Appendix B

2008
Point, Area, On-Road Mobile and Off-Road Mobile
Ozone Season Day Emissions Inventory
Summary

Appendix B-1	**2008 Point and Area Source Emissions**
Appendix B-2	**2008 On-Road Mobile Source Emissions Using Mobile 6.2 via NMIM**
Appendix B-3	**2008 On-Road Mobile Source Emissions Using MOVES 2010A**
Appendix B-4	**2008 Off-Road Mobile Source Emissions**
Appendix B-5	**EPA Region 7 Off-Road Emissions Modeling Protocol for 2008 and 2022 for the St. Louis, Missouri-Five County Nonattainment Area**

Appendix B-1 2008 Point and Area Source Emissions

The point and area source emissions by county for the Missouri portion of the 1997 St. Louis ozone nonattainment area are summarized below in Tables B-1 and B-2 for average ozone season day. The development of these emissions inventories is detailed in Appendix E, the 2008 Base Year Emissions Inventory. This 2008 Base Year emissions inventory was placed on a 30-day public notice beginning August 8, 2011.

Table B-2 summarizes the area source emissions. Due to the methods that are used to calculate the emissions for the marine and rail categories, these categories are sometimes included as area source emissions, although they really should be classified as off-road mobile source emissions. Therefore, the emissions for rail and marine are not included in the total area source emissions listed in Table B-2. The source classification codes for the rail and marine categories are listed in Table B-3, and the emissions from these categories are listed in Table B-25, to be included as off-road mobile source emissions.

Table B-1
2008 Point Source Emissions by County in the St. Louis Ozone Nonattainment Area
(Tons/Ozone Season Day)
(Missouri Counties Only)

County Name	CO	NO_X	VOC
Franklin County	7.54	27.71	2.47
Jefferson County	4.54	19.45	1.89
St. Charles County	2.45	20.74	3.90
St. Louis County	14.68	16.68	6.19
St. Louis City	3.93	4.26	3.56
Totals	**33.14**	**88.84**	**18.00**

Table B-2
2008 Area Source Emissions by County in the St. Louis Ozone Nonattainment Area
(Tons/Ozone Season Day)
(Missouri Counties Only)

County Name	CO	NO_X	VOC
Franklin County	3.71	0.71	3.87
Jefferson County	8.12	0.84	8.46
St. Charles County	0.79	0.52	14.48
St. Louis County	3.17	2.81	52.06
St. Louis City	1.52	1.64	19.87
Totals	**17.33**	**6.52**	**98.74**

Table B-3
SCC Codes and Descriptions not Included in the Analysis for Area Source Emissions

SCC	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four
2280002100	Mobile Sources	Diesel	Marine Vessels, Commercial	Port emissions
2280002200	Mobile Sources	Diesel	Marine Vessels, Commercial	Underway emissions
2285002006	Mobile Sources	Diesel	Railroad Equipment	Line Haul Locomotives: Class I Operations
2285002007	Mobile Sources	Diesel	Railroad Equipment	Line Haul Locomotives: Class II / III Operations

Appendix B-2 2008 On-Road Mobile Source Emissions Using Mobile 6.2 via NMIM

The 2008 on-road mobile emissions shown in Section 4 of this document were created using Mobile6.2 via the NMIM for the St. Louis nonattainment area for the purpose of submitting state wide emissions data for EPA's 2008 NEI. The NMIM NCD was updated with Missouri specific data. The fuel and meteorological data in the NCD for 2008 was used and all months for 2008 were selected to create an annual emissions profile. The emissions for the months of April through October were totaled and divided by 214, the number of days in those months, to give average ozone season day emissions. Table B-4 summarizes the emissions by county that were generated using NMIM.

Table B-4
2008 On-Road Mobile Source Emissions by County in the St. Louis Ozone Nonattainment Area Calculated using Mobile 6.2 and NMIM (Tons/Ozone Season Day)
(Missouri Counties Only)

County Name	CO	NO_X	VOC
Franklin County	43.85	7.17	4.28
Jefferson County	49.26	8.36	4.92
St. Charles County	69.84	12.13	7.27
St. Louis County	300.91	53.13	31.97
St. Louis City	86.14	15.40	9.43
Totals	**550.00**	**96.19**	**57.89**

The VMT Data used in conjunction with NMIM to estimate the emissions in Table B-5 is listed below in Table B-16. The county level VMT was broken down to SCC using the default distribution in NMIM. A vehicle distribution was created from registration data from Missouri's Department of Revenue.

Table B-5 - 2008 Annual VMT Data by County
(Missouri Counties Only)

County	2008 Annual VMT
Franklin	1,636,760,381
Jefferson	1,884,745,023
St. Charles	2,728,058,895
St. Louis	11,924,864,323
St. Louis City	3,450,450,085
Total	**21,624,878,706**

The following is the IM Program file used for the mobile modeling. This file includes the previous IM Program files for purposes of modeling earlier years. However, since only the year 2008 was modeled, only program 2 will apply.

```
**************************************************
> IM Programs for MO
* Added IM240 beginning 2000, OBD beginning 2005
* New programs include Evap GC

> Exhaust I/M program 1
* Original Idle program through 1999
I/M PROGRAM       : 1 1984 1999 1 TRC IDLE
I/M MODEL YEARS   : 1 1971 1995
I/M VEHICLES      : 1 22222 11111111 1
I/M STRINGENCY    : 1 20
I/M COMPLIANCE    : 1 96
I/M WAIVER RATES  : 1 3 3
NO I/M TTC CREDITS : 1

> Exhaust I/M program 2
* IM240
I/M PROGRAM       : 2 2000 2050 1 TRC IDLE
I/M MODEL YEARS   : 2 1971 1995
I/M VEHICLES      : 2 22222 11111111 1
I/M STRINGENCY    : 2 20
I/M COMPLIANCE    : 2 96
I/M WAIVER RATES  : 2 3 3
I/M CUTPOINTS     : 2 08152.CP1
NO I/M TTC CREDITS : 2

> Exhaust I/M program 3
* Cover OBD vehicles before 2005 OBD program
I/M PROGRAM       : 3 1996 2004 1 TRC IDLE
I/M MODEL YEARS   : 3 1996 2004
I/M VEHICLES      : 3 22222 11111111 1
I/M STRINGENCY    : 3 20
I/M COMPLIANCE    : 3 96
I/M WAIVER RATES  : 3 3 3
NO I/M TTC CREDITS : 3
**************************************************
```

The following is the anti-tampering program file:

```
**************************************************
* ATP data for 29071 from atp29071.txt
ANTI-TAMP PROG    :
84 71 50 22222 11111111 1 11 096. 22212222
**************************************************
```

Table B-6 shows the registration distribution created for the St. Louis ozone nonattainment area. The same registration distribution was used for all five counties in the non-attainment area.

