.15 MANE-VU Low Sulfur Fuel Oil Strategy

Inner Zone States (DE, NJ, NY, PA)		
Fuel Oil Type	**Sulfur Content 2012**	**Sulfur Content 2016**
Distillate	500 ppm	15 ppm
#4 Residual	0.25 %	0.25 %
#6 Residual	0.3 to 0.5 %	0.3 to 0.5 %
Outer Zone States (CT, DC, MA, MD, ME, NH, RI, VT)		
Fuel Oil Type	**Sulfur Content 2014**	**Sulfur Content 2018**
Distillate	500 ppm	15 ppm
#4 Residual	n/a	0.25 to 0.5 %
#6 Residual	n/a	0.5 %

Each state was polled and asked to provide guidance as to when, if at all, the MANE-VU strategy would be incorporated into their state rules. States were also asked to provide the 2007 sulfur contents for each fuel type by county in order to calculate the percent reduction in emissions for the future years. Three states (MD, NJ, and NY) have adopted or are committed to adopting the strategy into their rules. The reductions for these three states were accounted for in the "existing controls" inventory. All other jurisdictions indicated that not enough regulatory development progress has been made to include the reductions in future years with absolute certainty. The potential reductions for these states were accounted for in the "potential new controls" inventory. One state (VA) has no plans to adopt the low sulfur fuel oil strategy. The percent reductions by fuel type and county are contained in Appendix K.

5.0 NONEGU POINT SOURCE CONTROL FACTORS

Control factors were developed to estimate post-2007 emission reductions resulting from on-the-books regulations and proposed regulations/actions. Control factors were considered for the following national and regional measures:

- Federal Rules Affecting NonEGU Point Sources
- Control Technique Guidelines
- OTC Model Rules

These control programs are discussed in the following subsections. The control factors used for nonEGU point sources are provided in V3_3 NonEGU_07_17_20.xlsx.

5.1 FEDERAL ACTIONS AFFECTING NONEGU POINT SOURCES

USEPA made available its 2020 emissions projections associated with its 2005-based v4 modeling platform (USEPA 2010a). These categories, and how they were accounted for in the MANE-VU+VA emission projection inventories, are described below:

- MACT Standards - USEPA developed guidance for estimating VOC and NO_x emission changes from MACT Rules (USEPA 2007b). We reviewed the guidance to identify nonEGU source controls associated with MACT standards for controlling HAPs. The information concerning MACT compliance periods was used to determine whether the MACT standard resulted in post-2007 emission reductions. Because major source categories had a compliance period of 2007 or earlier, we assumed that the emission reductions from the MACT standard should be reflected in the baseline year and not as an additional post- 2007 credit. The only exception to the above discussion of area source MACT standards pertains to the recently promulgated rules for reciprocating internal combustion engines. USEPA made available an estimate of the percent reduction in emissions attributable to the RICE MACT rule in 2012 and 2014 (USEPA 2010b). These reductions by SCC are shown in Exhibit 5.1. The USEPA 2014 estimates were used for the MANE-VU+VA 2017, 2020 and 2025 inventories.

- Industrial, Commercial, and Institutional Boilers and Process Heaters MACT Standard - USEPA' s 2020 control factor file identified a number of solid fuel-burning SCCs for which they estimated an 87% reduction in both PM10 and PM2.5. These were used for 2025 also for the affected SCCs.

Exhibit 5.1 USEPA Estimated Percent Reductions for RICE MACT Standard

SCC	CO	NOx	PM10	PM2.5	VOC	SCC Description
20100102	20.36		15.14	15.14	36.72	Electric Generation;Distillate Oil (Diesel);Reciprocating
20100105	20.36		15.14	15.14	36.72	Electric Generation;Distillate Oil (Diesel);Reciprocating: Crankcase Blowby
20100107	20.36		15.14	15.14	36.72	Electric Generation;Distillate Oil (Diesel);Reciprocating: Exhaust
20100202	19.86	12.53			23.87	Electric Generation;Natural Gas;Reciprocating
20100207	19.86	12.53			23.87	Electric Generation;Natural Gas;Reciprocating: Exhaust
20200102	20.36		15.14	15.14	36.72	Industrial;Distillate Oil (Diesel);Reciprocating
20200104	20.36		15.14	15.14	36.72	Industrial;Distillate Oil (Diesel);Reciprocating: Cogeneration
20200107	20.36		15.14	15.14	36.72	Industrial;Distillate Oil (Diesel);Reciprocating: Exhaust
20200202	19.86	12.53			23.87	Industrial;Natural Gas;Reciprocating
20200204	19.86	12.53			23.87	Industrial;Natural Gas;Reciprocating: Cogeneration
20200207	19.86	12.53			23.87	Industrial;Natural Gas;Reciprocating: Exhaust
20200253	19.18	37.96			29.74	Industrial;Natural Gas;4-cycle Rich Burn
20200254	37.85				28.59	Industrial;Natural Gas;4-cycle Lean Burn
20200256	37.85				28.59	Industrial;Natural Gas;4-cycle Clean Burn
20200301	19.18	37.96			29.74	Industrial;Gasoline;Reciprocating
20200307	19.18	37.96			29.74	Industrial;Gasoline;Reciprocating: Exhaust
20201001	19.86	12.53			23.87	Industrial;Liquified Petroleum Gas (LPG);Propane
20201002	19.86	12.53			23.87	Industrial;Liquified Petroleum Gas (LPG);Butane
20201702	19.18	37.96			29.74	Industrial;Gasoline;Reciprocating Engine
20201707	19.18	37.96			29.74	Industrial;Gasoline;Reciprocating: Exhaust
20300101	20.36		15.14	15.14	36.72	Commercial/Institutional;Distillate Oil (Diesel);Reciprocating
20300105	20.36		15.14	15.14	36.72	Commercial/Institutional;Distillate Oil (Diesel);Reciprocating: Crankcase Blowby
20300106	20.36		15.14	15.14	36.72	Commercial/Institutional;Distillate Oil (Diesel);Reciprocating: Evaporative Losses
20300107	20.36		15.14	15.14	36.72	Commercial/Institutional;Distillate Oil (Diesel);Reciprocating: Exhaust
20300201	19.86	12.53			23.87	Commercial/Institutional;Natural Gas;Reciprocating

SCC	CO	NOx	PM10	PM2.5	VOC	SCC Description
20300204	19.86	12.53			23.87	Commercial/Institutional;Natural Gas;Cogeneration
20300207	19.86	12.53			23.87	Commercial/Institutional;Natural Gas;Reciprocating: Exhaust
20300301	19.18	37.96			29.74	Commercial/Institutional;Gasoline;Reciprocating
20300307	19.18	37.96			29.74	Commercial/Institutional;Gasoline;Reciprocating: Exhaust
20301001	19.86	12.53			23.87	Commercial/Institutional;Liquified Petroleum Gas (LPG);Propane
20301002	19.86	12.53			23.87	Commercial/Institutional;Liquified Petroleum Gas (LPG);Butane
20400401	19.18	37.96			29.74	Engine Testing;Reciprocating Engine;Gasoline
20400402	20.36		15.14	15.14	36.72	Engine Testing;Reciprocating Engine;Diesel/Kerosene
20400403	20.36		15.14	15.14	36.72	Engine Testing;Reciprocating Engine;Distillate Oil: CI: CI: VOC 2005cr = 0
31000203	19.86	12.53			23.87	Oil and Gas Production;Natural Gas Production;Compressors
50100421	19.86	12.53			23.87	Solid Waste Disposal;Landfill Dump;Waste Gas Recovery: Internal Combustion Device

- Petroleum refinery enforcement settlements - For the facilities identified by USEPA located in New Jersey and Pennsylvania we applied post-2007 estimated reductions for NO_x, PM10, PM2.5, and SO_2 to affected units.

5.2 RECENT CONTROL TECHNIQUE GUIDELINES

Control Techniques Guidelines (CTGs) are documents issued by USEPA to provide states with the USEPA's recommendation on how to control the emissions of VOC from a specific type of product or source category in an ozone nonattainment area. USEPA issued new or updated CTGs for 13 VOC categories in 3 groups during 2006, 2007 and 2008 (USEPA 2008b). The categories are:

- 2006 CTGs
  - Flat Wood Paneling Coatings
  - Industrial Cleaning Solvents
  - Flexible Package Printing
  - Lithographic Printing
  - Letterpress Printing
- 2007 CTGs
  - Large Appliance Surface Coating
  - Metal Furniture Coatings
  - Paper Film and Foil Coatings
- 2008 CTGs
  - Miscellaneous Metal Parts Coatings
  - Plastic Parts Coatings
  - Auto and Light-duty Truck Assembly Coatings
  - Fiberglass Boat Manufacturing
  - Miscellaneous Industrial Adhesives

States indicated that they expected very little additional reductions from these new or amended CTGs. Therefore, no emission reductions were included in the inventory.

5.3 OTC MODEL RULES FOR NONEGUs

The OTC developed NOx control measures for industrial, commercial, and institutional (ICI) boilers and distributed generation units in 2001 (OTC 2001). We reviewed the OTC's status reports to identify states status in adopting the OTC 2001 model rules (OTC 2009). Most states have adopted the OTC model rules with compliance dates in 2007 or earlier. As a result, we assumed that the emission reductions from the 2001 OTC model rules for nonEGUs are already reflected in the 2007 inventory and no post- 2007 reductions were applied.

In 2006, the OTC introduced model rules (OTC 2007) for one nonEGU VOC source category (adhesives/sealants) and new/more stringent requirements for several NOx source categories (asphalt production plants, cement kilns, glass/fiberglass furnaces, and industrial, commercial, and institutional {ICI} boilers).

These model rules and recommendations provided a consistent framework for air pollution regulation throughout the region. In addition, MANE-VU provided recommendations to require low sulfur home heating, distillate and residul fuel oil. Exhibit 5-2 briefly describes the OTC and MANE-VU control measures affecting point sources that have been recommended for adoption by the states in the OTR. Recommendations for EGUs are not addressed in this section since the projection of EGU emissions is being accomplished by ERTAC under a separate agreement.

Individual states are in various stages of adopting the OTC recommendations into the rules and SIPs. We reviewed the OTC's status reports to identify each state's adoption status (OTC 2009, OTC 2011a, OTC2011b). To obtain further clarification, states were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the OTC model rule or recommendation and whether credit for each rule was already accounted for in the 2007 inventory.

Not all states have adopted all rules. In order to evaluate the impact of both the rules currently in place as well as the potential adoption of all control measures by all states, the state Air Directors specified that two emission control scenarios should be developed.

- Existing Controls - this scenario represents the best estimates for the future year, accounting for all in-place controls that are fully adopted into federal or individual state regulations or SIPs.

- Potential New OTC Controls – this scenario accounts for all of the emission reductions from the existing control scenario plus new state or regional measures that are under consideration by the OTC or individual states. This is a "what if" scenario that assumes that all states in the MANE-VU+VA region except Virginia will adopt all new OTC control measures under consideration by 2017. It does not include any potential new <u>federal</u> control measures that are under consideration.

The following paragraphs describe the control factors applied for each control measure by state and future year.

Exhibit 5.2 Summary of Point Source OTC Control Measures

Source Category	**Pollutants**	**Description**
EGUs	NOx	OTC 2001. Provided emission standards for stationary combustion turbines, emergency generators, and load shaving units. OTC 2009/2010. Recommended NOx emission rate limits for oil and gas boilers serving EGUs and emission rate limits for high energy demand day combustion turbines.
Asphalt Production Plants	NOx	OTC 2006. Provided emission rate limits and recommended a 35% reduction in NOx emissions.
Cement Kilns	NOx	OTC 2006. Provided emission rate limits and recommended a 60% reduction in NOx emissions.
Glass Furnaces	NOx	OTC 2006. Provided emission rate limits and recommended a 85% reduction in NOx emissions.
ICI Boiler Controls	NOx	OTC 2001. Recommended NOx emission rate limits for industrial boilers greater than 5 mmBtu/hour OTC 2006. Recommended lower NOx emission rate limits for industrial, commercial, and institutional boilers OTC 2010. Recommended national NOx controls for ICI boilers
Low Sulfur Fuel Oil	SO2	MANE-VU 2006. Recommends sulfur content limits for home heating oil, distillate oil, and residual oil
Adhesives and Sealants	VOC	OTC 2006. Provided VOC content limits and other restrictions on adhesives used in industrial and commercial settings.
Large Petroleum Storage Tanks	VOC	OTC 2009/2010. Addresses high vapor pressure VOCs, such as gasoline and crude oil, stored in large aboveground stationary storage tanks, which are typically located at refineries, terminals and pipeline breakout stations.

5.3.1 OTC 2006 Model Rule for Adhesives and Sealants

The 2006 OTC model rule is intended to achieve VOC emission reductions from adhesive application sources. The OTC 2006 model rule for adhesives and sealants is based on the reasonably available control technology (RACT) and best available retrofit control technology (BARCT) determination by the California Air Resources Board (CARB) developed in 1998. The emission reduction benefit estimation methodology is based on information developed and used by CARB for their RACT/BARCT determination in 1998. The vast majority of the emissions regulated by this rule are in the area source inventory.

For point sources, we first identified those sources applying adhesives and sealants (using the SCC of 4-02-007-xx, adhesives application). Next, we reviewed the 2007 inventory to determine whether these sources had existing capture and control systems. Most of the sources did not have control information in the NIF database. However, several sources reported capture and destruction efficiencies in the 70 to 99 percent range, with a few sources reporting capture and destruction efficiencies of 99+ percent. Sources with existing control systems that exceeded an 85 percent overall capture and destruction efficiency would comply with the OTC 2006 model rule provision for add-on air pollution control equipment; therefore, no additional reductions were calculated for these sources. For point sources without add-on control equipment, we used a 64.4 percent reduction based on the CARB determination.

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC model rule and whether the estimated reduction in VOC emissions should be applied in 2017 and 2020. New Hampshire indicated that they have no existing rule in place and no reductions should be applied. Virginia indicated that reductions from existing rules only apply in three regions:

- Northern Virginia (Arlington, Alexandria, Manassas, Manassas Park, Prince William, Loudon, Fairfax, Fairfax City, Falls Church, and Stafford),
- Fredericksburg (Fredericksburg and Spotsylvania), and
- Richmond (Charles City, Colonial Heights, Chesterfield, Hopewell, Hanover, Petersburg, Henrico, City of Richmond, and Prince George).

All other states have existing rules in place that will require VOC reductions before 2017. Exhibit 5.3 shows the reduction that were applied by state under both the existing controls inventory and the “what if” inventory.

Exhibit 5.3 State Recommendations for OTC Adhesives/Sealants Rule

State	Is Rule Accounted for in 2007 Inventory*	Incremental VOC Reduction to Apply:			
		2017 Existing Controls	2017 Potential Controls	2020 Existing Controls	2020 Potential Controls
CT	No	64.4	0	64.4	0
DE	No	64.4	0	64.4	0
DC	n/a	n/a	n/a	n/a	n/a
ME	No	64.4	0	64.4	0
MD	No	64.4	0	64.4	0
MA	No	64.4	0	64.4	0
NH	No	0	64.40	0	64.4
NJ	No	64.4	0	64.4	0
NY	No	64.4	0	64.4	0
PA	No	64.4	0	64.4	0
RI	No	64.4	0	64.4	0
VT	n/a	n/a	n/a	n/a	n/a
VA-NVA	No	64.4	0	64.4	0
VA-FRD	No	64.4	0	64.4	0
VA-RCH	No	64.4	0	64.4	0
VA-Other	No	0	0	0	0

* Some sources in the 2007 inventory had VOC controls greater than 85% and already complied with the requirements; no incremental reduction was taken for these sources (see text)
n/a - no affected point sources identified in the inventory

5.3.2 OTC 2009/2010 Model Rule for Large Storage Tanks

The OTC model rule addresses high vapor pressure VOCs, such as gasoline and crude oil, stored in large aboveground stationary storage tanks, which are typically located at refineries, terminals and pipeline breakout stations. The OTC model rule is based on recent revisions to New Jersey's VOC storage tank rules located at N.J.A.C. 7:27-16.2. The OTC model rules requires: 1) retrofiting floating roof tanks to reduce emissions from deck fittings; 2) retrofitting external floating roof tanks with domes; 3) controlling roof landing losses; and 4) adding controls for degassing and interior tank cleaning. New Jersey estimated reductions for tanks located in New Jersey would total approximately 2,000 tons per year by 2020. In making these estimates, New Jersey developed the following VOC percent reduction estimates for the following categories of storage tanks:

Tank Location	Point Source SCC	VOC Percent Reduction	
		2017	2020
Refinery	4-03-011-xx (floating roof tank SCCs, gasoline or crude oil only)	82	85
Bulk Terminal	4-04-001-xx (floating roof tank SCCs)	40	50
Bulk Plant and Pipeline Breakout Station	4-04-002-xx (floating roof tank SCCs gasoline or crude oil only)	52	65

Only New Jersey has existing rules in place, and the above percent reductions were applied to the existing controls inventory.

For all other states with affected sources, the potential reductions from the OTC rule were applied in the "what if" inventory.

5.3.3 OTC 2006 Model Rule for Asphalt Production Plants

The OTC recommended that member states pursue state-specific rulemakings or other implementation methods that would achieve a 35 percent reduction in NOx emissions. States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC model rule and whether the estimated reduction in NOx emissions should be applied in 2017 and 2020. Only Maine, New Jersey and New York indicated that the reductions should be applied. A 35 percent reduction in NOx emissions for fuel burning SCCs in the 3-05-002-xx series was applied to the existing controls inventory for Maine, New Jersey, and New York.

All other states indicated that the NOx reductions should not be applied in the existing controls inventory. The 35 percent reduction for other states was applied in the "what if" inventory.

5.3.4 OTC 2006 Model Rule for Cement Manufacturing Plants

Cement kilns are located in Maine, Maryland, New York, Pennsylvania, and Virginia. The OTC recommended state-specific rulemakings or other implementation methods that would result in about a 60 percent reduction in uncontrolled levels NOx emissions or meet the following emission limits based on kiln type:

- Wet: 3.88 lb/ton clinker
- Long Dry: 3.44 lb/ton clinker
- Preheater: 2.36 lb/ton clinker
- Precalciner: 1.52 lb/ton clinker

Cement kilns are already subject to NOx controls as part of Phase I of the NO_x SIP call or state-specific RACT requriements. The emission reductions resulting from the NOx SIP call or RACT requirements are already accounted for in the 2007 inventory.

The following methods were used to calculate the additional reductions from the OTC 2006 Control Measure in each state:

- Maine has a single kiln that was converted from an existing wet process cement kiln to a dry process (preheater/precalciner type) kiln and underwent a BACT review around 2005. The permitted emission rate is 1,533 tons per year with an annual capacity of 766,500 tons of clinker (e.g., about 4 lbs/ton of clinker). Maine does not plan on any additional controls, so no incremental reductions were applied for the either the existing controls or “what if” inventory.

- Maryland indicated controls will become effective in 2011 for the two facilities in the state. Maryland specified a 25 percent reduction for the Holcim facility and a 40 percent reduction for the Lehigh facility for the existing controls inventory. No reductions were specified for the two kilns at the Essroc facility for the existing controls inventory. No additional reductions were specified for any cement kiln for the “what if” inventory.

- New York three cement plants: Each has a different RACT requirement effective 7/1/2012. The three limits are; 6.59 lb/ton, 2.88 lb/ton and 1.5 lb/tom (30 day rolling average). For this inventory, we have assumed that these post-2007 RACT requirements have an incremental control efficiency of 40 percent and we have applied this reduction in the existing controls inventory. No additional reductions were specified for any cement kiln for the “what if” inventory.

- Pennsylvania provided kiln-specific projected future year NOx emissions for 2017 and 2020 based on existing post-2007 state requirements. A kiln-specific control factor was calculated based on the ratio of the future year emissions to the 2007 emissions and was applied for the existing controls inventory. No additional reductions were specified for any cement kiln for the “what if” inventory.

- Virginia has a single preheater/precalciner kiln that is not located in the OTR. Virginia does not plan on any additional controls since the facility is not in the OTR, so no incremental reductions were applied for the either the existing controls or “what if “ inventories.

5.3.5 OTC 2006 Model Rule for Glass and Fiberglass Furnaces

The OTC recommended state-specific rulemakings or other implementation methods to achieve an approximately 85 percent reduction in NOx emissions from uncontrolled levels. Emission reductions for glass and fiberglass furnaces were calculated using the methodology previously developed and documented in the OTC report (OTC 2007). Glass and fiberglass furnaces are located in Maryland, Massachusetts, New Jersey, New York, Pennsylvania, and Virginia. The following methods were used to calculate the additional reductions from the OTC 2006 Control Measure in each state:

- Maryland indicated that a 48 percent reduction should be applied to the single glass manufacturing facility in Maryland.
- Massachusetts indicated that they have a single facility with two furnaces furnaces; one furnace installing oxy-firing at 1.3 lb NOx per ton of glass, and the other at 5.3 lb/ton. The facility will be complying with EPA NSR enforcement Consent Decree by 2017. Massachusetts indicated that plant-wide emissions are expected to decrease by 35 percent in 2017 and 2020.
- New Jersey indicated that a 50 percent reduction in NOx emissions should be applied to glass and fiberglass furnaces in 2013, 2017, 2020 and 2025.
- New York did not provide guidance regarding glass and fiberglass furnaces. We used the percent reductions developed and documented in the previous round of emission projections developed for MARAMA (MARAMA 2007). An incremental control efficiency of 70 percent was used for New York glass and fiberglass furnaces in that inventory.
- Virginia indicated that they have no plans to implement the OTC measure, and no NOx reductions were applied to glass/fiberglass furnaces in Virginia.

All of the above reductions for glass and fiberglass furnaces were accounted for in the existing controls inventory. No additional reductions were specified for any glass or fiberglass furnace for the "what if" inventory.

5.3.6 OTC 2006 Model Rule for ICI Boilers

In Resolution 06-02, the OTC recommended that OTC member states pursue as necessary and appropriate state-specific rulemakings or other implementation methods to establish emission reduction percentages, emission rates or technologies for ICI boilers based on guidelines that varied by boiler size and fuel type..

States were polled to determine whether they have adopted a rule that would achieve reductions equivalent to the 2006 OTC recommendations and whether the estimated reduction in NOx emissions should be applied in 2017 and 2020. Most states have not adopted rules equivalent to the 2006 OTC recommendations. These states indicated that they will likely to depend on USEPA national rule for possible inclusion in the BOTW inventory. Specifically, the OTC Resolution 10-01 (June, 2010) called on USEPA for national regulations for ICI boilers.

Three states specified that that have adopted post-2007 ICI boiler rules to reduce NOx emissions. The percent reductions for ICI boilers were for these states were calculated as describe in the following paragraphs.

New Jersey provided NOx percent reductions that varied by heat input rate and fuel/boiler type and included an 80 percent rule effectiveness adjustment, as shown in Exhibit 5.4. The NIF file submitted by New Jersey for this project did not include the boiler design capacity. This data gap was filled using the boiler design capacities previously developed for the OTC study in 2006, if available; otherwise the SCC description was used to assign a default boiler design capacity. No additional reductions were specified for the “what if” inventory for New Jersey.

Exhibit 5.4 NonEGU Point Source Emission Reductions from New Jersey ICI Boiler NOx Rules

Heat Input Rate (mmBtu/hr)	Fuel/Boiler Type	Overall % Reduction 2007-2017
at least 5 but < 10	All	20%
at least 10 but < 20	All	20%
at least 25 but < 50	Natural gas only	40%
	No. 2 Fuel oil only	40%
	Refinery fuel gas and other gaseous fuels	40%
	Other liquid fuels	40%
	Duel Fuel using fuel oil and/or natural gas	40%
at least 50 but < 100	Natural gas only	40%
	No. 2 Fuel oil only	27%
	Other liquid fuels	27%
	Duel Fuel using fuel oil and/or natural gas	40%
at least 100 or greater	No. 2 Fuel oil only	40%

New York specified that a 50 percent reduction should be applied in the existing controls inventory for all boilers with greater than 25 mmBtu/hour design capacity. The NIF file submitted by New York for this project did not include the boiler design capacity. This data gap was filled using the boiler design capacities previously developed for the OTC study in 2006, if available; otherwise the SCC description was used to assign a default boiler design capacity. No additional reductions were specified for the "what if" inventory for New York.

New Hampshire specified that reductions should be applied to boilers in the 50-100 and 100-250 mmBtu/hour size ranges. We used the methodology previously developed and documented in the OTC report (OTC 2007). Reductions vary by size range and fuel type. State-by-state emission reduction percentages were developed by comparing the state emission limit in lbs/mmBTU to the OTC 2006 recommended limit. There are no coal-fired ICI boilers in New Hampshire. For other fossil fuels used in New Hampshire, the NOx percent reduction was as follows:

- Natural gas, 50-100 mmBtu/hr: 50% reduction
- Natural gas, 100-250 mmBtu/hr: 0% reduction
- Residual/distillate oil, 50-100 mmBtu/hr: 33.3% reduction
- Residual/distillate oil, 100-250 mmBtu/hr: 33.3% reduction

No additional reductions were specified for the "what if" inventory for New Hampshire.

All other states do not have existing rules that would result in post-2007 emission reductions. These states indicated that they will likely to depend on USEPA national rule for possible inclusion in the BOTW inventory. Specifically, the OTC Resolution 10-01 (June, 2010) called on USEPA for national regulations for ICI boilers. However, in order to estimate the potential NOx emission reductions for the "what if" control scenario, the guidelines from OTC Resolution 06-02 shown in Exhibit 5.5 were used to estimate potential NOx reductions in the "what if" inventory for those states without existing rules, except Virginia.

Exhibit 5.5 OTC Resolution 06-02 Guidelines for ICI Boiler NOx Rules

Boiler Size (mmBtu/hr)	NOx Percent Reduction from Base Emissions by Fuel Type			
	Natural Gas	#2 Fuel Oil	#4/#6 Fuel Oil	Coal
<25	10	10	10	10
25 to 50	50	50	50	50*
50 to 100	10	10	10	10*
100 to 250	76	40	40	40*

>250	**	**	**	**

* Resolution 06-02 did not specify a percent reduction for coal; for modeling purposes, the same percent reduction specified for #4/#6 fuel oil was used for coal.

** Resolution 06-02 specified the reduction for > 250mmBtu/hour boilers to be the "same as EGUs of similar size." The OTC Commissioners have not yet recommended an emission rate or percent reduction for EGUs. As a result, no reductions for ICI boilers > 250 mmBtu/hour were included in the potential controls inventory.

Since the above guidelines vary by boiler size and fuel type, the specific percent reduction applied to an individual source depends on the SCC and design capacity of the source. The SCC identifies the fuel type, while the design capacity identifies the boiler size. In many cases, the design capacities in the MANE-VU NIF database were missing. The following hierarchy was used in filling in gaps where design capacities were missing:

- Use the design capacity field from the NIF EU table, if available;
- Use the design capacities provided by agencies to fill in the data gaps in the MANE-VU 2002 inventory;
- Use design capacity as reported either the Unit Description field in the NIF EU table or the Process Description field from the NIF EP table, if available;
- Use design capacity from the source's Title V permit, if the Title V permit was online;
- Use the SCC description to determine the design capacity (for example, SCC 1-02-006-01 describes a >100 mmBtu/hr natural gas-fired boiler, SCC 1-02-006-02 describes a 10-100 mmBtu/hr natural gas-fired boiler).

After performing this gap-filling exercise, each boiler was assigned to one of the size ranges and fuel types shown in the above table. The emission reduction percentages by boiler size range and fuel type were then applied.

5.4 FUEL OIL SULFUR LIMITS

MANE-VU developed a low sulfur fuel oil strategy to help states develop Regional Haze SIPs (MANE-VU 2007). As previously discussed in Section 4.5, Each state was polled and asked to indicate when, if at all, the MANE-VU strategy would be incorporated into their state rules. States were also asked to provide the 2007 sulfur contents for each fuel type by county in order to calculate the percent reduction in emissions for the future years. Three states (MD, NJ, and NY) have adopted or are committed to adopting the strategy into their rules. The reductions for these three states were accounted for in the "existing controls" inventory. All other jurisdictions indicated that not enough regulatory development progress has been made to include the reductions in future years with absolute certainty. The potential reductions for these states were accounted for in the "potential new controls" inventory. One state (VA) has no plans to adopt the low sulfur fuel oil strategy. The percent reductions by fuel type and county are contained in Appendix K.

5.5 STATE-SPECIFIC NONEGU CONTROL FACTORS

The following state-specific nonEGU control factors were provided:

- **Bellefield Boiler Plant, Allegheny County.** Allegheny County indicated that this facility changed their fuel source from coal to natural gas in July 2009 and future year emissions were changed to reflect the fuel switch.
- **USS Clairton Works**, **Allegheny County.** The facility will remove Batteries 7-9 and have Battery C operational by 2013, resulting in a change in PM emissions in 2013. Also, USS Clairton Works will remove Batteries 1-3 and have Battery D operational in 2015, resulting in a change in PM emissions in 2017 and 2020.
- **Chrysler, Delaware.** The Chrysler facility (ID 1000300128) shut down in 2009. Delaware specified that only a 25 percent reduction should be taken for all pollutants since some emissions will be banked for future use by other sources.
- **O S G Ship Management (ID 1000500093), Delaware.** Delaware provided source-specific growth factors and percent reductions in VOC emissions for 2017 and 2020 from the lightering operations at O S G Ship Management (ID 1000500093).
- **Control Technology Guidance (CTG) Documents, Delaware.** Delaware determined that VOC emission reductions from new CTG recommendations would be very small. Although the new CTGs set up new recommendations for higher control efficiencies, the actual VOC reductions would be minimum, if not none, because most DE's existing facilities are not affected by the new requirements and emissions from those facilities are relatively small (based on 2002 inventory).
- **Unit Shutdowns, Delaware.** Delaware identified several emission units that have shut down at the following facilities: Dow Reichhold Specialty Latex (ID 1000100016), SPI Poly-Ols (ID 1000300426), and Invistas (ID 1000500002). Emissions for all pollutants were set to zero for these units.

- **Dover Air Force Base, Delaware.** Delaware identified four boilers at Dover Air Force Base (ID 1000100001) that ceased using fuel oil in March 2010. SO2 emissions for these boilers were set to zero.
- **Premcor Refinery NOx Plantwide Cap, Delaware.** The refinery was sold to the Delaware City Refining Company and an agreement was reached with DNREC's Secretary that allows plant-wide applicability limit (cap) for NOx. To project emissions, as well as for modeling purposes, Delaware decided to spread out the NOx-cap to each stack. Delaware estimated a plantwide reduction of 10.05 percent in 2013 and 41.22 percent in both 2017 and 2020.
- **Wausau Paper Specialty Products, Maine.** The Wausau Paper Specialty Products facility (ID 2300700007) closed in 2009. All emissions were set to zero for this facility in the 2017 and 2020 projection inventories.
- **2009 NJ Rule for NOx for Municipal Solid Waste Incinerators, New Jersey.** This rule will achieve a 27 percent reduction from one facility - Camden County Energy Recovery Associates, L.P. (ID 3400751614).
- **NJ rule for VOC Storage Tanks, New Jersey.** New Jersey provided expected VOC emission reductions resulting from post-2007 rules for VOC storage tanks. For refinery floating roof storage tanks (SCC 4-03-011-xx), the reductions are 75 percent for 2013, 82 percent for 2017, and 85 percent for 2020. For bulk terminal tanks (SCC 4-04-001-xx), the reductions are 20 percent for 2013, 40 percent for 2017, and 50 percent for 2020. For pipeline breakout stations (SCCs 4-04-002-xx and 4-06-005-xx), the reductions are 26 percent for 2013, 52 percent for 2017, and 65 percent for 2020.
- **International Paper – Franklin Mill, Virginia.** The International Paper – Franklin Mill (ID 5109300006) closed effective 2010. All emissions were set to zero for this facility in the 2017 and 2020 projection inventories.

6.0 NONROAD MODEL CATEGORIES

The USEPA's NONROAD model estimates emissions from equipment such as recreational marine vessels, recreational land-based vehicles, farm and construction machinery, lawn and garden equipment, aircraft ground support equipment (GSE) and rail maintenance equipment. This equipment is powered by diesel, gasoline, compressed natural gas (CNG) or liquefied petroleum gas (LPG) engines.

The National Mobile Inventory Model (NMIM) was developed by USEPA to develop county-level emission estimates for certain types of nonroad equipment. NMIM uses the current version the NONROAD model to develop emission estimates and was used to develop the projection inventories discussed here. The NMIM national county database contains monthly input data to reflect county specific fuel parameters and temperatures. Most of the work associated with executing NMIM involved updating the NMIM county database with State-specific information. For this analysis, we used the NMIM2008 software (version NMIM20090504), the National County Database (version NCD20090531), and NONROAD2008a (July 2009 version) as a starting point. Changes were made to the NCD20090531 based on review of data by the States. The purpose of this review was to create a new NCD specific to the 2007 base year model runs and the three projection year model runs. Changes were made to a copy of the NCD20090531 to create a new NCD used for the emission inventory runs. That NCD is called NCD20090910MARAMA.

6.1 STATE REVIEW OF NMIM FUEL CHARACTERISTICS

For the 2017 and 2020 projection year inventories, AMEC provided data on fuel characteristics from the NCD20090531 to the States to determine if they had additional changes required for the fuel characteristics for future year inventories. None of the States had changes to the fuel characteristics, except for CT which provided revisions to the six fuels that they had provided for the 2007 base year inventory to account for a number of changes including changes to RVP and fuel sulfur.

Connecticut provided updated values for the volume and market share components for ethanol which is used by NMIM to determine the oxygen percentage for NONROAD runs. Complete data replacement records were obtained for CT for the following tables: gasoline inputs, diesel inputs, countymonthyear inputs, and datasource inputs. CT added six new fuels which were given NRGasolineIds of 5000-5005 inclusive. Data was provided for both the base year (2007) and projection years (2013, 2017, and 2020).

The diesel fuel sulfur values for the projection years were maintained at their default values for all other States since they matched the USEPA recommended values.

6.2 USE OF EXTERNAL FILES IN THE PROJECTION YEAR NMIM RUNS

For the 2007 base year inventory (MARAMA 2012), revisions were made to the allocation files for several categories. These files are used to allocate emissions calculated at the state level down to the county level and to add entries to the countynrfile NCD table. States were asked if they would like to revise this table for future years. No revisions were recommended. Thus external files used for the 2007 base year runs were used in the runs for the projection years.

