Appendix E

Future Year Ozone Season Day Emissions Inventory Summaries: 2020 and 2030

Future Year Ozone Season Day Emission Inventory Summaries: 2020 and 2030

Ozone season day emissions were estimated for both future years included in the 2008 Ozone Maintenance Plan. An emission summary by source category and county appear in Tables E-1 and E-2. More detailed descriptions of future year calculation methods for each source category follow the tables.

Table E-1 2020 Ozone Season Day Emissions Summary (tons per day)

County Name	Source Category	CO	NO_X	VOC
Franklin County	Point Sources	16.95	30.92	2.50
Jefferson County		9.95	23.58	1.75
St. Charles County		4.32	8.82	4.17
St. Louis County		16.12	21.19	3.06
St. Louis City		6.58	4.09	2.84
Totals *		**53.92**	**88.6**	**14.32**
Franklin County	Area Sources	3.72	3.11	5.87
Jefferson County		5.61	1.18	5.38
St. Charles County		9.76	2.41	11.39
St. Louis County		34.79	6.37	35.03
St. Louis City		2.62	3.79	11.16
Totals *		**56.51**	**16.87**	**68.86**
Franklin County	Onroad Mobile Sources	52.09	5.99	7.89
Jefferson County		31.74	4.99	2.41
St. Charles County		50.28	7.89	3.90
St. Louis County		147.97	23.60	10.47
St. Louis City		25.19	3.95	1.97
Totals *		**307.27**	**46.42**	**26.64**
Franklin County	Nonroad Sources	17.52	4.03	2.06
Jefferson County		29.69	2.19	2.17
St. Charles County		62.99	5.28	4.21
St. Louis County		327.21	12.65	17.84
St. Louis City		47.93	4.13	2.44
Totals *		**485.35**	**28.27**	**28.71**
Grand Total *		**903.05**	**180.16**	**138.53**

* Note: Figures may not total exactly due to rounding.

Table E-2 2030 Ozone Season Day Emissions Summary (tons per day)

County Name	Source Category	CO	NO_X	VOC
Franklin County	Point Sources	9.02	30.92	2.32
Jefferson County		9.96	27.72	1.96
St. Charles County		4.37	8.87	4.17
St. Louis County		14.59	21.75	3.08
St. Louis City		6.57	3.82	2.78
Totals *		**44.51**	**93.08**	**14.31**
Franklin County	Area Sources	3.80	2.20	5.82
Jefferson County		5.62	0.88	5.38
St. Charles County		9.79	1.81	11.38
St. Louis County		34.84	5.44	35.11
St. Louis City		2.67	2.70	11.12
Totals *		**56.72**	**13.03**	**68.80**
Franklin County	Onroad Mobile Sources	34.42	3.22	5.45
Jefferson County		20.73	2.73	1.70
St. Charles County		32.86	4.34	2.72
St. Louis County		97.11	13.10	7.21
St. Louis City		16.67	2.18	1.34
Totals *		**201.79**	**25.57**	**18.42**
Franklin County	Nonroad Sources	18.64	1.97	1.79
Jefferson County		33.08	2.32	2.13
St. Charles County		70.10	5.88	4.04
St. Louis County		373.86	16.93	19.45
St. Louis City		55.35	2.80	2.60
Totals *		**551.04**	**29.90**	**30.01**
Grand Total *		**854.06**	**161.58**	**854.06**

* Note: Figures may not total exactly due to rounding.

Point Sources

The air program followed EPA's Modeling Platform methodology (2011NEIv2-based Platform 2011v6.2 from the Emissions Modeling Clearinghouse website https://www.epa.gov/air-emissions-modeling) to develop growth factors out to 2020 and 2030 for both the point and nonpoint categories. The modeling platform provides emissions for 2017 and 2025, so it was necessary to make assumptions to interpolate to the 2020 year and go beyond the modeling platform to 2030.

EGU Growth:

In the modeling platform, EPA used IPM to grow 2011 EGU emissions to 2017 and 2025. The air program decided to use emissions from 2017 for 2020 and emissions from 2025 for 2030 for the following reasons:

- The modeling platform emissions at four St. Louis area coal-fired EGUs show a change of less than 5% in either NO_x or VOC from 2017 to 2025. Projecting these emission changes from year-to-year is not feasible given the limited information on interim years from the IPM model.