Table B-6 St. Louis NAA Registration Distribution

Vehicle Class	Vehicle Model Year Population Percentage Per Vehicle Classification												
	2008	**2007**	**2006**	**2005**	**2004**	**2003**	**2002**	**2001**	**2000**	**1999**	**1998**	**1997**	**1996**
LDV	0.0248	0.0564	0.0666	0.0649	0.0653	0.0632	0.0633	0.0679	0.0675	0.0652	0.0604	0.0501	0.0488
LDT1	0.0130	0.0345	0.0103	0.0666	0.0759	0.0255	0.0713	0.0780	0.0859	0.0487	0.0474	0.0398	0.0379
LDT2	0.0179	0.0593	0.0700	0.0750	0.0840	0.0759	0.0728	0.0808	0.0671	0.0640	0.0563	0.0522	0.0427
LDT3	0.0161	0.0734	0.0630	0.0760	0.0785	0.0842	0.0838	0.0728	0.0624	0.0539	0.0561	0.0365	0.0328
LDT4	0.0153	0.0843	0.1358	0.0771	0.0953	0.1119	0.0736	0.0461	0.0564	0.0549	0.0715	0.0395	0.0342
HDV2b	0.0078	0.0468	0.0483	0.0729	0.0660	0.0808	0.0871	0.0713	0.0773	0.0671	0.0642	0.0310	0.0519
HDV3	0.0066	0.0628	0.0602	0.0961	0.0876	0.0681	0.0715	0.0613	0.0774	0.0669	0.0734	0.0272	0.0331
HDV4	0.0040	0.0200	0.0638	0.0404	0.0338	0.0366	0.0385	0.0413	0.0653	0.0781	0.0821	0.0383	0.0630
HDV5	0.0187	0.1207	0.0664	0.0804	0.0535	0.0639	0.0560	0.0450	0.0578	0.0951	0.0899	0.0465	0.0572
HDV6	0.0311	0.0355	0.1005	0.0865	0.0529	0.0268	0.0212	0.0199	0.0840	0.0765	0.0685	0.0572	0.0591
HDV7	0.0182	0.0324	0.1250	0.1080	0.1033	0.0772	0.0847	0.0669	0.0285	0.0427	0.0285	0.0253	0.0281
HDV8a	0.0136	0.0110	0.0524	0.0497	0.0565	0.0513	0.0420	0.0301	0.0426	0.0791	0.0570	0.0386	0.0354
HDV8b	0.0189	0.0726	0.2263	0.0348	0.0639	0.0957	0.0899	0.0552	0.0522	0.1363	0.0697	0.0305	0.0203
HDBS	0.0343	0.0556	0.0925	0.0556	0.1004	0.0587	0.0623	0.0351	0.0489	0.0657	0.0669	0.0678	0.0426
HDBT	0.0060	0.0045	0.0132	0.0144	0.0138	0.0291	0.0378	0.0258	0.0249	0.0390	0.0351	0.0309	0.0351
MC	0.0190	0.0646	0.1035	0.1096	0.1172	0.0874	0.0922	0.0713	0.0610	0.0435	0.0360	0.0255	0.0208
	1995	**1994**	**1993**	**1992**	**1991**	**1990**	**1989**	**1988**	**1987**	**1986**	**1985**	**1984**	
LDV	0.0390	0.0420	0.0313	0.0274	0.0213	0.0184	0.0138	0.0121	0.0083	0.0065	0.0049	0.0106	
LDT1	0.0443	0.0211	0.0168	0.0210	0.0189	0.0193	0.0184	0.0363	0.0582	0.0433	0.0250	0.0426	
LDT2	0.0292	0.0287	0.0266	0.0215	0.0157	0.0149	0.0096	0.0096	0.0076	0.0054	0.0042	0.0090	
LDT3	0.0322	0.0423	0.0338	0.0207	0.0181	0.0106	0.0112	0.0104	0.0070	0.0067	0.0058	0.0117	
LDT4	0.0201	0.0158	0.0145	0.0101	0.0074	0.0055	0.0052	0.0063	0.0074	0.0045	0.0014	0.0059	
HDV2b	0.0350	0.0393	0.0244	0.0196	0.0151	0.0122	0.0124	0.0154	0.0097	0.0062	0.0102	0.0280	
HDV3	0.0266	0.0340	0.0223	0.0165	0.0122	0.0126	0.0134	0.0118	0.0126	0.0096	0.0098	0.0264	
HDV4	0.0504	0.0723	0.0647	0.0308	0.0247	0.0243	0.0238	0.0270	0.0198	0.0121	0.0128	0.0321	
HDV5	0.0517	0.0217	0.0147	0.0083	0.0067	0.0110	0.0113	0.0125	0.0080	0.0012	0.0000	0.0018	
HDV6	0.0557	0.0389	0.0134	0.0152	0.0093	0.0162	0.0292	0.0196	0.0184	0.0240	0.0062	0.0342	
HDV7	0.0253	0.0321	0.0174	0.0202	0.0158	0.0166	0.0139	0.0226	0.0162	0.0178	0.0103	0.0230	
HDV8a	0.0333	0.0786	0.0447	0.0381	0.0239	0.0228	0.0291	0.0360	0.0277	0.0261	0.0163	0.0641	
HDV8b	0.0087	0.0015	0.0015	0.0029	0.0044	0.0044	0.0029	0.0044	0.0000	0.0000	0.0015	0.0015	
HDBS	0.0489	0.0327	0.0185	0.0146	0.0106	0.0095	0.0114	0.0173	0.0024	0.0035	0.0032	0.0410	
HDBT	0.0830	0.0836	0.0492	0.0441	0.0267	0.0399	0.0609	0.0333	0.0558	0.0540	0.0351	0.1248	
MC	0.0189	0.0171	0.0122	0.0119	0.0073	0.0063	0.0063	0.0064	0.0054	0.0068	0.0097	0.0401	

Appendix B-3 On-Road Mobile Source Emissions Using MOVES 2010A

EPA released the Mobile Vehicle Emission System (MOVES) in December of 2010, and MOVES is now the official model to use for mobile emissions modeling. 2008 mobile emissions were initially created using Mobile6.2 via NMIM for the St. Louis nonattainment area for the purpose of submitting state wide emissions data for EPA's 2008 National Emissions Inventory (NEI). The NMIM NCD was updated with Missouri specific data. Local VMT data, vehicle registration distributions, and meteorology data from the updated NCD were converted to MOVES formatting using EPA provided conversion workbooks.

The local VMT data was gathered from East-West Gateway at the county level. This data is listed in Table B-5 above. The road type distribution in the baseyearvmt table from the NCD was used to distribute the county level VMT to road type. EPA's VMT converter workbook was then used to produce MOVES input tables. A vehicle registration distribution was originally created for NMIM using registration data from Missouri's Department of Revenue. The vehicle distribution was converted to MOVES age distribution table using EPA's VMT converter workbook. The registration data was also used to create the MOVES vehicle population input tables. Vehicle counts were converted from Mobile 6.2 vehicle classes to MOVES source types using the source type fractions from the Source Type Pop Fractions table in EPA's VMT converter workbook. MOVES base data was used for all other inputs, after reviewing the data to ensure accuracy. The base fuel supply tables in MOVES were used for the runs, as they already took into account the reformulated gasoline used in the St. Louis nonattainment area. A separate input database was created for each county, using county specific data where possible. All of the MOVES input tables, other than templates where EPA default data was used, which were used to create the 2008 on-road mobile emissions inventory referred to in Section 5 of this document can be found in this Appendix.

The MOVES model runs were set up selecting all available gasoline and diesel fuel vehicle type combinations, all months, days, hours, and all road types. A separate run was set-up for each pollutant. The emissions were post-aggregated to the year level using MOVES.

MOVES is a completely redesigned model, not just an updated version of the previous Mobile model. The way MOVES calculates emissions has changed to reflect EPA's more current understanding of the emissions produced by vehicles and the various factors that affect the emissions. NO_X emissions were found to be higher because of the larger portion extended idling of heavy duty vehicles contributes to the emissions total. $PM_{2.5}$ emissions were also higher because of a better understanding of the effect of stop and go traffic, which has a significant impact on emissions in highly urban areas, such as the St. Louis nonattainment area. VOC emissions were roughly the same from both models, with minimal increases with the switch to MOVES. As a result of these changes to the model, MOVES produced higher emissions estimates for both 2008 and 2022 than were originally created with NMIM.

Once MOVES input tables had been created, MOVES 2010a was ran and all months for 2008 were selected to create an annual emissions profile. The emissions for the months of April through October were totaled and divided by 214, the number of days in those months, to give average ozone season day emissions

Table B-7 summarizes the 2008 ozone season day on-road emissions by county as calculated using MOVES 2010A for the Missouri counties located in the St. Louis ozone nonattainment area. Tables B-8 through B-21 provide all of the MOVES inputs that were used to create the 2008 annual on-road mobile emissions inventory that were then used to generate the ozone season day emissions summarized in Table B-7, and also referred to in Section 5 of this document., except for templates where EPA default data was used. The development of this on-road mobile emissions inventory is detailed in Appendix E, the 2008 Base Year Emissions Inventory. The 2008 Base Year emissions inventory was placed on a 30-day public notice beginning August 8, 2011.