6.3 NMIM RUN SPECIFICATIONS

The specifications for each NMIM run were developed for groups of States within the MANE-VU+VA region. All States except for CT, NY, NJ and PA were run together for each year. CT was run alone for 2007, 2017, and 2020 because changes were requested for the base year. NY, NJ and PA were run together for each individual projection year. The settings for each specification panel within the NMIM model for the projection year runs are detailed below.

- Description: A short descriptive term for the run was entered for each specific run.
- Geography: The "county" option was selected for each run. All counties within the State were selected.
- Time: Every month in the Months check box area was selected. On the time panel, the year (2017 or 2020) was selected in the drop down box and added to the year selections area. With the exception of the CT, all runs were performed for only one year. The Use Yearly Weather Data check box was selected; however, year specific data was not available within NMIM for the projection years. The only years included within the NMIM model for NCD20090531 are 1999-2008 inclusive. If the specific year requested is not available, then NMIM uses 20 year average data for the estimates. Thus while the Use Yearly Weather Data box was checked, since the specific year was not there (except for the CT 2007 base year re-run), the 20 year average data in the countymonthhour table are used. However, because the meteorology data for future years will be assumed to be the same as was used for 2007, AMEC revised the AverageTemp and AverageRelHumidity values in the countymonthhour table of the NCD20090910MARAMA to reflect actual 2007 values. Thus the values in that table are 2007 values not 20 year average values and thus causes the NMIM model to run with the same data used for the 2007 base year runs.
- Vehicles/Equipment: Only the nonroad vehicle/equipment area was selected. All fuels and all vehicle types were selected for each State run. Aircraft ground support

equipment was included in the run specifications but those records were removed during post-processing steps.

- Fleet: No selections or information was entered in this panel.
- Pollutants: Exhaust PM10, PM2.5, and Criteria pollutants (with HC reported as VOC) were selected except for CO_2.
- Advanced features: Only the server and database were selected in this panel.
- Output: Under the Geographic Representation panel the County selection was made. In the General Output area, a new database was selected on the server for the output.

All added external files for use in each State run were placed in the externalfiles directory of the NCD. Entries for all external files included were included in the countynrfiles table of the NCD.

6.4 REMOVAL OF AIRPORT GROUND SUPPORT EQUIPMENT

The NMIM/NONROAD model calculates emissions from airport ground support equipment. As discussed in Section 7 of this TSD, emissions from airport ground support equipment is also included in USEPA's aircraft inventory prepared using the Federal Aviation Administration's Emissions and Dispersion Modeling System (EDMS). Correspondence with USEPA indicated that USEPA considers the emissions calculated by EDMS to be better than those calculated by NONROAD. For this reason, all emissions calculated by NMIM/NONROAD for airport ground support equipment were removed from the inventory to avoid double counting.

6.5 STATE AND STAKEHOLDER REVIEW AND COMMENT

New York state provided the results of their own NONROAD model runs for 2017 and 2020. These model results were provided by month and were used instead of the NMIM model runs made by MACTEC.

6.6 CHANGES MADE FOR VERSION 3 MODEL RUNS

Two sectors of the inventory were updated in version 3. First, Virginia and New York requested that their emissions be recalculated using the information developed through Version 2 of the inventory for the MARAMA States. The Virginia reruns were performed for all categories except for ground support equipment and for recreational marine vessels. Recreational marine vessel emissions for Virginia were calculated along with those for other states (see below). Those values replaced the SEMAP supplied values used in versions prior to Version 3. In addition, estimates for all sectors of the inventory for New York other than ground support equipment and recreational marine vessels were calculated using NMIM default data for the MARAMA area. New York had originally provided data from NONROAD model runs that they performed separately. For Version 3 of the inventory, New York emissions were calculated using NMIM runs set up using the same criteria as those for other states in earlier versions of the inventory. Both New York and Virginia were provided with the opportunity to review fuel characteristics prior to their runs. Only Virginia made changes to the fuels, however the only changes that were made were to assign alternative default fuels to counties. The fuel characteristics were not modified from the NMIM defaults, only the fuel IDs associated with a particular county/month combination were changed to another default fuel. Those changes were instituted in the NCD developed specifically for MARAMA. New York did not request any changes to the default values. In addition, the revisions made to the housing population allocation files were instituted for both states.

The second change in version 3 was to modify the recreational marine vessel populations for all states except Vermont and Maine. A revised population file was prepared for Virginia but not utilized in the version 3 runs. Estimates for Virginia, Vermont and Maine were prepared using the growth algorithm built into the NMIM/NONROAD model. For all other states, revised population data was estimated for the years 2017 and 2020. EPA had recommended that rather than use the default growth algorithm of the model for those states that had their 2007 base year data updated for this category, separate population estimates for each projection year should be prepared and included in the population files. The 2007 population data was provided by the National Marine Manufacturers Association (NMMA). Total state populations for each of the three major categories contained in the NONROAD model (outboard, inboard/sterndrive and personal watercraft) were provided for each state. Because the population files used by the NONROAD model (and thus NMIM) were configured with population values for various horsepower categories, AMEC (formerly AMEC) determined the fraction of the total for each marine vessel type in each horsepower category from the NONROAD default population files. These fractions were then used to allocate the total state population obtained from NMMA to the various horsepower categories.

The only exception to this was that some states added in data for sailboats. The sailboat populations were split among two of the default categories. In addition, New Hampshire provided their own revised population file. Their population data for New Hampshire was provided by the New Hampshire DMV and is not from NMMA.

AMEC then used the national growth factors supplied in the default NMIM/NONROAD model to estimate populations for each year. Each horsepower/population category in the 2007 population file was grown to either 2017 or 2020 using the ratio between the 2005 and 2015 growth factors (to represent growth between 2007 and 2017) and between the 2005 and 2025 growth factors (to represent growth between 2007 and 2020). Those ratios were used to grow the 2007 population to 2017 and 2020 respectively. The only exception to this was Pennsylvania. Pennsylvania presented data indicating that there was little growth expected during the time periods that were considered and thus maintained the 2007 population estimates for both 2017 and 2020.

Pennsylvania presented information showing from historical data that indicated a downward trend in the overall motorized pleasure craft population in 6 of the last 9 years. The data also indicated that the population was essentially unchanged in the last three years due to an adverse economic environment. Populations of all motorized pleasure craft in Pennsylvania as tracked by the Pennsylvania Fish and Boat Commission showed nearly a 6 percent decline from 2001 to 2007 or an average annual decline of 1.0 percent over that period. Pleasure craft populations remained nearly unchanged from 2008 to 2010.

As a consequence, they forecaste zero percent growth for pleasure craft is from 2007 to 2017 and 2007 to 2020. The types of pleasure craft affected by this growth rate are:

- 2282005010, 2-stroke outboard,
- 2282005015, 2-stroke personal water craft,
- 2282010005, 4-stroke inboard/sterndrive,
- 2282020005, diesel inboard/sterndrive, and
- 2282020010, diesel outboards

6.7 NMIM/NONROAD GROWTH AND CONTROL INFORMATION

In estimating future year emissions, the NMIM/NONROAD model includes growth and scrappage rates for equipment in addition to a variety of control programs. It is not possible separate out the future year emissions due to “growth only” or “control only” in a single run. That is, the model run provides a single future year estimate that is a “growth and control” scenario.

The growth data used in the NMIM/NONROAD model is documented in a USEPA report (USEPA 2004c). The GROWTH packet of the NONROAD model cross-references each SCC to a growth indicator code. The indicator code is an arbitrary code that identifies an actual predicted value such as human population or employment that is used to estimate the future year equipment population. The GROWTH packet also defines the scrappage curves used to estimate the future year model year distribution.

The NMIM/NONROAD model also accounts for all USEPA emission standards for nonroad equipment. There are mulitiple standards that vary by equipment type, rated power, model year, and pollutatant. Exhibit 6.1 is a summary of the emission control programs accounted for in the NMIM/NONROAD model. A complete summary of the nonroad equipment emission standards can be found on the USEPA nonroad emission standards reference guide website (USEPA 2011).

Exhibit 6.1 Control Programs Included in the NMIM/NONROAD Model

Regulation	**Description**
Control of Air Pollution; Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression Ignition Engines At or Above 37 Kilowatts 59 FR 31036 June 17, 1994	This rule establishes Tier 1 exhaust emission standards for HC, NOx, CO, and PM for nonroad compression-ignition (CI) engines ≥37kW (≥50hp). Marine engines are not included in this rule. The start dates and pollutants affected vary by hp category as follows: 50-100 hp: Tier 1,1998; NOx only 100-175 hp: Tier 1, 1997; NOx only 175-750 hp: Tier 1, 1996; HC, CO, NOx, PM >750 hp: Tier 1, 2000; HC, CO, NOx, PM
Emissions for New Nonroad Spark-Ignition Engines At or Below 19 Kilowatts; Final Rule 60 FR 34581 July 3, 1995	This rule establishes Phase 1 exhaust emission standards for HC, NOx, and CO for nonroad spark-ignition engines ≤19kW (≤25hp). This rule includes both handheld (HH) and nonhandheld (NHH) engines. The Phase 1 standards become effective in 1997 for : Class I NHH engines (<225cc), Class II NHH engines (≥225cc), Class III HH engines (<20cc), and Class IV HH engines (≥20cc and <50cc). The Phase 1 standards become effective in 1998 for: Class V HH engines (≥50cc)
Final Rule for New Gasoline Spark-Ignition Marine Engines; Exemptions for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts and New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts 61 FR 52088 October 4, 1996	This rule establishes exhaust emission standards for HC+NOx for personal watercraft and outboard (PWC/OB) marine SI engines. The standards are phased in from 1998-2006.
Control of Emissions of Air Pollution From Nonroad Diesel Engines 63 FR 56967 October 23, 1998	This final rule sets Tier 1 standards for engines under 50 hp, phasing in from 1999 to 2000. It also phases in more stringent Tier 2 standards for all engine sizes from 2001 to 2006, and yet more stringent Tier 3 standards for engines rated over 50 hp from 2006 to 2008. The Tier 2 standards apply to NMHC+NOx, CO, and PM, whereas the Tier 3 standards apply to NMHC+NOx and CO. The start dates by hp category and tier are as follows:

Regulation	Description
	hp<25: Tier 1,2000; Tier 2, 2005; no Tier 3 25-50 hp: Tier 1, 1999; Tier 2, 2004; no Tier 3 50-100 hp: Tier 2, 2004; Tier 3, 2008 100-175 hp: Tier 2, 2003; Tier 3, 2007 175-300 hp: Tier 2, 2003; Tier 3, 2006 300-600 hp: Tier 2, 2001, Tier 3, 2006 600-750 hp: Tier 2, 2002; Tier 3, 2006 >750 hp: Tier 2, 2006, no Tier 3 This rule does not apply to marine diesel engines above 50 hp.
Phase 2: Emission Standards for New Nonroad Nonhandheld Spark Ignition Engines At or Below 19 Kilowatts 64 FR 15207 March 30, 1999	This rule establishes Phase 2 exhaust emission standards for HC+NOx for nonroad nonhandheld (NHH) spark-ignition engines ≤19kW (≤25hp). The Phase 2 standards for Class I NHH engines (<225cc) become effective on August 1, 2007 (or August 1, 2003 for any engine initially produced on or after that date). The Phase 2 standards for Class II NHH engines (≥225cc) are phased in from 2001-2005.
Phase 2: Emission Standards for New Nonroad Spark-Ignition Handheld Engines At or Below 19 Kilowatts and Minor Amendments to Emission Requirements Applicable to Small Spark-Ignition Engines and Marine Spark-Ignition Engines; Final Rule 65 FR 24268 April 25, 2000	This rule establishes Phase 2 exhaust emission standards for HC+NOx for nonroad handheld (HH) spark-ignition engines ≤19kW (≤25hp). The Phase 2 standards are phased in from 2002-2005 for Class III and Class IV engines and are phased in from 2004-2007 for Class V engines.
Control of Emissions From Nonroad Large Spark-Ignition Engines and Recreational Engines (Marine and Land-Based); Final Rule 67 FR 68241 November 8, 2002	This rule establishes exhaust and evaporative standards for several nonroad categories: 1) Two tiers of emission standards are established for large spark-ignition engines over 19 kW. Tier 1 includes exhaust standards for HC+NOx and CO and is phased in from 2004-2006. Tier 2 becomes effective in 2007 and includes exhaust standards for HC+NOx and CO as well as evaporative controls affecting fuel line permeation, diurnal emissions and running loss emissions. 2) Exhaust and evaporative emission standards are established for recreational vehicles, which include snowmobiles, off-highway motorcycles, and all-terrain vehicles (ATVs). For snowmobiles, HC and CO exhaust standards are phased-in from 2006-2012. For off-highway motorcycles, HC+NOx and CO exhaust emission standards are phased in from 2006-2007. For ATVs, HC+NOx and CO exhaust emission standards are phased in from 2006-2007. Evaporative emission standards for fuel tank and hose permeation apply to all recreational vehicles beginning in 2008. 3) Exhaust emission standards for HC+NOx, CO, and PM for recreational marine diesel engines over 50 hp begin in 2006-2009, depending on the engine displacement. These are “Tier 2” equivalent standards.

Regulation	Description
Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel; Final Rule (Clean Air Nonroad Diesel Rule – Tier 4) 69 FR 38958 June 29, 2004	This final rule sets Tier 4 exhaust standards for CI engines covering all hp categories (except marine and locomotives), and also regulates nonroad diesel fuel sulfur content. 1) The Tier 4 start dates and pollutants affected vary by hp and tier as follows: hp<25: 2008, PM only 25-50 hp: Tier 4 transitional, 2008, PM only; Tier 4 final, 2013, NMHC+NOx and PM 50-75 hp: Tier 4 transitional, 2008; PM only; Tier 4 final, 2013, NMHC+NOx and PM 75-175 hp: Tier 4 transitional, 2012, HC, NOx, and PM; Tier 4 final, 2014, HC,NOx,PM 175-750 hp:Tier 4 transitional, 2011, HC, NOx, and PM; Tier 4 final, 2014, HC,NOx,PM >750 hp: Tier 4 transitional, 2011, HC, NOx, and PM; Tier 4 final, 2015, HC,NOx,PM 2) This rule will reduce nonroad diesel fuel sulfur levels in two steps. First, starting in 2007, fuel sulfur levels in nonroad diesel fuel will be limited to a maximum of 500 ppm, the same as for current highway diesel fuel. Second, starting in 2010, fuel sulfur levels in most nonroad diesel fuel will be reduced to 15 ppm.
Control of Emissions From Nonroad Spark-Ignition Engines and Equipment; Final Rule (Bond Rule) 73 FR 59034 October 8, 2008	This rule establishes exhaust and evaporative standards for small SI engines and marine SI engines: 1) Phase 3 HC+NOx exhaust emission standards are established for Class I NHH engines starting in 2012 and for Class II NHH engines starting in 2011. There are no new exhaust emission standards for handheld engines. New evaporative standards are adopted for both handheld and nonhandheld equipment. The new evaporative standards control fuel tank permeation, fuel hose permeation, and diffusion losses. The evaporative standards begin in 2012 for Class I NHH engines and 2011 for Class II NHH engines. For handheld engines, the evaporative standards are phased-in from 2012-2016. 2) More stringent HC+NOx and CO standards are established for marine SI PWC/OB engines beginning in 2010. In addition, new exhaust HC+NOx and CO standards are established for sterndrive and inboard (SD/I) marine SI engines also beginning in 2010. High performance SD/I engines are subject to separate HC+NOx and CO exhaust standards that are phased-in from 2010-2011. New evaporative standards were also adopted for all marine SI engines that control fuel hose permeation, diurnal emissions, and fuel tank permeation emissions. The hose permeation, diurnal, and tank permeation standards take effect in 2009, 2010, and 2011.

Source: USEPA 2010e

7.0 NONROAD MAR SOURCE CATEGORIES

The USEPA's NONROAD model does not estimate emissions for three nonroad source categories: commercial marine vessel, aircraft, and railroad locomotives. The emission projection methodology and data sources for these three categories (collectively referred to as marine, airport, railroad {or MAR}) are discussed in this section. The data used to calculate the growth and control factors for MAR sources are included in Appendix L.

7.1 COMMERCIAL MARINE VESSELS

For the purpose of emission calculations, marine vessel engines are divided into three categories based on displacement (swept volume) per cylinder. Category 1 and Category 2 marine diesel engines typically range in size from about 500 to 8,000 kW (700 to 11,000 hp). These engines are used to provide propulsion power on many kinds of vessels including tugboats, pushboats, supply vessels, fishing vessels, and other commercial vessels in and around ports. They are also used as stand-alone generators for auxiliary electrical power on vessels. Category 3 marine diesel engines typically range in size from 2,500 to 70,000 kW (3,000 to 100,000 hp). These are very large marine diesel engines used for propulsion power on ocean-going vessels such as container ships, oil tankers, bulk carriers, and cruise ships.

The majority of marine vessels are powered by diesel engines that are either fueled with distillate or residual fuel oil blends. For the purpose of emission inventories, USEPA has assumed that Category 3 vessels primarily use residual blends while Category 1 and 2 vessels typically use distillate fuels.

EPA developed national emission inventories for Category 1 and 2 vessels and Category 3 vessels for calendar years 2002 through 2040 as part of its effort to develop emission standards for these vessels. The methodologies used to develop the emission projections (for both a baseline and controlled scenario) are documented in a regulatory impact assessment (USEPA 2008c). We used the USEPA data and methodologies from these RIAs to develop separate growth and control factors for Category 1 and 2 vessels (diesel) and Category 3 vessels (residual).

7.1.1 CMV Diesel Growth Factors

For Category 1 and 2 diesel vessels, USEPA used projection data for domestic shipping from the AEO2006 (EIA 2006). The annual growth rate reported in the RIA is 0.9%. More recent growth data for domestic shipping is available in the AEO2010 (EIA 2010). Since Category 1 and 2 vessels primarily accounts for activity data for ships that carry domestic cargo, we decided to use the recent growth data for domestic shipping available in the AEO2010. We used Table A-7 of the AEO2010 for international shipping to calculate the growth factor for 2007-2013 to be 0.975, for 2007-2017 to be 1.003, and for 2007-2020 to be 1/033. These growth factors were used for for CMV diesel port emissions (SCC 22-80-002-100) and CMV diesel underway emissions (SCC 22-80-002-200).

7.1.2 CMV Diesel Control Factors

In developing their emission projections, USEPA developed two scenarios that accounted for both the 2004 nonroad diesel rule and the 2008 diesel marine vessel rule:

- The USEPA's baseline (pre-control) inventory accounted for:
    1. the 0.9 percent annual growth in fuel use,
    2. the impact of existing engine regulations that took effect in 2008,
    3. the 2004 Clean Air Nonroad Diesel Rule that will decrease the allowable levels of sulfur in fuel beginning in 2012, and
    4. fleet turnover.
- The USEPA's controlled inventory accounted for:
    1. the 0.9 percent annual growth in fuel use;
    2. the reductions included in the baseline inventory, and the reductions from USEPA's 2008 rule Final Locomotive-Marine rule for Tier 3 and 4 engines; and
    3. The 2008 final rule that includes the first-ever national emission standards for existing marine diesel engines, applying to engines larger than 600kW when they are remanufactured. The rule also sets Tier 3 emissions standards for newly-built engines that are phasing in from 2009. Finally, the rule establishes Tier 4 standards for newly-built commercial marine diesel engines above 600kW, phasing in beginning in 2014.

To calculate a control factor that accounts for reductions included in the USEPA controlled inventory, it was necessary to first calculate a "growth only" scenario applying USEPA's 0.9 percent annual growth rate to the 2006 base emissions. Once the growth rate was applied, then a control factor for each pollutant was calculated by dividing the future year controlled emissions by the future year "growth only" emissions. Exhibit 7.1 shows the control factors for 2017 and 2020 for diesel commercial marine vessels.

Exhibit 7.1 CMV Diesel Control Factors by Year and Pollutant

Year	CO	NOx	PM10	PM2.5	SO2	VOC
2013	0.885	0.787	0.747	0.747	0.464	0.871
2017	0.830	0.642	0.550	0.550	0.076	0.708
2020	0.801	0.537	0.460	0.460	0.032	0.586

7.1.3 CMV Residual Oil Growth Factors

For Category 3 residual oil vessels, data from an USEPA-sponsored study was used to develop an annualized growth factor of 4.5 percent for the region. A few states considered the growth rate to be extremely high and not reflective of recent economic conditions. Since USEPA's Category 3 vessel inventory is primarily based on activity data for ships that carry foreign cargo, we decided to use the recent growth data for international shipping available in the AEO2010. We used data from Table A-7 of the AEO2010 for international shipping to calculate the growth factor for 2007-2013 to be 0.940, for 2007-2017 to be 0.946, and for 2007-2020 to be 0.950. These growth factors were used for CMV residual oil port emissions (SCC 22-80-003-100) and CMV residual oil underway emissions (SCC 22-80-003-200).

7.1.4 CMV Residual Oil Control Factors

On December 22nd, 2009, USEPA announced final emission standards under the Clean Air Act for new marine diesel engines with per-cylinder displacement at or above 30 liters (called Category 3 marine diesel engines) installed on U.S.-flagged vessels. The final engine standards are equivalent to those adopted in the amendments to Annex VI to the International Convention for the Prevention of Pollution from Ships (a treaty called "MARPOL"). The emission standards apply in two stages: near-term standards for newly-built engines will apply beginning in 2011, and long-term standards requiring an 80 percent reduction in NOx will begin in 2016. USEPA also adopted changes to the diesel fuel program to allow for the production and sale of diesel fuel with no more than 1,000 ppm sulfur for use in Category 3 marine vessels. The regulations generally forbid production and sale of fuels with more than 1,000 ppm sulfur for use in most U.S. waters, unless operators achieve equivalent emission reductions in other ways.

On March 26, 2010, the International Maritime Organization (IMO) officially designated waters off North American coasts as an emissions control area (ECA) in which stringent international emission standards will apply to ships. In practice, implementation of the ECA means that ships entering the designated area would need to use compliant fuel for the duration of their voyage that is within that area, including time in port and voyages whose routes pass through the area without calling on a port. The North American ECA includes waters adjacent the Atlantic extending up to 200 nautical miles from east coast of the United States. The quality of fuel that complies with the ECA standard will change over time. From the effective date in 2012 until 2015, fuel used by vessels operating in designated areas cannot exceed 1.0 percent sulfur (10,000 ppm). Beginning in 2015, fuel used by vessels operating in these areas cannot exceed 0.1 percent sulfur (1000 ppm). Beginning in 2016, NOx aftertreatment requirements become applicable.

To calculate a control factor that accounted for reductions included in the USEPA controlled inventory, it was necessary to first calculate a "growth only" scenario applying USEPA's 4.5 percent annual growth rate to the 2006 base emissions. Once the growth rate was applied, then a control factor for each pollutant was calculated by dividing the future year controlled emissions by the future year "growth only" emissions.

Exhibit 7.2 shows the control factors for 2017 and 2020 for residual oil commercial marine vessels.

Exhibit 7.2 CMV Residual Oil Control Factors by Year and Pollutant

Year	CO	NOx	PM10	PM2.5	SO2	VOC
2013	1.000	0.736	0.353	0.353	0.270	1.000
2017	1.000	0.654	0.216	0.216	0.120	1.000
2020	1.000	0.597	0.137	0.137	0.036	1.000

7.1.5 Military Vessels Growth and Control Factors

Virginia reported emissions for military vessels, but did not distinguish between diesel or residual fuels. We assumed that there would be "no growth" for military vessel activity and emissions in Virginia would remain at 2007 levels in 2017 and 2020. Virginia was the only state to report emission from military vessels.

7.2 AIRCRAFT

Aircraft emissions in the 2007 MANE-VU+VA inventory are available on either a county-by-county or airport-by-airport basis for six types of aircraft operations:

- Air carrier operations represent landings and take-offs (LTOs) of commercial aircraft with seating capacity of more than 60 seats;
- Commuter/air taxi operations are one category. Commuter operations include LTOs by aircraft with 60 or fewer seats that transport regional passengers on

scheduled commercial flights. Air taxi operations include LTOs by aircraft with 60 or fewer seats conducted on non-scheduled or for-hire flights;

- General aviation represents all civil aviation LTOs not classified as commercial;
- Military operations represent LTOs by military aircraft;
- Ground Support Equipment (GSE) typically includes aircraft refueling and baggage handling vehicles and equipment, aircraft towing vehicles, and passenger buses; and
- Auxiliary power units (APUs) provide power to start the main engines and run the heating, cooling, and ventilation systems prior to starting the main engines.

7.2.1 Aircraft Growth Factors

Aircraft operations were projected to future years by applying activity growth using data on itinerant (ITN) operations at airports as reported in the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System for 2009-2030 (FAA 2010). The ITN operations are defined as aircraft take-offs or landings. This information is available for approximately 3300 individual airports. Actual LTOs are reported for 2007 and projected LTOs are provided for all years up to 2030.

We aggregated and applied this information at the county level for the four operation types: commercial, general, air taxi, military. We computed growth factors for each operation type by dividing future-year ITN by 2007-year ITN. We assigned factors to inventory SCCs based on the operation type, as shown in Exhibit 7.3.

Exhibit 7.3 Crosswalk between SCC and FAA Operations Type

SCC	SCC Description	FAA Operation Type Used for Growth Factor
2265008005	Airport Ground Support Equipment, 4-Stroke Gas	Total Itinerant Operations
2267008005	Airport Ground Support Equipment, LPG	Total Itinerant Operations
2268008005	Airport Ground Support Equipment, CNG	Total Itinerant Operations
2270008000	Airport Ground Support Equipment, Diesel	Total Itinerant Operations
2270008005	Airport Ground Support Equipment, Diesel	Total Itinerant Operations
2275001000	Aircraft /Military Aircraft /Total	Itinerant Military Operations
2275020000	Aircraft /Commercial Aircraft /Total: All Types	Itinerant Air Carrier Operations
2275050000	Aircraft /General Aviation /Total	Itinerant General Aviation Operations
2275050011	Aircraft /General Aviation /Piston	Itinerant General Aviation Operations
2275050012	Aircraft /General Aviation /Turbine	Itinerant General Aviation Operations

SCC	SCC Description	FAA Operation Type Used for Growth Factor
2275060000	Aircraft /Air Taxi /Total	Itinerant Air Taxi Operations
2275060011	Aircraft /Air Taxi /Piston	Itinerant Air Taxi Operations
2275060012	Aircraft /Air Taxi /Turbine	Itinerant Air Taxi Operations
2275070000	Aircraft /Aircraft Auxiliary Power Units /Total	Total Itinerant Operations

Exhibit 7.4 summarizes the region-wide growth factors by FAA operation type. The growth factor for individual airports/counties may deviate substantially from these region-wide growth factors.

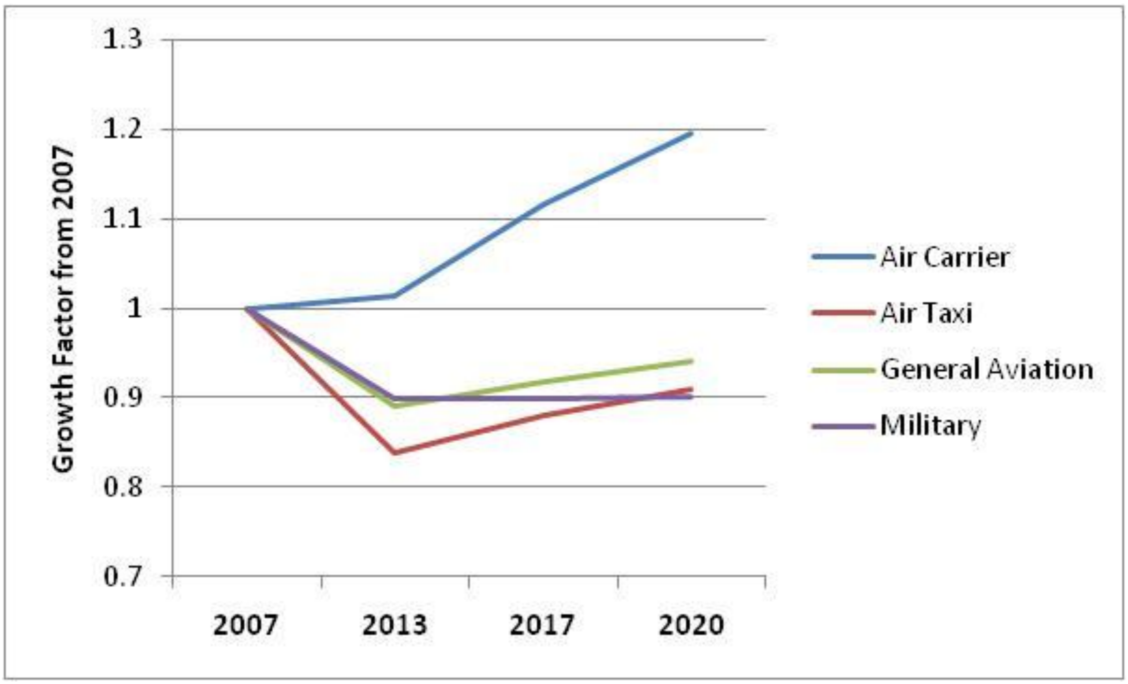


Exhibit 7.4 Region-wide Growth Factors from 2007 by FAA Operations Type

7.2.2 Aircraft Control Factors

The NOx aircraft engine emissions standards adopted by USEPA in November 2005 (USEPA 2005b) were reviewed. The standards are equivalent to the NOx emission standards (adopted in 1999 for implementation beginning in 2004) of the United Nations International Civil Aviation Organization (ICAO), and will bring the United States aircraft standards into alignment with the international standards. The standards apply to new aircraft engines used on commercial aircraft including small regional jets, single-aisle and twin-aisle aircraft, and 747s and larger aircraft. The standards also apply to general aviation and military aircraft, which sometimes use commercial engines. For example, small regional jet engines are used in executive general aviation aircraft, and larger commercial aircraft engines may be used in military transport aircraft.

Nearly all previously certified or in-production engine models currently meet or perform better than the standards USEPA adopted in the November 2005 rule. In addition, manufacturers have already been developing improved technology in response to the ICAO standards. According to USEPA's recent analysis for the proposed transport rule (USEPA 2010a), this rule is expected to reduce NOx emissions by approximately 2 percent in 2015 and 3 percent in 2020. Because of the relatively small amount of NOx reductions, our aircraft emission projections do not account for this control program.

EPA has also issued an Advance Notice of Proposed Rulemaking (ANPR) on lead emissions from piston-engine aircraft using leaded aviation gasoline (USEPA 2010d). However, this rule has not yet been adopted and co-benefits for criteria air pollutants are likely to be small. Therefore, the effects of this rule were not included in the future-year emissions projections.

7.3 RAILROAD EQUIPMENT

Railroad locomotive engine emissions in the 2007 MARAMA inventory are classified into the following categories:

- Class I line haul locomotives are operated by large freight railroad companies and are used to power freight train operations over long distances (SCC 22-85-002-006);
- Class II/III line haul locomotives are operated by smaller freight railroad companies and are used to power freight train operations over long distances (SCC 22-85-002-007);
- Inter-city passenger train locomotives are operated primarily by Amtrak to provide inter-city passenger transport (SCC 22-85-002-008);
- Independent commuter rail systems operate locomotives provide passenger transport within a metropolitan area (SCC 22-85-002-009); and
- Yard/switch locomotives are used in freight yards to assemble and disassemble trains, or for short hauls of trains that are made up of only a few cars (SCC 22-85-002-010).

7.3.1 Railroad Growth Factors

In March 2008, USEPA finalized a three part program that will dramatically reduce emissions from diesel locomotives of all types -- line-haul, switch, and passenger rail. As part of this work USEPA developed a national emission inventory for calendar years 2002 through 2040. Emission projections methodologies for a baseline and controlled scenario were developed and documented (USEPA 2008c). USEPA used projection data from the AEO2006 (EIA 2006). Table A-7 of AEO2006 showed that freight rail energy use will grow 1.6 percent annually.

More recent growth data is available in the AEO2010 which was published in May 2010. There are separate projections for passenger rail and freight rail energy use. For the MANE VU+VA inventory we relied on the more recent AEO2010 growth projections.

Passenger rail data from AEO2010 Table A-7 was used to calculate the growth factor for 2007-2013 to be 1.046, for 2007-2017 to be 1.121, and for 2007-2020 to be 1.171. These growth factors were applied to inter-city passenger train locomotives (SCC 22-85-002-008) and independent commuter rail systems (SCC 22-85-002-009).

For freight rail, the data from AEO2010 Table A-7 was used to calculate the growth factor for 2007-2013 to be 0.969, for 2007-2017 to be 1.018, and for 2007-2020 to be 1.053. We used the freight rail annual growth factors for Class I line haul (SCC 22-85-002-006), Class II/III line haul (SCC 22-85-002-007), and yard switch (SCC 22-85-002-010) locomotives.

7.3.2 Railroad Control Factors

USEPA developed two scenarios that accounted for both the 2004 nonroad diesel rule and the 2008 diesel locomotive rule:

- The USEPA baseline (pre-control) inventory accounted for

    1. AEO2006 annual growth in fuel use,
    2. The impact of existing regulations for Tier 0, 1, and 2 locomotive engines that take effect in 2008,
    3. The 2004 Clean Air Nonroad Diesel Rule that will decrease allowable levels of sulfur in locomotives fuel beginning in 2012, and
    4. Fleet turnover.

- The USEPA controlled inventory accounted for

    1. AEO2006 annual growth in fuel use,
    2. Reductions included in the baseline inventory, and

3. Reductions from USEPA's 2008 rule Final Locomotive-Marine rule for Tier 3 and 4 engines. This rule lowered diesel sulfur content and tightened emission standards for existing and new locomotives.
4. Voluntary retrofits under the National Clean Diesel Campaign are not included in our projections.

To calculate a factor that accounted for reductions included in the USEPA controlled inventory, it was necessary to first calculate a "growth only" scenario applying USEPA's 1.6% annual growth rate to the 2006 base emissions. Once the growth rate was applied, then a control factor for each pollutant was calculated by dividing the future year controlled emissions by the future year "growth only" emissions.

Exhibit 7.5 shows the control factors for 2017 and 2020 for the five locomotive classifications and pollutants.

