Chapter 3

Statewide Emission Trends and Forecasts

Introduction

Emission Trends and Forecasts

The most current emissions data available are for 2012. Included are the latest point source estimates provided by districts as well as inventory improvements from recent SIPs. Any data prior to this year are derived from historical emissions data where available, and backcasted emissions based on historical socioeconomic growth and control information. Future year estimates are forecasted from the 2012 base year and control measures reported through June 2013. Forecasts take into account emissions data, projected growth rates, and future adopted control measures to estimate emissions in future years.

On a statewide basis, emissions of NO_x are forecasted to decline between 2000 and 2035. Emissions of VOC are forecasted to decrease through 2025 with a slight increase after 2025. In addition to being ozone precursors, both NO_x and VOC contribute to secondary PM_{10} and $PM_{2.5}$. Direct PM_{10} and $PM_{2.5}$ emissions show a decrease from 2000 to 2015, and are predicted to increase slightly after 2015.

Emissions of DPM are forecasted to decline through 2020, remaining relatively constant thereafter.

Statewide SO_x emissions decreased overall from 2000 through 2035.

Statewide NH_3 emissions are expected to slowly increase from 2000 to 2035.

SIP and transportation conformity inventory forecasts may differ from the forecasts presented in this almanac. For more information on these forecasts, please see the ARB SIP web page at *www.arb.ca.gov/planning/sip/sip.htm*.

Statewide Emissions (tons/day, annual average)								
Pollutant	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
VOC	2902	2261	1943	1624	1561	1554	1568	1574
NO_X	3782	3214	2324	1887	1553	1312	1224	1200
SO_X	289	287	123	78	82	88	94	101
DPM	86	88	54	31	25	23	23	25
$PM_{2.5}$	661	524	447	410	414	419	434	441
PM_{10}	2436	1700	1549	1491	1525	1544	1572	1590
NH_3	730	741	752	719	742	770	776	779

Table 3-1

Statewide Population and VMT

Airborne pollutants result in large part from human activities, and growth generally has a negative impact on air quality. California is fortunate in that it boasts the world's most progressive emission controls. These controls have resulted in significant air quality improvements, despite substantial growth.

During 1992 through 2011, statewide maximum 8-hour ozone values decreased 38 percent. This air quality improvement occurred at the same time the State's population increased 21 percent and the average daily VMT increased 41 percent. Ambient annual average $PM_{2.5}$ values in the non-desert areas also show improvement: a 32 percent decrease from 1999 to 2011. While the air quality improvements are impressive, additional emission controls will be needed to offset future growth.