Table B-7
2008 On-Road Mobile Source Emissions by County in the St. Louis Ozone Nonattainment Area Calculated using MOVES 2010A
(Tons/Ozone Season Day)
(Missouri Counties Only)

County Name	CO	NO_X	VOC
Franklin County	38.50	11.34	3.86
Jefferson County	54.16	14.39	6.09
St. Charles County	78.58	21.16	8.70
St. Louis County	304.43	88.39	31.73
St. Louis City	81.35	25.11	8.15
Totals	**557.02**	**160.38**	**58.53**

Table B-8 – 2008 Source Type Population (MOVES Inputs for 2008 On-Road Mobile Source Emissions)

			Source Type Population by County				
YearID	**SourceTypeName**	**SourceTypeID**	**Franklin**	**Jefferson**	**St Charles**	**St Louis County**	**St Louis City**
2008	Motorcycle	11	6,067	13,018	11,151	19,243	3104
2008	Passenger Car	21	46,568	98,009	144,441	527,148	125,776
2008	Passenger Truck	31	45,890.24	82,509.19	110,385.78	303,295.72	59,405.61
2008	Light Commercial Truck	32	16,768.76	28,420.81	35,913.22	97,845.28	20,194.39
2008	Refuse Truck	41	8.25	41	35.5	93.5	69.5
2008	Single Unit Short-haul Truck	42	24.75	123	106.5	280.5	208.5
2008	Single Unit Long-haul Truck	43	302.08	541.2	549.04	2,709.24	661
2008	Motor Home	51	21.53	19.34	19.44	50.14	16.25
2008	School Bus	52	813.93	900.99	1,019.79	3,623.55	1,249.2
2008	Transit Bus	53	61.05	66.99	76.07	270.27	92.6
2008	Intercity Bus	54	44.26	71.09	82.23	378.69	143.45
2008	Combination Short-haul Truck	61	370.31	324.37	327.86	791.19	247.5
2008	Combination Long-haul Truck	62	306.84	257.02	257.57	544.92	160

Table B-9 – 2008 Annual VMT by HPMS Vehicle Type, County, and Year (MOVES Inputs for 2008 On-Road Mobile Source Emissions)

			HPMSBaseYearVMT by County				
HPMSVtypeID	**HPMSVtypeName**	**YearID**	**Franklin**	**Jefferson**	**St. Charles**	**St. Louis**	**St. Louis City**
10	Motorcycles	2008	11,619,323	13,841,651	20,770,584	91,989,970	26,665,063
20	Passenger Cars	2008	707,169,172	811,173,607	1,171,243,667	5,115,865,231	1,477,495,621
30	Other 2 axle-4 tire vehicles	2008	799,130,600	924,394,839	1,342,595,411	5,875,722,138	1,702,465,533
40	Buses	2008	4,781,820	5,578,789	8,183,119	35,928,481	10,469,862
50	Single Unit Trucks	2008	29,351,955	33,386,793	47,634,481	207,228,073	59,856,119
60	Combination Trucks	2008	84,673,330	96,333,716	137,528,782	598,448,609	173,536,046

Table B-10 – Age Distribution by Source Type (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	Source Type ID												
AgeID	**11**	**21**	**31**	**32**	**41**	**42**	**43**	**51**	**52**	**53**	**54**	**61**	**62**
0	0.019	0.0248	0.016038	0.015215	0.006	0.006	0.03372	0.019407	0.022549	0.022677	0.024421	0.018826	0.017834
1	0.0646	0.0564	0.059034	0.058508	0.0045	0.0045	0.054157	0.048521	0.039325	0.03937	0.032671	0.049995	0.052613
2	0.1035	0.0666	0.063189	0.062229	0.0132	0.0132	0.092687	0.158149	0.129508	0.130555	0.106219	0.16227	0.169835
3	0.1096	0.0649	0.073971	0.073529	0.0144	0.0144	0.057163	0.057986	0.082002	0.084645	0.091592	0.052692	0.04403
4	0.1172	0.0653	0.081725	0.079405	0.0138	0.0138	0.098055	0.068814	0.07432	0.076743	0.07138	0.066656	0.063479
5	0.0874	0.0632	0.072225	0.07206	0.0291	0.0291	0.05743	0.075516	0.060754	0.062113	0.04642	0.077218	0.080584
6	0.0922	0.0633	0.075227	0.075017	0.0378	0.0378	0.060728	0.071294	0.059753	0.061551	0.046468	0.072242	0.074392
7	0.0713	0.0679	0.075731	0.074101	0.0258	0.0258	0.034794	0.048222	0.045101	0.04668	0.038418	0.04791	0.047775
8	0.061	0.0675	0.069095	0.069315	0.0249	0.0249	0.049567	0.050551	0.053801	0.053336	0.05744	0.050259	0.049622
9	0.0435	0.0652	0.059343	0.060606	0.039	0.039	0.065329	0.101607	0.075238	0.074281	0.059218	0.106403	0.114631
10	0.036	0.0604	0.056546	0.058019	0.0351	0.0351	0.065952	0.060365	0.052757	0.052173	0.04901	0.061907	0.064481
11	0.0255	0.0501	0.045379	0.044021	0.0309	0.0309	0.066337	0.035034	0.038694	0.038608	0.041544	0.03448	0.033479
12	0.0208	0.0488	0.040069	0.041299	0.0351	0.0351	0.042714	0.030037	0.038252	0.038379	0.043733	0.028628	0.026173
13	0.0189	0.039	0.031719	0.032547	0.083	0.083	0.048635	0.022609	0.033622	0.033505	0.041779	0.020871	0.017769
14	0.0171	0.042	0.029341	0.030746	0.0836	0.0836	0.033323	0.026945	0.032499	0.031744	0.038573	0.026434	0.025331
15	0.0122	0.0313	0.025132	0.025766	0.0492	0.0492	0.018302	0.014853	0.01522	0.015277	0.015313	0.014766	0.014626
16	0.0119	0.0274	0.020261	0.020238	0.0441	0.0441	0.01489	0.014543	0.016624	0.016485	0.018482	0.014281	0.013778
17	0.0073	0.0213	0.01591	0.015912	0.0267	0.0267	0.010657	0.011093	0.012019	0.01218	0.012215	0.010861	0.010491
18	0.0063	0.0184	0.014002	0.013972	0.0399	0.0399	0.009968	0.011696	0.014667	0.014636	0.016859	0.011229	0.010394
19	0.0063	0.0138	0.011117	0.011398	0.0609	0.0609	0.012691	0.012448	0.018417	0.017168	0.026192	0.012123	0.011221
20	0.0064	0.0121	0.014109	0.014268	0.0333	0.0333	0.018084	0.014903	0.019136	0.018141	0.024946	0.014734	0.014172
21	0.0054	0.0083	0.015761	0.015219	0.0558	0.0558	0.00363	0.01022	0.014831	0.014247	0.019752	0.009773	0.008829
22	0.0068	0.0065	0.011686	0.011205	0.054	0.054	0.00501	0.010636	0.017272	0.016478	0.024234	0.009966	0.008574
23	0.0097	0.0049	0.00791	0.008124	0.0351	0.0351	0.003627	0.006385	0.007661	0.00744	0.00919	0.006293	0.006072
24	0.013837	0.003694	0.00582	0.006825	0.022815	0.022815	0.003017	0.003218	0.003631	0.003569	0.004095	0.003185	0.003108
25	0.019738	0.002785	0.004029	0.004856	0.01483	0.01483	0.002668	0.001864	0.001955	0.001889	0.002204	0.001885	0.001903
26	0.006525	0.002099	0.002201	0.002308	0.009639	0.009639	0.002379	0.001137	0.001109	0.001082	0.001162	0.001156	0.001183
27	0	0.001582	0.001069	0.001073	0.006266	0.006266	0.00214	0.00071	0.000645	0.000647	0.000595	0.000721	0.000739
28	0	0.00044	0.000253	0.000245	0.004073	0.004073	0.001953	0.000417	0.000378	0.000362	0.000398	0.000432	0.000454
29	0	0	0.000147	0.000139	0.002647	0.002647	0.001784	0.00024	0.000223	0.000197	0.000282	0.000256	0.000278
30	0	0	0.001957	0.001836	0.064531	0.064531	0.028609	0.010581	0.018036	0.013841	0.035194	0.011546	0.012147

Table B-11 – Inspection and Maintenance Data for 2008 (MOVES Inputs for 2008 On-Road Mobile Source Emissions)