Exhibit 7.5 Rail Control Factors by Year, Pollutant, and SCC

Year	NOx	PM10	PM2.5	HC	CO	VOC	SO2
SCC 22-85-002-006 Line Haul Class I Operations							
2017	0.633	0.449	0.449	0.480	1.000	0.480	0.003
2020	0.547	0.364	0.364	0.382	1.000	0.382	0.003
SCC 22-85-002-007 Line Haul Class II / III Operations							
2017	0.960	0.791	0.791	1.000	1.000	1.000	0.003
2020	0.920	0.752	0.752	1.000	1.000	1.000	0.003
SCC 22-85-002-008 Inter-City Passenger							
2017	0.421	0.402	0.402	0.437	0.917	0.437	0.003
2020	0.340	0.294	0.294	0.290	0.895	0.290	0.003
SCC 22-85-002-009 Commuter Rail							
2017	0.421	0.402	0.402	0.437	0.917	0.437	0.003
2020	0.340	0.294	0.294	0.290	0.895	0.290	0.003
SCC 22-85-002-010 Yard / Switch							
2017	0.843	0.712	0.712	0.809	1.000	0.809	0.003
2020	0.771	0.650	0.650	0.726	1.000	0.726	0.003

8.0 SUMMARY OF PROJECTED EMISSIONS

8.1 AREA SOURCE PROJECTED EMISSIONS

Exhibits 8.1 to 8.7 summarize the 2007 and projected future year area source emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

CO emissions in most states decline between 2007 and 2020, primarily due to decreases in residential wood combustion emissions resulting from the turnover to NSPS-compliant wood stoves. The two exceptions are DC and NY, where there is a slight increase in CO emissions from 2007 to 2020. There are no additional reductions expected from potential new OTC control measures.

NH3 emissions are projected to increase in most states between 2007 and 2020. This is due primarily to the growth predicted for fertilizer application on cropland and certain livestock waste products. There are no additional reductions expected from any existing control program or any potential new OTC control measures.

Under the "growth only" scenario, NOx emissions are projected to decline by about 5 percent between 2007 and 2017 due to AEO fuel use projections that generally show decreases in residential, commercial, and industrial fuel consumption. Under the "existing controls" scenario, NOx emissions in 2017 are projected to decrease by about 6.7 percent regionwide from 2007 levels due primarily to RICE MACT controls. Under the "potential new OTC controls" scenario, NOx emissions are projected to decrease by about 17 percent between 2007 and 2017 due to potential new controls on ICI boilers and new, small, natural gas-fired units.

PM10-PRI emissions are projected to increase slightly in all states between 2007 and 2017. Reentrained road dust on paved roads is a large source of PM10-PRI emissions and is directly proportional to the projected increases in VMT on paved roads. These increases from paved road dust are somewhat offset by decreases resulting from the turnover to NSPS-compliant wood stoves and the AEO fuel use projections that generally show decreases in residential, commercial, and industrial fuel consumption, especially for coal and oil. There are no additional reductions expected from potential new OTC control measures.

PM25-PRI emissions are projected to increase slightly from 2007 to 2020. Increases from paved road dust are somewhat offset by decreases resulting from the turnover to NSPS-compliant wood stoves and the AEO fuel use projections that generally show decreases in residential, commercial, and industrial fuel consumption, especially for coal and oil. There are no additional reductions expected from potential new OTC control measures.

Under the "growth only" scenario, SO2 emissions are projected to decline by about 16 percent between 2007 and 2017 due to AEO fuel use projections that generally show decreases in residential, commercial, and industrial fuel consumption, especially for coal and oil. Under the "existing controls" scenario, SO2 emissions in 2017 are projected to decrease by about 42 percent regionwide from 2007 levels due primarily to low sulfur fuel oil limits in MD, NJ, and NY. Under the "potential new OTC controls" scenario, SO2 emissions are projected to decrease by about 68 percent between 2007 and 2017 due to the potential implementation of low sulfur fuel oil limits in other MANE-VU states.

Under the "growth only" scenario, VOC emissions are projected to decrease slightly due to the turnover to NSPS-compliant wood stoves and the turnover over of vehicles equipped with on-board vapor recovery canisters. Under the "existing controls" scenario, VOC emissions in 2017 are projected to decrease by about 10 percent regionwide from 2007 levels due implementation of various OTC control measures in multiple states. Under the "potential new OTC controls" scenario, VOC emissions are projected to decrease by about 15 percent between 2007 and 2017 due to the continued implementation of both OTC control measures.

Exhibit 8.1 2007 and Projected Future Year Area Source CO Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	41,496	38,245	38,161	38,161	37,352	37,266	37,266
DE	8,266	7,961	7,881	7,881	7,857	7,776	7,776
DC	5,488	5,319	5,247	5,247	5,274	5,200	5,200
ME	50,496	47,290	47,266	47,266	46,359	46,337	46,337
MD	74,188	72,896	72,631	72,631	72,501	72,231	72,231
MA	79,226	75,912	75,482	75,482	75,073	74,626	74,626
NH	39,677	37,470	37,405	37,405	36,883	36,816	36,816
NJ	77,687	74,444	73,562	73,562	73,298	72,406	72,406
NY	205,055	218,875	218,374	218,374	223,510	223,021	223,021
PA	217,079	205,020	203,489	203,489	202,084	200,507	200,507
RI	15,419	14,391	14,308	14,308	14,097	14,011	14,011
VT	51,109	46,595	46,551	46,551	45,288	45,243	45,243
VA	132,098	129,923	129,479	129,479	129,390	128,937	128,937
	997,285	**974,342**	**969,836**	**969,836**	**968,966**	**964,377**	**964,377**

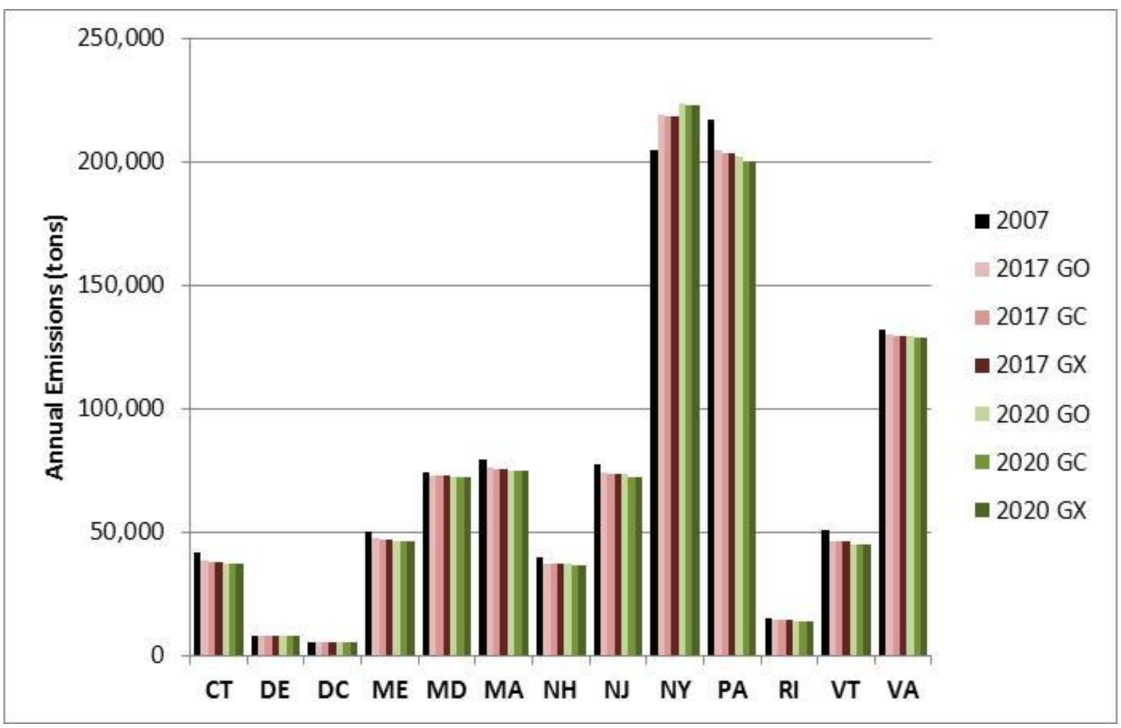


Exhibit 8.2 2007 and Projected Future Year Area Source NH3 Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	4,421	4,451	4,451	4,451	4,476	4,476	4,476
DE	12,382	15,233	15,233	15,233	15,924	15,924	15,924
DC	183	188	188	188	191	191	191
ME	5,736	6,203	6,203	6,203	6,337	6,337	6,337
MD	26,006	26,081	26,081	26,081	26,102	26,102	26,102
MA	13,791	13,913	13,913	13,913	13,996	13,996	13,996
NH	1,500	1,528	1,528	1,528	1,534	1,534	1,534
NJ	15,736	16,375	16,375	16,375	16,593	16,593	16,593
NY	45,693	46,221	46,221	46,221	46,368	46,368	46,368
PA	72,569	77,383	77,383	77,383	78,550	78,550	78,550
RI	625	629	629	629	636	636	636
VT	8,013	8,013	8,013	8,013	8,013	8,013	8,013
VA	43,394	45,862	45,862	45,862	46,434	46,434	46,434
	250,049	**262,079**	**262,079**	**262,079**	**265,152**	**265,152**	**265,152**

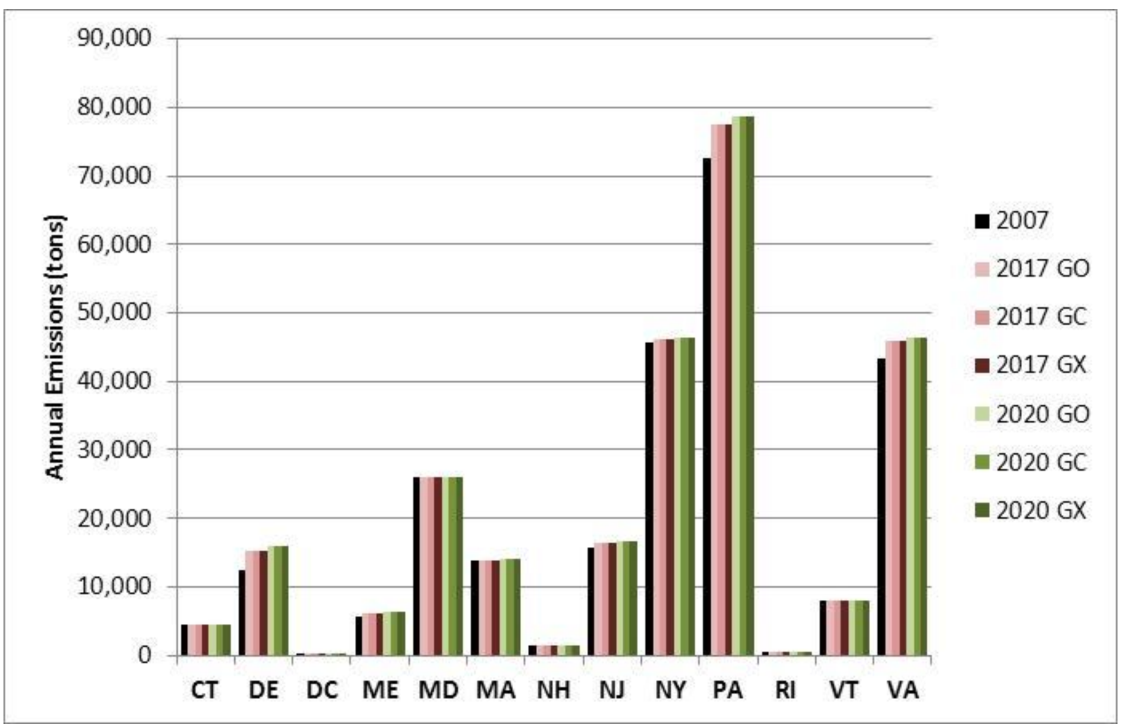


Exhibit 8.3 2007 and Projected Future Year Area Source NOx Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	12,421	11,278	11,101	9,747	11,232	11,049	9,560
DE	2,237	2,292	2,210	1,796	2,300	2,218	1,768
DC	1,547	1,620	1,560	1,318	1,654	1,592	1,325
ME	6,656	5,960	5,960	5,734	5,851	5,851	5,633
MD	10,312	11,148	10,948	9,887	11,389	11,185	9,978
MA	20,252	19,316	18,984	16,730	19,498	19,151	16,638
NH	4,737	4,196	4,152	3,761	4,156	4,111	3,699
NJ	24,175	24,662	23,331	22,727	24,685	23,339	22,310
NY	72,053	63,961	63,711	55,057	63,337	63,082	53,872
PA	47,545	47,179	45,925	37,636	47,613	46,318	37,392
RI	3,469	3,370	3,301	2,830	3,400	3,329	2,788
VT	3,996	3,667	3,641	3,305	3,672	3,645	3,302
VA	19,056	18,704	18,411	18,411	18,821	18,520	18,520
	228,457	**217,352**	**213,235**	**188,939**	**217,608**	**213,387**	**186,784**

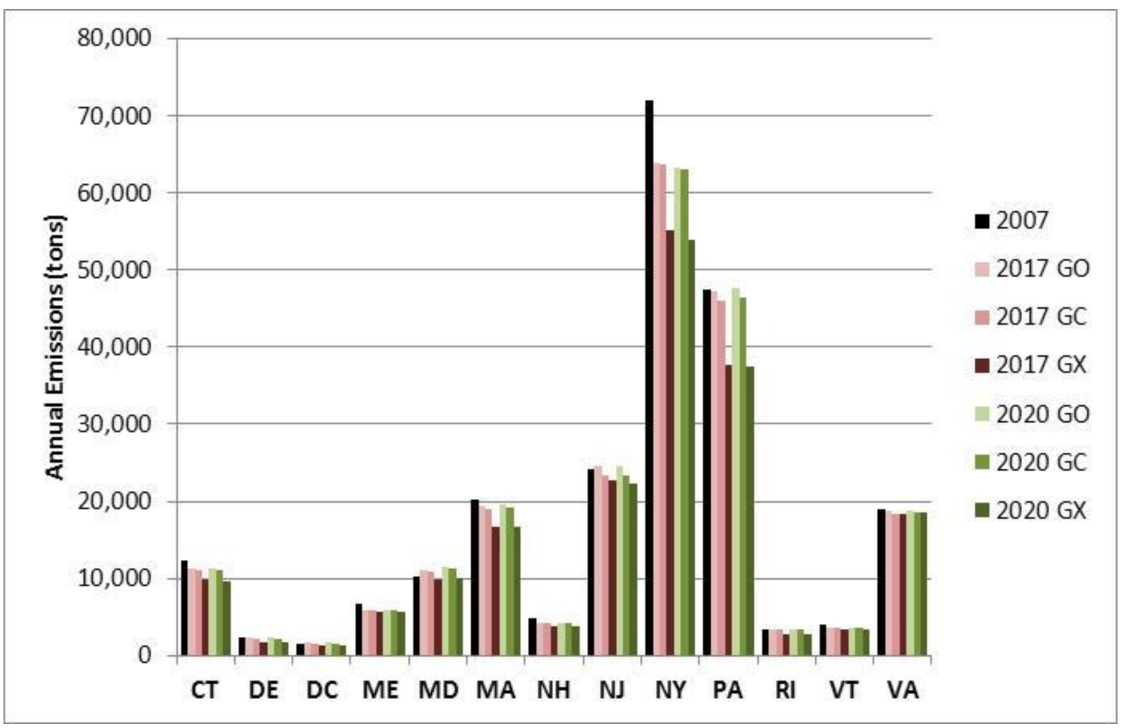


Exhibit 8.4 2007 and Projected Future Year Area Source PM10-PRI Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	30,577	31,061	31,052	31,052	31,224	31,214	31,214
DE	10,499	11,169	11,168	11,168	11,675	11,675	11,675
DC	4,873	5,078	5,077	5,077	5,141	5,141	5,141
ME	54,445	54,438	54,431	54,431	54,995	54,988	54,988
MD	72,454	78,559	78,555	78,555	80,345	80,340	80,340
MA	148,756	148,471	148,459	148,459	148,577	148,564	148,564
NH	27,742	28,916	28,912	28,912	29,420	29,416	29,416
NJ	39,140	41,202	41,189	41,189	42,104	42,090	42,090
NY	272,674	291,578	291,476	291,476	297,738	297,639	297,639
PA	287,998	295,026	295,006	295,006	298,020	298,001	298,001
RI	11,361	12,151	12,150	12,150	12,395	12,394	12,394
VT	47,993	47,675	47,671	47,671	47,823	47,819	47,819
VA	183,341	188,240	188,211	188,211	190,126	190,097	190,097
	1,191,853	**1,233,566**	**1,233,356**	**1,233,356**	**1,249,581**	**1,249,377**	**1,249,377**

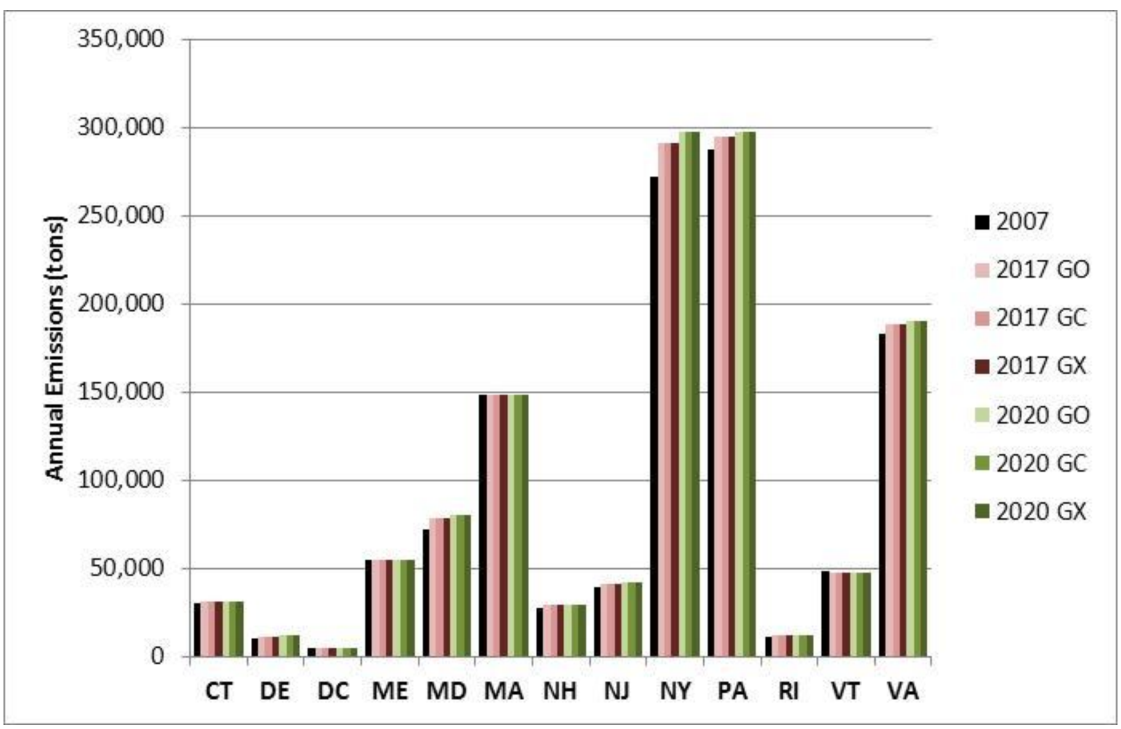


Exhibit 8.5 2007 and Projected Future Year Area Source PM25-PRI Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	10,606	10,298	10,290	10,290	10,225	10,217	10,217
DE	3,031	3,131	3,131	3,131	3,212	3,212	3,212
DC	1,542	1,560	1,560	1,560	1,567	1,566	1,566
ME	12,526	12,068	12,062	12,062	12,005	11,999	11,999
MD	19,789	20,888	20,884	20,884	21,206	21,201	21,201
MA	30,438	29,955	29,945	29,945	29,893	29,883	29,883
NH	8,623	8,602	8,598	8,598	8,637	8,633	8,633
NJ	18,299	18,453	18,441	18,441	18,579	18,568	18,568
NY	63,906	68,492	68,408	68,408	70,080	70,000	70,000
PA	73,514	73,070	73,054	73,054	73,243	73,227	73,227
RI	3,896	3,923	3,922	3,922	3,937	3,936	3,936
VT	13,106	12,596	12,593	12,593	12,520	12,517	12,517
VA	44,102	44,872	44,851	44,851	45,237	45,216	45,216
	303,378	**307,908**	**307,739**	**307,739**	**310,340**	**310,175**	**310,175**

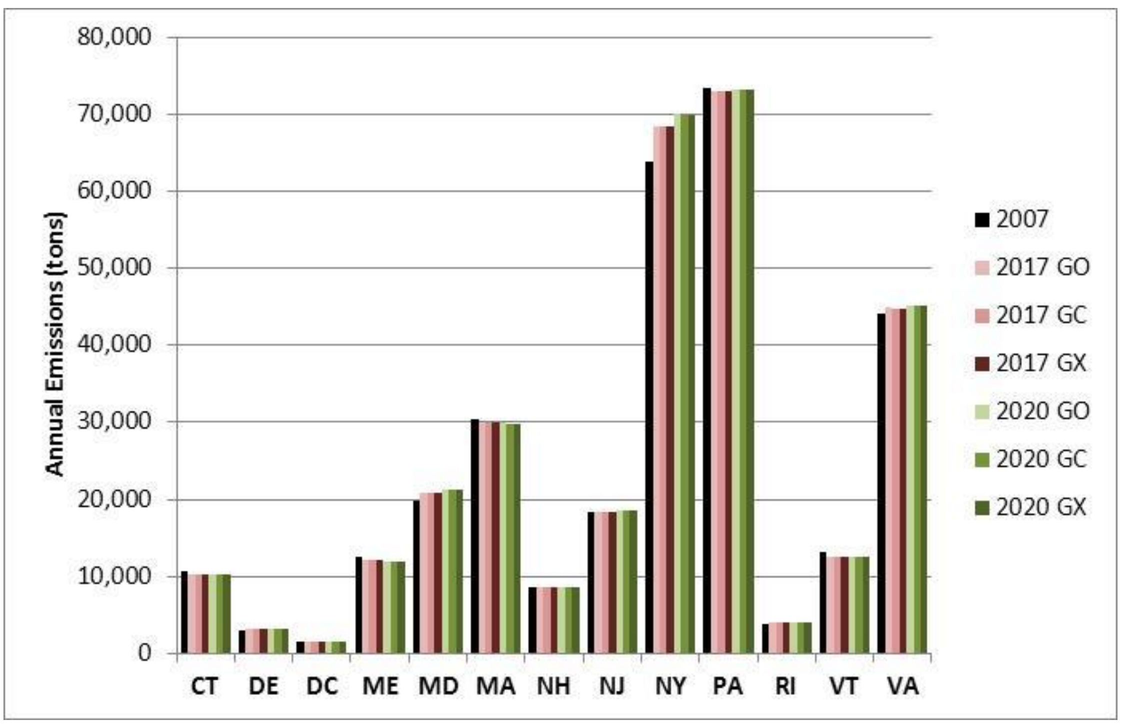


Exhibit 8.6 2007 and Projected Future Year Area Source SO2 Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	16,083	12,943	12,943	3,325	12,401	12,401	838
DE	1,144	946	946	107	911	911	106
DC	1,241	995	995	181	953	953	23
ME	9,812	7,870	7,870	1,450	7,609	7,609	200
MD	5,960	6,566	1,674	1,674	6,745	1,704	1,704
MA	19,859	15,996	15,996	4,093	15,357	15,357	1,391
NH	5,283	4,176	4,176	804	3,991	3,991	147
NJ	8,811	7,423	706	706	7,090	704	704
NY	70,044	58,753	11,651	11,651	57,030	11,670	11,670
PA	66,584	55,878	55,878	32,309	55,018	55,018	32,278
RI	3,897	3,222	3,222	1,270	3,108	3,108	491
VT	3,752	3,158	3,158	1,654	3,085	3,085	634
VA	17,098	14,880	14,880	14,880	14,616	14,616	14,616
	229,569	**192,807**	**134,097**	**74,104**	**187,914**	**131,127**	**64,803**

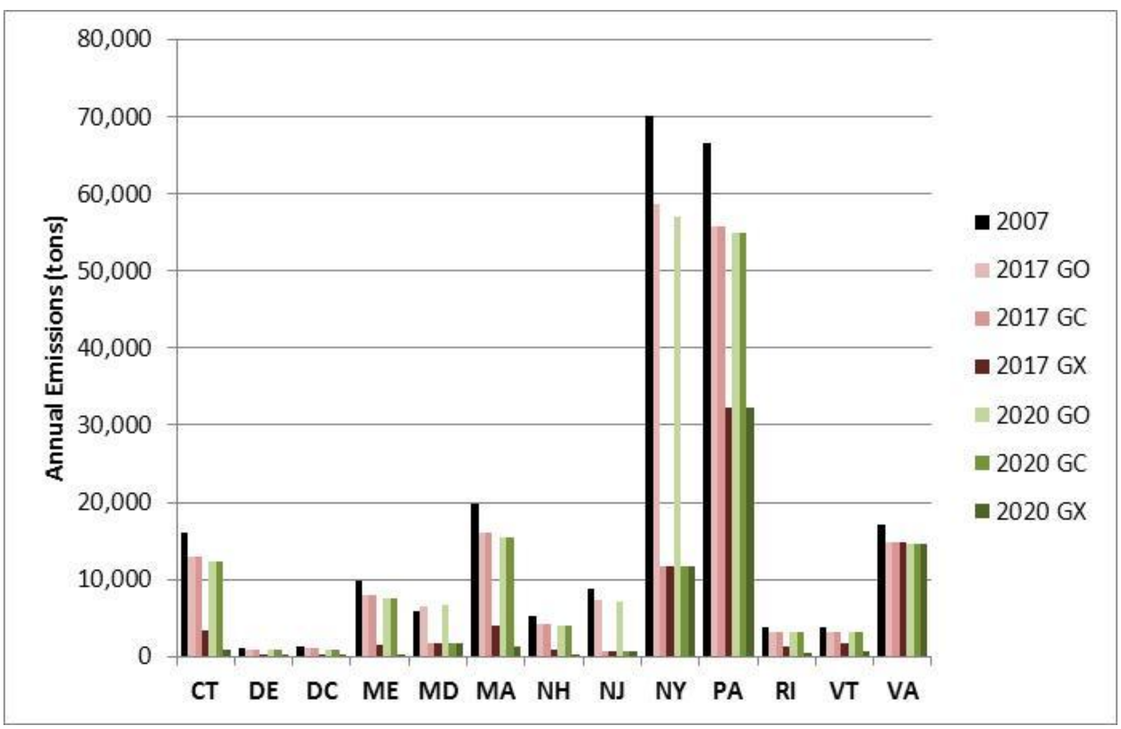
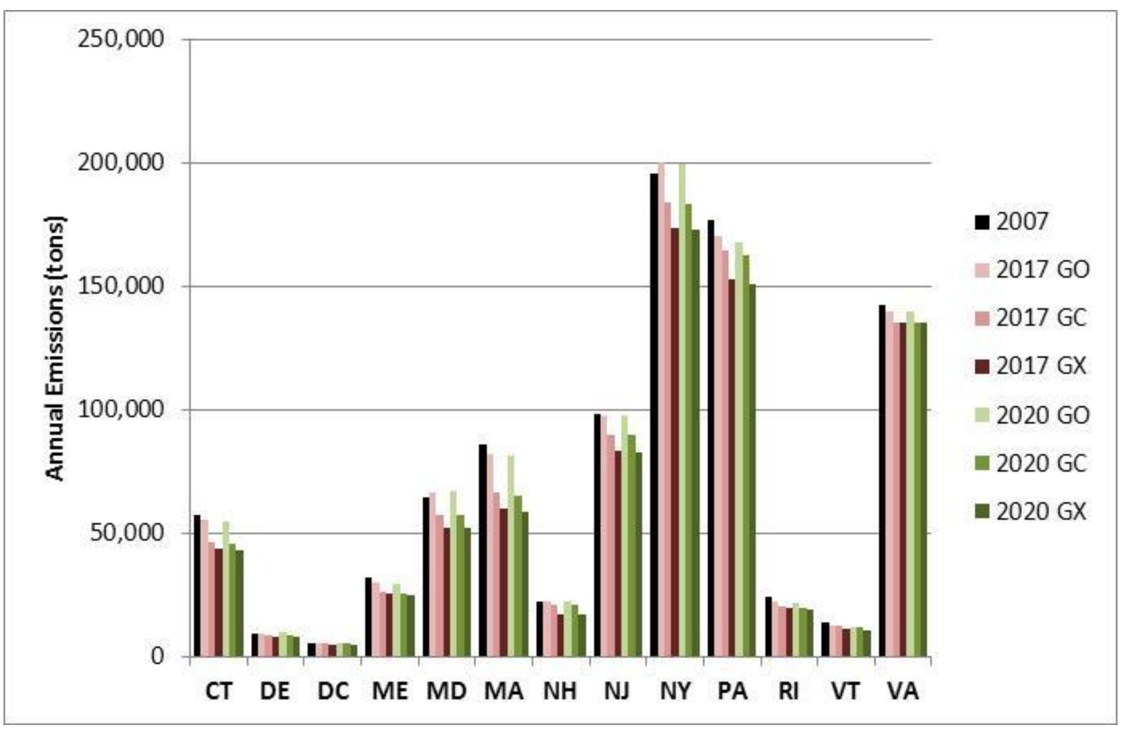


Exhibit 8.7 2007 and Projected Future Year Area Source VOC Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	57,253	55,386	46,364	43,764	54,857	45,849	43,229
DE	9,482	9,525	8,631	7,910	9,596	8,673	7,930
DC	5,568	5,540	5,324	4,932	5,591	5,369	4,965
ME	31,966	29,957	26,113	25,412	29,422	25,631	24,931
MD	64,429	66,399	57,045	52,018	66,825	57,042	51,901
MA	85,870	82,334	66,211	59,886	81,373	65,306	58,945
NH	22,343	22,117	20,894	17,258	22,041	20,807	17,164
NJ	98,121	97,769	89,972	83,323	97,551	89,699	82,956
NY	195,976	199,975	184,269	173,703	199,522	183,721	173,081
PA	176,781	170,123	164,863	153,166	167,744	162,374	150,596
RI	24,214	22,319	20,292	19,603	21,796	19,750	19,053
VT	14,108	12,516	12,311	10,972	12,127	11,904	10,561
VA	142,218	139,719	135,379	135,379	139,631	135,002	135,002
	928,330	**913,678**	**837,668**	**787,325**	**908,077**	**831,128**	**780,314**



8.2 NONEGU POINT SOURCE PROJECTED EMISSIONS

Exhibits 8.8 to 8.14 summarize the 2007 and projected future year area source emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

Regionwide, CO emissions increase slightly between 2007 and 2020. Maryland shows a significant decline due to a source closure. Maine, New Hampshire, and Vermont show significant increases due to projected increases in nonEGU wood combustion. There are no additional reductions expected from potential new OTC control measures.

NH3 emissions are projected to increase slightly between 2007 and 2020. There are no additional reductions expected from any existing control program or any potential new OTC control measures.

Under the "growth only" scenario, regional NOx emissions are projected to increase by about 12 percent from 2007 to 2017. This is due partially to the projected increases in fuel consumption and the addition of ERCs to the inventory. Under the "existing controls" scenario, NOx emissions are projected to be about 2 percent lower in 2017 than in 2007 because of petroleum refinery enforcement settlements; source shutdowns; ICI boiler controls in New Hampshire, New Jersey, and New York; and additional controls on glass furnace and cement kilns. Under the "potential new OTC controls" scenario, NOx emissions are projected to be about 5 percent lower in 2017 than in 2007 because of ICI boiler controls in additional states.

Under the "growth only" scenario, regional PM10-PRI and PM2.5-PRI emissions are projected to increase slightly. Under the "existing controls" scenario, PM10-PRI and PM2.5-PRI are project to be about 5 percent lower in 2017 than in 2007 due primarily to reductions the ICI boiler MACT standard and source closures. There are no additional reductions expected from potential new OTC control measures.

Under the "growth only" scenario, regional SO2 emissions are projected to remain relatively constant from 2007 to 2017. Under the "existing controls" scenario, SO2 emissions are projected to be about 5 percent lower in 2017 than in 2007 because of petroleum refinery enforcement settlements; source shutdowns; and low sulfur fuel oil requirements in Maryland, New Jersey, and New York. Under the "potential new OTC controls" scenario, SO2 emissions are projected to be about 8 percent lower in 2017 than in 2007 because of low sulfur fuel oil limits in additional states. SO2 emission are projected to be about 12 percent lower in 2020 than in 2007 because of additional low sulfur fuel oil limits in outer zone states that are projected to take effect in 2018..

VOC emissions are projected to increase slightly between 2007 and 2020 under the "growth only" scenario due primarily to the inclusion of ERCs in the future year inventories. Under the "existing controls" scenario, VOC emissions are projected to be less than 1 percent lower in 2017 than in 2007, with reductions resulting from the RICE MACT standard and OTC adhesives application rule. Under the "potential new OTC controls" scenario, VOC emissions are projected to be about 1.5 percent lower in 2017 than in 2007 due to the projected implementation of the OTC rule on large storage tanks.

