

Attachment 2

Discussion of Actual Emissions Decrease from Nonattainment Designation Year to Attainment Year for the 2008 Ozone Standard

Project 2008-O3-7 Redesignation and Maintenance

Issue

Missouri submitted a redesignation request and maintenance plan for the 2008 ozone standard to EPA in September of 2016. Within that request is a discussion of emissions for the 2011 base year, also known as the nonattainment designation year, and the emissions inventory for the 2014 attainment year. On June 28, 2017, EPA requested clarification regarding the change in NO_x and VOC emissions from the 2011 to 2014 years, especially regarding the projected increase in mobile source emissions. This document addresses EPA’s question and discusses corrections that are needed to the 2014 inventory.

Response

Typical ozone season day emissions from Tables 4-1 and 4-3 in the Redesignation Request and Maintenance Plan are displayed below. These represent the base year inventory for 2011 and the attainment year inventory for 2014. The difference by emission sector and county are calculated to the right. Blue text indicates downward emission trends, and red text indicates increases in emissions for the period.

Table 1 - Emission Inventory Comparison (tons per ozone season day)

2011			2014		Difference	
Point	NO _x	VOC	NO _x	VOC	NO _x	VOC
Franklin County	27.75	2.52	21.13	2.08	-6.62	-0.44
Jefferson County	16.66	1.63	17.96	1.91	1.30	0.28
St. Charles County	25.04	3.34	21.05	4.12	-3.99	0.78
St. Louis County	16.74	3.5	16.79	2.87	0.05	-0.63
St. Louis City	4.49	3.59	4.78	2.88	0.29	-0.71
Total	90.68	14.58	81.7	13.86	-8.98	-0.72

Area/Nonpoint	NO _x	VOC	NO _x	VOC	NO _x	VOC
Franklin County	0.49	3.36	0.46	5.80	-0.03	2.44
Jefferson County	0.62	7.48	0.42	5.44	-0.20	-2.04
St. Charles County	0.68	11.21	0.89	11.50	0.21	0.29
St. Louis County	2.65	38.68	3.77	35.88	1.12	-2.80
St. Louis City	1.16	12.04	0.93	11.19	-0.23	-0.85
Total	5.60	72.77	6.47	69.81	0.87	-2.96

2011			2014		Difference	
Onroad	NO _x	VOC	NO _x	VOC	NO _x	VOC
Franklin	7.83	2.4	8	2.57	0.17	0.17
Jefferson	12.45	4.24	12.87	4.65	0.42	0.41
St. Charles	21.04	6.73	19.68	7.75	-1.36	1.02
St. Louis Co	66.34	20.17	118.61	73.21	52.27	53.04
St. Louis City	16.55	4.46	10.92	4.23	-5.63	-0.23
Total	124.21	38	170.08	92.41	45.87	54.41

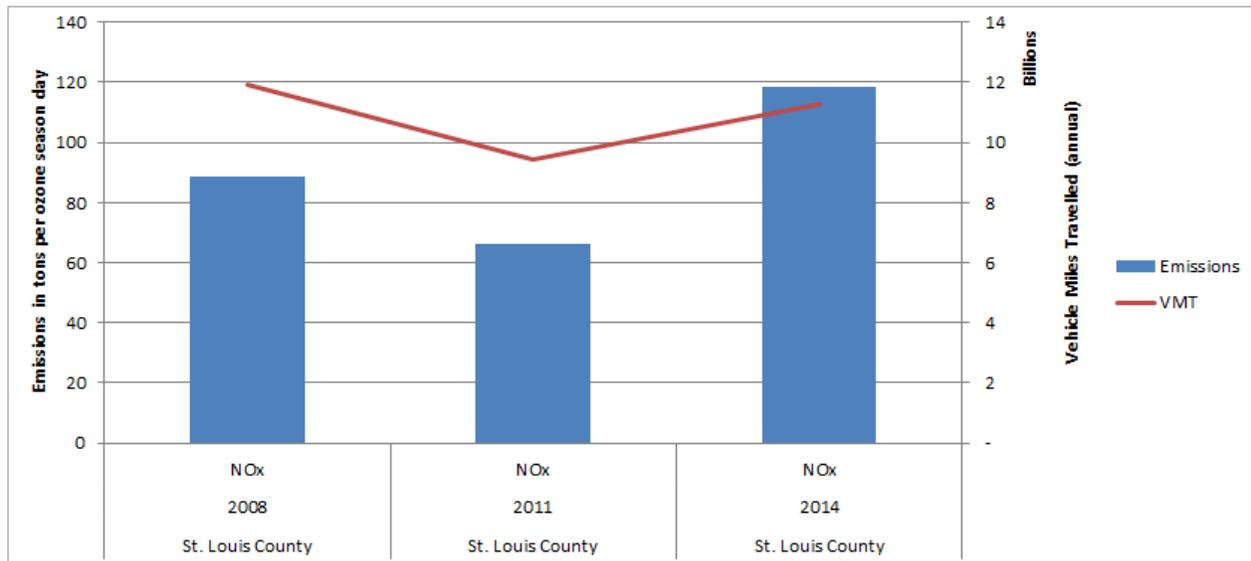
Nonroad	NO _x	VOC	NO _x	VOC	NO _x	VOC
Franklin	5.72	3.31	5.24	2.91	-0.48	-0.40
Jefferson	3.33	3.12	3.04	2.72	-0.29	-0.40
St. Charles	8.34	6.23	7.40	5.25	-0.94	-0.98
St. Louis County	23.85	22.99	17.53	19.61	-6.32	-3.38
St. Louis City	6.31	3.38	5.23	2.92	-1.08	-0.46
Total	47.55	39.03	38.44	33.42	-9.11	-5.61