Pol ProcessID	stateID	yearID	Source typeID	Fuel TypeID	IM ProgramID	Inspect Freq	Test StandardsID	Beg Model YearID	End Model YearID	Use IMyn	Compliance Factor
101	29	2008	21	1	1	1	11	1971	1995	Y	93.12
101	29	2008	21	1	10	1	51	1996	2006	Y	93.12
101	29	2008	31	1	1	1	11	1971	1995	Y	93.12
101	29	2008	31	1	10	1	51	1996	2006	Y	93.12
101	29	2008	32	1	1	1	11	1971	1995	Y	93.12
101	29	2008	32	1	10	1	51	1996	2006	Y	93.12
102	29	2008	21	1	1	1	11	1971	1995	Y	93.12
102	29	2008	21	1	10	1	51	1996	2006	Y	93.12
102	29	2008	31	1	1	1	11	1971	1995	Y	93.12
102	29	2008	31	1	10	1	51	1996	2006	Y	93.12
102	29	2008	32	1	1	1	11	1971	1995	Y	93.12
102	29	2008	32	1	10	1	51	1996	2006	Y	93.12
112	29	2008	21	1	7	1	41	1971	1995	Y	93.12
112	29	2008	21	1	8	1	43	1996	2006	Y	93.12
112	29	2008	31	1	7	1	41	1971	1995	Y	93.12
112	29	2008	31	1	8	1	43	1996	2006	Y	93.12
112	29	2008	32	1	7	1	41	1971	1995	Y	93.12
112	29	2008	32	1	8	1	43	1996	2006	Y	93.12
113	29	2008	21	1	7	1	41	1971	1995	Y	93.12
113	29	2008	21	1	8	1	43	1996	2006	Y	93.12
113	29	2008	31	1	7	1	41	1971	1995	Y	93.12
113	29	2008	31	1	8	1	43	1996	2006	Y	93.12
113	29	2008	32	1	7	1	41	1971	1995	Y	93.12
113	29	2008	32	1	8	1	43	1996	2006	Y	93.12
201	29	2008	21	1	1	1	11	1971	1995	Y	93.12
201	29	2008	21	1	10	1	51	1996	2006	Y	93.12
201	29	2008	31	1	1	1	11	1971	1995	Y	93.12
201	29	2008	31	1	10	1	51	1996	2006	Y	93.12
201	29	2008	32	1	1	1	11	1971	1995	Y	93.12

201	29	2008	32	1	10	1	51	1996	2006	Y	93.12
202	29	2008	21	1	1	1	11	1971	1995	Y	93.12
202	29	2008	21	1	10	1	51	1996	2006	Y	93.12
202	29	2008	31	1	1	1	11	1971	1995	Y	93.12
202	29	2008	31	1	10	1	51	1996	2006	Y	93.12
202	29	2008	32	1	1	1	11	1971	1995	Y	93.12
202	29	2008	32	1	10	1	51	1996	2006	Y	93.12
301	29	2008	21	1	10	1	51	1996	2006	Y	93.12
301	29	2008	31	1	10	1	51	1996	2006	Y	93.12
301	29	2008	32	1	10	1	51	1996	2006	Y	93.12
302	29	2008	21	1	10	1	51	1996	2006	Y	93.12
302	29	2008	31	1	10	1	51	1996	2006	Y	93.12
302	29	2008	32	1	10	1	51	1996	2006	Y	93.12

Table B-12 – Fuel Formulation for 2008 (MOVES Inputs for 2008 On-Road Mobile Source Emissions)

Fuel FormulationID	Fuel SubtypeID	FuelSubtypeDesc	RVP	Sulfur Level	ETOH Volume	MTBE Volume	ETBE Volume	TAME Volume	Aromatic Content	Olefin Content
2302	12	Gasohol (E10)	11.2917	43.0622	10	0	0	0	20.2606	8.39154
2303	12	Gasohol (E10)	8.75115	46.6452	10	0	0	0	18.9623	8.14345
2304	12	Gasohol (E10)	6.84571	49.3325	10	0	0	0	17.9886	7.95739
2305	12	Gasohol (E10)	13.1972	40.375	10	0	0	0	21.2343	8.57759
20043	20	Conventional Diesel	0	43	0	0	0	0	0	0

Fuel FormulationID	Fuel SubtypeID	fuelSubtypeDesc	Benzene Content	e200	e300	biodiesel EsterVolume	cetaneIndex	PAHContent
2302	12	Gasohol (E10)	0.848747	56.4983	84.16	0	0	0
2303	12	Gasohol (E10)	0.763743	53.3414	85.1429	0	0	0
2304	12	Gasohol (E10)	0.69999	50.9738	85.88	0	0	0
2305	12	Gasohol (E10)	0.9125	58.8659	83.4229	0	0	0
20043	20	Conventional Diesel	0	0	0	0	0	0

Table B-13 – 2008 Fuel Supply (MOVES Inputs for 2008 On-Road Mobile Source Emissions)

FuelYearID	Month GroupID	Fuel FormulationID	Market Share	Market ShareCV
2008	1	2305	1	0.5
2008	1	20043	1	0.5
2008	2	20043	1	0.5
2008	2	2302	1	0.5
2008	3	2302	1	0.5
2008	3	20043	1	0.5
2008	4	20043	1	0.5
2008	4	2303	1	0.5
2008	5	2303	1	0.5
2008	5	20043	1	0.5
2008	6	20043	1	0.5
2008	6	2304	1	0.5
2008	7	2304	1	0.5
2008	7	20043	1	0.5
2008	8	20043	1	0.5
2008	8	2304	1	0.5
2008	9	2304	1	0.5
2008	9	20043	1	0.5
2008	10	20043	1	0.5
2008	10	2303	1	0.5
2008	11	2302	1	0.5
2008	11	20043	1	0.5
2008	12	20043	1	0.5
2008	12	2302	1	0.5

Table B-14 – Average Monthly Temperatures by Hour of the Day for Franklin County in Fahrenheit (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	25.8	29	39.1	48.4	55.9	68.2	70.9	67.1	60.6	49	38.4	24.7
2	24.8	27.4	37	46.4	54.7	67.1	69.6	66.2	60.8	47.9	38.4	24.7
3	23.8	26.3	35.8	45	53.6	66	68.8	65.4	60	47.1	37.5	24
4	22.8	25.3	34.5	44.1	52.6	65	68.1	64.8	59.1	46.5	36.8	23.5
5	22	24.9	33.5	43.2	51.7	64.1	67.5	63.9	58.6	45.7	36	23
6	21.4	24.2	32.6	42.7	51.1	63.5	66.8	63.4	58.2	45.1	35.3	22.5
7	21.2	23.8	32.1	42.7	52.6	65.7	68.2	63.9	57.9	44.6	34.7	22.8
8	21	23.4	32.4	45.3	56.2	69.3	71.4	67.6	60	45.9	34.2	22.3
9	22.2	24.9	36.4	48.9	59.6	72.9	75.2	71.7	63.8	50.9	37.1	23.8
10	26.6	27.8	40.5	52.5	63.2	76.2	78.5	75.7	67.8	56	41.5	27.4
11	31.2	31.1	44.7	55.7	66.4	79	81.3	78.9	71.4	60.5	45.6	31.7
12	36	34.3	48.5	58.5	68.8	81.3	83.6	81.2	74.4	63.9	49.3	36.1
13	39.6	37.2	51.7	61.5	70.6	83	85.6	82.9	76.5	66.1	51.9	39.7
14	42.4	39.5	53.9	63.3	72.1	84.3	87	84.1	77.9	67.5	54	42.2
15	44	41	55.6	64.9	73.6	85.1	88	84.9	78.7	68.4	55.1	43.9
16	44.4	41.6	56.3	65.8	74.3	85.5	88.1	85.1	78.7	68.5	55.1	44.1
17	43.2	41.4	56.1	65.6	74.3	85.2	87.7	84.7	77.9	67.4	53.7	42.2
18	39.4	39.9	54.8	64.6	73.3	84.1	86.7	83.3	75.8	64.2	50.1	37.8
19	35.2	37	51.7	62.1	71.3	82.3	84.6	80.4	71.3	58.9	46.8	34.4
20	32.8	34.9	47.9	58.2	67.3	79	81	75.9	67	55.9	44.8	32
21	31	33.6	45.7	55.6	63.2	74.6	76.9	72.5	65.1	54.1	43.1	30.1
22	29.6	32.2	43.9	53.4	60.7	72.2	75	70.6	63.8	52.7	41.9	28.4
23	28.2	30.9	42.3	51.5	58.9	70.7	73.4	69.2	62.5	51.3	40.7	27.1
24	27.2	29.9	40.5	50	57.2	69.3	72.1	68.1	61.4	50.2	39.5	25.7