Percent Change in Air Quality and Growth

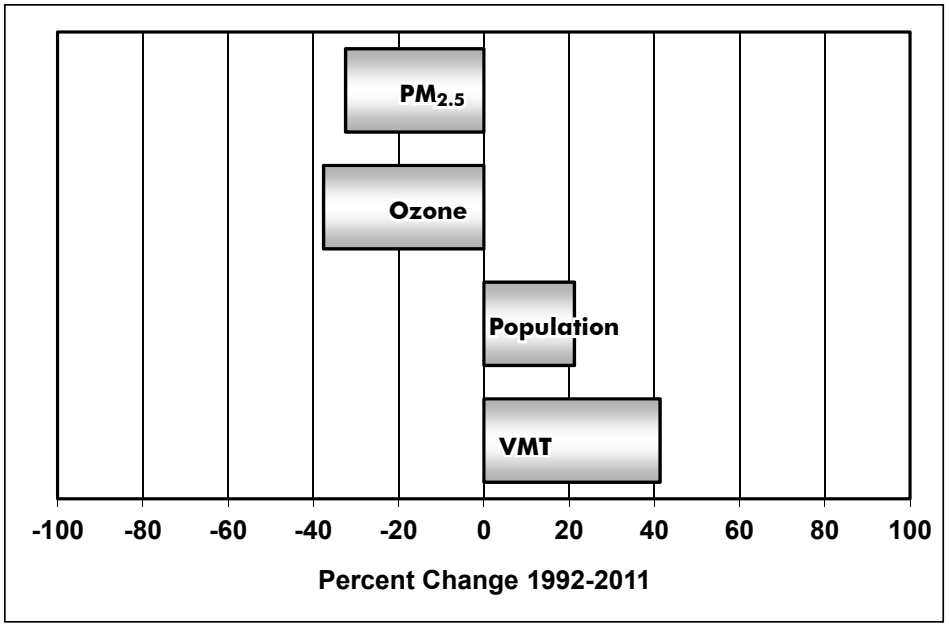

Figure 3-1

$PM_{2.5}$ percentage reflects from 1999 to 2011.

Statewide Population and VMT Trends										
Parameter	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
Population	29828496	31711849	34000835	35985582	37309382	38801063	40643643	42451760	44279354	46083482
Avg. Daily VMT/1000	655348	726101	813292	892024	953029	1013538	1079011	1138889	1200801	1260425

Table 3-2

Emission Trends and Forecasts - NO_x

NO_x emission standards for on-road motor vehicles were introduced in 1971, followed in later years by the implementation of increasingly more stringent standards and the introduction of three-way catalysts. NO_x emissions from on-road motor vehicles have declined by 42 percent from 2000 to 2010. NO_x emissions are projected to further decrease by 73 percent between 2010 and 2035. This occurs as vehicles meeting more stringent emission standards enter the fleet, and all vehicles use cleaner burning gasoline and diesel fuel or alternative fuels.

NOx emissions from other mobile categories on the whole are projected to decrease from 2000 to 2035. The two largest NO_x contributors in the other mobile category are off-road equipment and ships. Stationary source NO_x emissions are estimated to drop by 51 percent between 2000 and 2015. This decrease has been largely due to a switch from fuel oil to natural gas and the implementation of combustion controls such as low-NO_x burners for boilers and catalytic converters for both external and internal combustion stationary sources. For additional information on these forecasts, please refer to the ARB SIP web page at *www.arb.ca.gov/planning/sip/sip.htm.*