Exhibit 8.8 2007 and Projected Future Year NonEGU CO Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	2,583	3,067	3,041	3,041	3,197	3,171	3,171
DE	7,027	7,300	7,271	7,271	7,320	7,292	7,292
DC	301	335	327	327	338	330	330
ME	14,023	20,975	20,941	20,941	21,238	21,204	21,204
MD	77,574	68,273	68,221	68,221	68,323	68,268	68,268
MA	4,592	5,999	5,919	5,919	6,165	6,082	6,082
NH	2,255	4,977	4,975	4,975	5,084	5,081	5,081
NJ	6,907	7,227	7,151	7,151	7,323	7,246	7,246
NY	52,877	54,959	54,646	54,646	55,439	55,115	55,115
PA	80,540	84,178	83,211	83,211	84,799	83,800	83,800
RI	1,051	873	870	870	940	937	937
VT	702	1,242	1,242	1,242	1,294	1,294	1,294
VA	63,079	67,090	65,740	65,740	67,833	66,212	66,212
	313,512	**326,496**	**323,556**	**323,556**	**329,293**	**326,031**	**326,031**

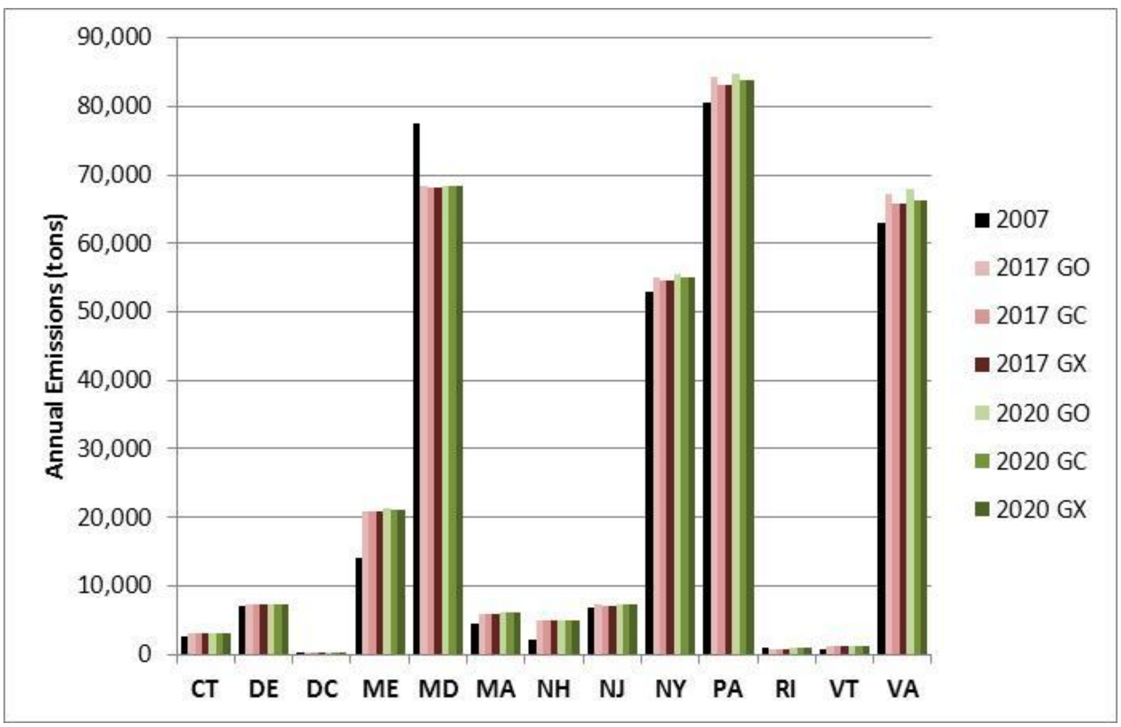


Exhibit 8.9 2007 and Projected Future Year NonEGU NH3 Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	0	0	0	0	0	0	0
DE	62	63	58	58	63	58	58
DC	0	0	0	0	0	0	0
ME	605	588	585	585	569	566	566
MD	137	137	137	137	137	137	137
MA	365	353	353	353	357	357	357
NH	30	36	36	36	36	36	36
NJ	208	216	216	216	219	219	219
NY	1,064	1,083	1,083	1,083	1,086	1,086	1,086
PA	2,070	2,111	2,111	2,111	2,119	2,119	2,119
RI	16	13	13	13	13	13	13
VT	0	0	0	0	0	0	0
VA	1,618	1,698	1,698	1,698	1,709	1,709	1,709
	6,175	**6,298**	**6,290**	**6,290**	**6,307**	**6,300**	**6,300**

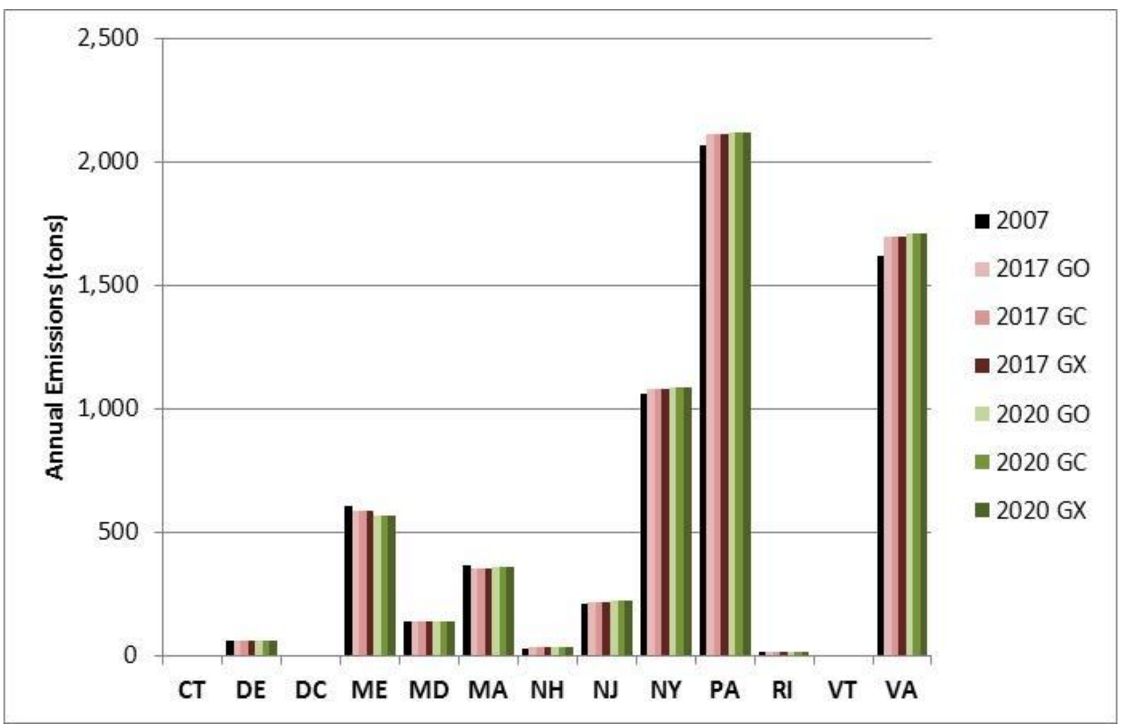


Exhibit 8.10 2007 and Projected Future Year NonEGU NOx Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	6,302	8,949	8,913	8,531	9,336	9,297	8,900
DE	5,122	4,774	3,328	2,861	4,652	3,271	2,796
DC	734	844	779	598	860	792	609
ME	17,050	20,527	20,398	19,272	20,573	20,447	19,332
MD	23,472	28,520	26,322	25,197	28,694	26,496	25,353
MA	12,872	15,011	14,797	13,238	15,525	15,298	13,695
NH	2,687	5,529	3,388	3,277	5,642	3,467	3,356
NJ	13,517	14,880	11,879	11,879	15,155	12,092	12,092
NY	35,583	38,125	27,632	27,632	38,686	28,080	28,080
PA	71,382	76,378	63,904	61,046	77,220	62,606	59,691
RI	950	857	854	720	868	862	727
VT	441	791	791	743	808	808	761
VA	50,265	53,919	53,236	53,236	54,476	53,591	53,591
	240,378	**269,103**	**236,221**	**228,228**	**272,496**	**237,107**	**228,984**

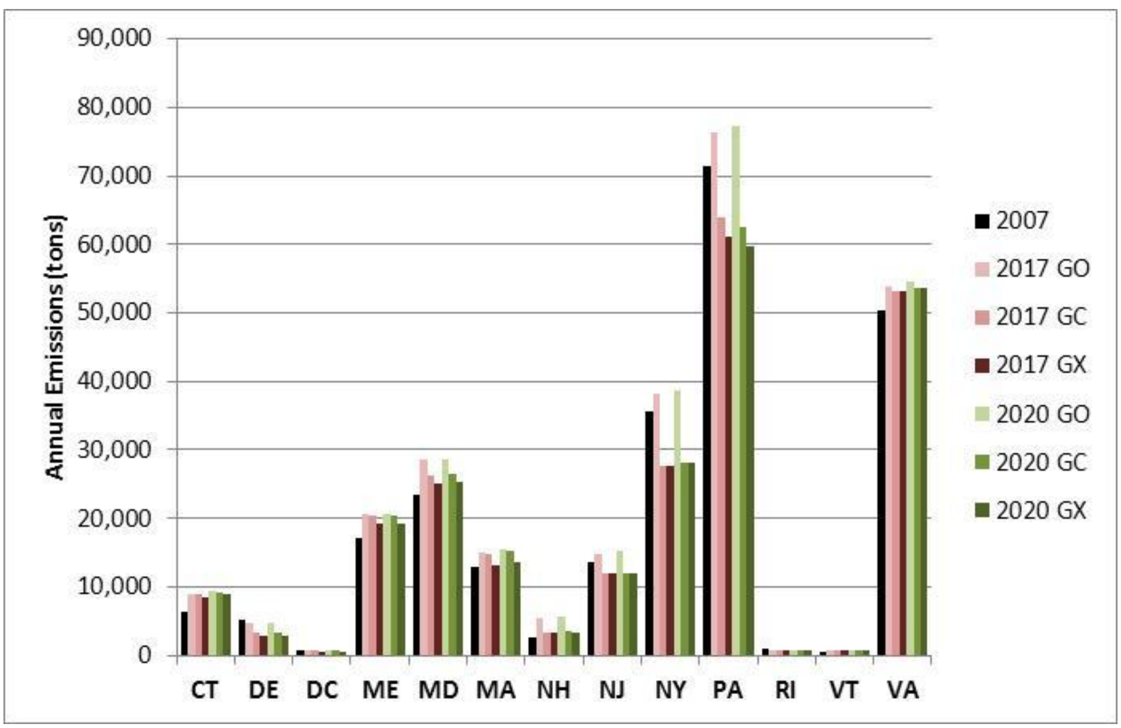


Exhibit 8.11 2007 and Projected Future Year NonEGU PM10-PRI Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	645	702	594	594	717	609	609
DE	1,197	1,140	973	973	1,115	947	947
DC	46	52	29	29	53	30	30
ME	4,748	4,667	4,475	4,475	4,636	4,449	4,449
MD	5,711	6,177	5,498	5,498	6,181	5,502	5,502
MA	3,029	2,927	2,904	2,904	2,977	2,953	2,953
NH	1,141	1,259	1,258	1,258	1,270	1,269	1,269
NJ	3,147	3,381	3,331	3,331	3,444	3,392	3,392
NY	4,463	4,572	4,260	4,260	4,595	4,283	4,283
PA	22,275	22,832	20,891	20,891	22,937	20,996	20,996
RI	173	174	174	174	179	179	179
VT	146	128	128	128	128	128	128
VA	13,028	13,419	12,517	12,517	13,507	12,602	12,602
	59,749	**61,430**	**57,032**	**57,032**	**61,741**	**57,339**	**57,339**

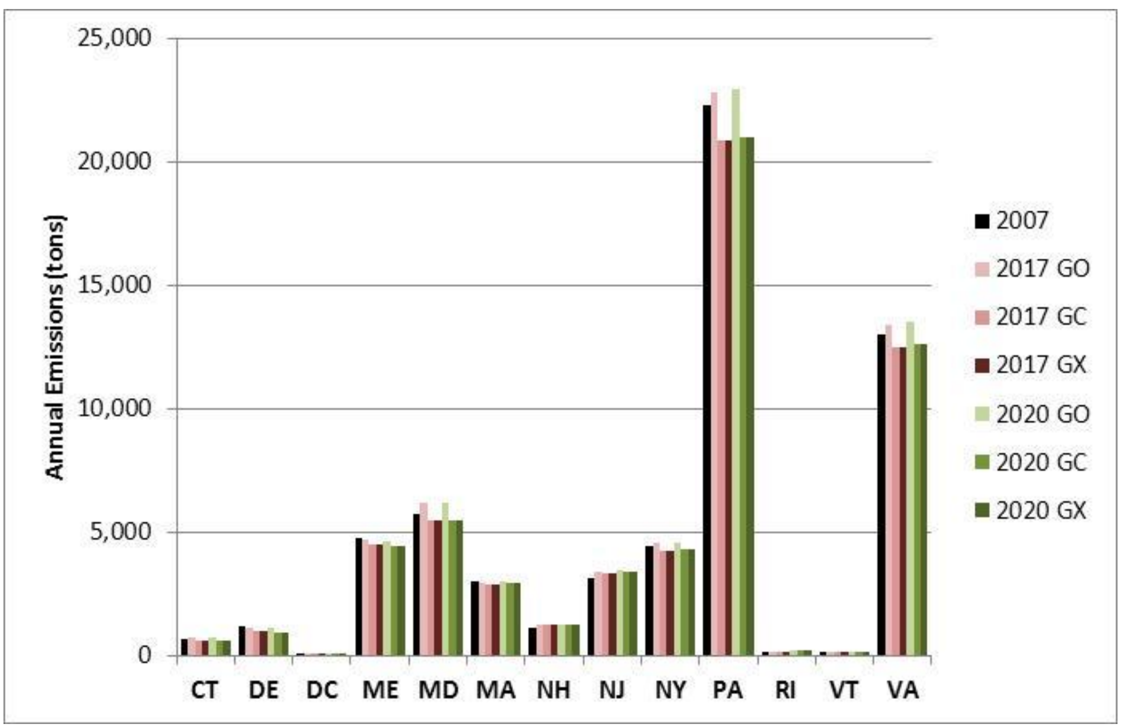


Exhibit 8.12 2007 and Projected Future Year NonEGU PM25-PRI Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	573	627	526	526	641	540	540
DE	1,083	1,021	876	876	993	848	848
DC	43	48	28	28	48	29	29
ME	3,727	3,811	3,658	3,658	3,802	3,653	3,653
MD	3,876	4,328	3,764	3,764	4,336	3,772	3,772
MA	2,572	2,495	2,485	2,485	2,542	2,532	2,532
NH	1,061	1,169	1,169	1,169	1,179	1,179	1,179
NJ	2,452	2,583	2,533	2,533	2,625	2,574	2,574
NY	2,415	2,517	2,329	2,329	2,538	2,350	2,350
PA	13,389	13,851	12,729	12,729	13,934	12,845	12,845
RI	124	124	124	124	128	128	128
VT	114	98	98	98	97	97	97
VA	10,296	10,611	9,885	9,885	10,674	9,947	9,947
	41,726	**43,281**	**40,204**	**40,204**	**43,538**	**40,492**	**40,492**

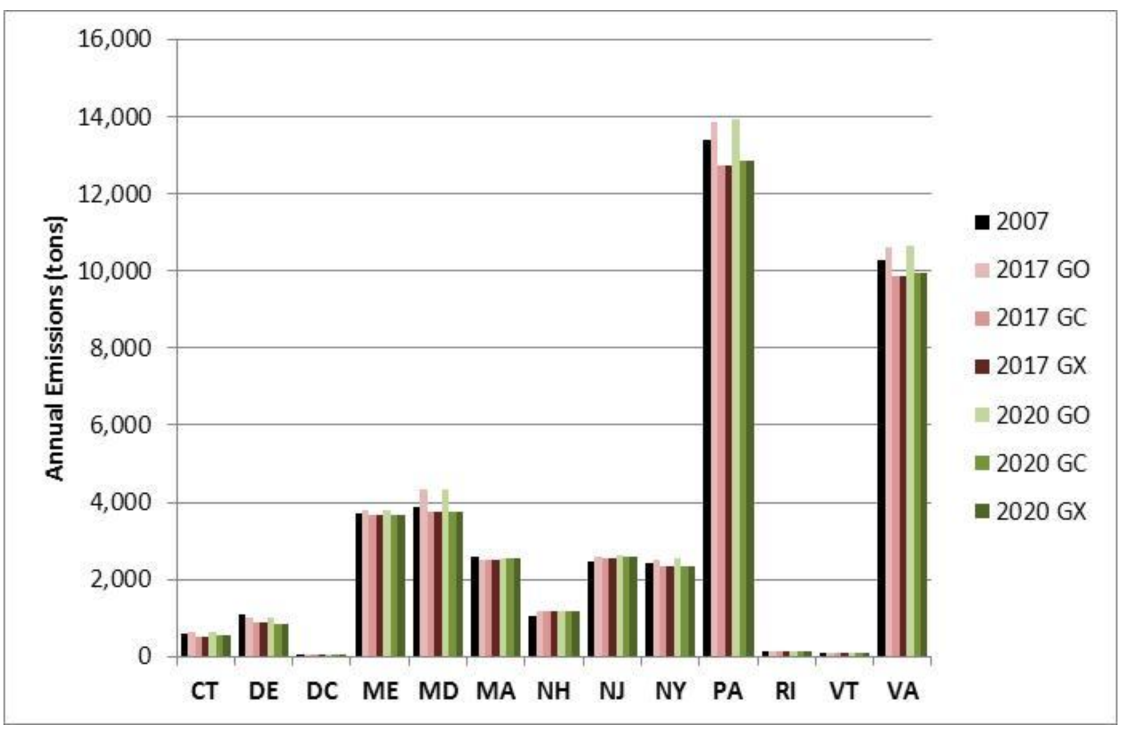


Exhibit 8.13 2007 and Projected Future Year NonEGU SO2 Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	3,185	3,236	3,236	3,117	3,253	3,253	2,773
DE	8,206	7,883	6,541	5,598	7,703	6,357	5,378
DC	471	510	380	358	518	382	337
ME	15,571	13,194	12,678	12,462	13,049	12,545	6,510
MD	31,176	36,658	34,278	34,278	36,636	34,289	34,289
MA	9,057	8,259	8,041	7,592	8,254	8,041	5,192
NH	2,734	2,655	2,655	2,582	2,658	2,658	1,030
NJ	3,401	3,736	2,591	2,591	3,818	2,645	2,645
NY	44,307	44,712	42,072	42,072	44,792	42,150	42,150
PA	57,330	58,464	53,489	49,814	58,627	53,652	49,975
RI	1,501	1,415	1,415	1,321	1,437	1,437	1,002
VT	316	248	248	243	243	243	92
VA	54,486	55,328	52,044	52,044	55,623	52,338	52,338
	231,742	**236,297**	**219,668**	**214,071**	**236,610**	**219,988**	**203,710**

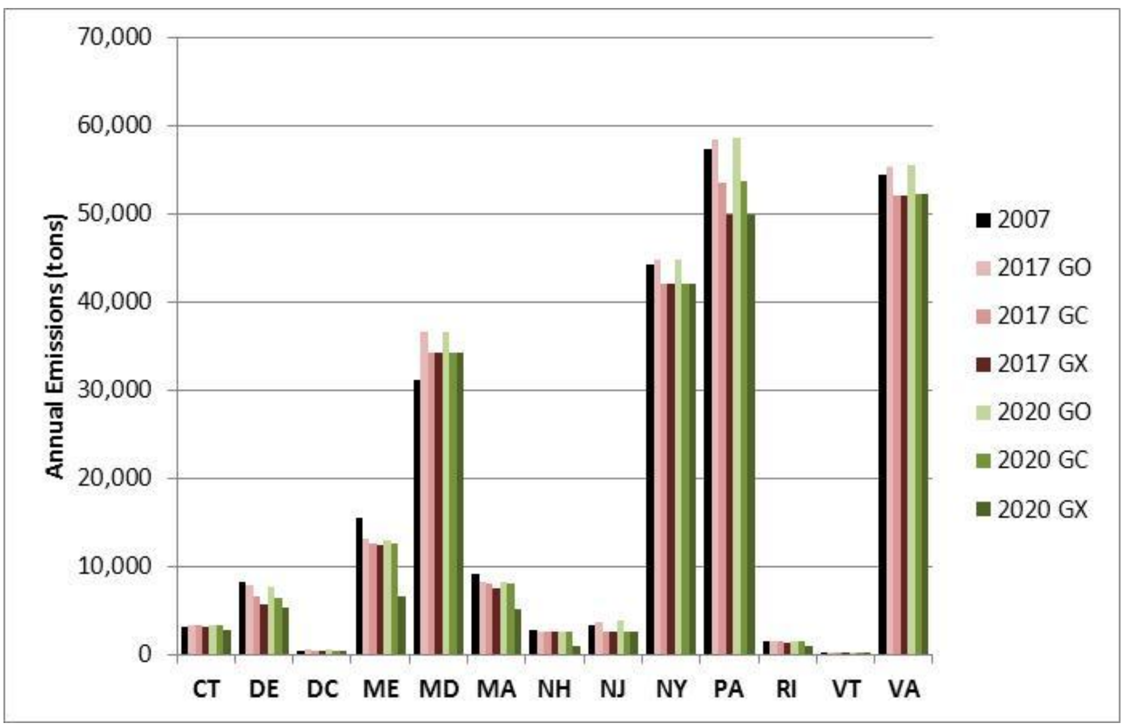
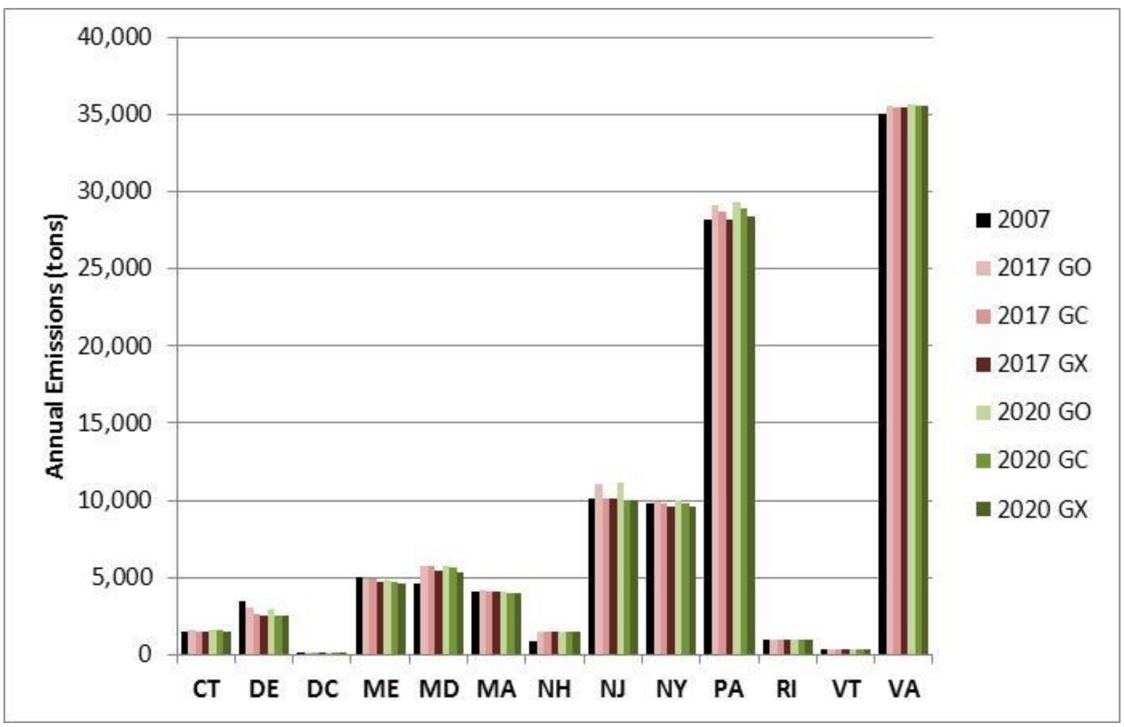


Exhibit 8.14 2007 and Projected Future Year NonEGU VOC Emissions (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,447	1,547	1,530	1,468	1,574	1,556	1,476
DE	3,406	3,068	2,588	2,547	2,972	2,572	2,530
DC	58	60	59	59	60	59	59
ME	4,987	4,931	4,885	4,745	4,760	4,718	4,559
MD	4,598	5,745	5,715	5,466	5,707	5,677	5,367
MA	4,094	4,156	4,102	4,057	4,077	4,022	3,965
NH	807	1,490	1,489	1,448	1,479	1,478	1,440
NJ	10,106	11,044	10,086	10,086	11,180	10,041	10,041
NY	9,772	9,948	9,815	9,640	9,985	9,849	9,635
PA	28,195	29,153	28,712	28,236	29,376	28,925	28,396
RI	922	950	945	919	967	963	930
VT	373	316	316	316	302	302	302
VA	35,018	35,538	35,461	35,461	35,670	35,593	35,593
	103,783	**107,947**	**105,705**	**104,450**	**108,110**	**105,755**	**104,292**



8.3 NONROAD NMIM SOURCE PROJECT EMISSIONS

Exhibits 8.15 to 8.21 summarize the 2007 and projected emissions for NONROAD model sources by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

It is not possible to isolate the emission changes due to growth versus the emission changes due to future controls in a single NMIM run. Therefore, the emissions under the growth only (GO) and growth and existing controls (GC) scenarios are the same. There are currently no potential new OTC control measures for sources whose emissions are estimated by the NONROAD model. Therefore, the emissions under the growth and existing controls (GC) and with growth, existing and potential new OTC controls (GX) scenarios are the same.

Exhibit 8.15 presents a state-level comparison of 2007, 2017 and 2020 annual CO emissions for NMIM/NONROAD sources. Emissions decrease by about 21% between 2007 and 2013, but remain relatively flat from 2017 to 2020.

Exhibit 8.16 shows that annual NH3 emissions are very small relative to other source sectors (e.g., agricultural ammonia) and generally increase slightly from 2007 to 2020.

Exhibit 8.17 shows that annual NOx emissions decrease by about 42% between 2007 and 2020 and by about 49% between 2007 and 2020 due to the turnover to newer engines subject to more stringent national emission standards.

Exhibits 8.18 and 8.19 shows that PM10-PRI and PM25-PRI emissions decrease about 33% between 2007 and 2020 and by about 41% between 2007 and 2020.

Exhibit 8.20 shows that annual SO2 emissions are virtually eliminated by 2017 due to lower national limits on the sulfur content of nonroad diesel fuel.

Exhibit 8.21 shows that annual VOC emissions decrease by about 41% between 2007 and 2020 and by about 46% between 2007 and 2020 due to the turnover to newer engines subject to more stringent national emission standards.

Exhibit 8.15 2007/2013/2017/2020 NMIM/NONROAD CO Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	181,817	143,586	143,586	143,586	147,193	147,193	147,193
DE	55,173	40,188	40,188	40,188	40,703	40,703	40,703
DC	14,319	10,246	10,246	10,246	10,322	10,322	10,322
ME	131,319	92,029	92,029	92,029	90,629	90,629	90,629
MD	297,832	247,766	247,766	247,766	254,083	254,083	254,083
MA	324,793	240,812	240,812	240,812	246,540	246,540	246,540
NH	90,461	73,012	73,012	73,012	73,294	73,294	73,294
NJ	445,302	362,054	362,054	362,054	372,857	372,857	372,857
NY	911,813	716,153	716,153	716,153	730,897	730,897	730,897
PA	719,517	533,798	533,798	533,798	542,133	542,133	542,133
RI	54,028	35,863	35,863	35,863	36,713	36,713	36,713
VT	52,497	35,978	35,978	35,978	35,608	35,608	35,608
VA	415,093	335,531	335,531	335,531	341,458	341,458	341,458
	3,693,965	**2,867,016**	**2,867,016**	**2,867,016**	**2,922,431**	**2,922,431**	**2,922,431**

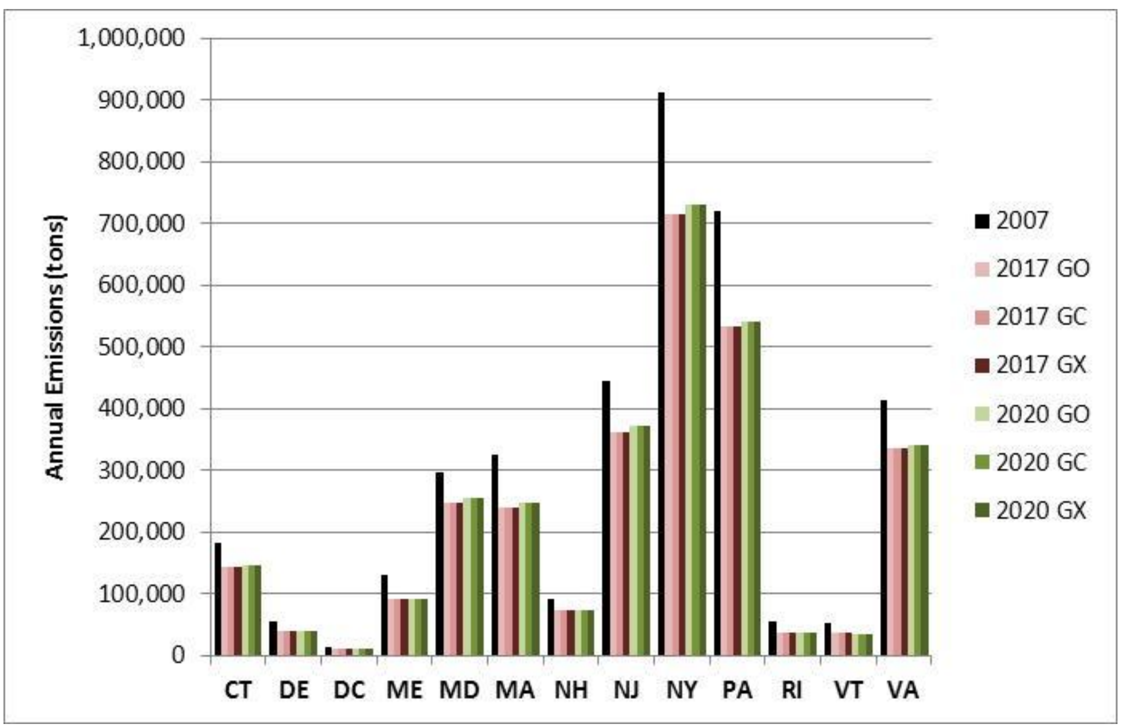


Exhibit 8.16 2007/2013/2017/2020 NMIM/NONROAD NH3 Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	16	20	20	20	21	21	21
DE	6	6	6	6	7	7	7
DC	3	3	3	3	3	3	3
ME	13	15	15	15	15	15	15
MD	29	35	35	35	37	37	37
MA	28	34	34	34	36	36	36
NH	10	12	12	12	13	13	13
NJ	40	47	47	47	50	50	50
NY	83	99	99	99	105	105	105
PA	60	71	71	71	74	74	74
RI	5	5	5	5	5	5	5
VT	5	6	6	6	6	6	6
VA	45	53	53	53	55	55	55
	342	**405**	**405**	**405**	**427**	**427**	**427**

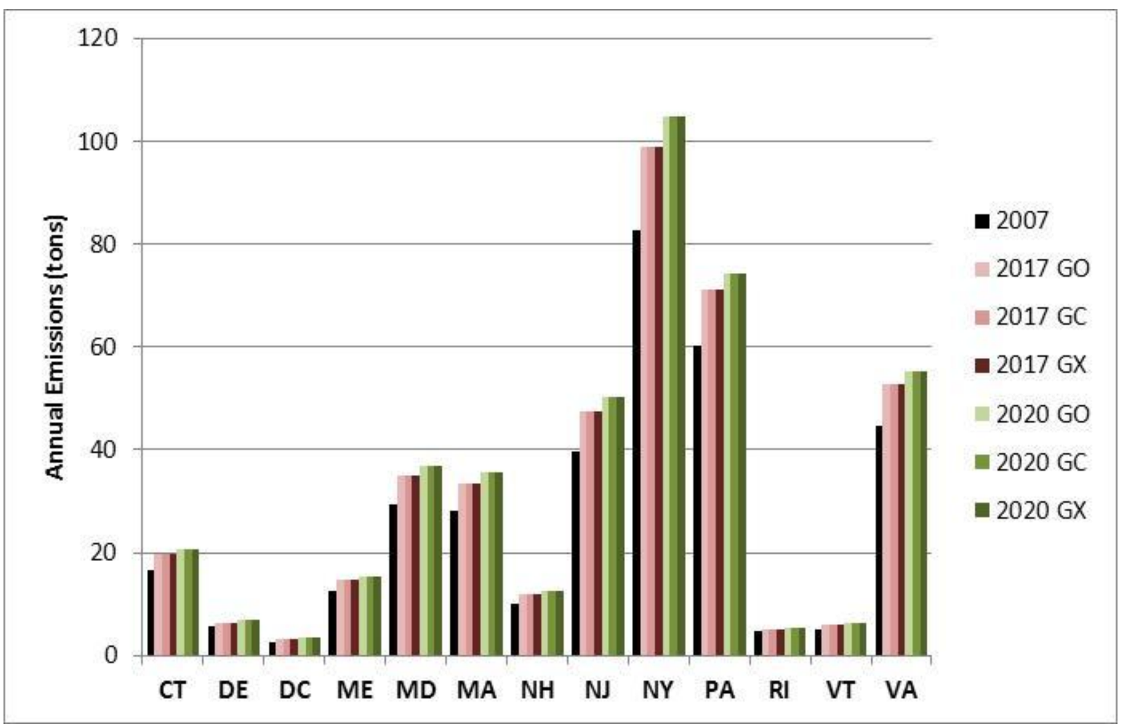


Exhibit 8.17 2007/2013/2017/2020 NMIM/NONROAD NOx Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	16,056	8,748	8,748	8,748	7,786	7,786	7,786
DE	4,998	3,096	3,096	3,096	2,723	2,723	2,723
DC	2,788	1,534	1,534	1,534	1,250	1,250	1,250
ME	7,439	5,216	5,216	5,216	4,783	4,783	4,783
MD	25,726	15,357	15,357	15,357	13,481	13,481	13,481
MA	26,471	14,820	14,820	14,820	13,163	13,163	13,163
NH	8,562	5,530	5,530	5,530	5,277	5,277	5,277
NJ	36,345	20,713	20,713	20,713	18,361	18,361	18,361
NY	72,271	43,490	43,490	43,490	38,871	38,871	38,871
PA	55,362	30,467	30,467	30,467	26,182	26,182	26,182
RI	4,388	2,348	2,348	2,348	2,114	2,114	2,114
VT	3,743	2,364	2,364	2,364	2,109	2,109	2,109
VA	41,325	23,658	23,658	23,658	20,189	20,189	20,189
	305,475	**177,343**	**177,343**	**177,343**	**156,288**	**156,288**	**156,288**