Table B-15 – Average Monthly Percent Relative Humidity by Hour of the Day for Franklin County (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	68.3	76	71.8	70.6	77	78.3	83.9	86.1	88.2	77	68.9	69.9
2	69	77.2	72.8	72.9	77.2	80.2	84.4	86.9	88.5	78.7	70.3	71.8
3	70.1	78	73.9	74.5	78.2	81.6	85.3	87.5	89.2	79.8	71.7	72.9
4	70.9	78.3	75.3	75.3	79.3	82.4	86.1	88.1	90.1	80.4	72.8	73.8
5	71.8	78.3	76.8	76.1	80.5	83.8	86.4	89.3	90.4	81.6	73.9	75.1
6	72.3	78.9	77.6	77	81.1	84.4	87.3	89.6	90.4	82.5	75	75.7
7	72	78.8	78.2	77.6	80.3	83	85.8	89	90.4	83.4	75.9	76.1
8	72	78.8	78.3	74.5	76.2	77.9	81.4	84.9	89.5	83.2	76.5	76
9	71.2	77.6	74.8	69.8	71.5	72.4	74.9	77.5	84.7	76.8	74.3	75.2
10	66.9	74.3	69.7	64.8	65.8	66.9	69.3	70.2	77.2	67.7	68.4	72.4
11	62	70.4	63.5	61.1	61.1	62.1	64.5	64.2	70.5	59.4	62.1	68.4
12	56.8	67	58.7	58.2	58.1	58.2	60.9	60	64.6	53.3	56.5	64.8
13	53	63.8	54.8	55	56.3	55.4	57.9	57.2	60.9	49.9	52.7	62.1
14	50.2	61.5	52.6	53	55.1	53.7	55.8	55.4	58.3	47.7	49.4	60.2
15	48.4	60	51	51.1	53.1	52.2	54.6	54.2	56.8	46.3	47.6	58.7
16	47.3	59.4	50.7	49.7	52.5	51.5	54.4	54	56.6	46	47.1	58
17	47.9	59.8	50.7	49.1	51.7	51.5	55.1	54.9	58.1	47.2	48.4	59.2
18	51.2	61.6	52.5	49.9	52.1	52.8	56.7	57.6	62.8	52.3	52.9	62.9
19	55.5	65.4	56.2	52.8	54.6	55.5	61.1	63.5	72.5	61.5	57.2	65.6
20	58.3	68.2	61	57.5	60.3	61.6	68.4	72.7	80.5	66.9	60	67
21	60.6	70.1	63.9	60.8	66.3	68.8	75.3	78.4	83.9	69.6	62.5	67.6
22	62.8	72	66.3	63.9	70.3	72.8	78.3	81.9	85.3	71.9	64.4	68.3
23	64.5	73.7	68.2	66.4	73.1	75	80.7	83.8	86.4	73.7	65.9	68.7
24	66.1	75.1	70.3	68.3	75.4	77	82.3	85.2	87.6	75.6	67.6	69.1

Table B-16 – Average Monthly Temperatures by Hour of the Day for Jefferson County in Fahrenheit (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	25.6	28.3	38.5	47.4	55	68.3	70.1	67	60.2	48.6	37.5	24.2
2	24.7	26.8	36.3	45.5	53.8	67.3	68.8	66.1	60.4	47.7	37.3	24.2
3	23.7	25.7	35.2	44.3	52.8	66.3	68.1	65.3	59.5	46.9	36.4	23.2
4	22.5	24.8	34.2	43.3	51.8	65.2	67.5	64.6	58.9	46.3	35.8	22.8
5	22	24.2	33.3	42.6	50.9	64.5	66.8	63.9	58.2	45.4	35	22.3
6	21.2	23.5	32.3	42.3	50.5	63.8	66.2	63.4	57.9	44.8	34.3	21.8
7	20.8	23.1	31.8	42.3	52.1	66	67.6	63.9	57.6	44.3	33.7	22.1
8	20.8	22.9	32	44.9	55.7	69.6	70.8	67.6	59.9	45.6	33.5	21.6
9	22	24.2	35.7	48.4	58.9	73	74.5	71.6	63.7	50.7	36.6	23.2
10	26.2	27	39.5	51.7	62.4	76.3	77.6	75.6	67.6	55.8	41	27
11	30.7	30	43.6	54.7	65.5	78.9	80.3	78.7	71.3	60.2	45	31
12	35	33.2	47.1	57.1	67.7	81.1	82.5	80.8	74.2	63.7	48.6	35.2
13	38.3	35.7	50.1	59.7	69.3	82.8	84.3	82.5	76.4	65.8	51.1	38.8
14	41.2	37.9	52.3	61.6	70.4	83.9	85.6	83.7	77.7	67.2	53.2	41.1
15	42.9	39.2	53.7	62.9	71.7	84.6	86.6	84.4	78.5	68.1	54.3	42.8
16	43.3	40	54.5	63.8	72.6	84.9	86.9	84.4	78.6	68.1	54.3	43
17	42.1	39.8	54.3	63.5	72.6	84.6	86.5	84.2	77.8	67.1	52.9	41.1
18	38.5	38.3	53	62.6	71.6	83.6	85.4	82.7	75.6	63.9	49.1	36.9
19	34.4	35.7	50	60.1	69.7	81.8	83.4	79.9	71	58.7	45.7	33.8
20	32	33.6	46.8	56.8	65.8	78.6	79.9	75.6	66.7	55.6	43.7	31.5
21	30.3	32.1	44.6	54.1	62	74.4	76.1	72.3	64.7	53.7	41.9	29.8
22	29.1	31.2	42.7	52.2	59.7	72.2	74.1	70.4	63.3	52.3	40.7	27.9
23	28	29.9	41.4	50.3	57.6	70.7	72.6	69	62.1	50.9	39.5	26.8
24	27	29.1	39.7	48.9	56.2	69.4	71.3	68.1	61.1	49.7	38.4	25.1

Table B-17 – Average Monthly Percent Relative Humidity by Hour of the Day for Jefferson County (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	67.9	75.6	72.4	70.8	76.6	76.7	83	85.5	87.6	77.2	68.8	69.6
2	69	77.1	73	73.1	76.8	78.3	83.8	86.6	87.6	78.3	70.2	71.1
3	70.1	78	74.1	74.4	77.6	79.9	84.6	86.9	88.5	80.1	71.3	72.5
4	71.2	78.2	75.2	75.5	78.7	81.2	85.2	87.8	88.8	80.7	72.1	73.1
5	71.8	78.2	76.1	76.1	79.5	82.3	85.8	88.4	89.4	81.9	73.2	74.4
6	72.3	78.8	77.6	76.9	80.1	83.2	86.3	88.7	89.4	82.8	74.3	75
7	72.6	78.8	78.2	77.3	79.3	81.3	85.2	88.4	89.4	83.4	75.2	75.3
8	72.3	78.4	78.5	73.9	75	76	80.5	84	88.2	83.2	75.5	75.6
9	71.1	77.2	75.4	69	70.7	70.4	73.8	76.7	83.2	77.1	73.4	74.8
10	67.1	74.2	70.2	64.4	65	64.8	68.5	69.4	76.1	67.5	67.5	71.7
11	62.2	70.5	64.4	60.9	60.3	60.1	63.7	63.8	69.5	58.9	61.3	68
12	57.2	67.1	59.9	58.5	57.6	56.1	60	59.5	63.9	52.9	56.2	64.6
13	53.7	64.7	56.4	55.6	56.1	53	57.4	56.9	60	49.3	52.6	62
14	50.9	62.1	54.1	53.4	54.8	51.8	55	55.1	57.9	46.8	49.5	59.8
15	48.8	60.8	53	51.6	53.4	50.2	53.7	54.1	56.4	45.5	47.7	58.3
16	47.7	59.9	52.5	50.1	52.4	49.5	53.5	54.1	56	45.4	47	57.9
17	48.1	60.1	52.7	49.7	52	49.5	53.9	54.8	57.5	46.4	48.3	59
18	51.3	61.6	54.4	50.7	52.1	50.5	55.6	57.6	62.3	51.7	52.9	62.7
19	55.6	65.2	58.2	54	54.5	53.5	59.7	63.5	71.7	61	57.3	65.3
20	58.2	68.3	62.5	58.4	60.3	59.2	67.1	71.6	79.3	66.7	59.9	66.6
21	60.5	70.2	65.3	61.8	66.2	66.5	73.7	77.6	82.9	69.6	62.9	67.3
22	62.5	71.9	67.5	64.5	70	70.6	77.2	81	84.6	71.8	64.5	68.2
23	64.2	73.6	69.5	67.3	73.2	72.7	79.5	83.2	85.8	73.7	66.3	68.4
24	65.8	74.7	71.3	68.7	75.3	74.9	81.1	84.3	86.7	75.8	67.8	69.1