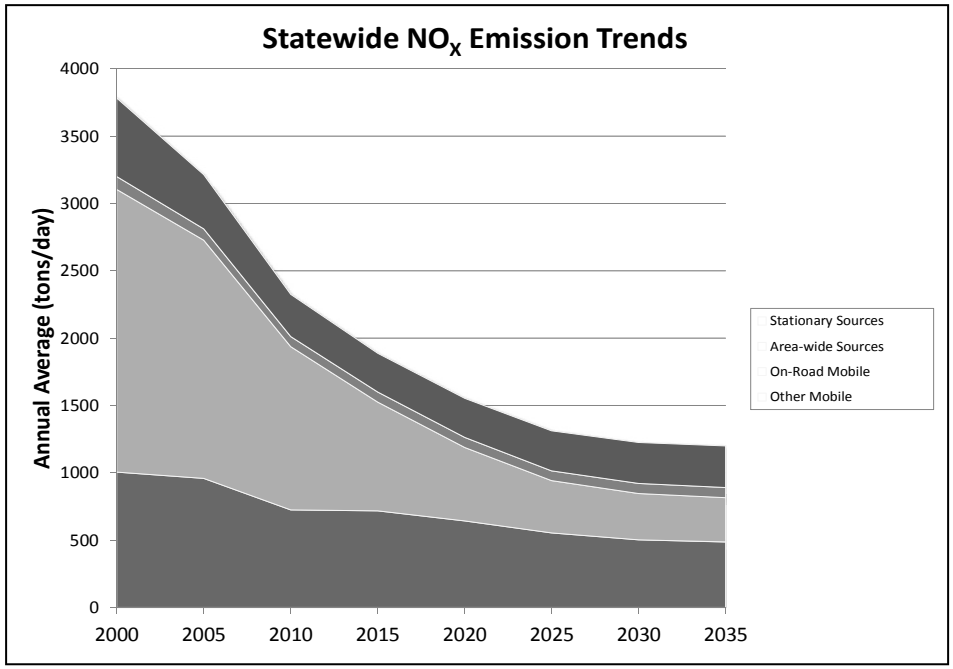

Figure 3-2

NO_X Emission Trends (tons/day, annual average)								
Emission Source	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
All Sources	***3782***	***3214***	***2324***	***1887***	***1553***	***1312***	***1224***	***1200***
Stationary Sources	584	402	313	288	291	297	303	310
Area-wide Sources	96	85	75	74	74	73	75	75
On-Road Mobile	2097	1769	1210	808	545	389	345	328
Gasoline Vehicles	1098	681	489	313	211	153	119	94
Diesel Vehicles	999	1088	721	496	333	235	226	235
Other Mobile	1006	958	725	717	643	553	502	487
Gasoline Fuel	62	62	47	42	40	39	39	40
Diesel Fuel	867	826	613	608	532	441	389	372
Other Fuel	77	70	65	66	72	73	73	74

Table 3-3

Emission Trends and Forecasts - VOCs

VOC emissions in California are projected to decrease by about 46 percent between 2000 and 2035, largely as a result of the State's on-road motor vehicle emission control program. This includes the use of improved evaporative emission control systems, computerized fuel injection, engine management systems to meet increasingly stringent California emission standards, cleaner gasoline, and the Smog Check program. VOC emissions from other mobile sources are projected to decline between 2000 and 2035 as more stringent emission standards are adopted and implemented. Substantial reductions have also been obtained for area-wide sources through the vapor recovery program for service stations, bulk plants, and other fuel distribution operations. There are also on-going programs to reduce overall solvent VOC emissions from coatings, consumer products, cleaning and degreasing solvents, and other substances used within California. For additional information on these forecasts, please refer to the ARB SIP web page at *www.arb.ca.gov/planning/sip/sip.htm*.