Total	268.04	164.38	296.69	209.50	28.65	45.12
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The largest increase in emissions is in the onroad emissions sector with over 45 tons of NO_x and 54 tons of VOC increase per day. Most individual counties within the onroad sector show small increases or decreases in emissions between 2011 and 2014, except for St. Louis County. The St. Louis County estimate is for a 52 ton increase in NO_x and 53 ton increase in VOC from 2011 to 2014. The redesignation request discusses that this increase is a result of the use of a new estimation method from the Missouri Department of Transportation for vehicle miles travelled (VMT). During development of the redesignation request, the air program did not make any other changes to the MOVES calculations.

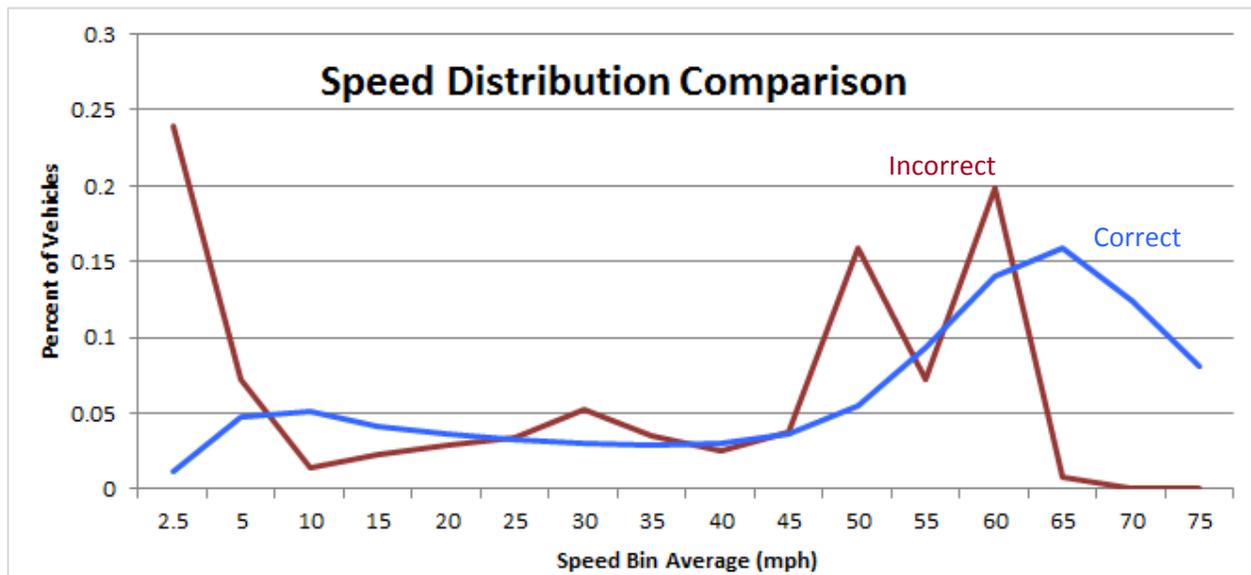
Although an increase in VMT is attributable to the new methodology, in response to EPA's question, the air program further examined the greater than expected increase of emissions in St. Louis County. Additional analysis of emissions and VMT for St. Louis County show that emissions in 2014 are considerably higher than would be predicted when looking at 2008 and 2011 VMT and emissions as in Figure 1. This cursory look at VMT prompted further investigation of the St. Louis County data to confirm the source of the emissions increase.