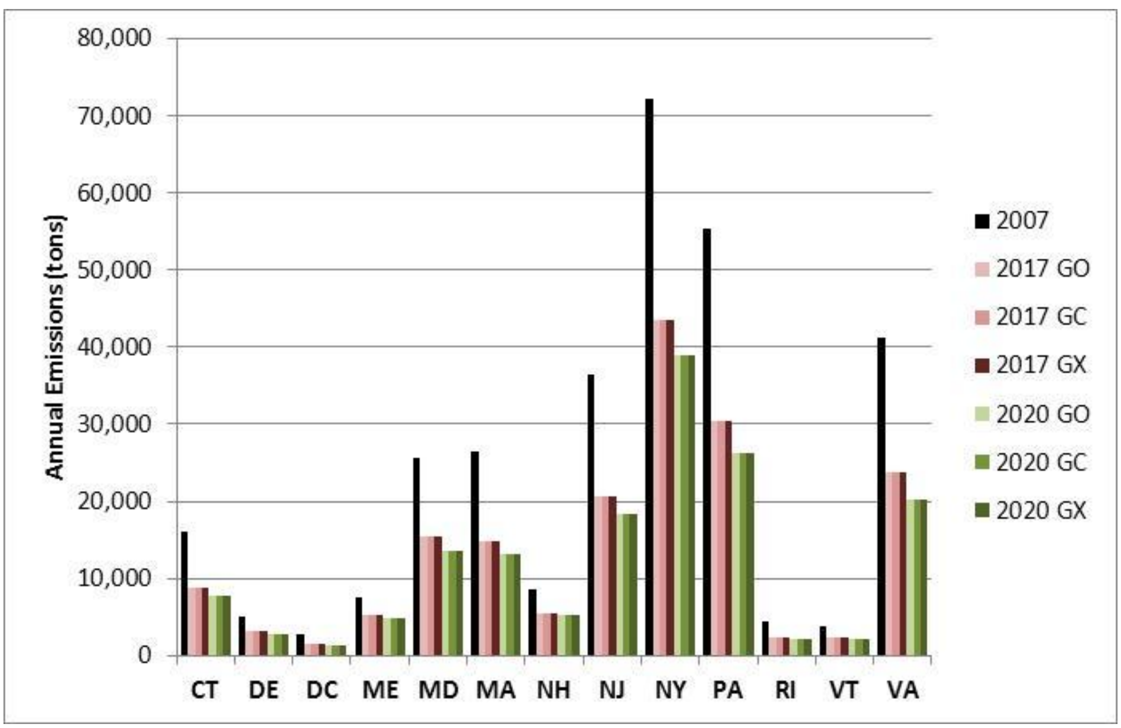


Exhibit 8.18 2007/2013/2017/2020 NMIM/NONROAD PM10-PRI Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,412	976	976	976	868	868	868
DE	476	300	300	300	258	258	258
DC	242	138	138	138	106	106	106
ME	1,151	810	810	810	706	706	706
MD	2,600	1,781	1,781	1,781	1,570	1,570	1,570
MA	2,384	1,630	1,630	1,630	1,438	1,438	1,438
NH	846	595	595	595	527	527	527
NJ	3,377	2,347	2,347	2,347	2,086	2,086	2,086
NY	7,059	4,684	4,684	4,684	4,075	4,075	4,075
PA	5,623	3,717	3,717	3,717	3,217	3,217	3,217
RI	367	229	229	229	202	202	202
VT	482	327	327	327	281	281	281
VA	4,128	2,695	2,695	2,695	2,319	2,319	2,319
	30,146	**20,229**	**20,229**	**20,229**	**17,652**	**17,652**	**17,652**

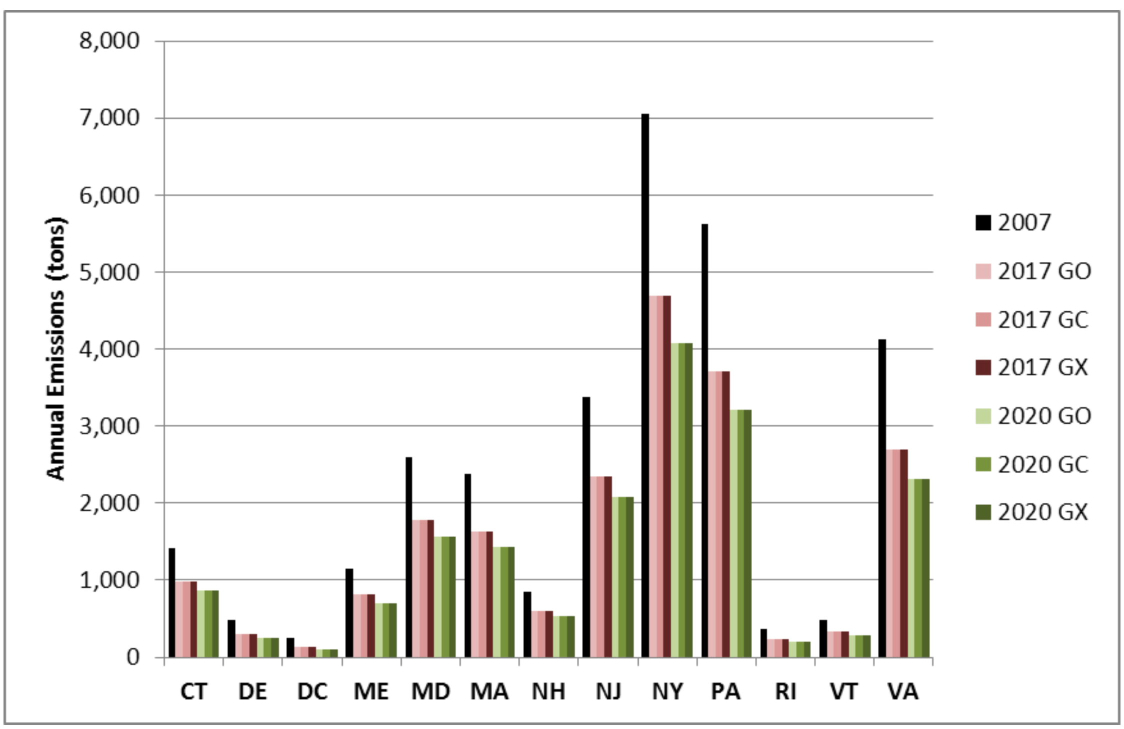


Exhibit 8.19 2007/2013/2017/2020 NMIM/NONROAD PM25-PRI Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,343	922	922	922	818	818	818
DE	453	284	284	284	243	243	243
DC	234	132	132	132	102	102	102
ME	1,080	756	756	756	657	657	657
MD	2,473	1,681	1,681	1,681	1,477	1,477	1,477
MA	2,268	1,540	1,540	1,540	1,355	1,355	1,355
NH	799	559	559	559	494	494	494
NJ	3,213	2,217	2,217	2,217	1,964	1,964	1,964
NY	6,715	4,430	4,430	4,430	3,843	3,843	3,843
PA	5,346	3,511	3,511	3,511	3,029	3,029	3,029
RI	349	216	216	216	191	191	191
VT	455	307	307	307	263	263	263
VA	3,933	2,549	2,549	2,549	2,185	2,185	2,185
	28,660	**19,105**	**19,105**	**19,105**	**16,621**	**16,621**	**16,621**

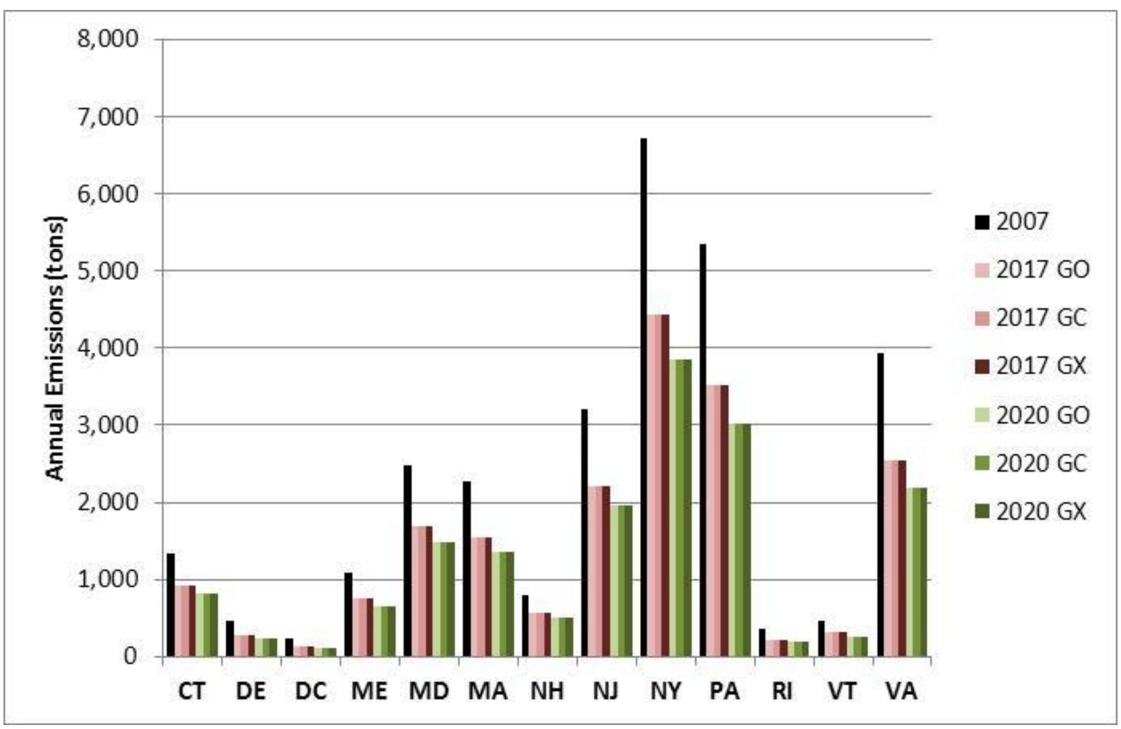


Exhibit 8.20 2007/2013/2017/2020 NMIM/NONROAD SO2 Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	802	30	30	30	32	32	32
DE	266	7	7	7	7	7	7
DC	196	3	3	3	3	3	3
ME	416	16	16	16	17	17	17
MD	1,436	36	36	36	38	38	38
MA	1,377	41	41	41	44	44	44
NH	441	16	16	16	18	18	18
NJ	1,905	55	55	55	58	58	58
NY	3,957	118	118	118	126	126	126
PA	2,972	84	84	84	86	86	86
RI	211	7	7	7	7	7	7
VT	202	7	7	7	7	7	7
VA	2,284	90	90	90	94	94	94
	16,464	**511**	**511**	**511**	**537**	**537**	**537**

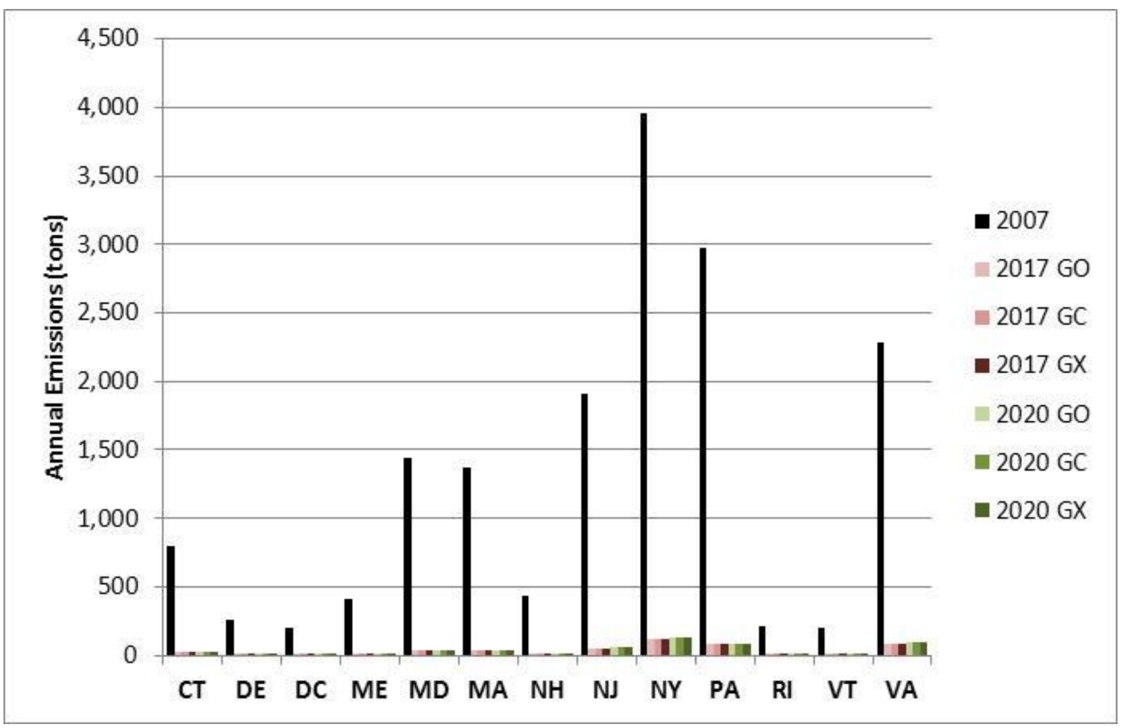
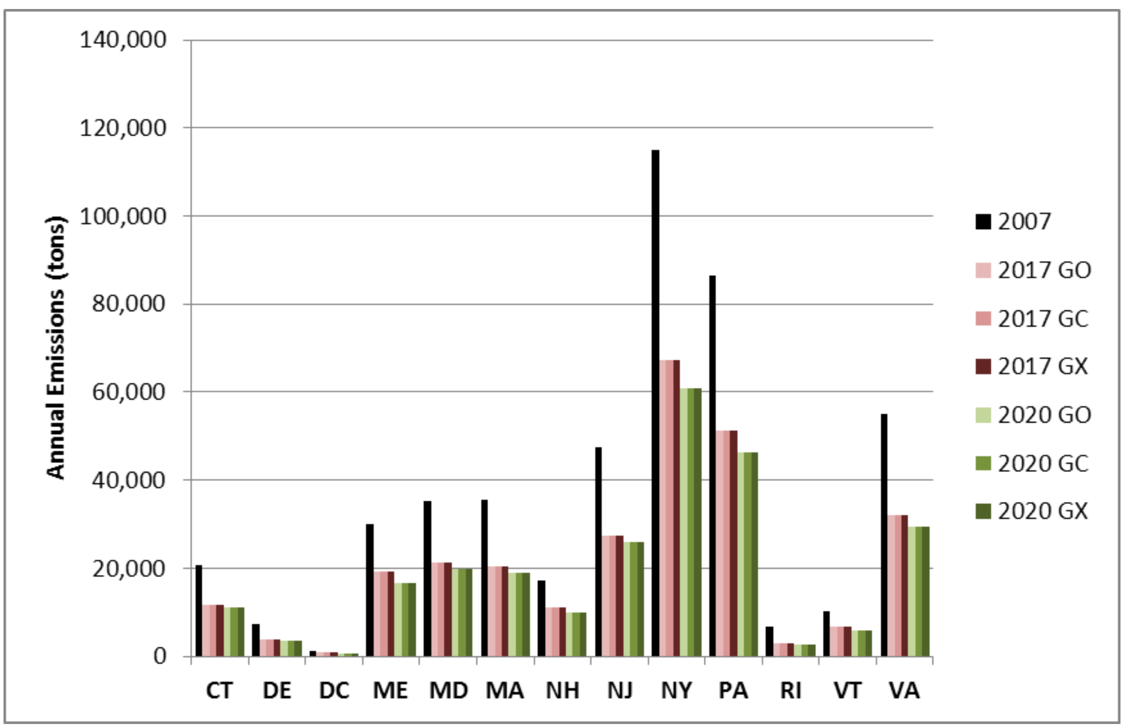


Exhibit 8.21 2007/2013/2017/2020 NMIM/NONROAD VOC Emissions by State (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	20,721	11,803	11,803	11,803	10,985	10,985	10,985
DE	7,157	3,888	3,888	3,888	3,498	3,498	3,498
DC	1,324	749	749	749	710	710	710
ME	29,880	19,303	19,303	19,303	16,729	16,729	16,729
MD	35,160	21,226	21,226	21,226	19,890	19,890	19,890
MA	35,676	20,510	20,510	20,510	18,990	18,990	18,990
NH	17,108	11,030	11,030	11,030	9,785	9,785	9,785
NJ	47,521	27,430	27,430	27,430	25,802	25,802	25,802
NY	114,935	67,238	67,238	67,238	60,945	60,945	60,945
PA	86,397	51,382	51,382	51,382	46,399	46,399	46,399
RI	6,721	2,885	2,885	2,885	2,657	2,657	2,657
VT	10,339	6,714	6,714	6,714	5,864	5,864	5,864
VA	55,135	32,141	32,141	32,141	29,303	29,303	29,303
	468,074	**276,299**	**276,299**	**276,299**	**251,556**	**251,556**	**251,556**



8.4 NONROAD COMMERCIAL MARINE VESSEL EMISSIONS

Exhibits 8.22 to 8.28 summarize the 2007 and projected future year commercial marine vessel emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

Emissions of all pollutants except NH3 are projected to decrease as a result of Federal rules affecting Category 1 / 2 and Category 3 marine engines, including more stringent engine emission standards and sulfur in fuel limitations. There are currently no potential new OTC control measures for commercial marine vessels.

Exhibit 8.22 presents a state-level comparison of 2007, 2017 and 2020 annual CO emissions for commercial marine vessels. Emissions decrease by about 13 percent from 2007 to 2017, and 12 percent from 2007 to 2020.

Exhibit 8.23 shows that there are very little NH3 emissions from this sector.

Exhibit 8.24 shows that annual NOx emissions from commercial marine vessels decrease by 32 percent from 2007 to 2017 and 40 percent from 2007 to 2020.

Exhibits 9.25 and 9.26 show that annual PM10-PRI and PM2.5-PRI emissions from commercial marine vessels decrease substantially after 2007. For both pollutants, emissions are reduced by about 57 percent from 2007 to 2017 and 66 percent from 2007 to 2020.

Exhibit 8.27 shows that that annual SO2 emissions from commercial marine vessels decrease dramatically after 2007. SO2 emissions are reduced by about 89 percent from 2007 to 2017 and 93 percent from 2007 to 2020.

Exhibit 8.28 shows that annual VOC emissions from commercial marine vessels decrease by 15 percent from 2007 to 2017, and 20 percent from 2007 to 2020.

Exhibit 8.22 2007 and Projected CO Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,078	1,073	912	912	1,102	908	908
DE	554	543	485	485	554	484	484
DC	1	1	1	1	1	1	1
ME	522	521	438	438	536	435	435
MD	2,795	2,792	2,350	2,350	2,871	2,337	2,337
MA	1,473	1,475	1,232	1,232	1,518	1,225	1,225
NH	89	84	83	83	85	84	84
NJ	1,619	2,202	2,067	2,067	2,427	2,254	2,254
NY	3,476	3,452	2,961	2,961	3,541	2,949	2,949
PA	1,294	1,283	1,106	1,106	1,315	1,102	1,102
RI	522	523	437	437	538	434	434
VT	0	0	0	0	0	0	0
VA	3,735	3,731	3,166	3,166	3,831	3,150	3,150
	17,156	**17,681**	**15,238**	**15,238**	**18,319**	**15,363**	**15,363**

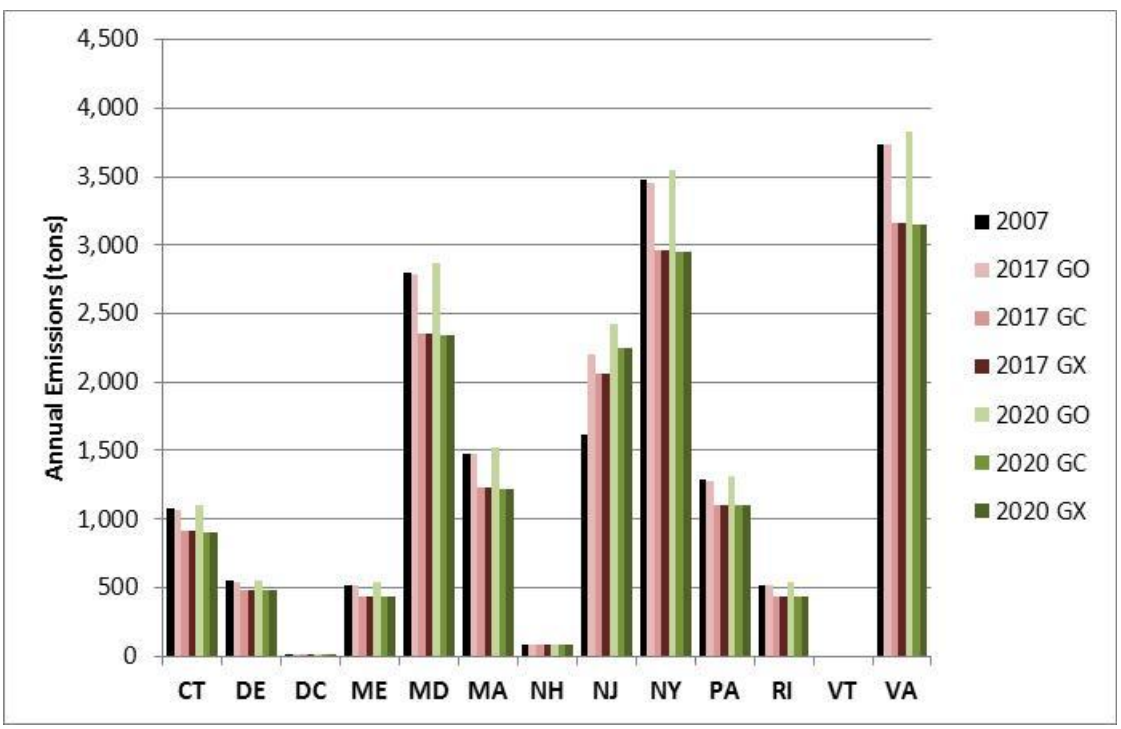


Exhibit 8.23 2007 and Projected NH3 Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	3	3	3	3	3	3	3
DE		0	0	0	0	0	0
DC	0	0	0	0	0	0	0
ME		0	0	0	0	0	0
MD	8	8	8	8	8	8	8
MA		0	0	0	0	0	0
NH		0	0	0	0	0	0
NJ	8	11	11	11	12	12	12
NY	2	2	2	2	2	2	2
PA	13	12	12	12	13	13	13
RI	1	1	1	1	1	1	1
VT	0	0	0	0	0	0	0
VA	9	9	9	9	9	9	9
	44	**46**	**46**	**46**	**47**	**47**	**47**

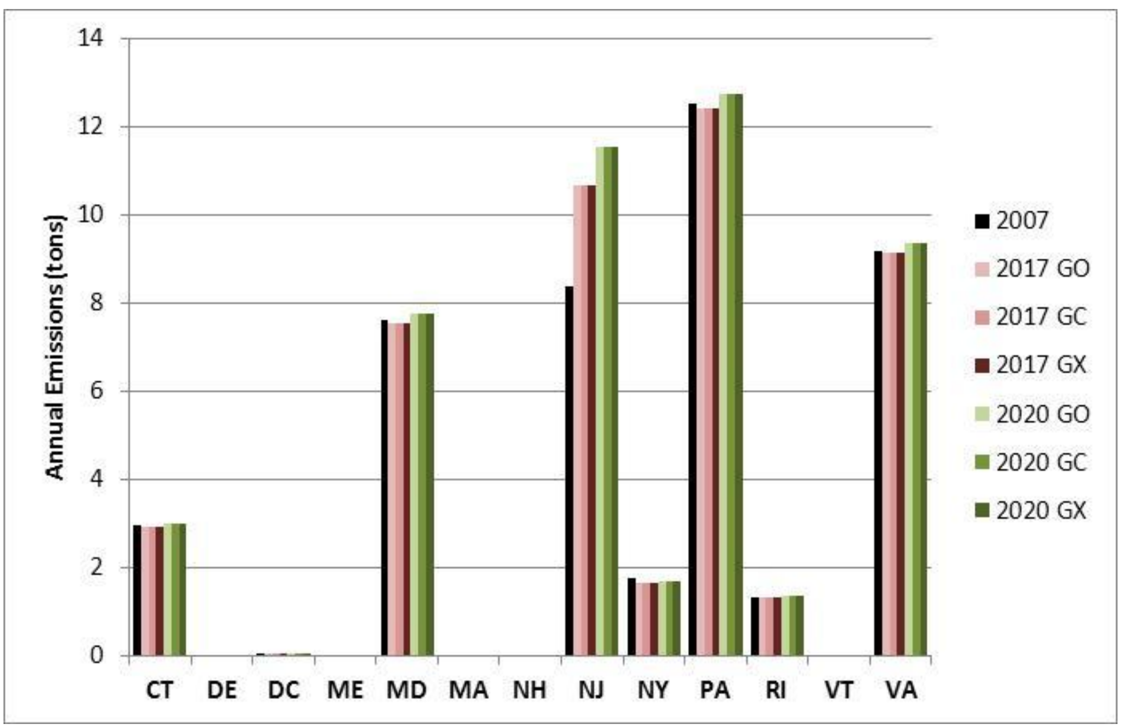


Exhibit 8.24 2007 and Projected NOx Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	6,528	6,454	4,162	4,162	6,608	3,642	3,642
DE	5,095	4,966	3,217	3,217	5,054	2,857	2,857
DC	6	6	4	4	6	3	3
ME	1,659	1,638	1,057	1,057	1,676	926	926
MD	16,027	15,929	10,256	10,256	16,343	8,922	8,922
MA	3,246	3,247	2,086	2,086	3,340	1,803	1,803
NH	271	258	169	169	260	154	154
NJ	11,197	15,318	11,140	11,140	16,906	10,251	10,251
NY	28,180	27,913	17,990	17,990	28,598	15,709	15,709
PA	11,378	11,237	7,249	7,249	11,498	6,350	6,350
RI	2,829	2,825	1,816	1,816	2,904	1,572	1,572
VT	0	0	0	0	0	0	0
VA	21,760	21,643	14,445	14,445	22,172	12,750	12,750
	108,175	**111,435**	**73,591**	**73,591**	**115,365**	**64,937**	**64,937**

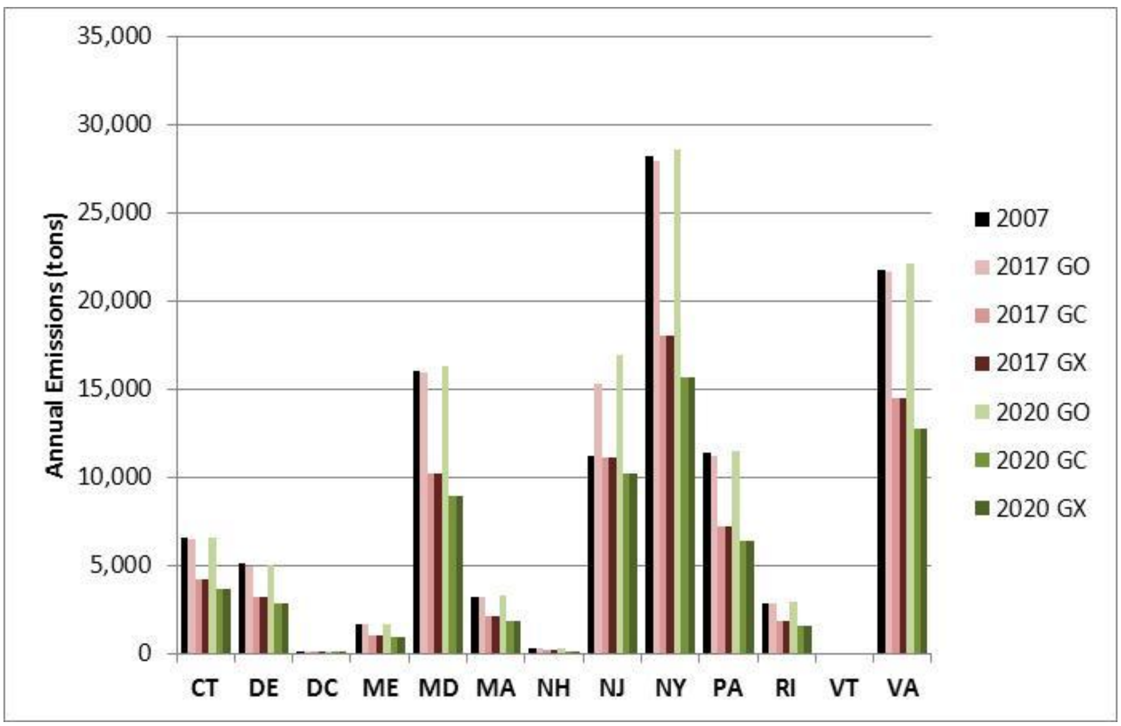


Exhibit 8.25 2007 and Projected PM10-PRI Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	312	305	124	124	310	101	101
DE	327	315	99	99	319	75	75
DC	0	0	0	0	0	0	0
ME	395	384	144	144	391	114	114
MD	657	649	301	301	664	251	251
MA	316	315	162	162	323	138	138
NH	13	12	3	3	13	2	2
NJ	622	887	244	244	989	241	241
NY	1,671	1,649	753	753	1,686	626	626
PA	524	511	197	197	519	158	158
RI	112	112	55	55	115	47	47
VT	0	0	0	0	0	0	0
VA	947	934	461	461	953	394	394
	5,897	**6,072**	**2,543**	**2,543**	**6,283**	**2,146**	**2,146**

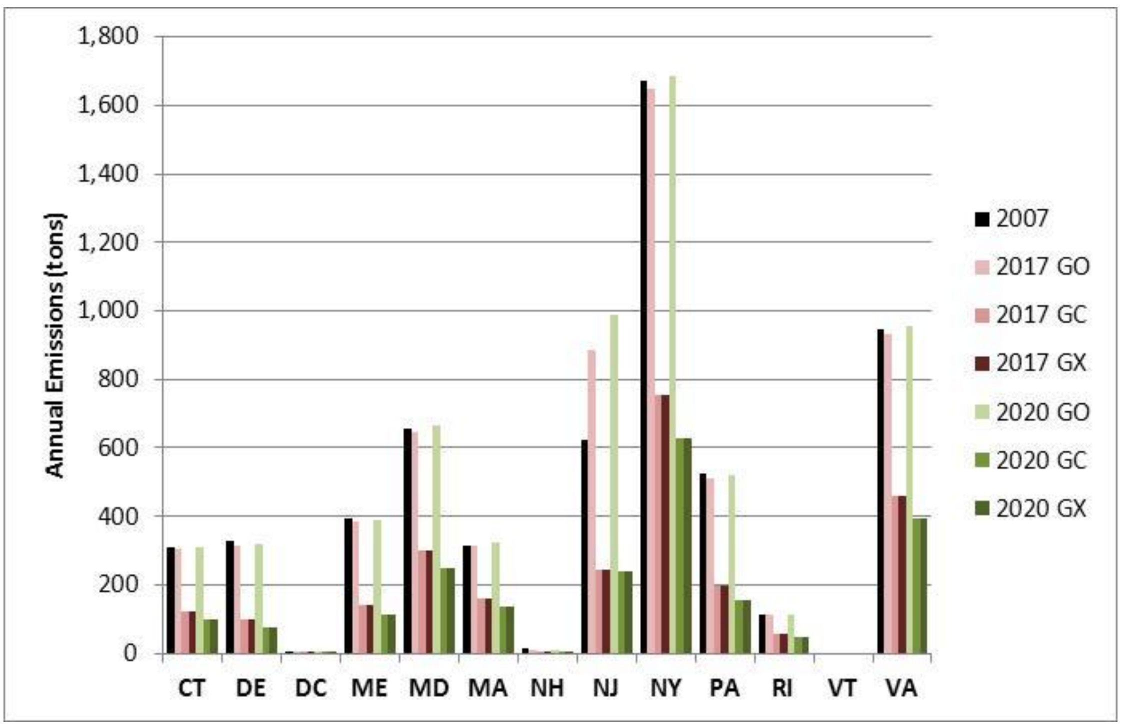


Exhibit 8.26 2007 and Projected PM25-PRI Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	2007	2017 GO	2017 GC	2017 GX	2020 GO	2020 GC	2020 GX
CT	296	290	119	119	295	97	97
DE	305	294	93	93	297	70	70
DC	0	0	0	0	0	0	0
ME	364	354	132	132	359	105	105
MD	606	600	285	285	614	239	239
MA	290	289	149	149	297	127	127
NH	12	11	3	3	12	2	2
NJ	575	820	225	225	915	223	223
NY	1,541	1,520	695	695	1,555	578	578
PA	484	472	183	183	480	146	146
RI	108	107	53	53	110	45	45
VT	0	0	0	0	0	0	0
VA	908	896	446	446	915	383	383
	5,491	**5,654**	**2,384**	**2,384**	**5,851**	**2,016**	**2,016**

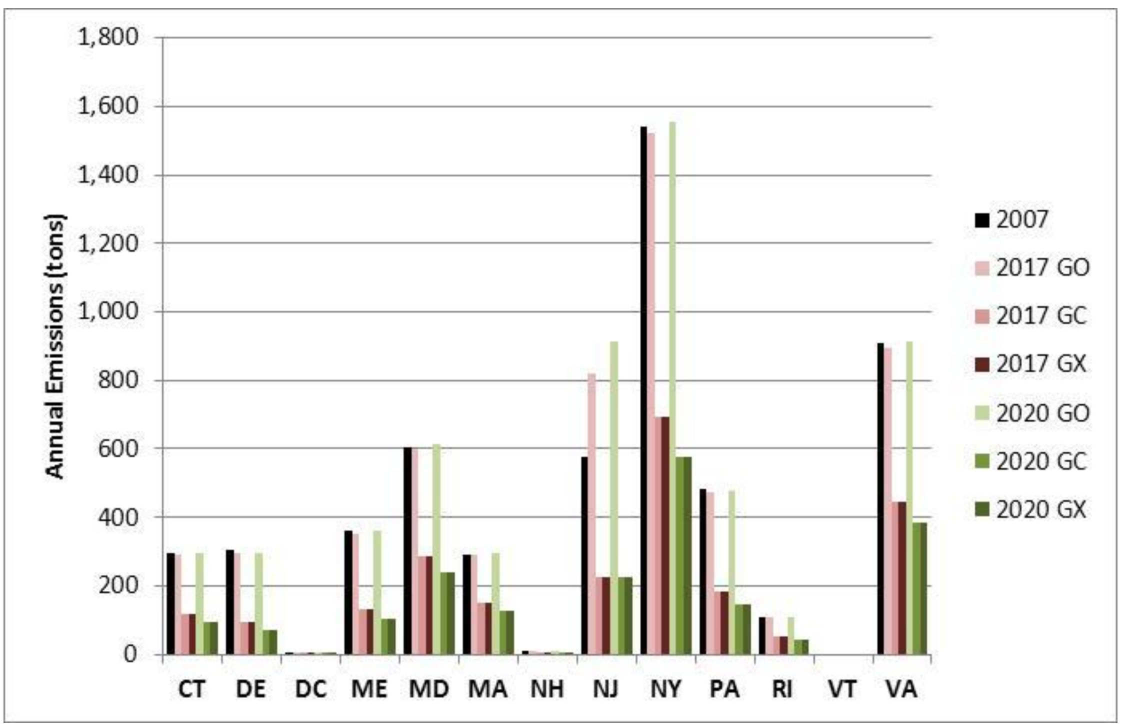


Exhibit 8.27 2007 and Projected SO2 Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,386	1,327	147	147	1,341	60	60
DE	2,079	1,984	225	225	2,000	84	84
DC	1	1	0	0	1	0	0
ME	189	185	17	17	189	12	12
MD	2,170	2,099	217	217	2,128	109	109
MA	698	684	64	64	698	42	42
NH	506	482	55	55	486	20	20
NJ	6,712	10,085	403	403	11,405	452	452
NY	9,321	9,181	821	821	9,383	601	601
PA	3,067	2,909	343	343	2,925	111	111
RI	632	607	66	66	613	28	28
VT	0	0	0	0	0	0	0
VA	4,058	3,928	940	940	3,969	747	747
	30,820	**33,473**	**3,296**	**3,296**	**35,139**	**2,268**	**2,268**