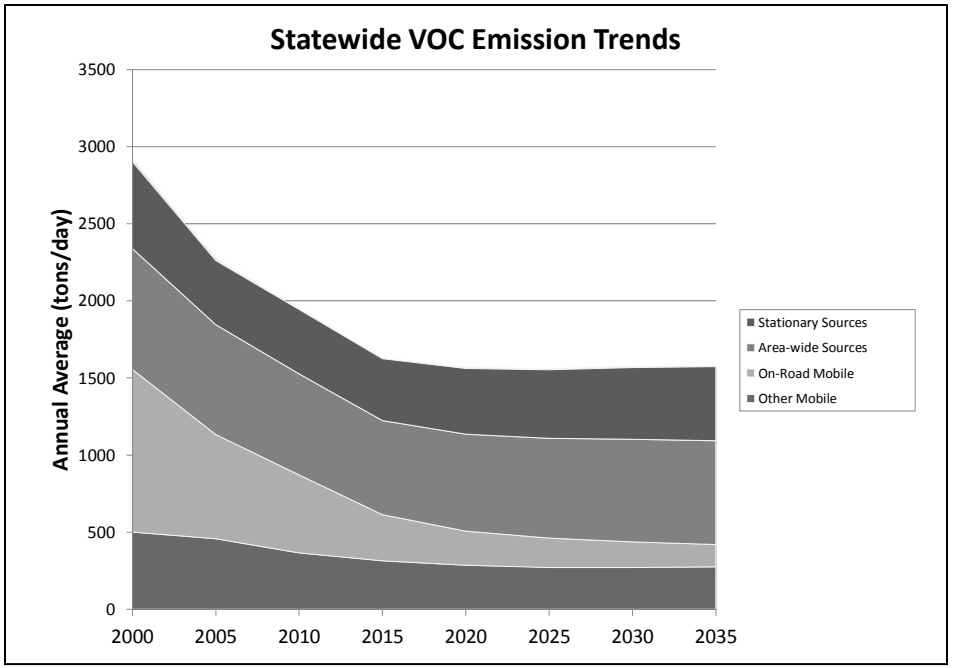

Figure 3-3

VOC Emission Trends (tons/day, annual average)								
Emission Source	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
All Sources	***2902***	***2261***	***1943***	***1624***	***1561***	***1554***	***1568***	***1574***
Stationary Sources	564	416	417	401	425	445	465	481
Area-wide Sources	783	713	655	611	630	647	665	673
On-Road Mobile	1056	675	505	299	220	188	168	145
Gasoline Vehicles	1005	621	468	276	199	167	145	120
Diesel Vehicles	51	54	37	23	21	21	23	25
Other Mobile	500	458	366	314	286	273	270	275
Gasoline Fuel	388	352	282	234	207	193	187	187
Diesel Fuel	84	79	56	50	45	45	47	52
Other Fuel	27	27	28	30	34	35	36	36

Table 3-4

Emission Trends and Forecasts - Directly Emitted $PM_{2.5}$

$PM_{2.5}$ emissions are projected to decrease from 2000 to 2035 as a result of reduced stationary source and area-wide source emissions. $PM_{2.5}$ emissions are dominated by area-wide sources. Emissions from paved road dust and unpaved road dust emissions remain fairly constant through the forecast period. Other area-wide source emissions, which include managed burning, residential wood combustion, and fugitive windblown dust, decrease from 2000 to 2035. Exhaust emissions from diesel mobile sources dropped from 2000 to 2035 due to more stringent emissions standards and the introduction of cleaner burning diesel fuel. $PM_{2.5}$ emissions from stationary sources and area-wide sources are expected to increase slightly after 2015.