- It is not appropriate to use the same growth methodology used for Non-EGU sources since growth in the EGU sector depends on energy demand and environmental, transmission, dispatch, and reliability constraints.

Where the modeling platform provided annual emissions, ozone season day emissions were calculated using additional information from the 2011NEIv2-based Platform. The emission files for 2017 and 2025 contain columns with number of hours a unit operated per year and monthly emissions. The air program used the month of July in this calculation. The number of operating hours was divided by the 8760 (number of hours per year) to come up with the percent the unit operated per year. To come up with the number of days the unit operated in July, the number of days in July (31) was multiplied by the above percentage. Then the ozone season day emissions for July were calculated by dividing the July emissions by the number of days the unit operated in July.

Non-EGU Growth:

The modeling platform contains emission information on all non-EGU point sources as well. The program calculated growth factors for years 2017 and 2025 by dividing 2011 annual emissions by 2017 and 2025 annual emissions. The methodology is consistent with projection methods used by Illinois. To estimate 2020 and 2030 growth factors, the air program interpolated the 2017 and 2025 growth factors and then extrapolated to 2030. The air program used the TREND function in Excel and years 2018-2025 to project data for 2026-2030. The base year then was moved to 2014 and 2020 and 2030 growth factors were recalculated. Then, the air program matched 2014 ozone season emission data with these growth factors based on facility IDs, SCC, and pollutant codes. For all facilities left without growth factors, the air program averaged all growth factors based on SCC and applied the resulting growth factors to these facilities. Airport point sources from 2011 base year were grown to 2020 and 2030 based on 2011 base year growth year. It should be noted that before growing the 2011 annual airport point sources, their emissions were converted from annual tons per year to ozone season pounds per day using temporal allocation factors from EPA's Emissions Modeling Clearinghouse Temporal Allocation.

Nonpoint Sources

Similar to the method for non-EGU point sources, the program calculated growth factors for years 2017 and 2025 by dividing 2011 annual emissions by 2017 and 2025 annual emissions. The air program interpolated between the 2017 and 2025 growth factors and then extrapolated to 2030. The air program used the TREND function in Excel and years 2018-2025 to project data for 2026-2030. The base year then was moved to 2014 and 2020 & 2030 growth factors were recalculated. Then, the air program matched 2014 ozone season nonpoint emission data with these growth factors based on SCC and pollutant codes. For all nonpoint SCCs left without

growth factors, the air program averaged all growth factors based on SCC and applied the resulting growth factors to these SCCs.

Onroad Mobile Sources

Emissions for the mobile sector were grown using the MOVES2014a model because it accepts state-specific data and reflects changes in vehicle standards that take effect in future years. The growth of onroad mobile source emissions via the MOVES model requires consideration of several future year model input tables. Specifically, the air program developed age distribution, VMT, and vehicle population tables for 2020 and 2030. Other tables that were not modified, other than changing the analysis year to 2020 or 2030, are the speed, ramp fraction, fuels, I/M, starts, hotelling, and meteorology.

Future year age distribution guidance is given in section 4.4 of the *MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emission Inventories for State Implementation Plans and Transportation Conformity* guidance document, last updated November 2015. While MOVES can produce default age distributions, the guidance states that state-specific data is preferred. The air program prepared state-specific 2014 age distributions for light duty vehicles from decoded VINs obtained from the Missouri Department of Revenue vehicle registration database. MOVES can also produce future year default age distributions, but in past SIPs, the air program used the age distribution from the base year in the future years without modification. The air program did not use MOVES-produced default future year age distributions because of the possibility of projecting a future fleet that is younger than the base year, against EPA guidance. The air program will continue to follow past EPA guidance and uses the same age distribution for all analysis years, including the state-specific light duty profile. While EPA has provided an Age Distribution Projection Tool for MOVES2014 (found at www.epa.gov/otaq/models/moves/tools.htm), it is not used in the current projections.