Table B-18 – Average Monthly Temperatures by Hour of the Day for St. Charles County in Fahrenheit (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	24.3	26.9	37.9	47.5	54.9	68.8	70.2	67.6	60.6	49.2	37.6	23.3
2	23.3	25.3	36.1	45.7	53.7	67.8	69	66.8	60.7	48.1	37.5	23.5
3	22.2	24.1	34.9	44.4	52.6	66.7	68.3	65.9	59.9	47.6	36.6	22.8
4	21.2	23.2	33.8	43.5	51.5	65.7	67.9	65.1	59.2	46.8	35.9	22
5	20.7	22.9	32.8	42.7	50.8	64.8	67.2	64.5	58.6	46	35	21.5
6	20.3	22.4	31.7	42.4	50.2	64.3	66.7	63.9	58.1	45.4	34.2	21.3
7	20.1	21.8	31.2	42.4	51.9	66.4	68	64.5	58	44.8	33.8	21
8	20.1	21.5	31.5	45	55.3	69.8	71	68	60.1	46.1	33.5	20.5
9	21.4	23.1	35.2	48.4	58.2	73	74.4	71.9	63.7	50.8	36.5	22.3
10	25.8	25.6	38.9	51.4	61.8	75.9	77.5	75.7	67.6	55.4	40.5	26
11	30.3	28.6	42.7	54.3	64.7	78.4	79.9	78.7	71.3	59.7	44.2	30.3
12	34.4	31.7	46.2	56.7	66.7	80.8	82.2	80.7	74.1	63.1	47.9	34.8
13	38	34.1	48.9	59.3	68	82.3	84.1	82.2	76.2	65	50.5	38.3
14	40.7	36.2	51	61.1	69.4	83.3	85.4	83.5	77.6	66.4	52.6	40.3
15	42	37.6	52.4	62.5	70.8	84	86.4	84.1	78.3	67.3	53.8	41.8
16	42	38.1	52.9	63.4	71.7	84.4	86.5	84.3	78.4	67.4	53.8	42.1
17	41.1	37.8	52.7	63.3	71.8	84.3	86	84	77.8	66.3	52.5	40.6
18	37.5	36.4	51.6	62.4	71	83.3	85	82.7	75.7	63.3	48.9	36.3
19	33.3	33.6	48.8	60.1	69.1	81.8	83	79.8	71	58.4	45.8	33.3
20	30.9	31.9	45.4	56.5	65.3	78.6	79.7	75.8	66.8	55.4	43.9	31
21	29	30.5	43.5	54	61.5	74.6	76	72.5	65	53.9	42.5	29.3
22	27.8	29.5	41.9	52.3	59.1	72.5	74	70.7	63.4	52.6	41.4	27.3
23	26.5	28.2	40.8	50.5	57.4	71.1	72.7	69.4	62.4	51.4	40	25.8
24	25.4	27.7	39	49.1	56	69.8	71.3	68.5	61.2	50.3	38.8	24.3

Table B-19 – Average Monthly Percent Relative Humidity by Hour of the Day for St. Charles County (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	67.5	75.8	71.7	70.5	76.6	77.3	83.3	85.5	87.9	76.1	68.8	69.8
2	68.2	77	72.1	72.8	76.5	78.9	84.1	86.4	88.2	77.8	70.2	71.3
3	69.6	77.5	73.5	74.4	77.9	80.5	84.9	86.9	88.8	78.9	71.6	72.5
4	70.7	78.1	74.9	75.3	79.3	82.1	85.2	88.1	89.4	79.5	72.4	73.4
5	71.6	78.1	76.4	75.8	79.8	82.9	86.4	88.4	90.1	81	73.8	74.9
6	71.9	78	77.5	76.3	81	84.1	86.7	89	90.4	81.9	75.3	75.6
7	71.6	78.7	78.2	77	79.9	81.9	85.2	88.1	90	83.1	76.2	76.5
8	71.6	78.3	78.2	73	75.5	76.3	80.2	84	88.8	82.6	76.4	76.2
9	70.5	76.7	74.7	67.9	71.4	70.6	73.8	76.5	83.8	76.8	73.9	75
10	66.2	73.8	69.8	63.9	64.7	65.5	68.2	69	76.3	67.9	68.3	72.2
11	61.3	70.1	63.8	60.2	59.8	60.5	63.5	62.9	69.2	59.8	62.4	68.5
12	56.4	66.7	58.8	57.5	57	55.9	59.5	58.5	63.9	53.4	56.9	65.4
13	52.5	64	55.1	54.7	55.9	53.1	56.6	55.9	59.8	49.9	53.2	62.7
14	49.9	61.3	53	52.7	54.3	51.7	54.4	54	57.3	47.6	49.8	61.2
15	48.1	59.5	51.6	50.9	52.7	50.1	53.1	52.9	56	46.3	47.8	59.6
16	47.1	58.9	51.4	49.5	51.7	49.2	52.9	53	55.6	46	47.1	59.2
17	47.3	59.5	51.8	49.1	50.8	49.2	53.8	53.9	57.1	47	48.6	60.2
18	50.9	61.1	53.5	50.3	50.7	50.3	55.5	56.4	61.6	52.2	53.3	64
19	55.7	65.2	57.5	53.3	53.1	53.2	60	62.4	71.9	61	57.6	66.6
20	58.6	68.1	62.3	58.2	59	59.3	66.8	71.2	80.5	66.9	60.4	67.7
21	61.1	70.6	64.9	61.5	65.4	66.9	74	77.6	83.5	69.3	62.2	67.8
22	62.6	72.3	67.1	63.7	70.2	71.1	77.4	81.3	85.6	71.1	63.9	68.1
23	64	73.7	68.6	66.6	72.9	73.5	79.2	83.3	86.1	72.9	65.5	68.5
24	65.6	74.9	70.7	68.2	75	76	81.1	84.7	87.6	74.7	67.3	69.3

Table B-20 – Average Monthly Temperatures by Hour of the Day for St. Louis County in Fahrenheit (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	25.5	28.1	39	48.2	56.2	70.2	71.8	68.8	62.4	50.7	38.8	24.4
2	24.5	26.6	37.3	46.2	55	69.1	70.6	68.1	62.5	49.8	38.6	24.6
3	23.6	25.2	36.1	45.1	53.8	68	69.9	67.2	61.6	49.1	37.8	23.9
4	22.7	24.5	35.1	44.3	52.8	67	69.6	66.5	60.9	48.4	37	23.2
5	21.9	23.9	34.2	43.6	52.1	66.1	68.9	65.9	60.4	47.6	36.3	22.5
6	21.4	23.4	33.1	43.3	51.6	65.6	68.4	65.3	59.9	47.1	35.6	22.5
7	21.2	23.1	32.6	43.3	53.2	67.7	69.7	65.8	59.8	46.6	35	22.5
8	21.2	22.7	32.9	45.7	56.5	70.9	72.5	69.4	61.9	47.9	34.9	22
9	22.5	24.1	36.4	48.9	59.4	73.9	75.7	72.8	65.2	52.2	37.8	23.9
10	26.6	26.7	39.8	51.8	62.5	76.8	78.5	76.6	68.7	56.7	41.5	27.2
11	30.8	29.5	43.3	54.6	65.2	79.3	81	79.5	72.2	60.7	45.1	31.1
12	34.9	32.5	46.7	56.8	67.1	81.6	83.1	81.4	74.8	63.9	48.4	35.1
13	38.2	35	49.4	59.3	68.4	83.1	84.8	83	76.8	65.8	50.9	38.7
14	41	37.1	51.3	61	69.4	84	86.2	84.1	78.3	67.2	52.8	40.8
15	42.5	38.5	52.7	62.4	70.8	84.8	87.2	84.8	79	67.9	54	42
16	42.5	39	53	63.2	71.6	85	87.3	84.9	79	68.1	54.1	42.5
17	41.6	38.6	53	63.1	71.9	84.9	86.8	84.6	78.4	67	52.8	40.8
18	38.1	37.2	51.7	62.4	70.9	84	85.9	83.2	76.3	64.2	49.5	37
19	34.2	34.6	49.1	60.1	69.3	82.5	83.9	80.5	72.3	59.9	46.6	34.4
20	31.8	32.9	46.3	56.8	65.6	79.5	80.7	76.8	68.5	57.1	44.8	32.3
21	30.1	31.6	44.4	54.4	62.5	76	77.4	73.9	66.6	55.5	43.4	30.6
22	29.2	30.8	42.6	52.8	60.2	73.9	75.8	72.1	65.2	54.1	42.2	28.4
23	27.9	29.5	41.7	51	58.4	72.4	74.4	70.8	64.1	52.9	41.1	27
24	26.8	28.8	40	49.6	57.2	71.2	73	69.8	63.1	51.7	39.9	25.3