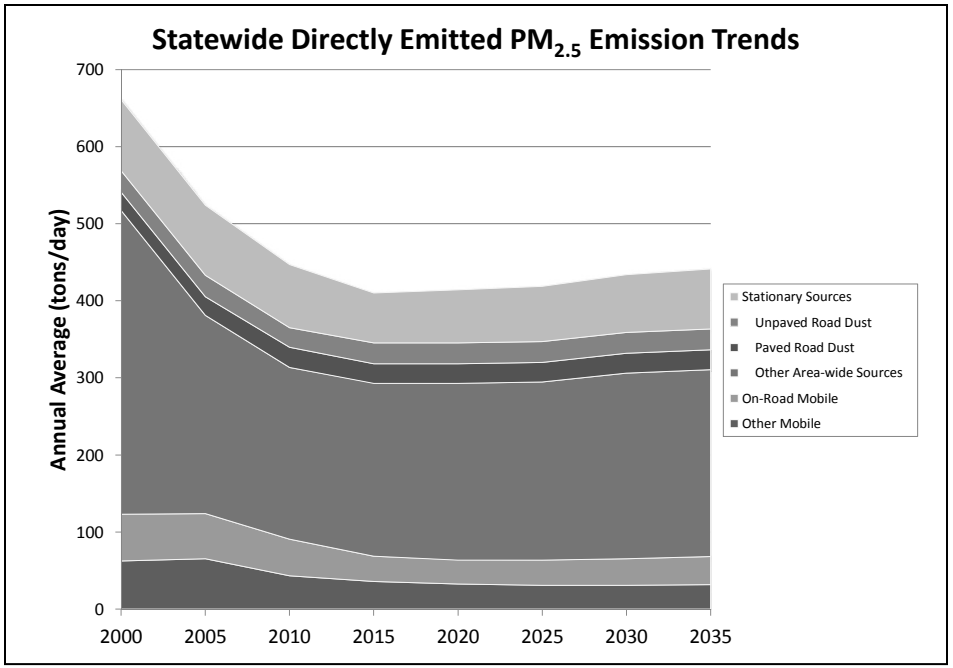

Figure 3-4

Directly Emitted $PM_{2.5}$ Emission Trends (tons/day, annual average)								
Emission Source	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
All Sources	***661***	***524***	***447***	***410***	***414***	***419***	***434***	***441***
Stationary Sources	92	91	82	65	69	72	75	78
Area-wide Sources	445	309	275	277	281	284	294	295
Paved Road Dust	24	24	26	25	25	26	26	26
Unpaved Road Dust	28	28	26	27	27	27	27	27
Other Area-wide Sources	394	257	223	225	229	231	241	242
On-Road Mobile	61	59	47	33	31	33	34	36
Gasoline Vehicles	27	23	21	21	21	22	23	24
Diesel Vehicles	34	36	26	12	10	11	11	12
Other Mobile	62	65	43	36	33	31	31	32
Gasoline Fuel	9	10	9	8	8	7	7	7
Diesel Fuel	45	47	26	19	16	14	14	15
Other Fuel	8	8	8	8	9	9	9	9

Table 3-5

Emission Trends and Forecasts - Directly Emitted PM_{10}

PM_{10} emissions are projected to decrease from 2000 to 2035 as a result of reduced area-wide source emissions. PM_{10} emissions are dominated by other area-wide sources, primarily managed burning, residential wood combustion, and fugitive windblown dust. Emissions from paved road dust and unpaved road dust emissions remain fairly constant through the forecast period. Other area-wide source emissions decrease by 52 percent from 2000 to 2010 and increase after 2010. Exhaust emissions from diesel mobile sources dropped by 32 percent from 2000 to 2010 due to more stringent emissions standards and the introduction of cleaner burning diesel fuel. PM_{10} emissions from stationary sources and area-wide sources are expected to increase slightly after 2015.