VMT for future years was developed with the input of the Missouri Department of Transportation (MoDOT), FHWA, and the East West Gateway Council of Governments. MoDOT provided historic VMT data from 2007 to 2015, broken out by road type and urban/rural classification. Urban road types include both the St. Louis counties of interest, but also include Kansas City, Springfield, and Columbia areas. All urban road types were combined, and the trend of VMT change was plotted year by year and over discreet time periods. Both the average and median growth rates were examined over the entire 9 year period, and again over more recent 5 and 3 year periods. Negative urban VMT growth from 2008 to 2012 occurred during the recession, but VMT in the 2013 to 2015 shows strong growth of up to 9% per year on certain road types, as measured by vehicle counts. With such a large variation in growth over the period, the average growth rate is ruled out because it skews toward outlier values. The median growth rate of 1.7% per year from 2013-2015 is a preferred option as it shows a growth rate that straddles the recession years and post-recession growth years, is a positive growth rate similar to

past SIP growth rates of 1.5%, and is similar to the FHWA long term 1990-2014 national average VMT growth rate of 1.74%. The FHWA national average VMT from travel monitoring data was retrieved from https://www.fhwa.dot.gov/policyinformation/travel_monitoring/historicvmt.cfm (last updated April 18, 2016). Because the growth rate is to be applied out to 2030, more than 15 years beyond the base year, the growth rate is chosen to be reasonable over the entire period, recognizing the individual years will show variations from this average. The 1.7% per year growth rate is preferred because it has origins in MoDOT data, is supported by FHWA, and is consistent with previous growth estimates.

Vehicle population for the future year is estimated using FHWA Office of Highway Policy Information Highway Statistics reports (http://www.fhwa.dot.gov/policyinformation/statistics.cfm). Within the annual report is a table named MV-1 that lists the total reported state motor vehicle registrations. The level of detail provided is state total registrations broken out by vehicle types (automobiles, buses, trucks, and motorcycles). Multiple years of this table are available to construct historical trends. The Missouri total registration information is examined for the years of 2011 and 2014 as these correspond to triennial emission inventory years and the base years used for past ozone SIP documents. The average annual compound growth rate is estimated for each vehicle type from the FHWA data as shown below in Table E-3.

Table E-3 FHWA Vehicle Population Growth

	Vehicle Population				
Year	**Automobiles**	**Buses**	**Trucks**	**Motorcycles**	**All Motor Vehicles**
2011	2,440,765	16,087	2,572,195	140,947	5,169,994
2014	2,231,294	5,901	2,941,907	153,799	5,332,901
Compound Annual Average Growth Percentage	-2.9%	-28.4%	4.6%	3.0%	1.0%

The numbers for Missouri align generally with the national trend showing total motor vehicle registrations over the same period growing by 0.93%, close to the Missouri trend of 1.0% growth. National automobile growth is also negative as it is in Missouri, with the strongest positive growth in the truck category. Because the truck category includes most sport utility vehicles and crossover body types, the growth anecdotally corresponds to trends in vehicle sales in recent years. The air program is using the FHWA compound annual average growth percentages to estimate future vehicle populations with two changes. The negative growth in

automobiles and buses seen in the statewide numbers may not be reflective of the St. Louis area. Specifically, the St. Louis transit agency METRO shrunk their bus fleet after the late 2000's recession. The agency plans to hold the bus fleet population steady for the next several years, so the negative trend in Missouri's FHWA bus population will not be used in favor of a flat growth assumption in future years (0% growth). Likewise, the negative growth in automobiles, mainly light duty passenger cars, may not be reflective of the specific St. Louis area. To maintain a conservative and likely higher future year emission estimate, the negative automobile trend will be replaced with a flat growth assumption (0%) in future years.

Two other sources of information were considered for use in creating future year vehicle population estimates. The Missouri Department of Revenue registered vehicle list used to develop the 2014 base year vehicle population was considered for use in constructing a historical trend. The lack of consistent vehicle types in past Missouri DOR data and limited decoding of certain vehicle types (heavy duty, buses) makes the Missouri DOR data less desirable for creating historical vehicle population trends. EPA's method of growing vehicle populations based on the human population growth and heavy duty VMT were also considered but not chosen. Using human population as a surrogate for light duty vehicle growth does not account for the use of transit in densely populated areas. Additionally, the St. Louis area population trend for 2011 to 2014 is positive 3%, but the state and national trend in registered automobiles is negative according to FHWA. Using heavy duty VMT to grow heavy duty populations assumes a constant rate of travel per vehicle in future years and creates a linear relationship between vehicle population and vehicle travel that may not exist. While these other methods may be sufficient for EPA, the air program believes the registration data reported by FHWA is the dataset most directly related to growth in vehicle population.