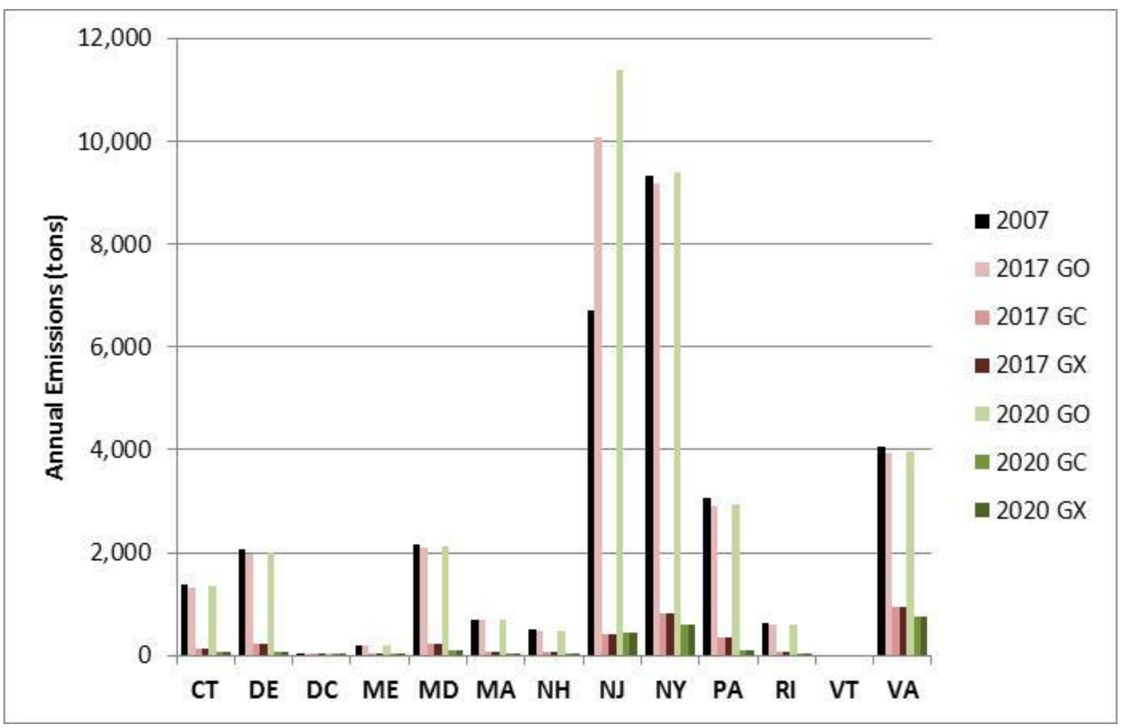
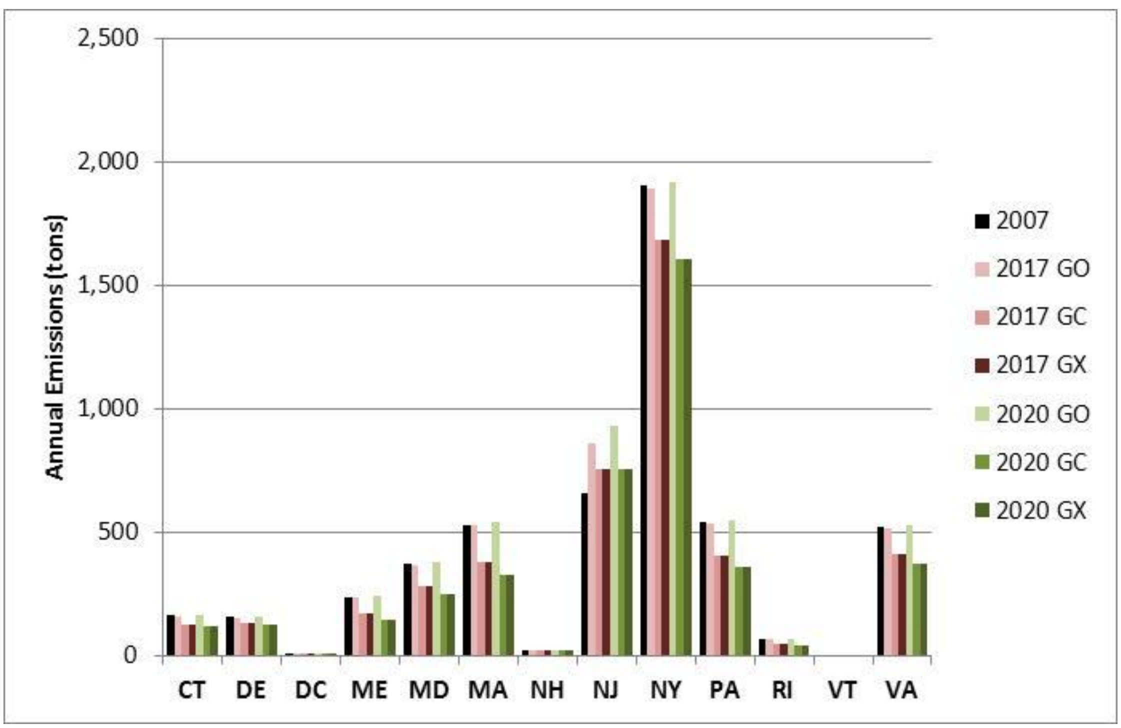


Exhibit 8.28 2007 and Projected VOC Emissions for CMV (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	161	158	127	127	162	117	117
DE	158	153	133	133	156	127	127
DC	0	0	0	0	0	0	0
ME	234	234	168	168	240	145	145
MD	371	367	282	282	376	252	252
MA	528	529	381	381	544	328	328
NH	23	21	21	21	22	21	21
NJ	658	857	753	753	933	754	754
NY	1,906	1,895	1,681	1,681	1,918	1,606	1,606
PA	538	534	406	406	547	360	360
RI	64	64	47	47	66	42	42
VT	0	0	0	0	0	0	0
VA	523	518	409	409	530	370	370
	5,164	**5,331**	**4,410**	**4,410**	**5,493**	**4,121**	**4,121**



8.5 NONROAD AIRPORT EMISSIONS

Exhibits 9.29 to 9.35 summarize the 2007 and projected future year airport emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

There were no NH3 emissions reported for airport operations. Emissions of other pollutants are projected to change as a result of changes in airline activity levels. No state or Federal rules were identified that would reduce emissions from aircraft operations in the future. There are currently no potential new OTC control measures for airports.

CO, PM10, PM2.5 and VOC emissions are projected to remain relatively constant between 2007 levels by 2017. By 2020, the will be a slight increase in emissions from 2007 due to increased operations by 2020.

NOx and SO2 emissions are projected to increase by 7 percent from 2007 levels by 2017 and by 13 percent by 2020 due to increased air traffic.

Exhibit 8.29 2007 and Projected CO Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	4,659	4,224	4,224	4,224	4,386	4,386	4,386
DE	1,625	1,550	1,550	1,550	1,593	1,593	1,593
DC	14	14	14	14	14	14	14
ME	32,879	32,774	32,774	32,774	32,802	32,802	32,802
MD	10,265	10,042	10,042	10,042	10,335	10,335	10,335
MA	15,495	14,592	14,592	14,592	14,940	14,940	14,940
NH	2,089	1,861	1,861	1,861	1,883	1,883	1,883
NJ	21,878	21,837	21,837	21,837	22,411	22,411	22,411
NY	17,403	18,579	18,579	18,579	19,706	19,706	19,706
PA	26,540	26,165	26,165	26,165	27,345	27,345	27,345
RI	1,739	2,255	2,255	2,255	2,280	2,280	2,280
VT	2,420	2,100	2,100	2,100	2,127	2,127	2,127
VA	22,009	22,689	22,689	22,689	23,190	23,190	23,190
	159,016	**158,684**	**158,684**	**158,684**	**163,012**	**163,012**	**163,012**

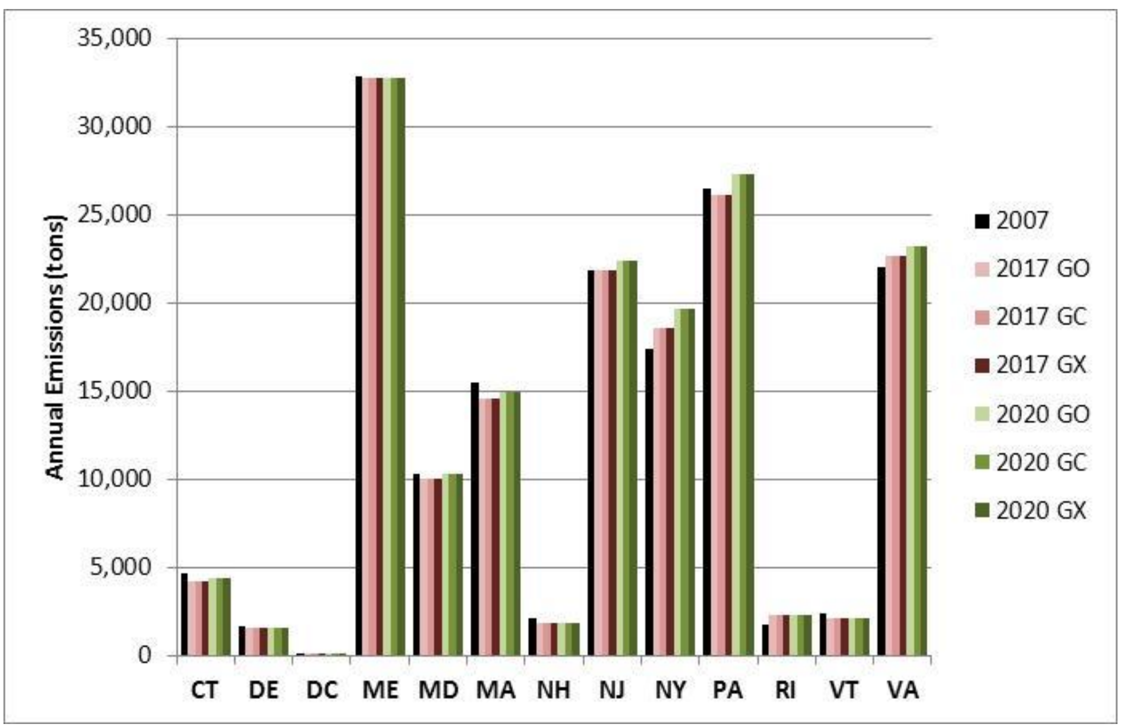


Exhibit 8.30 2007 and Projected NH3 Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	0	0	0	0	0	0	0
DE	0	0	0	0	0	0	0
DC	0	0	0	0	0	0	0
ME	0	0	0	0	0	0	0
MD	0	0	0	0	0	0	0
MA	0	0	0	0	0	0	0
NH	0	0	0	0	0	0	0
NJ	0	0	0	0	0	0	0
NY	0	0	0	0	0	0	0
PA	0	0	0	0	0	0	0
RI	0	0	0	0	0	0	0
VT	0	0	0	0	0	0	0
VA	0	0	0	0	0	0	0
	0	0	0	0	0	0	0

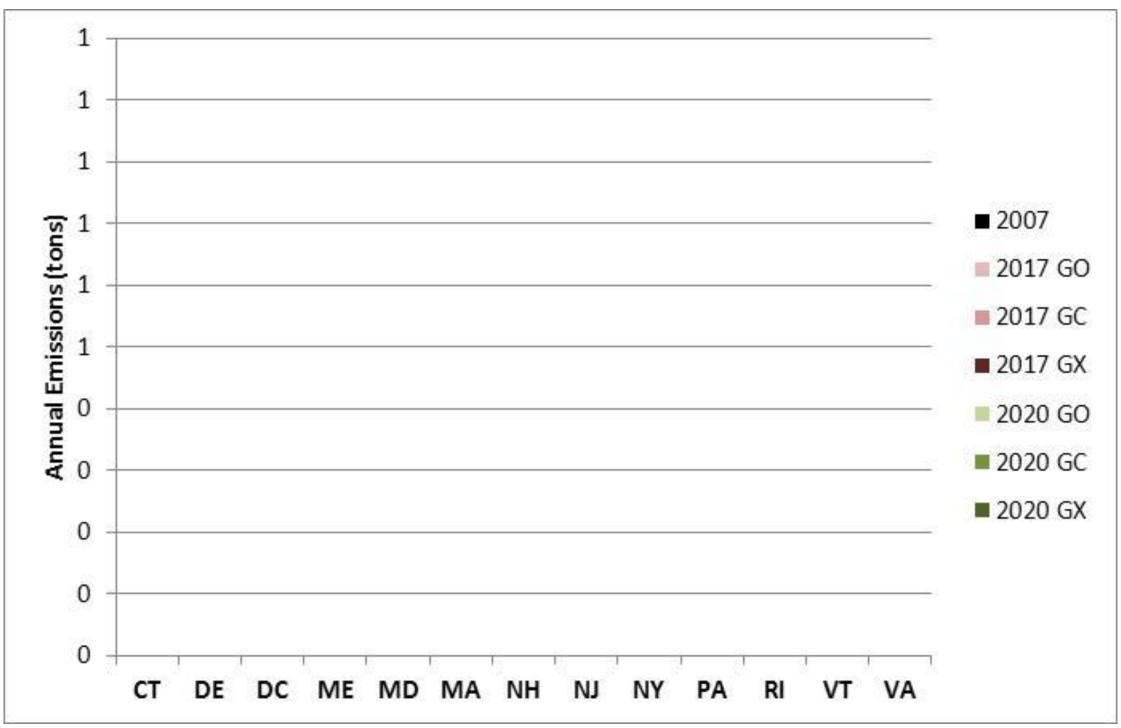


Exhibit 8.31 2007 and Projected NOx Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	713	657	657	657	688	688	688
DE	805	801	801	801	802	802	802
DC	0	0	0	0	0	0	0
ME	134	144	144	144	144	144	144
MD	1,910	2,021	2,021	2,021	2,119	2,119	2,119
MA	3,190	3,267	3,267	3,267	3,365	3,365	3,365
NH	278	256	256	256	260	260	260
NJ	5,105	5,408	5,408	5,408	5,612	5,612	5,612
NY	6,998	8,081	8,081	8,081	8,789	8,789	8,789
PA	3,738	4,094	4,094	4,094	4,406	4,406	4,406
RI	289	281	281	281	294	294	294
VT	103	113	113	113	117	117	117
VA	5,520	5,762	5,762	5,762	5,889	5,889	5,889
	28,783	**30,885**	**30,885**	**30,885**	**32,485**	**32,485**	**32,485**

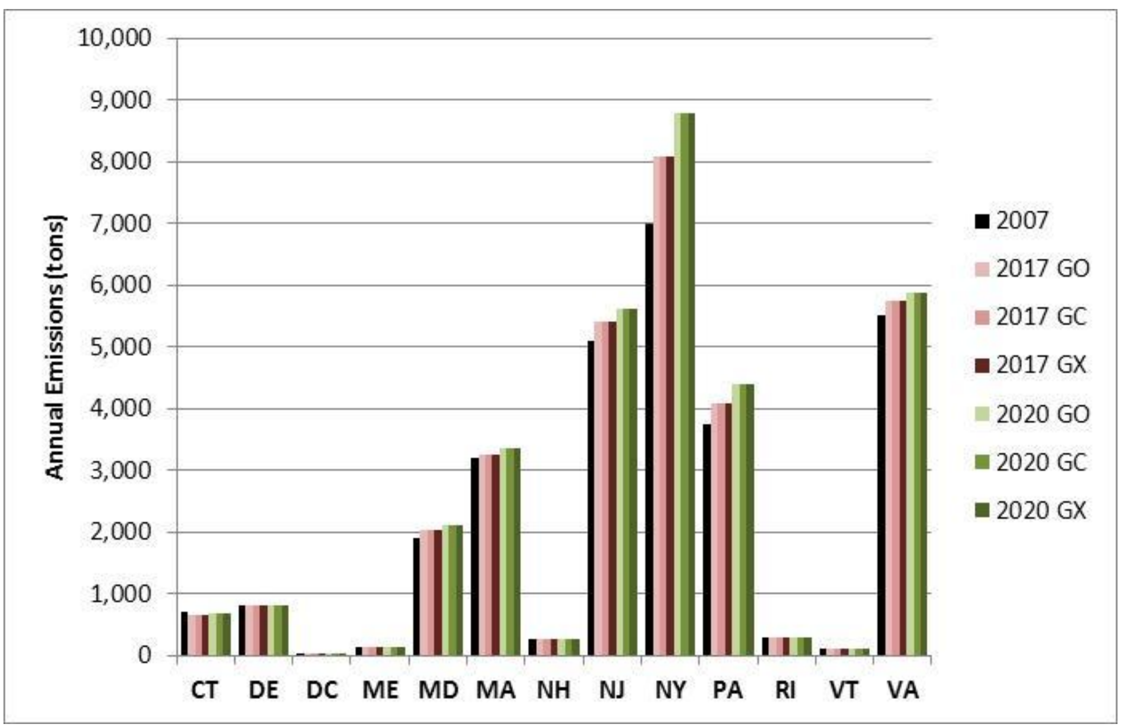


Exhibit 8.32 2007 and Projected PM10-PRI Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	66	59	59	59	61	61	61
DE	27	25	25	25	25	25	25
DC	0	0	0	0	0	0	0
ME	83	82	82	82	82	82	82
MD	74	70	70	70	73	73	73
MA	295	284	284	284	289	289	289
NH	37	34	34	34	34	34	34
NJ	170	173	173	173	177	177	177
NY	140	158	158	158	170	170	170
PA	396	385	385	385	400	400	400
RI	22	33	33	33	33	33	33
VT	46	40	40	40	40	40	40
VA	821	840	840	840	847	847	847
	2,176	**2,183**	**2,183**	**2,183**	**2,234**	**2,234**	**2,234**

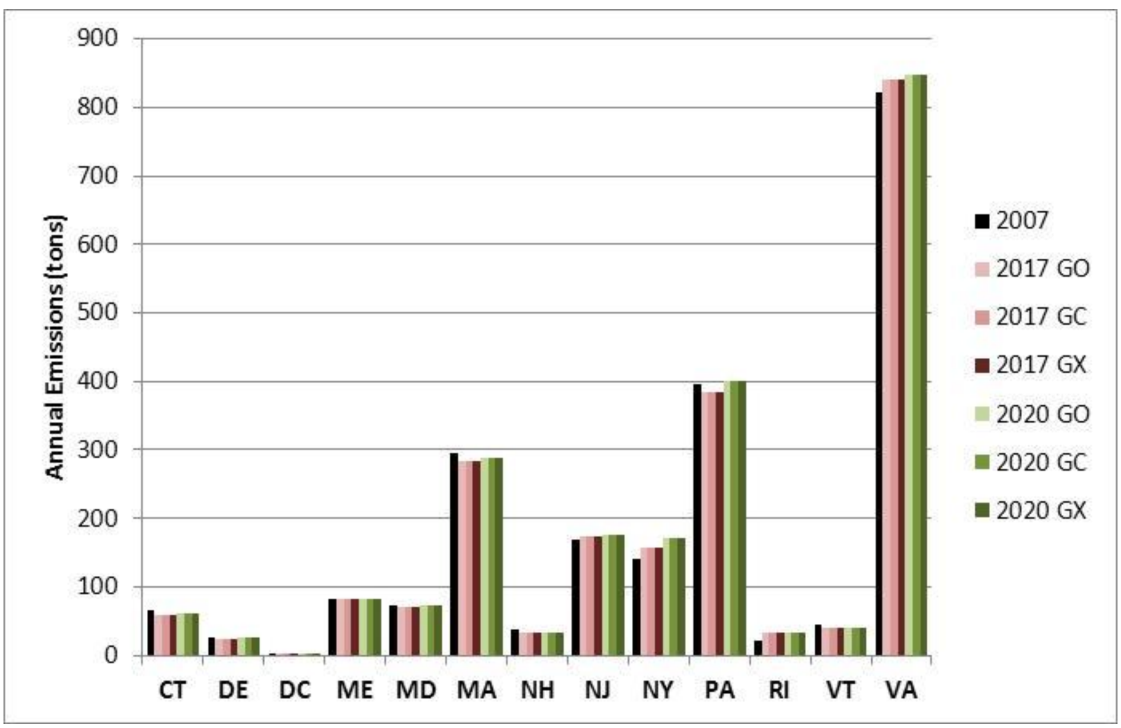


Exhibit 8.33 2007 and Projected PM25-PRI Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	51	46	46	46	48	48	48
DE	19	17	17	17	18	18	18
DC	0	0	0	0	0	0	0
ME	61	61	61	61	61	61	61
MD	16	17	17	17	17	17	17
MA	215	208	208	208	212	212	212
NH	27	25	25	25	25	25	25
NJ	143	146	146	146	150	150	150
NY	139	157	157	157	170	170	170
PA	294	288	288	288	300	300	300
RI	17	25	25	25	25	25	25
VT	32	28	28	28	29	29	29
VA	580	595	595	595	601	601	601
	1,595	**1,613**	**1,613**	**1,613**	**1,656**	**1,656**	**1,656**

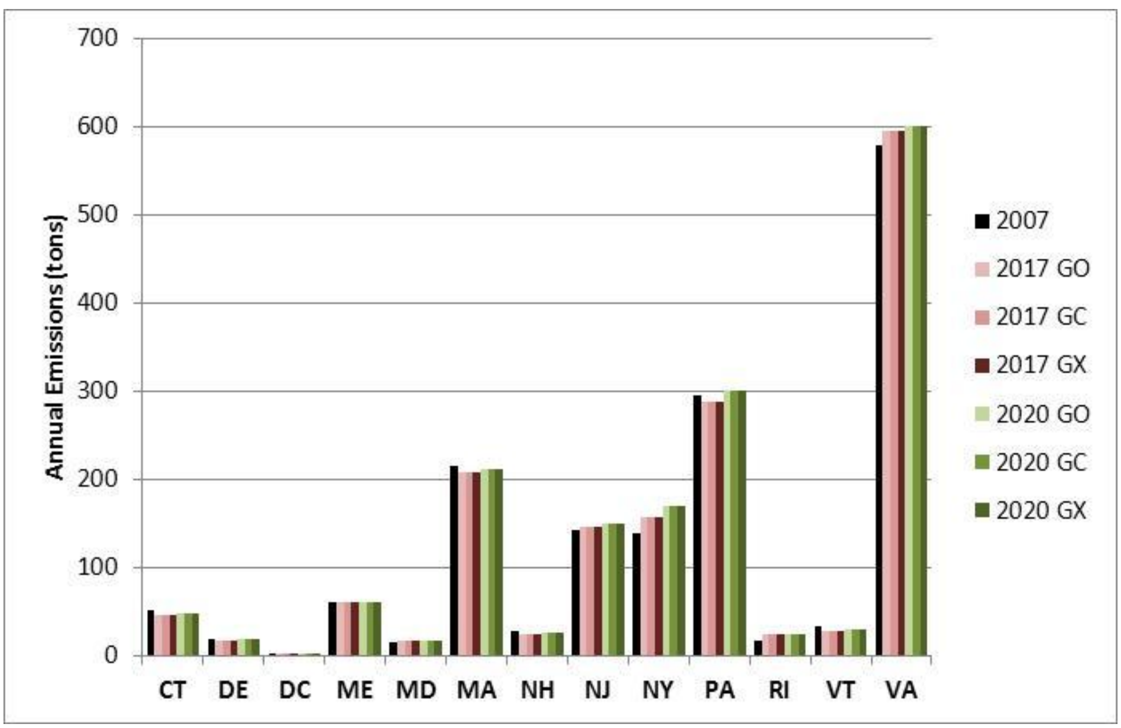


Exhibit 8.34 2007 and Projected SO2 Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	96	87	87	87	91	91	91
DE	55	55	55	55	55	55	55
DC	0	0	0	0	0	0	0
ME	14	16	16	16	16	16	16
MD	247	255	255	255	266	266	266
MA	218	226	226	226	236	236	236
NH	28	26	26	26	26	26	26
NJ	507	534	534	534	557	557	557
NY	699	808	808	808	877	877	877
PA	416	455	455	455	488	488	488
RI	30	29	29	29	31	31	31
VT	12	13	13	13	13	13	13
VA	424	455	455	455	466	466	466
	2,746	**2,959**	**2,959**	**2,959**	**3,122**	**3,122**	**3,122**

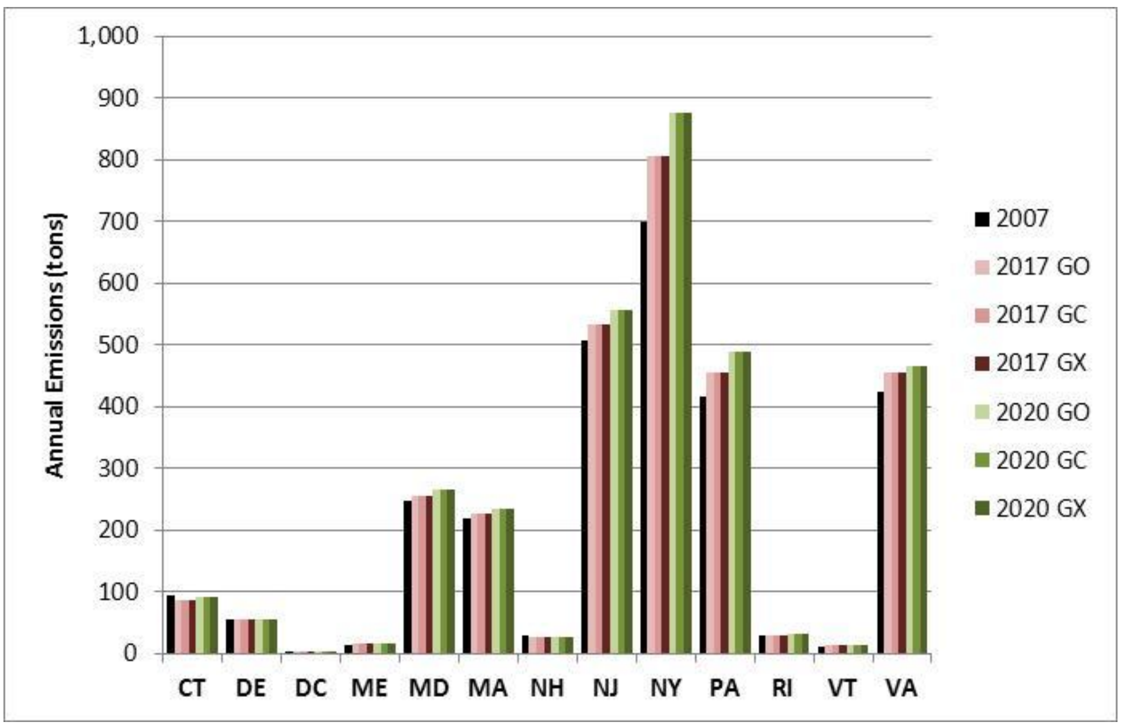
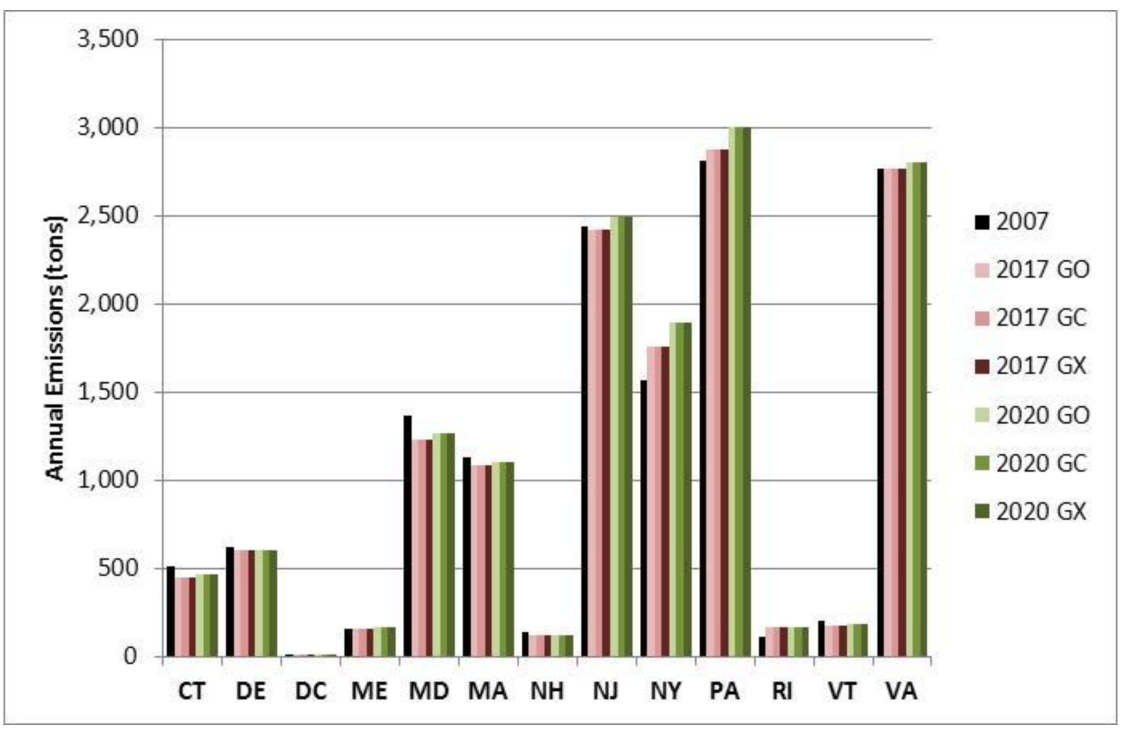


Exhibit 8.35 2007 and Projected VOC Emissions for Airports (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	509	452	452	452	469	469	469
DE	620	598	598	598	600	600	600
DC	1	1	1	1	1	1	1
ME	161	161	161	161	162	162	162
MD	1,365	1,228	1,228	1,228	1,265	1,265	1,265
MA	1,129	1,080	1,080	1,080	1,105	1,105	1,105
NH	134	116	116	116	118	118	118
NJ	2,438	2,426	2,426	2,426	2,498	2,498	2,498
NY	1,571	1,761	1,761	1,761	1,896	1,896	1,896
PA	2,813	2,879	2,879	2,879	3,004	3,004	3,004
RI	112	166	166	166	168	168	168
VT	204	179	179	179	181	181	181
VA	2,764	2,764	2,764	2,764	2,802	2,802	2,802
	13,822	**13,813**	**13,813**	**13,813**	**14,269**	**14,269**	**14,269**



8.6 NONROAD RAILROAD LOCOMOTIVE EMISSIONS

Exhibits 9.36 to 9.42 summarize the 2007 and projected future year railroad locomotive emissions by state for each criteria air pollutant. Seven values are listed for each pollutant:

- 2007 emissions
- 2017 projected emissions with growth only (GO)
- 2017 projected emissions with growth and existing controls (GC)
- 2017 projected emissions with growth, existing and potential new OTC controls (GX)
- 2020 projected emissions with growth only (GO)
- 2020 projected emissions with growth and existing controls (GC)
- 2020 projected emissions with growth, existing and potential new OTC controls (GX)

Detailed summaries by County and SCC are provided on MARAMA's ftp site.

Emissions of all pollutants except CO and NH3 are projected to decrease as a result of Federal rules affecting railroad locomotive engines, including more stringent engine emission standards and sulfur in fuel limitations. There are currently no potential new OTC control measures for railroad locomotives.

Exhibit 8.36 presents a state-level comparison of 2007, 2017 and 2020 annual CO emissions for railroad locomotives. CO emissions show small changes (< 7 percent) between 2007 and 2017/2020.

Exhibit 8.37 shows that there are very little NH3 emissions from this sector.

Exhibit 8.38 shows that annual NOx emissions from railroad locomotives decrease by 33 percent from 2007 to 2017, and 39 percent from 2007 to 2020.

Exhibits 9.39 and 9.40 show that annual PM10-PRI and PM2.5-PRI emissions from railroad locomotives decrease substantially after 2007. For both pollutants, emissions are reduced by about 49 percent from 2007 to 2017, and 57 percent from 2007 to 2020.

Exhibit 8.41 shows that SO2 emissions from railroad locomotives are virtually eliminatd by 2017.

Exhibit 8.42 shows that annual VOC emissions from railroad locomotives decrease by 42 percent from 2007 to 2017 and 50 percent from 2007 to 2020.