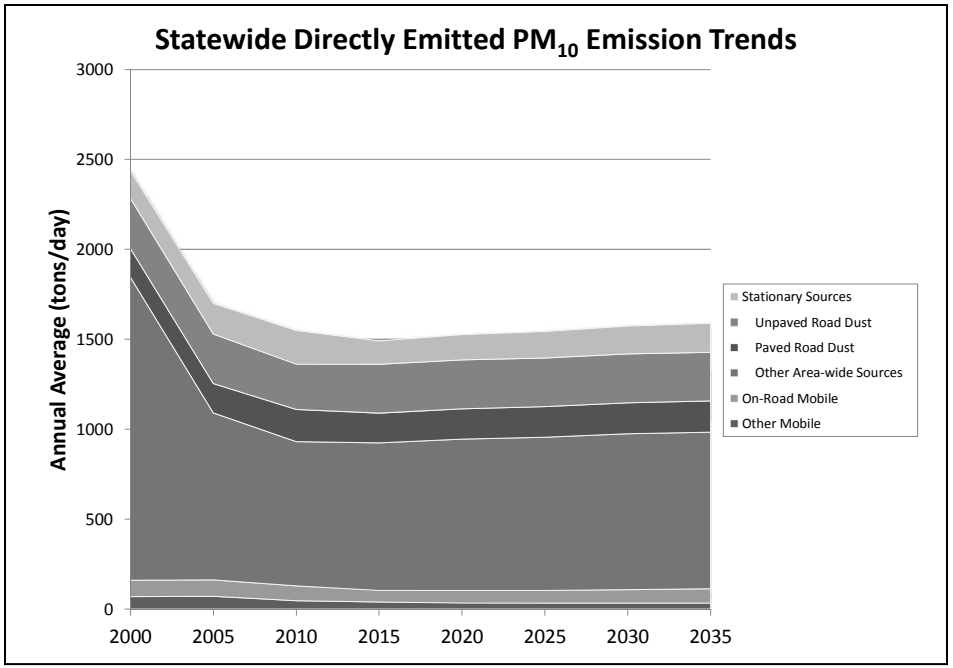

Figure 3-5

Directly Emitted PM_{10} Emission Trends (tons/day, annual average)								
Emission Source	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
All Sources	***2436***	***1700***	***1549***	***1491***	***1525***	***1544***	***1572***	***1590***
Stationary Sources	153	170	184	130	140	147	154	162
Area-wide Sources	2122	1366	1236	1254	1282	1292	1310	1314
Paved Road Dust	160	162	179	166	170	171	172	173
Unpaved Road Dust	278	276	255	271	271	271	271	271
Other Area-wide Sources	1685	928	802	817	841	850	866	871
On-Road Mobile	92	92	82	67	68	71	75	79
Gasoline Vehicles	50	48	48	49	50	52	55	57
Diesel Vehicles	42	44	33	19	18	18	20	22
Other Mobile	69	70	47	39	36	34	33	34
Gasoline Fuel	12	12	11	10	9	8	8	8
Diesel Fuel	48	50	28	21	17	15	15	16
Other Fuel	8	8	8	9	10	10	10	10

Table 3-6

Emission Trends and Forecasts - Diesel PM

Diesel PM emissions decreased 37 percent from 2000 to 2010 primarily as a result of more stringent emissions standards and the introduction of cleaner burning diesel fuel. Emissions from diesel mobile sources are projected to continue to decrease after 2010. Overall, statewide emissions are forecasted to decline by 71 percent between 2000 and 2035.

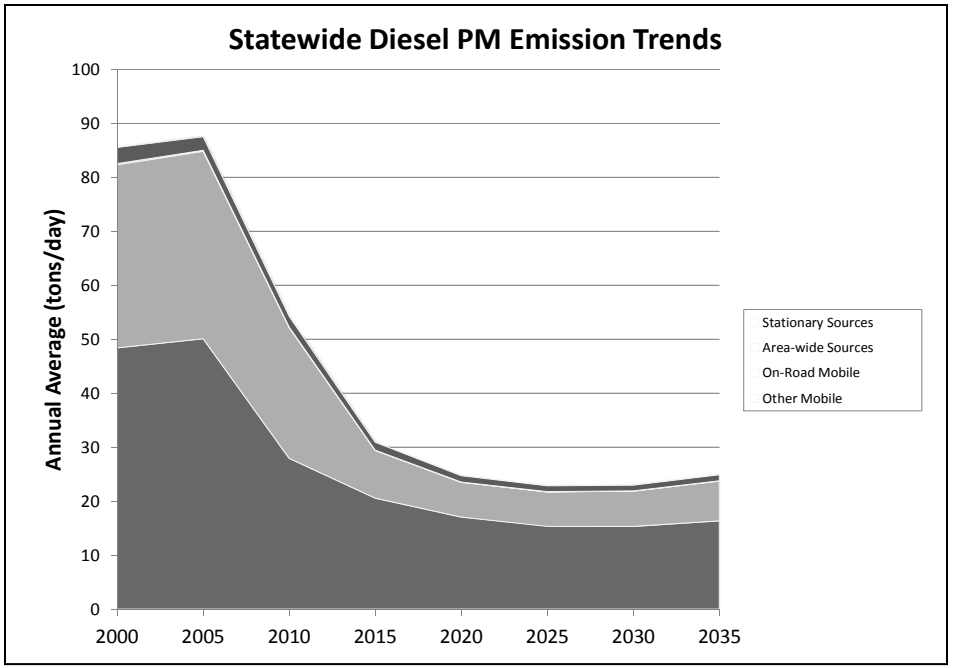

Figure 3-6

Diesel PM Emission Trends (tons/day, annual average)								
Emission Source	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
All Sources	***86***	***88***	***54***	***31***	***25***	***23***	***23***	***25***
Stationary Sources	3	3	2	1	1	1	1	1
Area-wide Sources	0	0	0	0	0	0	0	0
On-Road Mobile	34	35	24	9	6	6	7	7
Gasoline Vehicles	0	0	0	0	0	0	0	0
Diesel Vehicles	34	35	24	9	6	6	7	7
Other Mobile	48	50	28	21	17	15	15	16
Gasoline Fuel	0	0	0	0	0	0	0	0
Diesel Fuel	48	50	28	20	17	15	15	16
Other Fuel	0	0	0	0	0	0	0	0