Transportation conformity requirements in state rule 10 CSR 10-5.480 were met during the process of creating the future year emission estimates. The rule requires state air programs to consult with the metropolitan planning organization when developing mobile emission estimates, especially for projects where these estimates are used to update a SIP that contains new or revised mobile emission budgets. Consulting began informally at the March 29, 2016 Interagency Consulting Group (IACG) meeting with general discussions of the budgets to be developed. A formal presentation was given to the IACG at the May 24th, 2016 meeting where specific feedback was requested from the group on VMT, age distribution, and vehicle population growth methodologies. The rule required IACG review period for the proposed updated mobile budgets began on June 20th, 2016, more than 30 days in advance of presentation of the budget to the Missouri Air Conservation Commission at the July 28th meeting.

Nonroad Mobile Sources

Nonroad emissions were also estimated using the MOVES2014a model because it reflects nonroad emission standards taking effect in future years. The air program does not collect sate-

specific information on nonroad equipment operating characteristics or populations, and accepts the default model input tables. Accepting default information for nonroad equipment in 2020 and 2030 model runs is the same methodology used for base year 2014 emission estimates.

Appendix F

Illinois Emissions Inventories

Illinois Emissions Inventories

The Illinois Environmental Protection Agency (IEPA) Bureau of Air provided 2014, 2020 and 2030 emission estimates for the ozone precursor pollutants VOC and NO_x for the Illinois side of the St. Louis nonattainment area. Emissions in Tables F-1, F-2 and F-3 are listed in tons per ozone season day.

Table F-1 Illinois St. Louis Nonattainment Area County 2014 Emissions

County Name	Source Category	NO_X	VOC
Madison County	Point Sources	21.39	7.52
Monroe County		0.48	0.10
St. Clair County		1.42	1.76
Totals *		**23.29**	**9.38**
Madison County	Area Sources	0.83	9.41
Monroe County		0.15	1.72
St. Clair County		0.55	7.93
Totals *		**1.53**	**19.06**
Madison County	Onroad Mobile Sources	13.05	4.85
Monroe County		1.62	0.63
St. Clair County		12.27	4.63
Totals *		**26.94**	**10.11**
Madison County	Nonroad Sources	9.29	3.86
Monroe County		8.01	1.03
St. Clair County		7.32	2.58
Totals *		**24.62**	**7.47**
Grand Total *		**76.38**	**46.02**

Table F-2 Illinois St. Louis Nonattainment Area County 2020 Emissions

County Name	Source Category	NO_X	VOC
Madison County	Point Sources	14.80	7.20
Monroe County		0.61	0.09
St. Clair County		1.40	1.74
Totals *		**16.81**	**9.03**
Madison County	Area Sources	0.82	9.07
Monroe County		0.15	1.68
St. Clair County		0.54	7.65
Totals *		**1.51**	**18.40**
Madison County	Onroad Mobile Sources	6.39	3.05
Monroe County		0.82	0.42
St. Clair County		6.01	2.92
Totals *		**13.22**	**6.39**
Madison County	Nonroad Sources	6.81	2.89
Monroe County		6.22	0.72
St. Clair County		5.42	2.04
Totals *		**18.45**	**5.65**
Grand Total *		**49.99**	**39.47**

Table F-3 Illinois St. Louis Nonattainment Area County 2030 Emissions

County Name	Source Category	NO_X	VOC
Madison County	Point Sources	14.57	6.75
Monroe County		0.93	0.09
St. Clair County		1.43	1.69
Totals *		**16.93**	**8.53**
Madison County	Area Sources	0.82	8.90
Monroe County		0.15	1.66
St. Clair County		0.54	7.49
Totals *		**1.51**	**18.05**
Madison County	Onroad Mobile Sources	3.24	1.79
Monroe County		0.42	0.25
St. Clair County		3.05	1.72
Totals *		**6.71**	**3.76**
Madison County	Nonroad Sources	4.30	2.64
Monroe County		3.56	0.51
St. Clair County		3.45	1.94
Totals *		**11.31**	**5.09**
Grand Total *		**36.46**	**35.43**