Table B-21 – Average Monthly Percent Relative Humidity by Hour of the Day for St. Louis County (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	67.3	75.9	71.8	70	75.9	75.8	82.3	85	87.4	75.9	68.9	70.2
2	68.1	77.1	72.2	72.6	76	78.1	83.3	85.8	87.7	77.6	70.3	71.8
3	69.5	78.3	73.3	74.2	77.4	80	84.2	86.7	88.6	79.1	71.7	72.9
4	70.3	78.5	74.4	74.7	78.5	81.3	84.7	87	89.5	79.6	72.5	73.8
5	71.5	78.5	75.9	75.6	79.3	82.4	85.9	87.9	89.8	81.1	73.6	75.7
6	72	78.8	77.7	76.1	80.5	83.3	86.2	88.4	90.1	82	75.4	76.4
7	71.7	79.1	78	76.4	79.4	81.1	84.7	88.2	90.1	82.9	76.3	76.7
8	71.4	78.4	78.6	72.5	75	75.6	79.8	83.2	88.6	82.4	76.6	76.6
9	70.3	77.2	74.8	67.9	71	70	73.4	76.3	83.3	76.7	74.1	75.2
10	66	74.2	69.9	63.7	65	64.7	67.9	68.6	76.2	67.6	68.2	72.7
11	61.4	70.5	64.6	60.2	60	60	63.2	62.8	69.1	59.4	62.3	68.9
12	56.7	67.1	59.6	57.8	57.5	55.2	59.2	58.4	63.5	53.1	57.5	66
13	52.8	64.6	56	54.9	56.4	52.3	56.3	55.8	59.6	49.5	53.4	63.2
14	49.8	62	53.9	53.1	55.1	51.3	54.2	53.9	57	47.2	50.4	61.2
15	47.8	59.9	52.4	51.3	53.5	49.5	52.5	52.9	55.5	45.9	48.4	59.9
16	46.8	59	52.7	49.9	52.7	48.6	52.5	52.9	55.3	45.5	47.5	59.2
17	47.2	59.7	52.9	49.6	51.4	48.6	53.2	53.9	56.8	46.6	48.8	60.5
18	50.6	61.2	54.8	50.5	51.4	49.7	54.7	56.4	61.5	51.4	53.2	64.1
19	55.1	65.1	58.5	54	53.5	52.4	58.9	62	70.6	59.1	57.2	66.5
20	58.2	68.2	62.5	58.2	59	57.9	65.8	69.8	78.6	65.1	60	67.9
21	60.2	70.4	65.3	61.4	64.5	64.3	72.3	76.1	82.2	68.2	62.1	68.3
22	61.9	72.1	67.7	63.6	69.2	69	75.5	80	84.2	70.4	64	68.6
23	63.7	73.8	69.3	66.6	72.5	71.6	77.7	82.2	85.3	72.5	65.7	69
24	65.2	75	71.1	68.3	74.6	74.3	80.1	83.9	86.5	74.6	67.4	69.7

Table B-22 – Average Monthly Temperatures by Hour of the Day for St. Louis City in Fahrenheit (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	25.9	28.9	40.2	48.1	56	70.1	72.4	69.2	62.7	51.5	39.4	25.9
2	25	27.5	38.4	46.2	54.9	69.1	71.2	68.5	62.9	50.7	39.2	25.9
3	24	26.3	37.4	45.3	53.8	68	70.6	67.7	62.2	49.9	38.3	25
4	22.9	25.4	36.3	44.3	52.9	67	70.1	67	61.5	49.4	37.8	24.6
5	22.4	24.9	35.6	43.7	52.2	66.2	69.6	66.3	61	48.6	37.1	23.9
6	21.7	24.4	34.5	43.4	51.8	65.6	69.1	65.9	60.6	47.9	36.4	23.9
7	21.5	23.8	33.9	43.7	53.6	67.9	70.6	66.5	60.5	47.5	35.8	23.9
8	21.3	23.5	34.2	46	57	71.2	73.5	70.2	62.6	48.8	35.8	23.2
9	22.8	24.9	37.7	49.2	59.8	74.4	76.5	73.7	66	53.3	38.7	25.2
10	27	27.5	41	52.1	62.9	77.4	79.2	77.5	69.5	57.8	42.5	28.4
11	31	30.3	44.3	54.8	65.6	79.9	81.6	80.3	72.9	61.8	45.9	32
12	35	33	47.4	57	67.7	82.1	83.6	82.3	75.4	64.8	49.3	35.9
13	38.1	35.5	50.1	59.3	68.7	83.8	85.2	83.7	77.3	66.8	51.7	39.3
14	41.1	37.4	51.8	61	69.7	84.5	86.7	84.9	78.7	68.1	53.5	41.5
15	42.7	38.8	53.3	62.4	71.1	85.3	87.6	85.5	79.4	68.8	54.6	42.9
16	42.5	39.3	53.6	63.2	71.7	85.4	87.8	85.5	79.5	68.8	54.6	42.9
17	41.6	39.1	53.4	62.9	72	85.4	87.5	85.3	78.7	67.9	53.3	41.5
18	38.1	37.7	52.2	62.1	71.2	84.4	86.4	83.8	76.8	65.1	50	37.7
19	34.3	35.1	49.5	60.1	69.4	82.9	84.5	81.2	72.5	60.7	47.2	35
20	32.1	33.4	47	56.7	65.8	79.8	81.4	77.2	68.5	57.8	45.2	33.4
21	30.4	32.2	45	54.5	62.5	76	77.9	74.3	66.8	56.2	43.8	31.6
22	29.5	31.3	43.5	52.8	60.2	73.6	76.2	72.3	65.5	54.9	42.7	29.8
23	28.3	30.1	42.6	51	58.3	72.2	74.8	71.2	64.3	53.6	41.6	28.4
24	27.2	29.6	41.1	49.5	57.1	71	73.6	70.3	63.4	52.4	40.6	26.8

Table B-23 – Average Monthly Percent Relative Humidity by Hour of the Day for St. Louis City (MOVES Inputs for 2008, 2017, and 2022 On-Road Mobile Source Emissions)

	MonthID											
HourID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	68	76.6	72.6	71.4	77	76.6	83.4	85.9	87.7	76.9	69.3	69.8
2	69	78.1	73.2	73.8	76.9	78.7	84.2	86.5	87.7	78	71	71.3
3	69.8	79	74	74.8	78	80.8	85.4	87	88	79.7	72.1	72.7
4	70.9	79	75.2	75.9	79.1	81.9	85.6	87.6	88.9	80.3	72.3	73.6
5	72.1	78.9	76.3	76.5	79.9	82.7	86.5	88.5	89.5	81.5	73.4	75.2
6	72.4	79.2	78.4	77.4	80.5	83.9	86.8	88.5	89.8	82.7	75.2	75.8
7	72.7	79.5	79	77.1	79.4	81.7	85.1	88.2	89.5	83.3	76.3	76.2
8	72.3	79.1	79.4	73.4	75.1	75.9	80.1	83.3	88.3	83.1	76.3	76.4
9	70.9	77.9	75.6	68.3	71	70	74	76.4	83	77	73.6	75
10	66.7	74.9	70.6	64.2	64.8	64.5	68.4	68.9	75.7	67.4	68	72.5
11	61.9	71.5	65.5	60.7	60.1	59.6	63.7	63.1	68.9	59.1	62.4	69
12	57.4	68.3	60.7	58.5	57.1	55.3	59.7	58.7	63.6	52.8	57.2	66.1
13	53.7	65.5	57	55.7	56.4	52	57.1	56.3	59.7	48.9	53.8	63.1
14	50.6	63.3	55.1	53.7	55.1	51.2	54.6	54.2	57	46.4	50.7	61.1
15	48.4	61.4	53.4	51.7	53.7	49.5	53.1	53.5	55.5	45.5	48.5	59.5
16	47.8	60.3	53.4	50.4	52.9	48.9	52.7	53.5	55.1	45.3	47.8	59.1
17	48	60.7	53.8	50.2	51.8	48.9	53.4	54.2	56.8	46.4	48.9	60.1
18	51.2	62.1	55.8	51.4	51.4	49.9	55.2	57.1	61.6	51.3	53.3	63.6
19	55.9	66	59.7	54.8	53.9	52.4	59.2	62.6	71.1	59.4	57.3	66.2
20	58.7	69.2	63.6	59.6	59.7	58.2	66.3	71.1	79.7	65.7	60.6	67.5
21	60.8	71.1	66.4	62.1	65.5	65	73.6	77.5	83.4	68.8	62.6	68.4
22	62.5	73.1	68.7	64.8	70	70.2	76.8	81.4	84.8	71	64.5	68.7
23	64.3	74.8	70.2	67.7	73.6	72.8	79.1	83.1	86.2	73.1	66.3	68.9
24	66.1	75.7	71.8	69.4	75.7	75.3	81	84.8	87.1	75.5	67.8	69.6

Appendix B-4 2008 Off-Road Mobile Source Emissions

At the request of the Department, EPA Region 7 calculated off-road mobile emissions for the Missouri counties in the St. Louis ozone nonattainment area. Using the fuel and meteorological data from the NCD, EPA ran the NONROAD model and created ozone season day emissions for 2008, 2017, and 2022. The modeling protocol submitted by EPA Region 7 to the Department, for the development of the 2008, 2017, and 2022 off-road mobile emissions can be found in Appendix B-5 of this document. The data generated by EPA for the 2008 off-road mobile source emissions for the Missouri counties in the St. Louis ozone nonattainment area are summarized in B-24.