Table 3-7

Emission Trends and Forecasts - Oxides of Sulfur

Emissions of SO_x declined about 57 percent in California between 2000 and 2010. Sulfur dioxide emissions from stationary sources decreased between 2000 and 2010 due to improved industrial source controls and switching from fuel oil to natural gas for electric generation and industrial boilers. The SO_x emissions from land-based on- and off-road gasoline and diesel-fueled engines and vehicles have also decreased due to lower sulfur content in the fuel and recent regulations adopted by the ARB. The "Fuel Sulfur and Other Operation Requirements for Ocean-Going Vessels within California Waters and 24 Nautical Miles of the California Baseline" adopted in 2008 requires the use of cleaner marine distillate fuels in ocean-going vessels that visit California seaports. The SO_x reductions seen in the "Other Mobile" category can be attributed to this effort.

Despite major reductions overall since 2000, SO_x emissions from the "other mobile" categories are expected to increase slightly in the future due to the significant growth in shipping activities expected for California.

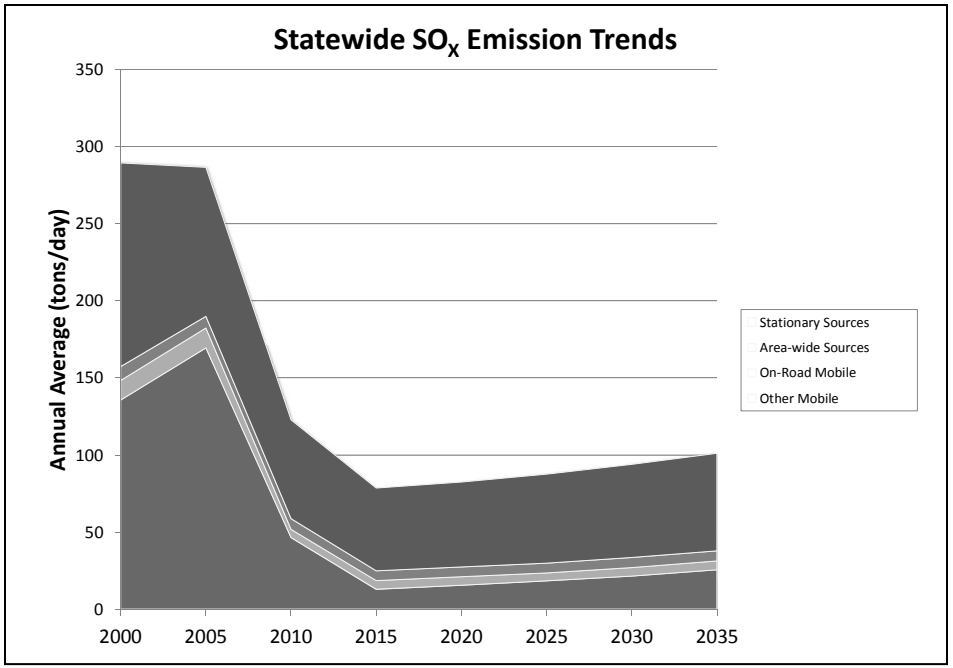

Figure 3-7

SO_X Emission Trends (tons/day, annual average)								
Emission Source	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
All Sources	***289***	***287***	***123***	***78***	***82***	***88***	***94***	***101***
Stationary Sources	132	97	64	54	55	58	60	63
Area-wide Sources	9	7	7	6	6	6	7	7
On-Road Mobile	13	13	5	6	6	5	5	6
Gasoline Vehicles	5	4	4	5	4	4	4	4
Diesel Vehicles	7	9	1	1	1	1	1	2
Other Mobile	136	169	46	13	15	18	21	26
Gasoline Fuel	0	0	0	0	0	0	0	0
Diesel Fuel	133	166	43	9	11	14	17	21
Other Fuel	3	3	4	4	4	4	5	5