Figure 1 - NO_x Emission and VMT Trend for St. Louis County



Review of the onroad modeling input files for the MOVES model showed that the default speed distribution table was incorrect for the 2014 St. Louis County model run. The air program determined this by plotting the speed distributions used in our modeling against EPA’s default speed distribution charts (figures 9-1 and 9-2) in the MOVES Technical Report Population and Activity of On-road Vehicles in MOVES2014. The results showed differences that were not expected as seen in the following figures.

Figure 2 - Urban Restricted Roads aka Highways, Passenger Car hour 17 (5pm) Weekday Speed Distribution

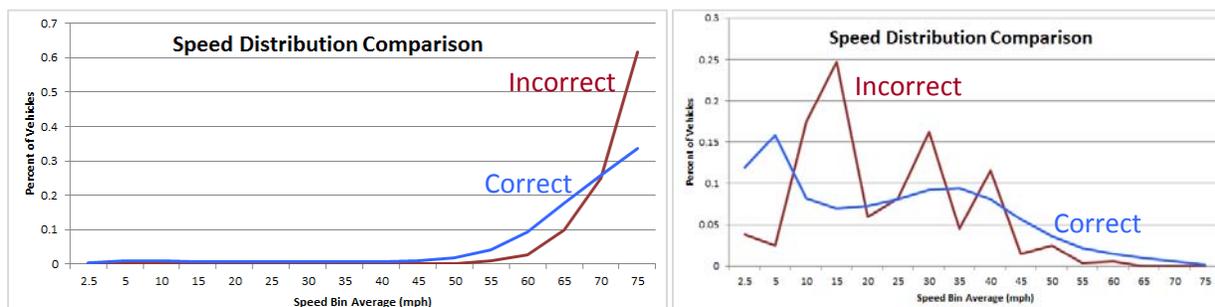


The incorrect speed distribution seems to have increased emissions primarily through incorrect urban highway speeds. The incorrect speed distribution overestimated the number of vehicles travelling between 2.5 and 10 mph. At very slow highway speeds, vehicles produce higher emissions and the incorrect speed distribution appears to have larger numbers of vehicles at these lower speeds. The

correct speed distribution shows the average speed is near more emissions-efficient speed of 50-70 mph. This difference in speed distribution skews emissions higher when using the incorrect speed distributions.

Similar incorrect speed distributions are found in rural highways and urban non-highways as below. In both cases, the incorrect distribution causes emissions to increase by incorrectly identifying vehicles as traveling too fast or too slow. The air program believes this is the basis of the larger than expected emissions increase.

Figure 3 - Rural Highway (left) and Urban non-highway (right), Passenger Car hour 17 (5pm) Weekday Speed Distribution



The air program also investigated other counties in the St. Louis nonattainment area. The speed distribution tables used to produce the 2014 emissions for the other counties coincide with the correct speed distribution. Therefore, they were modeled using the correct speed distribution and no further analysis was performed.

Conclusion

The air program conducted a new MOVES run that includes the correct speed distribution for St. Louis County. Based upon this run, the 2014 St. Louis County onroad emission estimate is revised downward in the below table. The corrected 2014 St. Louis County onroad emission estimate revises the inventory and demonstrates an emissions decrease for ozone precursor emissions NO_x and VOC from the base year to attainment year.