Exhibit 8.36 2007 and Projected CO Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	184	198	188	188	206	193	193
DE	75	76	76	76	79	79	79
DC	73	75	75	75	78	77	77
ME	188	191	191	191	198	198	198
MD	700	720	713	713	746	736	736
MA	646	695	662	662	723	679	679
NH	88	90	90	90	93	93	93
NJ	665	780	744	744	818	771	771
NY	3,061	3,181	3,122	3,122	3,298	3,220	3,220
PA	2,987	3,044	3,041	3,041	3,149	3,145	3,145
RI	15	15	15	15	16	16	16
VT	72	74	74	74	76	76	76
VA	2,701	2,758	2,750	2,750	2,854	2,843	2,843
	11,456	**11,899**	**11,741**	**11,741**	**12,333**	**12,126**	**12,126**

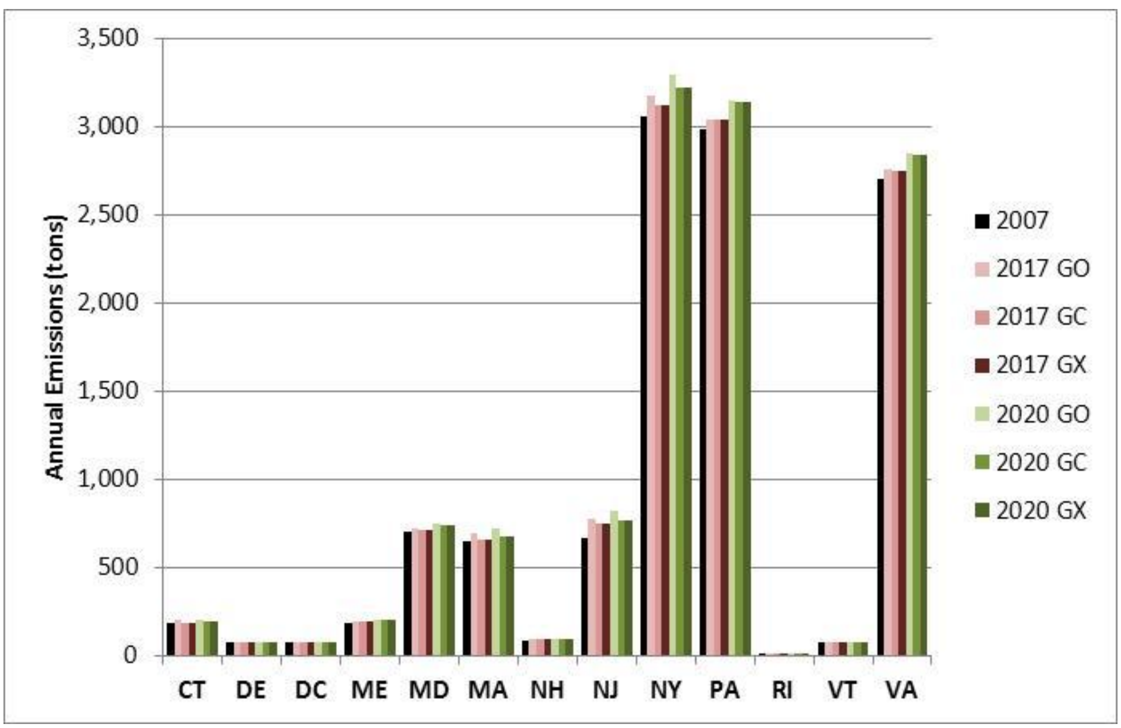


Exhibit 8.37 2007 and Projected NH3 Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1	1	1	1	1	1	1
DE	0	0	0	0	0	0	0
DC	0	0	0	0	0	0	0
ME	0	0	0	0	0	0	0
MD	0	0	0	0	0	0	0
MA	2	2	2	2	2	2	2
NH	0	0	0	0	0	0	0
NJ	2	2	2	2	3	3	3
NY	0	1	1	1	1	1	1
PA	9	9	9	9	10	10	10
RI	0	0	0	0	0	0	0
VT	0	0	0	0	0	0	0
VA	8	8	8	8	9	9	9
	23	**24**	**24**	**24**	**25**	**25**	**25**

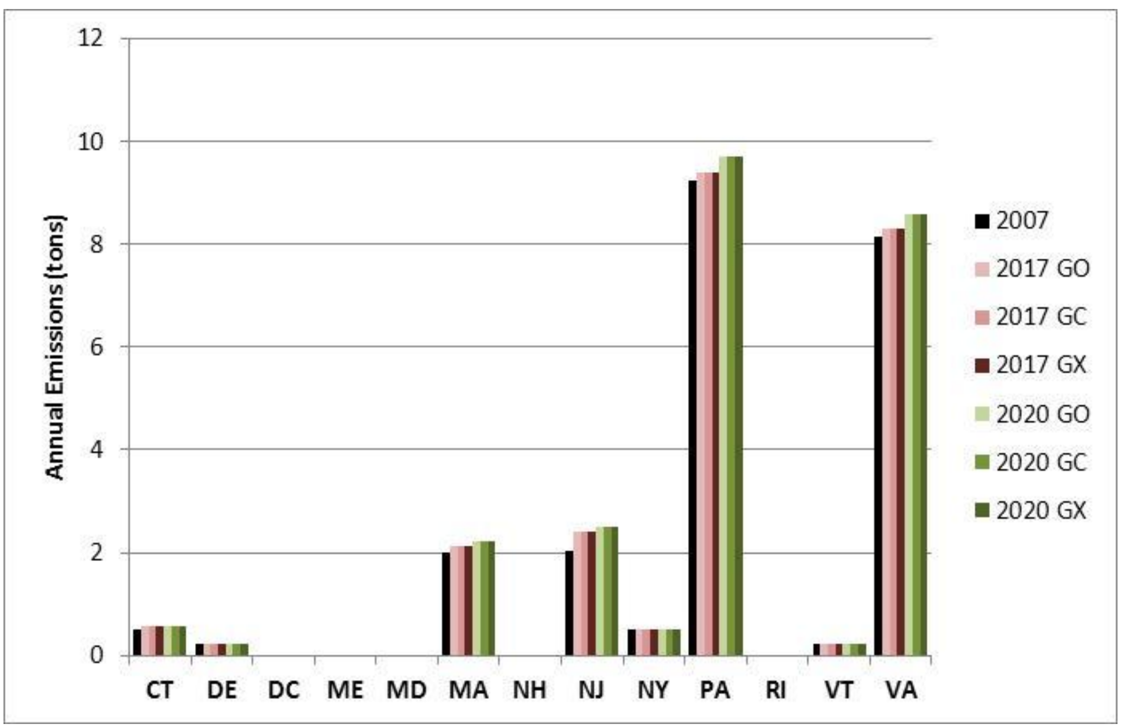


Exhibit 8.38 2007 and Projected NOx Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	1,723	1,866	1,088	1,088	1,942	991	991
DE	384	391	279	279	404	256	256
DC	505	521	353	353	540	322	322
ME	1,369	1,394	1,289	1,289	1,442	1,262	1,262
MD	4,767	4,904	3,127	3,127	5,078	2,815	2,815
MA	6,133	6,623	3,743	3,743	6,893	3,368	3,368
NH	891	907	871	871	939	864	864
NJ	5,957	6,982	3,839	3,839	7,323	3,469	3,469
NY	20,675	21,473	13,144	13,144	22,259	11,782	11,782
PA	20,675	21,080	14,413	14,413	21,808	13,174	13,174
RI	144	147	99	99	152	90	90
VT	736	749	719	719	775	713	713
VA	18,319	18,728	12,061	12,061	19,381	10,856	10,856
	82,279	**85,765**	**55,025**	**55,025**	**88,936**	**49,960**	**49,960**

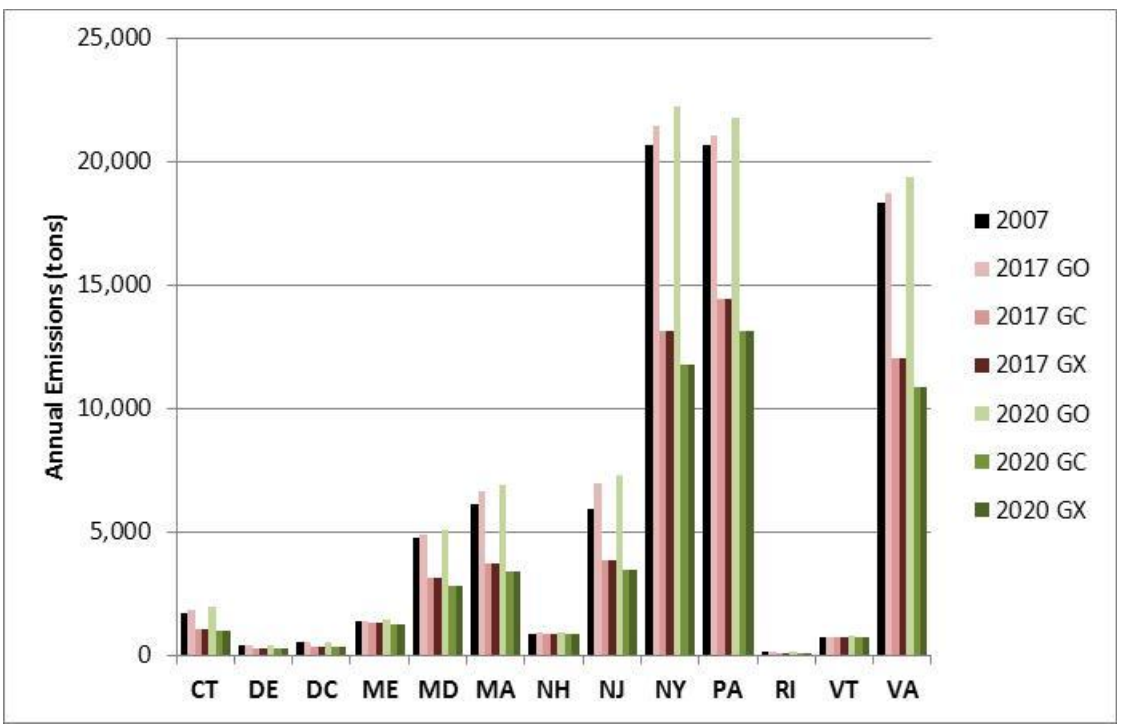


Exhibit 8.39 2007 and Projected PM10-PRI Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	46	49	27	27	51	23	23
DE	15	16	8	8	16	7	7
DC	12	12	6	6	13	6	6
ME	28	28	22	22	29	21	21
MD	166	171	80	80	177	68	68
MA	159	171	84	84	178	71	71
NH	22	22	18	18	23	17	17
NJ	160	187	89	89	196	75	75
NY	608	631	295	295	654	249	249
PA	704	717	356	356	742	309	309
RI	4	4	2	2	4	2	2
VT	18	18	15	15	19	14	14
VA	634	648	303	303	670	257	257
	2,574	**2,675**	**1,303**	**1,303**	**2,772**	**1,119**	**1,119**

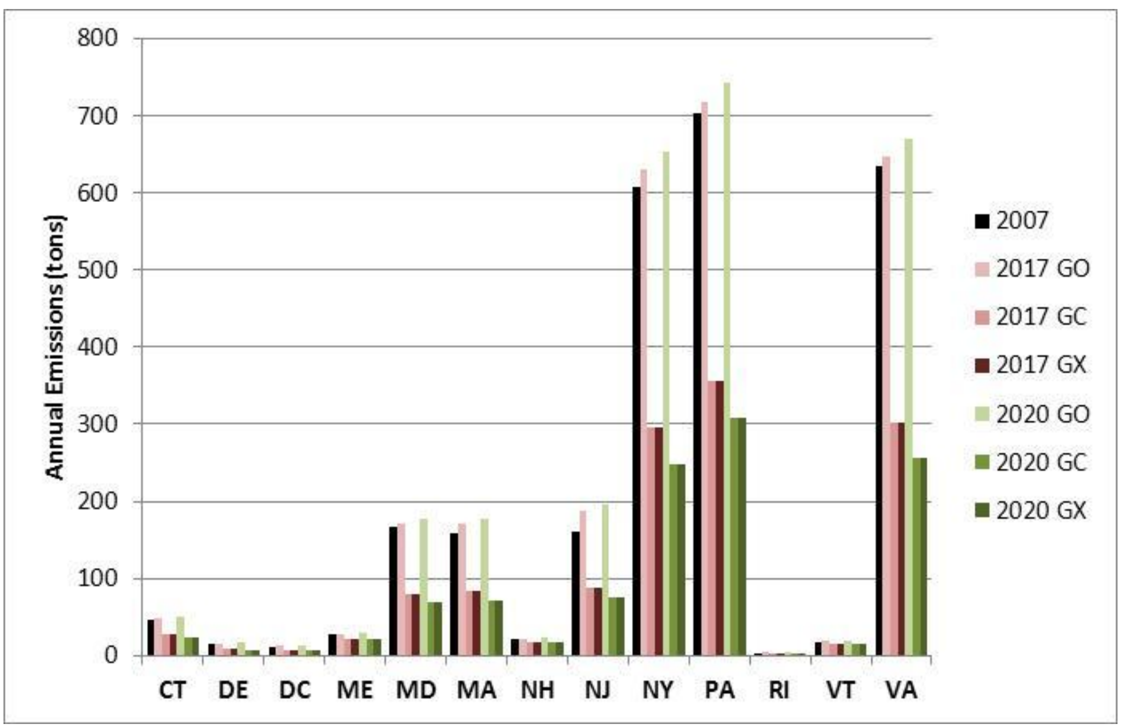


Exhibit 8.40 2007 and Projected PM25-PRI Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	39	42	22	22	44	19	19
DE	15	15	8	8	16	7	7
DC	11	12	6	6	12	6	6
ME	25	26	20	20	27	19	19
MD	161	166	78	78	172	66	66
MA	145	157	77	77	163	65	65
NH	21	21	17	17	22	17	17
NJ	147	173	82	82	181	69	69
NY	572	595	278	278	616	235	235
PA	650	663	330	330	686	286	286
RI	3	3	2	2	3	1	1
VT	17	17	13	13	18	13	13
VA	586	599	280	280	620	238	238
	2,395	**2,488**	**1,213**	**1,213**	**2,579**	**1,041**	**1,041**

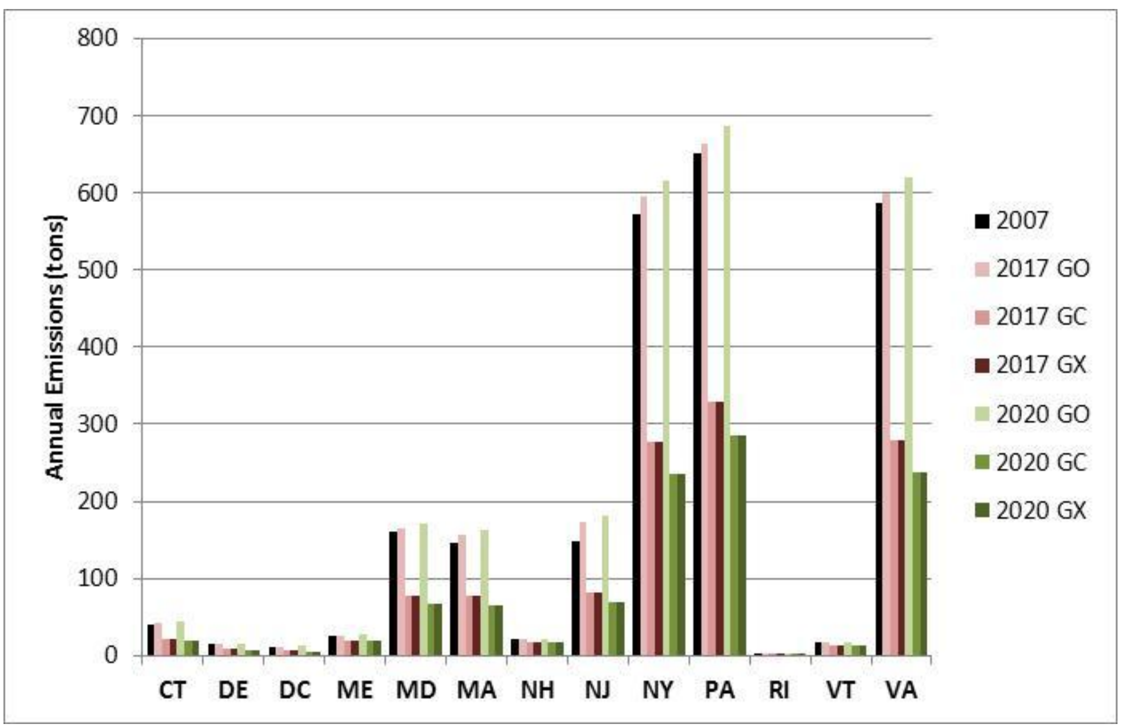


Exhibit 8.41 2007 and Projected SO2 Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	57	61	5	5	64	5	5
DE	5	5	0	0	6	0	0
DC	37	38	0	0	39	0	0
ME	92	94	0	0	97	0	0
MD	64	66	0	0	68	0	0
MA	66	70	0	0	73	0	0
NH	10	10	0	0	11	0	0
NJ	52	61	0	0	64	0	0
NY	616	641	2	2	665	2	2
PA	211	216	1	1	223	1	1
RI	5	6	0	0	6	0	0
VT	5	5	0	0	5	0	0
VA	192	196	1	1	203	1	1
	1,413	**1,469**	**9**	**9**	**1,522**	**10**	**10**

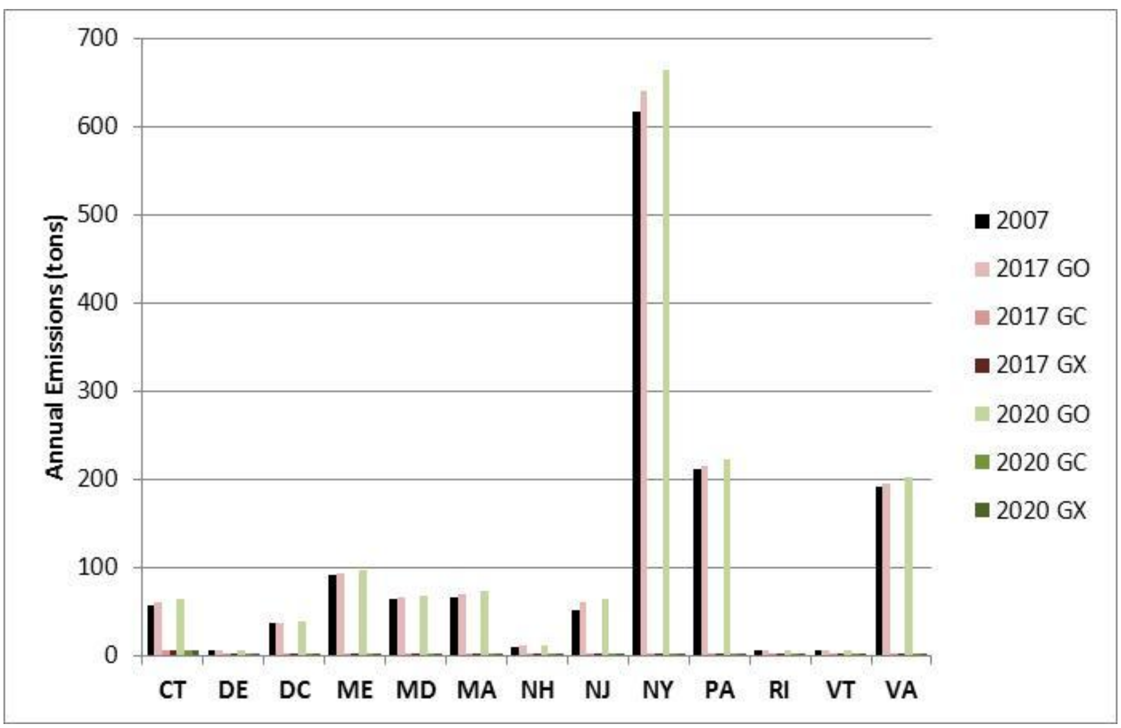
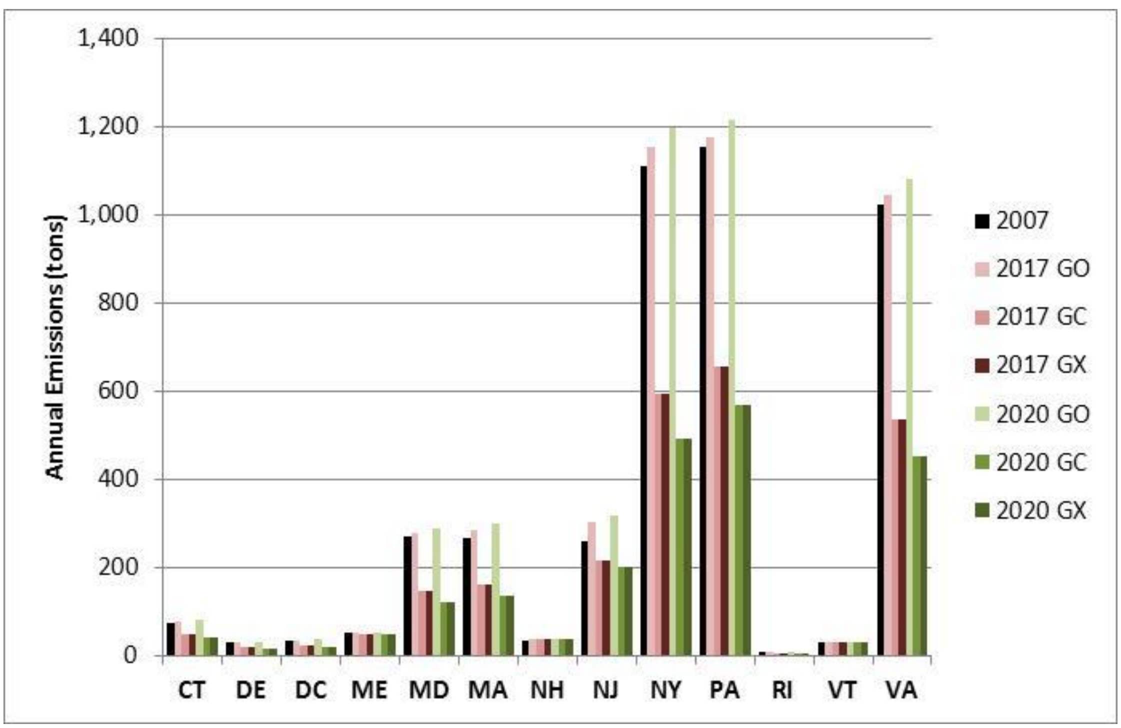


Exhibit 8.42 2007 and Projected VOC Emissions for Railroads (tons)

	2007	2017 Growth Only	2017 Growth & Existing Controls	2017 Growth & Existing & New OTC Controls	2020 Growth Only	2020 Growth & Existing Controls	2020 Growth & Existing & New OTC Controls
State	**2007**	**2017 GO**	**2017 GC**	**2017 GX**	**2020 GO**	**2020 GC**	**2020 GX**
CT	73	79	49	49	82	42	42
DE	28	29	17	17	30	15	15
DC	34	35	23	23	36	20	20
ME	51	51	47	47	53	47	47
MD	271	279	146	146	289	122	122
MA	267	286	162	162	298	135	135
NH	35	36	36	36	37	37	37
NJ	258	302	216	216	317	200	200
NY	1,112	1,155	596	596	1,197	493	493
PA	1,153	1,176	655	655	1,216	569	569
RI	8	8	4	4	8	4	4
VT	29	29	29	29	30	30	30
VA	1,025	1,047	537	537	1,083	451	451
	4,343	**4,511**	**2,519**	**2,519**	**4,676**	**2,167**	**2,167**



9.0 PREPARATION OF SMOKE MODEL FILES

Air quality modelers in the Mid-Atlantic and Northeastern states use the SMOKE Modeling System to create gridded, speciated, hourly emissions for input into a variety of air quality models. This section describes how the SMOKE inventory files were developed. It also describes how the SMOKE the temporal allocation, speciation, and spatial allocation profiles, respectively, were developed. . SMOKE inventory files were created for the following types of sources (which are described in Section 1.3):

9.1 NONEGU POINT SOURCE SMOKE EMISSION FILES

Annual nonEGU point source inventories were prepared in SMOKE PTINV ORL format.

9.2 AREA SOURCE SMOKE EMISSION FILES

Annual area source inventories for 2017 and 2020 were prepared in SMOKE ARINV ORL format. In developing the SMOKE ARINV ORL files for area sources, the USEPA "transport factor" was applied to reduce fugitive dust emissions to account for the removal of particles near their emission source by vegetation and surface features. The transport factor was NOT applied to the NIF-formatted annual emissions, but only to the SMOKE ARINV ORL-formatted file.

The standard transport fractions and SCC assignments from the USEPA CHIEF website (USEPA 2007c) were used to reduce the PM10-PRI and PM25-PRI emissions in the area source inventories. Two files were used. The first file contains a list of SCCs for which the transport factor was applied. The major source categories included paved and unpaved roads, construction activity, agricultural crop land tilling, and agricultural livestock operations. The second file contains the transport factor which varies by county. For example, in Connecticut the transport fraction ranges from 0.21 in Tolland County to 0.44 in New Haven County.

Applying the transport factor to area source fugitive dust emissions significantly reduces that amount of particulate matter included in the air quality modeling. Region wide, PM10-PRI emissions are reduced by about 54 percent and PM25-PRI emissions are reduced by about 25 percent by applying the transport fraction. The percent reduction varies by state due to the relative importance of the area source fugitive dust emissions compared to non-fugitive dust source emissions.

9.3 NONROAD NMIM SMOKE EMISSION FILES

As discussed in Section 7, the NMIM/NONROAD model was executed using specifications to generate monthly emission files. Monthly SMOKE ARINV ORL files were created. Average day emissions were calculated by dividing the NONROAD generated monthly emissions by the number of days in each month. Summary reports were prepared to verify agreement between the average day, monthly, and annual emissions.

9.4 NONROAD MAR SMOKE EMISSION FILES

Annual inventories for marine vessels, airport operations and railroad locomotives were prepared in SMOKE ARINV ORL format for each county in the region. Average day emissions were calculated by dividing the annual emissions by 365 days. The ORL files for Category 3 commercial marine vessels include only the emissions that occur in state waters (generally from the shoreline to 3–10 nautical miles from shore).

10.0 FINAL DELIVERABLES

Exhibits 10.1 to10.3 identify the deliverable products for the 2017 and 2020 MANE-VU+VA emission inventories developed by MACTEC under this contract. The exhibit also identifies deliverables associated with the 2017 and 2020 MANE-VU+VA inventories under development by other agencies.

Files are stored on MARAMA ftp site:

Address: ftp.marama.org

Login ID: regionalei

Password: marama2007

Files are stored in the following directories:

\MARAMA 07-17-20 Version 3\Final 2017 2020 (Version 3_3)/NIF

\MARAMA 07-17-20 Version 3\Final 2017 2020 (Version 3_3)/SMOKE

\MARAMA 07-17-20 Version 3\Final 2017 2020 (Version 3_3)/TSD

\MARAMA 07-17-20 Version 3\Final 2017 2020 (Version 3_3)/XLS

The contents of each folder are provided in Exhibits 10.1, 10.2, and 10.3.

Exhibit 10.1 – NIF Data Files for the 2017/2020 MANE-VU+VA Emission Inventories

File Description	File Name	Format	Notes
2017 Annual Point Source Emission Inventory in NOF format	MANEVU+VA_V3_3 Point_2017_NOF.mdb	NOF ACCESS	File includes only those point sources classified as "nonEGU" according to the ERTAC definition. See file for Field Definitions
2020 Annual Point Source Emission Inventory in NOF format	MANEVU+VA_V3_3 Point_2020_NOF.mdb	NOF ACCESS	
2017 Annual Area Source Emission Inventory in NOF format	MANEVU+VA_V3_3 Area_2017_NOF.mdb	NOF ACCESS	See file for Field Definitions
2020 Annual Area Source Emission Inventory in NOF format	MANEVU+VA_V3_3 Area_2020_NOF.mdb	NOF ACCESS	See file for Field Definitions
2017 Annual NMIM/NONROAD Emission Inventory in NOF format	2017MARAMANMIMv3.mdb	NOF ACCESS	See file for Field Definitions
2020 Annual NMIM/NONROAD Emission Inventory in NOF format	2020MARAMANMIMv3.mdb	NOF ACCESS	See file for Field Definitions
2017 Annual MAR Emission Inventory in NOF format	MANEVU+VA_V3_3_MAR_2017_NOF.mdb	NOF ACCESS	See file for Field Definitions
2020 Annual MAR Emission Inventory in NOF format	MANEVU+VA_V3_3_MAR_2020_NOF.mdb	NOF ACCESS	See file for Field Definitions

Exhibit 10.2 – Summary Spreadsheet Files for the 2017/2020 MANE-VU+VA Emission Inventories

File Description	File Name	Format	Notes
County/SCC level emissions for all 2017/2020 scenarios	V3_3 Area_07_17_20.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_Area_2017_ExistingControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_Area_2017_What IfControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_Area_2020_ExistingControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_Area_2020_What IfControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Tables and graphs used in the TSD	TSD V3_3 2017_2020 Area Graphs.xlsx	MS EXCEL	See file for Field Definitions
County/SCC level emissions for all 2017/2020 scenarios	V3_3 MAR_07_17_20.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_MAR_2017_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_MAR_2020_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Tables and graphs used in the TSD	TSD V3_3 2017_2020 MAR Graphs.xlsx	MS EXCEL	See file for Field Definitions
Process level emissions for all 2017/2020 scenarios	V3_3 NonEGU_07_17_20.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_NonEGU_2017_ExistingControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_NonEGU_2017_What IfControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_NonEGU_2020_ExistingControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions

Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_NonEGU_2020_What IfControls_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Tables and graphs used in the TSD	TSD V3_3 2017_2020 NonEGU Graphs.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2017	MANEVU+VA_V3_3_NMIM_2017_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Excel summary of emissions by State and SCC for 2020	MANEVU+VA_V3_3_NMIM_2020_StateSCCSummaries.xlsx	MS EXCEL	See file for Field Definitions
Tables and graphs used in the TSD	TSD V3_3 2017_2020 NMIM Graphs.xlsx	MS EXCEL	See file for Field Definitions

Exhibit 10.2 – SMOKE Files for the 2013/2017/2020 MANE-VU+VA Emission Inventories

File Description	File Name	Format	Notes
2017 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2017_NonHourly_ExistingControls_Jan2012.orl	SMOKE PTINV ORL	Files includes only those point sources classified as "nonEGU" according to the ERTAC definition. See file for Field Definitions
2017 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2017_NonHourly_WhatIfControls_Jan2012.orl	SMOKE PTINV ORL	
2020 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2020_NonHourly_ExistingControls_Jan2012.orl	SMOKE PTINV ORL	
2020 Annual Point Source Emission Inventory in SMOKE ORL format	PTINV_2020_NonHourly_WhatIfControls_Jan2012.orl	SMOKE PTINV ORL	
2017 Annual Area Source Emission Inventory in SMOKE ORL format	ARINV_2017_Area_ExistingControls_Jan2012.orl	SMOKE ARINV ORL Nonpoint	These files have the PM transport factors by county applied to the NOF emissions. See section 10.2 for discussion. See http://www.smoke-model.org/version2.6/html/ for file format
2017 Annual Area Source Emission Inventory in SMOKE ORL format	ARINV_2017_Area_WhatIfControls_Jan2012.orl	SMOKE ARINV ORL Nonpoint	
2020 Annual Area Source Emission Inventory in SMOKE ORL format	ARINV_2020_Area_ExistingControls_Jan2012.orl	SMOKE ARINV ORL nonpoint	
2020 Annual Area Source Emission Inventory in SMOKE ORL format	ARINV_2020_Area_WhatIfControls_Jan2012.orl	SMOKE ARINV ORL nonpoint	
2013 Annual MAR Source Emission Inventory in SMOKE ORL format	ARINV_2017_MAR_Jan2012.txt	SMOKE ARINV ORL Nonpoint	See http://www.smoke-model.org/version2.6/html/ for file format
2017 Annual MAR Source Emission Inventory in SMOKE ORL format	ARINV_2020_MAR_Jan2012.txt	SMOKE ARINV ORL Nonpoint	See http://www.smoke-model.org/version2.6/html/ for file format