Table 3-8

Emission Trends and Forecasts - Ammonia

Ammonia emissions are projected to increase slightly from 2000 to 2035 by about seven percent. Most of the ammonia emissions are from area-wide sources. The major area-wide source of ammonia is livestock waste. Area-wide source emissions are projected to remain relatively flat from 2000 to 2035. Ammonia emissions from on-road vehicles are produced by three-way catalyst equipped gasoline vehicles. On-road mobile ammonia emissions are forecasted to decrease by 40 percent between 2000 and 2035. Ammonia emissions from stationary sources are primarily related to NO_x emission controls, the manufacture of a variety of products, and waste disposal. Their emissions are expected to double by 2035. However, because area-wide dominate, the overall trend is flat.

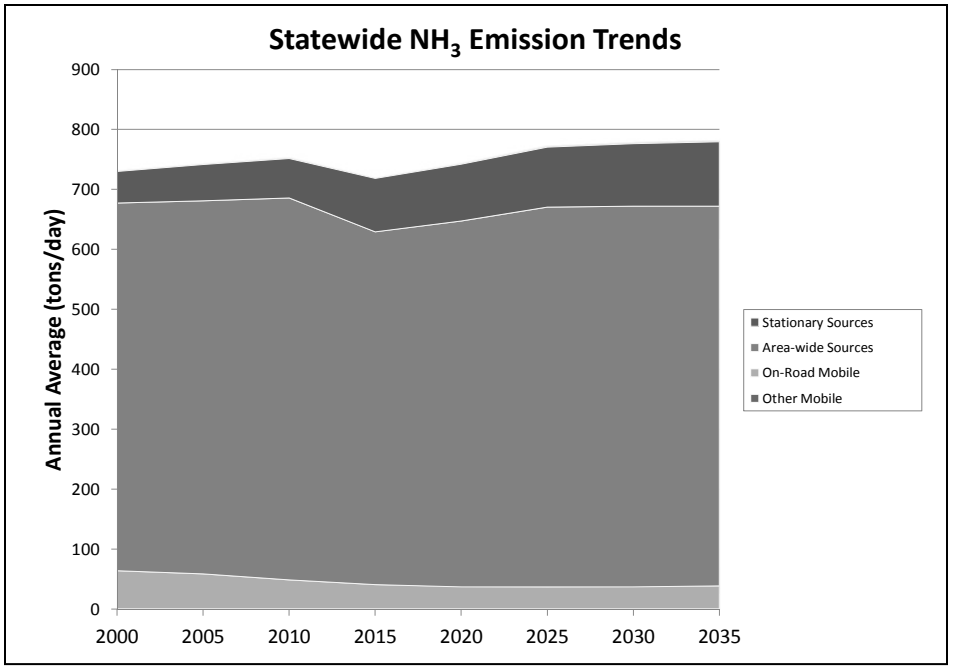

Figure 3-8

NH_3 Emission Trends (tons/day, annual average)								
Emission Source	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
All Sources	***730***	***741***	***752***	***719***	***742***	***770***	***776***	***779***
Stationary Sources	53	61	66	89	95	100	104	107
Area Wide	614	622	637	588	610	634	634	633
On-Road Mobile	63	58	48	41	37	36	37	38
Gasoline Vehicles	62	57	47	39	35	34	35	36
Diesel Vehicles	1	1	1	1	2	2	2	2
Other Mobile	0	0	0	0	1	1	1	1
Gasoline Fuel	0	0	0	0	0	0	0	0
Diesel Fuel	0	0	0	0	1	1	1	1
Other Fuel	0	0	0	0	0	0	0	0

Table 3-9