Table 2 - Revised Emission Inventory Comparison (tons per ozone season day)

2011			2014		Difference	
Point	NO _x	VOC	NO _x	VOC	NO _x	VOC
Franklin County	27.75	2.52	21.13	2.08	-6.62	-0.44
Jefferson County	16.66	1.63	17.96	1.91	1.30	0.28
St. Charles County	25.04	3.34	21.05	4.12	-3.99	0.78
St. Louis County	16.74	3.5	16.79	2.87	0.05	-0.63
St. Louis City	4.49	3.59	4.78	2.88	0.29	-0.71
Total	90.68	14.58	81.7	13.86	-8.98	-0.72

2011			2014		Difference	
Area/Nonpoint	NO _x	VOC	NO _x	VOC	NO _x	VOC
Franklin County	0.49	3.36	0.46	5.80	-0.03	2.44
Jefferson County	0.62	7.48	0.42	5.44	-0.20	-2.04
St. Charles County	0.68	11.21	0.89	11.50	0.21	0.29
St. Louis County	2.65	38.68	3.77	35.88	1.12	-2.80
St. Louis City	1.16	12.04	0.93	11.19	-0.23	-0.85
Total	5.60	72.77	6.47	69.81	0.87	-2.96

Onroad	NO _x	VOC	NO _x	VOC	NO _x	VOC
Franklin	7.83	2.4	8	2.57	0.17	0.17
Jefferson	12.45	4.24	12.87	4.65	0.42	0.41
St. Charles	21.04	6.73	19.68	7.75	-1.36	1.02
St. Louis Co	66.34	20.17	60.29	19.01	-6.05	-1.16
St. Louis City	16.55	4.46	10.92	4.23	-5.63	-0.23
Total	124.21	38	111.76	38.21	-12.45	0.21

Nonroad	NO _x	VOC	NO _x	VOC	NO _x	VOC
Franklin	5.72	3.31	5.24	2.91	-0.48	-0.40
Jefferson	3.33	3.12	3.04	2.72	-0.29	-0.40
St. Charles	8.34	6.23	7.40	5.25	-0.94	-0.98
St. Louis County	23.85	22.99	17.53	19.61	-6.32	-3.38
St. Louis City	6.31	3.38	5.23	2.92	-1.08	-0.46
Total	47.55	39.03	38.44	33.42	-9.11	-5.61

Total	268.04	164.38	238.37	155.30	-29.67	-9.08
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In addition, this revision in emissions inventory for 2014 does not affect the air program's analysis of the maintenance period emissions inventory. The maintenance demonstration is based on the comparison of the emission levels in 2014 and the projection of emissions in the future year of 2030. The aggregate emissions of NO_x and VOC in 2030 continue to show a decrease from 2014 emission levels. For reference, Table 3 is provided below along with Table 4 using the revised 2014 emissions inventory.

Table 3 - 2030 VOC, NO_x, and CO Emissions for St. Louis (MO) ozone NAA (tons per ozone season day)

County Name	Source Category	VOC	NO _x	CO
Franklin County	Point Sources	2.32	30.92	9.02
Jefferson County		1.96	27.72	9.96
St. Charles County		4.17	8.87	4.37
St. Louis County		3.08	21.75	14.59
St. Louis City		2.78	3.82	6.57
Total *		14.31	93.08	44.51

County Name	Source Category	VOC	NO _x	CO
Franklin County	Area Sources	5.82	2.20	3.80
Jefferson County		5.38	0.88	5.62
St. Charles County		11.38	1.81	9.79
St. Louis County		35.11	5.44	34.84
St. Louis City		11.12	2.70	2.67
Total *		68.80	13.03	56.72
Franklin County	Onroad Mobile Sources	5.45	3.22	34.42
Jefferson County		1.70	2.73	20.73
St. Charles County		2.72	4.34	32.86
St. Louis County		7.21	13.10	97.11
St. Louis City		1.34	2.18	16.67
Total *		18.42	25.57	201.79
Franklin County	Nonroad Sources	1.79	1.97	18.64
Jefferson County		2.13	2.32	33.08
St. Charles County		4.04	5.88	70.10
St. Louis County		19.45	16.93	373.86
St. Louis City		2.60	2.80	55.35
Total *		30.01	29.90	551.04
Grand Total *		131.54	161.58	854.06

Table 4 - 2014 to 2030 Emissions Difference (tons per ozone season day)

State	Source Category	2014		2030		Difference	
		VOC	NO _x	VOC	NO _x	VOC	NO _x
Missouri	Point Sources	13.86	81.7	14.31	93.08	0.45	11.38
	Area Sources	69.81	6.47	68.80	13.03	-1.01	6.56
	Onroad Mobile Sources	38.21	111.76	18.42	25.57	-19.79	-86.19
	Nonroad Sources	33.42	38.44	30.01	29.90	-3.41	-8.54
	Total	155.30	238.37	131.54	161.58	-23.76	-76.79