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		Virginia 2007 Annual Emissions (tons)						
FIP	**County**	**CO**	**NH3**	**NOx**	**PM10**	**PM25**	**SO2**	**VOC**
51001	ACCOMACK COUNTY	7662.715	22.174	1044.267	33.162	31.660	9.383	604.024
51003	ALBEMARLE COUNTY	21221.980	67.721	3260.186	109.771	104.711	28.016	1618.048
51005	ALLEGHANY COUNTY	4493.630	13.544	1142.940	43.986	42.253	7.157	334.036
51007	AMELIA COUNTY	3418.679	10.190	525.263	16.922	16.189	4.386	266.654
51009	AMHERST COUNTY	6666.312	17.402	937.854	31.191	29.774	7.429	561.966
51011	APPOMATTOX COUNTY	3325.742	8.925	504.556	17.378	16.636	3.997	270.692
51013	ARLINGTON COUNTY	15199.232	73.547	1834.432	61.146	57.706	14.035	1462.596
51015	AUGUSTA COUNTY	20462.049	62.924	4984.926	184.860	177.451	31.754	1572.553
51017	BATH COUNTY	1361.793	3.005	153.624	4.847	4.591	1.256	109.660
51019	BEDFORD COUNTY	13932.581	30.586	1642.537	51.483	48.993	13.091	1231.481
51021	BLAND COUNTY	2936.282	12.355	1073.414	41.918	40.337	6.565	185.421
51023	BOTETOURT COUNTY	10254.854	34.632	3266.101	127.833	123.134	19.491	768.593
51025	BRUNSWICK COUNTY	4794.766	17.521	1463.914	57.838	55.758	9.389	354.069
51027	BUCHANAN COUNTY	5422.818	12.530	647.148	20.699	19.699	5.445	441.903
51029	BUCKINGHAM COUNTY	3133.907	7.667	457.933	15.728	15.054	3.511	263.115
51031	CAMPBELL COUNTY	11363.062	29.885	1588.997	51.009	48.696	12.784	953.879
51033	CAROLINE COUNTY	10650.500	41.631	2738.919	104.142	100.088	19.682	700.093
51035	CARROLL COUNTY	8599.413	28.427	2263.730	85.844	82.532	14.812	635.604
51036	CHARLES CITY COUNTY	1257.303	3.914	230.053	8.176	7.854	1.080	143.928
51037	CHARLOTTE COUNTY	2737.958	7.078	570.937	22.088	21.262	3.757	236.792
51041	CHESTERFIELD COUNTY	46284.449	163.812	6941.723	227.222	216.951	37.303	4794.962
51043	CLARKE COUNTY	4502.511	14.744	693.076	23.416	22.340	6.181	335.640
51045	CRAIG COUNTY	1082.680	2.104	98.304	2.913	2.743	0.847	89.502
51047	CULPEPER COUNTY	9933.461	27.552	1342.150	43.137	41.125	11.601	814.366
51049	CUMBERLAND COUNTY	1903.780	4.321	223.473	6.666	6.345	1.846	161.164
51051	DICKENSON COUNTY	2981.747	6.134	374.710	13.229	12.630	2.829	248.522
51053	DINWIDDIE COUNTY	7411.698	24.066	1642.238	60.380	58.023	11.598	554.687
51057	ESSEX COUNTY	2717.150	7.793	384.279	12.013	11.464	3.278	215.048
51059	FAIRFAX COUNTY	92181.220	441.599	12990.144	446.075	423.665	93.476	9117.498
51061	FAUQUIER COUNTY	19686.633	63.433	3554.119	127.806	122.328	28.136	1482.630
51063	FLOYD COUNTY	3191.012	6.403	312.443	9.458	8.943	2.662	269.976
51065	FLUVANNA COUNTY	4478.792	8.655	506.957	16.164	15.384	3.854	390.741
51067	FRANKLIN COUNTY	11307.391	26.840	1559.529	54.064	51.687	12.137	987.074
51069	FREDERICK COUNTY	20161.924	57.766	4089.992	158.085	151.675	29.156	1599.527
51071	GILES COUNTY	3754.830	9.969	556.865	20.448	19.532	4.399	303.340
51073	GLOUCESTER COUNTY	7661.671	15.859	741.859	20.992	19.913	6.912	657.775
51075	GOOCHLAND COUNTY	8263.634	31.052	1602.154	54.317	51.982	13.126	546.946
51077	GRAYSON COUNTY	3180.433	6.591	358.985	11.655	11.066	2.836	270.902
51079	GREENE COUNTY	3568.277	8.557	397.658	11.963	11.340	3.444	296.559
51081	GREENSVILLE COUNTY	3521.373	14.625	1114.086	43.658	42.067	7.477	227.321
51083	HALIFAX COUNTY	7627.518	20.579	1314.210	46.617	44.745	9.706	663.303
51085	HANOVER COUNTY	19349.755	76.908	3849.276	130.336	124.881	19.780	1871.550
51087	HENRICO COUNTY	41186.623	146.315	6172.767	191.888	182.989	32.858	4301.271
51089	HENRY COUNTY	11117.354	29.867	1575.007	54.159	51.782	13.002	935.299
51091	HIGHLAND COUNTY	706.344	1.457	92.424	3.374	3.213	0.683	56.524
51093	ISLE OF WIGHT COUNTY	9752.758	31.177	1403.110	50.284	48.202	13.880	798.258
51095	JAMES CITY COUNTY	7784.415	33.299	1420.839	46.751	44.625	10.703	799.992
51097	KING & QUEEN COUNTY	1904.225	5.349	320.047	10.860	10.408	2.450	150.820
51099	KING GEORGE COUNTY	5057.713	14.269	738.692	23.625	22.562	6.060	416.681
51101	KING WILLIAM COUNTY	3248.799	7.018	489.450	17.373	16.650	3.440	281.014
51103	LANCASTER COUNTY	2670.573	6.234	305.564	9.085	8.641	2.678	222.520
51105	LEE COUNTY	4308.432	10.364	519.013	16.002	15.214	4.326	353.970
51107	LOUDOUN COUNTY	24909.843	102.872	3582.841	119.572	113.971	23.600	2587.840
51109	LOUISA COUNTY	8578.226	24.217	1373.814	46.709	44.641	10.615	662.319
51111	LUNENBURG COUNTY	2193.579	4.429	253.883	7.891	7.523	1.976	196.927
51113	MADISON COUNTY	3517.198	10.444	488.646	15.503	14.777	4.262	273.651
51115	MATHEWS COUNTY	1863.329	3.561	179.537	4.690	4.435	1.492	159.922
51117	MECKLENBURG COUNTY	7826.490	23.723	1776.404	65.342	62.849	11.955	630.306
51119	MIDDLESEX COUNTY	2806.415	6.700	316.949	8.895	8.446	2.791	229.744
51121	MONTGOMERY COUNTY	17167.619	53.084	3662.752	136.732	131.131	25.831	1306.080
51125	NELSON COUNTY	4095.652	12.223	690.876	24.349	23.308	5.380	323.349
51127	NEW KENT COUNTY	7723.268	30.714	1643.557	57.869	55.436	13.038	467.027
51131	NORTHAMPTON COUNTY	3485.592	13.148	610.021	19.458	18.621	5.390	247.681
51133	NORTHUMBERLAND COUNTY	2898.120	5.788	315.648	9.377	8.915	2.558	245.659
51135	NOTTOWAY COUNTY	3189.203	9.545	549.125	18.627	17.856	4.262	253.408
51137	ORANGE COUNTY	6579.127	14.916	788.236	24.413	23.225	6.362	564.140
51139	PAGE COUNTY	4917.650	9.485	486.358	15.476	14.647	4.079	417.824
51141	PATRICK COUNTY	3746.968	8.025	455.580	14.786	14.096	3.528	330.496
51143	PITTSYLVANIA COUNTY	12606.247	31.459	1866.047	65.766	63.004	14.381	1106.534
51145	POWHATAN COUNTY	6219.459	16.327	772.906	23.360	22.250	6.850	509.698
51147	PRINCE EDWARD COUNTY	4066.833	12.810	717.941	23.897	22.900	5.619	317.205
51149	PRINCE GEORGE COUNTY	7752.537	22.178	1508.545	58.042	55.774	11.083	622.086
51153	PRINCE WILLIAM COUNTY	31727.495	138.479	5396.906	186.040	177.734	34.241	3231.503
51155	PULASKI COUNTY	8338.358	26.183	2026.291	76.217	73.210	13.369	637.302
51157	RAPPAHANNOCK COUNTY	2084.933	5.283	233.653	7.188	6.810	2.149	167.417
51159	RICHMOND COUNTY	2233.044	6.136	305.352	9.363	8.929	2.594	179.203
51161	ROANOKE COUNTY	18687.048	44.439	2940.917	107.537	102.914	21.497	1599.036
51163	ROCKBRIDGE COUNTY	8696.986	34.058	3636.001	144.267	139.106	20.533	603.042
51165	ROCKINGHAM COUNTY	18039.052	49.987	3414.131	124.185	118.925	23.896	1465.693
51167	RUSSELL COUNTY	6348.297	16.610	795.771	24.974	23.747	6.872	508.767
51169	SCOTT COUNTY	5130.885	14.387	697.493	23.411	22.343	6.122	410.047
51171	SHENANDOAH COUNTY	12086.108	37.821	3314.194	127.697	122.750	20.350	913.989
51173	SMYTH COUNTY	7381.811	21.526	1565.473	57.274	54.886	10.555	557.251
51175	SOUTHAMPTON COUNTY	5524.100	20.226	1441.701	57.579	55.511	10.273	424.164
51177	SPOTSYLVANIA COUNTY	25100.874	62.496	3563.240	124.314	118.838	28.869	2053.570
51179	STAFFORD COUNTY	13666.789	73.253	3160.426	130.325	125.180	20.630	1279.877
51181	SURRY COUNTY	1525.189	3.170	185.473	6.078	5.807	1.474	135.533
51183	SUSSEX COUNTY	4341.586	18.331	1408.886	56.283	54.248	9.412	279.488
51185	TAZEWELL COUNTY	9438.805	22.300	1059.866	34.560	32.792	9.418	760.117
51187	WARREN COUNTY	8750.161	22.175	1438.982	52.517	50.223	10.524	712.291
51191	WASHINGTON COUNTY	12761.692	37.090	2612.207	94.016	90.126	17.935	994.204
51193	WESTMORELAND COUNTY	3645.872	7.389	403.039	12.417	11.815	3.252	322.718
51195	WISE COUNTY	8434.736	22.552	1158.225	40.895	39.045	9.882	674.059
51197	WYTHE COUNTY	9854.201	36.587	3250.438	125.861	121.119	19.870	680.692
51199	YORK COUNTY	8765.101	41.470	1614.278	50.273	47.997	12.996	885.493
51510	ALEXANDRIA CITY	11187.734	31.840	1151.918	37.370	35.340	7.158	1252.354
51515	BEDFORD CITY	1086.427	2.717	153.072	6.046	5.800	1.321	90.848
51520	BRISTOL CITY	3651.993	11.322	863.356	32.823	31.552	5.958	275.368
51530	BUENA VISTA CITY	846.752	1.041	70.966	2.469	2.342	0.539	78.192
51540	CHARLOTTESVILLE CITY	5495.303	11.696	506.691	16.097	15.247	5.235	481.096
51550	CHESAPEAKE CITY	28269.934	122.936	4636.634	136.977	130.505	37.851	3022.279
51570	COLONIAL HEIGHTS CITY	2783.453	9.835	454.014	16.319	15.602	2.419	280.073
51580	COVINGTON CITY	1074.675	2.008	130.767	4.893	4.667	0.995	89.867
51590	DANVILLE CITY	7223.061	18.966	970.051	33.344	31.892	8.535	620.616
51595	EMPORIA CITY	1232.303	3.871	267.114	10.382	9.986	1.990	95.357
51600	FAIRFAX CITY	2158.007	8.283	260.738	8.762	8.344	1.901	227.255
51610	FALLS CHURCH	1144.638	2.827	112.831	3.632	3.445	0.710	131.521
51620	FRANKLIN CITY	1159.151	1.909	93.422	2.434	2.300	0.870	109.782
51630	FREDERICKSBURG CITY	5606.351	18.391	973.607	34.754	33.258	8.133	414.457
51640	GALAX CITY	1175.861	2.769	127.176	4.049	3.844	1.184	96.193
51650	HAMPTON CITY	15974.350	70.594	2399.446	67.268	63.856	20.556	1725.511
51660	HARRISONBURG CITY	6111.888	15.275	1072.593	40.177	38.486	7.708	508.860
51670	HOPEWELL CITY	2828.588	9.583	503.132	17.286	16.576	2.612	303.088
51678	LEXINGTON CITY	682.495	1.170	56.009	1.848	1.749	0.562	62.200
51680	LYNCHBURG CITY	11467.757	30.597	1261.381	40.290	38.230	12.626	911.387
51683	MANASSAS	3160.036	11.629	434.791	15.172	14.505	2.927	337.452
51685	MANASSAS PARK	813.802	1.083	82.607	2.160	2.044	0.324	98.329
51690	MARTINSVILLE CITY	2275.442	5.013	212.876	6.558	6.228	2.243	201.270
51700	NEWPORT NEWS CITY	21136.535	92.284	3237.318	92.399	87.808	27.325	2271.795
51710	NORFOLK CITY	23885.939	104.033	3599.873	99.993	94.866	29.737	2596.829
51720	NORTON CITY	888.395	2.756	130.171	5.152	4.920	1.228	64.884
51730	PETERSBURG CITY	5751.693	15.976	904.036	35.097	33.631	7.636	476.072
51735	POQUOSON CITY	1209.966	2.951	133.955	3.376	3.198	0.975	153.014
51740	PORTSMOUTH CITY	8850.232	33.010	1269.013	34.874	33.119	9.907	1040.463
51750	RADFORD CITY	1804.350	3.755	150.547	4.854	4.583	1.635	158.475
51760	RICHMOND CITY	25129.610	92.935	3837.015	120.940	115.328	20.478	2587.727
51770	ROANOKE CITY	16597.662	38.083	1887.807	66.053	62.910	17.295	1434.171
51775	SALEM CITY	4378.728	8.514	413.407	12.995	12.319	3.825	384.237
51790	STAUNTON CITY	3762.287	6.374	321.838	10.284	9.717	2.881	334.428
51800	SUFFOLK CITY	12225.619	62.062	2903.070	108.994	104.673	21.624	1222.866
51810	VIRGINIA BEACH CITY	42892.097	155.321	5631.774	144.721	137.091	45.873	5150.324
51820	WAYNESBORO	3427.291	6.976	372.545	12.433	11.799	3.069	287.489
51830	WILLIAMSBURG CITY	1456.148	4.740	178.776	4.478	4.235	1.405	176.321
51840	WINCHESTER CITY	4339.311	7.962	376.419	12.599	11.924	3.726	390.746
	TOTAL	1,195,237.09	4,041.05	197,822.24	6,798.41	6,499.27	1,434.42	108,001.04

Virginia 2020 Annual Emissions (tons)								
FIP	County	CO	NH3	NOx	PM10	PM25	SO2	VOC
51001	ACCOMACK COUNTY	4405.076	13.501	398.889	12.649	12.026	9.766	250.102
51003	ALBEMARLE COUNTY	13624.864	43.691	1187.530	40.721	38.548	31.234	702.762
51005	ALLEGHANY COUNTY	2862.304	9.300	346.619	12.065	11.483	7.885	144.820
51007	AMELIA COUNTY	2067.239	6.625	203.331	6.071	5.775	4.815	116.430
51009	AMHERST COUNTY	3924.406	10.636	346.180	10.652	10.092	7.736	238.938
51011	APPOMATTOX COUNTY	1890.239	5.415	178.062	5.592	5.320	4.095	111.831
51013	ARLINGTON COUNTY	9927.611	40.046	527.450	32.719	30.835	13.341	524.082
51015	AUGUSTA COUNTY	13123.668	43.431	1608.925	51.775	49.209	35.259	697.563
51017	BATH COUNTY	770.650	1.763	62.622	1.903	1.793	1.238	45.752
51019	BEDFORD COUNTY	8428.575	19.387	670.438	19.926	18.840	14.165	560.157
51021	BLAND COUNTY	1971.638	9.004	313.759	11.102	10.585	7.556	76.159
51023	BOTETOURT COUNTY	6318.326	23.864	941.581	30.912	29.541	21.061	318.957
51025	BRUNSWICK COUNTY	2938.007	11.926	430.117	14.139	13.544	10.212	143.235
51027	BUCHANAN COUNTY	2971.250	7.206	263.922	7.989	7.576	5.309	179.940
51029	BUCKINGHAM COUNTY	1775.976	4.662	166.367	5.046	4.799	3.570	109.535
51031	CAMPBELL COUNTY	6740.263	18.575	619.951	18.004	17.072	13.496	413.318
51033	CAROLINE COUNTY	7254.907	29.490	888.891	30.976	29.527	23.084	302.543
51035	CARROLL COUNTY	5717.392	20.625	726.233	25.193	24.027	17.284	284.326
51036	CHARLES CITY COUNTY	725.925	2.413	80.168	2.613	2.496	1.094	57.850
51037	CHARLOTTE COUNTY	1539.406	4.532	186.590	5.704	5.459	3.821	97.086
51041	CHESTERFIELD COUNTY	30106.019	105.046	2339.769	101.918	96.923	41.868	2012.272
51043	CLARKE COUNTY	2948.698	10.129	273.239	9.393	8.905	7.209	152.170
51045	CRAIG COUNTY	634.911	1.240	42.247	1.357	1.275	0.876	38.986
51047	CULPEPER COUNTY	6317.010	18.233	545.439	17.420	16.515	13.154	371.370
51049	CUMBERLAND COUNTY	1109.733	2.652	92.763	2.645	2.507	1.932	69.955
51051	DICKENSON COUNTY	1692.704	3.689	142.612	4.579	4.346	2.865	106.540
51053	DINWIDDIE COUNTY	4551.638	15.734	510.294	16.649	15.871	12.534	233.771
51057	ESSEX COUNTY	1547.998	4.689	139.899	4.220	4.002	3.345	87.659
51059	FAIRFAX COUNTY	66533.123	277.251	4054.480	228.111	215.436	100.076	3615.433
51061	FAUQUIER COUNTY	13128.458	44.437	1313.601	44.822	42.555	32.983	680.644
51063	FLOYD COUNTY	1884.730	3.851	138.225	4.321	4.076	2.777	118.109
51065	FLUVANNA COUNTY	2726.330	5.511	210.826	6.265	5.925	4.167	178.923
51067	FRANKLIN COUNTY	6759.094	17.057	598.185	18.849	17.907	13.024	435.655
51069	FREDERICK COUNTY	13289.012	40.692	1410.429	50.809	48.391	33.505	719.531
51071	GILES COUNTY	2146.906	5.912	188.920	6.685	6.340	4.442	125.173
51073	GLOUCESTER COUNTY	4465.045	9.713	321.519	10.011	9.491	7.263	290.192
51075	GOOCHLAND COUNTY	5548.494	21.276	581.836	18.840	17.878	15.252	237.608
51077	GRAYSON COUNTY	1838.401	3.935	144.188	4.506	4.255	2.878	115.899
51079	GREENE COUNTY	2020.280	5.499	163.759	5.056	4.774	3.803	118.965
51081	GREENSVILLE COUNTY	2226.172	9.884	323.130	10.841	10.372	8.160	88.442
51083	HALIFAX COUNTY	4313.123	12.680	446.299	13.647	13.018	9.927	271.915
51085	HANOVER COUNTY	12824.041	51.719	1219.072	48.206	45.856	22.648	786.104
51087	HENRICO COUNTY	25947.949	89.623	1987.798	83.309	79.080	35.457	1726.237
51089	HENRY COUNTY	6483.592	17.911	562.367	18.512	17.595	13.456	392.038
51091	HIGHLAND COUNTY	403.616	0.882	35.079	1.169	1.106	0.673	23.411
51093	ISLE OF WIGHT COUNTY	5588.728	18.929	495.478	19.309	18.484	14.530	316.570
51095	JAMES CITY COUNTY	5087.832	22.081	491.484	19.302	18.297	12.052	349.056
51097	KING & QUEEN COUNTY	1109.074	3.437	117.668	3.422	3.257	2.568	63.617
51099	KING GEORGE COUNTY	3101.888	9.413	289.265	8.667	8.220	6.721	189.837
51101	KING WILLIAM COUNTY	1977.629	4.736	186.266	5.584	5.313	3.783	128.562
51103	LANCASTER COUNTY	1565.145	3.877	127.840	3.812	3.614	2.833	96.878
51105	LEE COUNTY	2457.435	6.146	202.190	6.088	5.757	4.393	148.901
51107	LOUDOUN COUNTY	19244.106	72.207	1327.118	64.865	61.456	27.426	1125.983
51109	LOUISA COUNTY	5546.922	16.306	515.170	16.517	15.656	12.045	304.205
51111	LUNENBURG COUNTY	1232.249	2.646	102.869	2.924	2.775	2.000	83.600
51113	MADISON COUNTY	2113.631	6.509	183.524	5.853	5.544	4.595	117.564
51115	MATHEWS COUNTY	1023.015	2.090	76.445	2.036	1.920	1.484	68.038
51117	MECKLENBURG COUNTY	4663.591	15.479	561.585	17.140	16.361	12.665	262.842
51119	MIDDLESEX COUNTY	1588.986	4.046	130.758	3.698	3.498	2.850	97.152
51121	MONTGOMERY COUNTY	11037.695	35.603	1163.041	41.828	39.777	28.772	565.835
51125	NELSON COUNTY	2448.768	7.736	239.805	7.865	7.473	5.742	137.366
51127	NEW KENT COUNTY	5185.091	20.801	558.451	18.633	17.684	14.922	199.642
51131	NORTHAMPTON COUNTY	2031.372	8.211	215.801	6.860	6.529	5.739	99.484
51133	NORTHUMBERLAND COUNTY	1623.473	3.469	133.122	3.767	3.569	2.574	104.454
51135	NOTTOWAY COUNTY	1847.291	5.974	192.249	5.757	5.481	4.459	105.545
51137	ORANGE COUNTY	3990.849	9.472	323.942	9.535	9.015	6.857	255.274
51139	PAGE COUNTY	2907.473	5.713	205.750	6.681	6.300	4.214	182.428
51141	PATRICK COUNTY	2148.240	4.828	184.608	5.380	5.100	3.613	142.364
51143	PITTSYLVANIA COUNTY	7520.700	20.004	677.979	21.556	20.518	15.498	485.161
51145	POWHATAN COUNTY	3871.189	10.801	329.800	9.857	9.345	7.733	234.616
51147	PRINCE EDWARD COUNTY	2386.045	8.085	245.553	7.406	7.044	5.943	131.849
51149	PRINCE GEORGE COUNTY	4875.306	14.875	496.967	17.355	16.567	12.241	271.501
51153	PRINCE WILLIAM COUNTY	23342.870	93.661	1719.961	78.180	73.950	37.854	1368.280
51155	PULASKI COUNTY	5279.837	17.667	614.848	21.369	20.347	14.734	276.847
51157	RAPPAHANNOCK COUNTY	1174.158	3.044	88.894	2.957	2.791	2.133	68.293
51159	RICHMOND COUNTY	1296.229	3.785	122.922	3.470	3.291	2.701	75.401
51161	ROANOKE COUNTY	11624.089	28.606	1001.814	34.738	32.980	23.234	703.234
51163	ROCKBRIDGE COUNTY	5557.286	24.820	987.188	33.410	31.960	22.930	242.565
51165	ROCKINGHAM COUNTY	11237.516	32.914	1165.114	38.413	36.462	25.870	645.001
51167	RUSSELL COUNTY	3706.479	10.076	316.975	9.839	9.307	7.135	216.982
51169	SCOTT COUNTY	3045.000	8.932	260.342	8.763	8.318	6.510	173.588
51171	SHENANDOAH COUNTY	8006.266	27.116	1024.468	34.447	32.794	23.192	409.271
51173	SMYTH COUNTY	4553.405	14.069	497.774	16.820	15.966	11.249	237.839
51175	SOUTHAMPTON COUNTY	3335.408	13.886	457.103	15.435	14.812	11.436	174.978
51177	SPOTSYLVANIA COUNTY	17764.620	45.860	1486.645	51.393	48.834	35.905	1036.853
51179	STAFFORD COUNTY	10793.351	54.335	953.340	50.271	47.939	24.693	567.935
51181	SURRY COUNTY	844.617	1.903	70.728	2.141	2.036	1.473	56.943
51183	SUSSEX COUNTY	2708.822	12.363	405.977	13.853	13.263	10.226	107.269
51185	TAZEWELL COUNTY	5481.760	13.196	429.088	14.437	13.651	9.575	319.659
51187	WARREN COUNTY	5812.226	15.410	529.637	18.279	17.332	12.139	335.985
51191	WASHINGTON COUNTY	7984.502	24.694	854.053	27.860	26.455	19.554	436.000
51193	WESTMORELAND COUNTY	2140.311	4.573	168.569	4.957	4.695	3.422	142.399
51195	WISE COUNTY	4931.978	13.814	436.014	15.148	14.394	10.295	283.816
51197	WYTHE COUNTY	6445.429	26.198	946.275	32.776	31.259	22.519	286.968
51199	YORK COUNTY	5565.906	26.956	538.801	21.701	20.604	14.414	376.766
51510	ALEXANDRIA CITY	7279.013	17.743	364.845	19.927	18.818	6.857	462.014
51515	BEDFORD CITY	606.656	1.591	53.367	2.029	1.941	1.310	35.771
51520	BRISTOL CITY	2231.242	7.369	252.912	8.961	8.549	6.283	111.162
51530	BUENA VISTA CITY	496.624	0.623	31.314	1.057	1.000	0.548	33.959
51540	CHARLOTTESVILLE CITY	3240.772	6.673	208.223	7.910	7.504	5.297	195.208
51550	CHESAPEAKE CITY	18133.941	80.363	1714.902	65.955	62.612	42.213	1303.236
51570	COLONIAL HEIGHTS CITY	1739.592	6.023	134.859	6.143	5.838	2.579	112.827
51580	COVINGTON CITY	623.404	1.195	47.392	1.703	1.615	0.990	37.459
51590	DANVILLE CITY	4173.701	11.155	338.996	11.601	11.042	8.688	250.961
51595	EMPORIA CITY	729.099	2.409	80.968	2.881	2.756	2.037	36.494
51600	FAIRFAX CITY	1351.406	4.542	79.292	4.755	4.529	1.777	80.164
51610	FALLS CHURCH	737.798	1.593	35.675	2.143	2.036	0.681	48.604
51620	FRANKLIN CITY	634.951	1.062	40.248	1.234	1.169	0.850	45.097
51630	FREDERICKSBURG CITY	3832.654	12.652	353.684	12.713	12.079	9.562	186.204
51640	GALAX CITY	668.981	1.605	51.488	1.737	1.646	1.183	39.392
51650	HAMPTON CITY	9854.188	43.016	828.777	34.500	32.697	21.956	714.175
51660	HARRISONBURG CITY	3825.281	9.881	381.120	12.877	12.246	8.178	216.836
51670	HOPEWELL CITY	1712.079	5.918	145.576	6.187	5.903	2.757	120.941
51678	LEXINGTON CITY	395.732	0.670	23.538	0.952	0.903	0.565	25.629
51680	LYNCHBURG CITY	6836.278	17.748	480.757	17.604	16.665	12.908	369.561
51683	MANASSAS	2159.879	7.265	151.543	7.901	7.539	3.004	133.103
51685	MANASSAS PARK	517.794	0.652	36.662	1.108	1.045	0.294	37.682
51690	MARTINSVILLE CITY	1273.057	2.772	85.715	3.205	3.051	2.206	79.098
51700	NEWPORT NEWS CITY	13082.935	57.215	1141.497	46.994	44.574	29.504	955.886
51710	NORFOLK CITY	14090.494	60.489	1238.544	47.062	44.513	30.163	1034.553
51720	NORTON CITY	518.968	1.624	45.589	1.928	1.835	1.239	24.735
51730	PETERSBURG CITY	3503.149	9.735	297.003	11.544	11.005	7.949	190.975
51735	POQUOSON CITY	677.967	1.700	50.082	1.940	1.843	0.978	62.961
51740	PORTSMOUTH CITY	5341.608	19.986	460.688	16.903	16.005	10.414	436.757
51750	RADFORD CITY	1063.794	2.152	63.646	2.642	2.506	1.685	65.748
51760	RICHMOND CITY	14920.928	52.836	1250.279	50.384	47.879	20.435	961.362
51770	ROANOKE CITY	9716.805	22.121	726.791	26.687	25.353	17.403	581.517
51775	SALEM CITY	2536.808	4.881	171.514	5.886	5.576	3.849	159.584
51790	STAUNTON CITY	2172.969	3.629	138.980	4.748	4.484	2.855	140.202
51800	SUFFOLK CITY	7773.055	41.633	914.843	37.319	35.613	24.157	512.730
51810	VIRGINIA BEACH CITY	25796.469	94.476	2078.825	80.107	75.878	48.723	2195.460
51820	WAYNESBORO	2070.721	4.201	145.393	4.943	4.664	3.180	125.754
51830	WILLIAMSBURG CITY	826.663	2.666	63.351	2.357	2.228	1.400	72.469
51840	WINCHESTER CITY	2610.242	4.684	162.165	6.402	6.070	3.845	163.337
	TOTAL	760,988.28	2,595.24	67,655.90	2,553.17	2,424.15	1,562.25	45,543.19

Tons/Year Emission Rates	CO			NH3			NOx			PM10			PM25			SO2			VOC		
	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020	2007	2017	2020
Caroline	**10,650.50**	**8,038.51**	**7,254.91**	**41.63**	**32.29**	**29.49**	**2,738.92**	**1,315.82**	**888.89**	**104.14**	**47.86**	**30.98**	**100.09**	**45.81**	**29.53**	**19.68**	**22.30**	**23.08**	**700.09**	**394.29**	**302.54**
Spotsylvania	25,100.87	19,457.60	17,764.62	62.50	49.70	45.86	3,563.24	1,965.86	1,486.65	124.31	68.22	51.39	118.84	64.99	48.83	28.87	34.28	35.91	2,053.57	1,271.48	1,036.85
Stafford	13,666.79	11,456.45	10,793.35	73.25	58.70	54.33	3,160.43	1,462.67	953.34	130.33	68.74	50.27	125.18	65.76	47.94	20.63	23.76	24.69	1,279.88	732.23	567.94
Fredericksburg	5,606.35	4,241.97	3,832.65	18.39	13.98	12.65	973.61	496.74	353.68	34.75	17.80	12.71	33.26	16.97	12.08	8.13	9.23	9.56	414.46	238.88	186.20
Fred Totals:	**44,374.01**	**35,156.02**	**32,390.63**	**154.14**	**122.38**	**112.85**	**7,697.27**	**3,925.27**	**2,793.67**	**289.39**	**154.77**	**114.38**	**277.28**	**147.72**	**108.85**	**57.63**	**67.27**	**70.16**	**3,747.90**	**2,242.59**	**1,790.99**
Charles City	1,257.30	848.55	725.92	3.91	2.76	2.41	230.05	114.76	80.17	8.18	3.90	2.61	7.85	3.73	2.50	1.08	1.09	1.09	143.93	77.71	57.85
Chesterfield	46,284.45	33,839.50	30,106.02	163.81	118.61	105.05	6,941.72	3,401.76	2,339.77	227.22	130.83	101.92	216.95	124.62	96.92	37.30	40.81	41.87	4,794.96	2,654.43	2,012.27
Hanover	19,349.76	14,329.97	12,824.04	76.91	57.53	51.72	3,849.28	1,826.04	1,219.07	130.34	67.16	48.21	124.88	64.09	45.86	19.78	21.99	22.65	1,871.55	1,036.59	786.10
Henrico	41,186.62	29,464.57	25,947.95	146.31	102.71	89.62	6,172.77	2,953.56	1,987.80	191.89	108.37	83.31	182.99	103.06	79.08	32.86	34.86	35.46	4,301.27	2,320.48	1,726.24
Prince George	7,752.54	5,539.28	4,875.31	22.18	16.56	14.88	1,508.55	730.41	496.97	58.04	26.74	17.36	55.77	25.62	16.57	11.08	11.97	12.24	622.09	352.41	271.50
Colonial Heights	2,783.45	1,980.48	1,739.59	9.84	6.90	6.02	454.01	208.51	134.86	16.32	8.49	6.14	15.60	8.09	5.84	2.42	2.54	2.58	280.07	151.42	112.83
Hopewell	2,828.59	1,969.73	1,712.08	9.58	6.76	5.92	503.13	228.09	145.58	17.29	8.75	6.19	16.58	8.37	5.90	2.61	2.72	2.76	303.09	162.97	120.94
Petersburg	5,751.69	4,022.04	3,503.15	15.98	11.18	9.74	904.04	437.09	297.00	35.10	16.98	11.54	33.63	16.23	11.00	7.64	7.88	7.95	476.07	256.77	190.97
Richmond	25,129.61	17,276.78	14,920.93	92.93	62.09	52.84	3,837.01	1,847.22	1,250.28	120.94	66.67	50.38	115.33	63.44	47.88	20.48	20.44	20.44	2,587.73	1,336.68	961.36
Rich-Pet Totals:	**152,324.01**	**109,270.92**	**96,354.99**	**541.46**	**385.09**	**338.19**	**24,400.56**	**11,747.43**	**7,951.49**	**805.30**	**437.88**	**327.66**	**769.59**	**417.25**	**311.55**	**135.25**	**144.31**	**147.03**	**15,380.76**	**8,349.46**	**6,240.07**
Gloucester	7,661.67	5,202.73	4,465.05	15.86	11.13	9.71	741.86	418.52	321.52	20.99	12.54	10.01	19.91	11.90	9.49	6.91	7.18	7.26	657.77	375.02	290.19
Isle of Wight	9,752.76	6,549.66	5,588.73	31.18	21.76	18.93	1,403.11	704.93	495.48	50.28	26.46	19.31	48.20	25.34	18.48	13.88	14.38	14.53	798.26	427.73	316.57
James City	7,784.41	5,710.12	5,087.83	33.30	24.67	22.08	1,420.84	705.95	491.48	46.75	25.64	19.30	44.62	24.37	18.30	10.70	11.74	12.05	799.99	453.12	349.06
York	8,765.10	6,304.18	5,565.91	41.47	30.31	26.96	1,614.28	786.99	538.80	50.27	28.29	21.70	48.00	26.93	20.60	13.00	14.09	14.41	885.49	494.16	376.77
Chesapeake	28,269.93	20,473.02	18,133.94	122.94	90.19	80.36	4,636.63	2,389.15	1,714.90	136.98	82.34	65.96	130.51	78.28	62.61	37.85	41.21	42.21	3,022.28	1,699.94	1,303.24
Hampton	15,974.35	11,266.53	9,854.19	70.59	49.38	43.02	2,399.45	1,191.24	828.78	67.27	42.06	34.50	63.86	39.89	32.70	20.56	21.63	21.96	1,725.51	947.56	714.17
Newport News	21,136.54	14,941.46	13,082.93	92.28	65.31	57.21	3,237.32	1,625.15	1,141.50	92.40	57.47	46.99	87.81	54.55	44.57	27.33	29.00	29.50	2,271.79	1,259.56	955.89
Norfolk	23,885.94	16,350.98	14,090.49	104.03	70.54	60.49	3,599.87	1,783.47	1,238.54	99.99	59.28	47.06	94.87	56.13	44.51	29.74	30.06	30.16	2,596.83	1,395.08	1,034.55
Poquoson	1,209.97	800.74	677.97	2.95	1.99	1.70	133.95	69.44	50.08	3.38	2.27	1.94	3.20	2.16	1.84	0.97	0.98	0.98	153.01	83.74	62.96
Portsmouth	8,850.23	6,151.29	5,341.61	33.01	22.99	19.99	1,269.01	647.22	460.69	34.87	21.05	16.90	33.12	19.95	16.00	9.91	10.30	10.41	1,040.46	576.07	436.76
Suffolk	12,225.62	8,800.57	7,773.06	62.06	46.35	41.63	2,903.07	1,373.66	914.84	108.99	53.86	37.32	104.67	51.55	35.61	21.62	23.57	24.16	1,222.87	676.61	512.73
Virginia Beach	42,892.10	29,741.61	25,796.47	155.32	108.52	94.48	5,631.77	2,898.74	2,078.83	144.72	95.02	80.11	137.09	90.00	75.88	45.87	48.06	48.72	5,150.32	2,877.35	2,195.46
Williamsburg	1,456.15	971.93	826.66	4.74	3.14	2.67	178.78	89.99	63.35	4.48	2.85	2.36	4.24	2.69	2.23	1.40	1.40	1.40	176.32	96.43	72.47
Hampton Roads Totals:	**189,864.76**	**133,264.82**	**116,284.83**	**769.74**	**546.26**	**479.22**	**29,169.94**	**14,684.44**	**10,338.79**	**861.38**	**509.13**	**403.46**	**820.09**	**483.74**	**382.84**	**239.75**	**253.61**	**257.77**	**20,500.92**	**11,362.37**	**8,620.81**
Virginia Totals:	**1,195,237.09**	**861,199.54**	**760,988.28**	**4,041.05**	**6,162.09**	**6,798.41**	**197,822.24**	**97,694.29**	**67,655.90**	**6,798.41**	**953.63**	**2,553.17**	**6,499.27**	**3,364.56**	**2,424.15**	**1,434.42**	**1,532.75**	**1,562.25**	**108,001.04**	**59,956.54**	**45,543.19**