As stated in Appendix B-1, EPA generates emissions data for marine and rail sources using a method similar to the way emissions are generated for non-point sources. Therefore, 2008 emissions data for marine and rail emissions, which are calculated similarly to nonpoint emissions, need to be added to the off-road mobile source category. The 2008 emissions for rail and marine sources are summarized by county in Table B-25. The total off-road mobile source emissions by county are listed in Table B-26.

Table B-24
EPA Generated 2008 Off-Road Mobile Source Emissions by County in the St. Louis Ozone Nonattainment Area (Excludes Marine and Rail Emissions)
(Tons/Ozone Season Day)
(Missouri Counties Only)

County Name	CO	NO_X	VOC
Franklin County	23.56	2.93	3.59
Jefferson County	38.72	2.89	3.64
St. Charles County	85.2	7.61	7.49
St. Louis County	424.33	20.55	27.22
St. Louis City	65.9	2.86	3.97
Totals	**637.71**	**36.84**	**45.91**

Table B-25
2008 Marine and Rail Emissions by County in the St. Louis Ozone Nonattainment Area
(Tons/Ozone Season Day)
(Missouri Counties Only)

County Name	CO	NO_X	VOC
Franklin County	0.00	0.01	0.00
Jefferson County	0.08	0.43	0.01
St. Charles County	0.32	1.65	0.04
St. Louis County	0.08	0.44	0.01
St. Louis City	4.14	21.48	0.47
Totals	**4.63**	**24.01**	**0.52**

Table B-26
Total 2008 Off-Road Mobile Source Emissions by County in the St. Louis Ozone Nonattainment Area
(Tons/Ozone Season Day)
(Missouri Counties Only)

County Name	CO	NO_X	VOC
Franklin County	23.56	2.94	3.59
Jefferson County	38.8	3.32	3.65
St. Charles County	85.52	9.26	7.53
St. Louis County	424.41	20.99	27.23
St. Louis City	70.04	24.34	4.44
Totals	**642.33**	**60.85**	**46.44**

Appendix B-5 **EPA Region 7 Off-Road Emissions Modeling Protocol for 2008 and 2022 for the St. Louis, Missouri-Five County Nonattainment Area**

Ozone and PM2.5 Maintenance Plan Work Share
St. Louis, Missouri-Five County Area
Nonroad modeling for inventory development

For this modeling exercise, the EPA Region 7 utilized the NONROAD2008a model to calculate an ozone and PM2.5 nonroad inventory in five counties in the St. Louis nonattainment area for the 1997 PM2.5 annual and 1997 Ozone NAAQS. The NONROAD2008a model provides the emissions for all nonroad source categories except aircraft, commercial marine vessel, and railroad locomotive.

In running the NONROAD model, the user must specify a modeling scenario by the inventory year, geographic area (nation, state, county), period (annual, seasonal, monthly, daily), and the equipment categories. For all other required variables, the NONROAD model provides default input values. For the following modeling exercises, fuel parameters (Reid Vapor Pressure (RVP), oxygen weight, sulfur content, ethanol volume and market percentage) and temperatures for each geographical area were provided by MDNR in lieu of the modeling default settings for more accurate results (see attachment).

Ozone Precursor Emissions

Ozone Methodology/Input Data
Nonroad mobile source emissions for the years of 2008 and 2022 are calculated using the EPA approved model, NONROAD2008a, and included Franklin County, Jefferson County, St. Charles County, St. Louis County and St. Louis City in St. Louis, Missouri.
For modeling ozone precursor pollutants, temperatures and fuel characteristics representative of each county during an ozone summer weekday, were entered into NONROAD2a and modeled to calculate an ozone season weekday emissions for nonroad sources. Minimum, maximum, and average temperatures for a typical summer season were provided by MDNR (see attachment). Modeling input parameters are as follows:

Table B-27
NONROAD Model Temperature & Fuel Characteristic Input Values by County

County	Oxygen Weight %	RVP psi	Gasoline Sulfur %	Diesel Sulfur	Marine Diesel Sulfur %	CNG / LPG Sulfur %	Temperatures		
							Min.	Max.	Avg.
Franklin	0.35	7	0.0049	0.0355	0.0402	0.003	61.8	90	75.96
Jefferson	0.35	7	0.0049	0.0355	0.0402	0.003	61	88.6	75.16
St. Charles	0.35	7	0.0049	0.0355	0.0402	0.003	62.2	89.2	76.15
St. Louis	0.35	7	0.0049	0.0355	0.0402	0.003	64.1	89.5	77.1
St. Louis City	0.35	7	0.0049	0.0355	0.0402	0.003	65.1	89.8	77.72

Direct $PM_{2.5}$ / $PM_{2.5}$ Precursor Emissions

Methodology/Input Data

Nonroad mobile source emissions for the years of 2008 and 2022 were calculated using the EPA approved model, NONROAD2008a, and included Franklin County, Jefferson County, St. Charles County, St. Louis County and St. Louis City in St. Louis, Missouri.

For modeling $PM_{2.5}$ and $PM_{2.5}$ precursor pollutants, temperatures and fuel characteristics representative of each county for each of the four seasons (winter, spring, summer, and fall) were entered into the NONROAD2008a model as input parameters. The highest temperature and lowest temperature from each three month period (December-February, March-May, June-August, and September-November) were averaged to create a seasonal average temperature. Those seasonal average temperatures, seasonal minimum and seasonal maximum temperatures were then utilized in the model, including the fuel parameters, to calculate the total emissions for each county and season. Summing the emissions of all four seasons for each county gave the total annual emissions. The temperatures and fuel characteristics representative of each county were provided by MDNR. Modeling input parameters are as follows:

Table B-28
NONROAD Model Temperature & Fuel Characteristic Input Values by County & Season

County	Season	Oxygen Weight %	RVP psi	Gasoline Sulfur %	Diesel Sulfur	Marine Diesel Sulfur %	CNG / LPG Sulfur %	Temperatures		
								Min.	Max.	Avg.
Franklin	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	19.7	47	33.4
Franklin	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	33.5	76.9	55.2
Franklin	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	61.8	90	75.9
Franklin	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	34.3	80.9	57.6
Jefferson	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	18.6	45.6	32.1
Jefferson	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	32.4	75.8	54.1
Jefferson	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	61	88.6	74.8
Jefferson	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	33.6	79.8	56.7
St. Charles	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	18.7	43.9	31.3
St. Charles	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	32.3	75.8	54.1
St. Charles	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	62.2	89.2	75.7
St. Charles	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	34.8	80.3	57.6
St. Louis	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	19.8	44.2	32
St. Louis	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	34.5	76.1	55.3
St. Louis	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	64.1	89.5	76.8
St. Louis	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	35.5	80.2	57.9
St. Louis City	Winter	0.35	11.5	0.0043	0.0355	0.0402	0.003	20.7	45.5	32.6
St. Louis City	Spring	0.35	9	0.0046	0.0355	0.0402	0.003	35.7	76.4	56
St. Louis City	Summer	0.35	7	0.0049	0.0355	0.0402	0.003	65.1	89.8	77.5
St. Louis City	Autumn	0.35	9	0.0046	0.0355	0.0402	0.003	36.6	80.4	58.5

QA/QC
Quality control and quality assurance were conducted throughout this nonroad modeling process. Data collected from various data sources were verified and correctly entered or transcribed into the model. In some instances, input values, i.e., temperatures and fuel values were double and/or triple checked for accuracy to insure they corresponded to the data supplied by MDNR. In addition, a spot-checking of the modeling results, including rerunning the model for those results in question, was performed to insure reliability.

Nonroad Modeling Results Summary Tables

Table B-29

Ozone Typical Summer Day Emissions Tons / Day						
County	**NO_X**		**VOC**		**CO**	
	2008	**2022**	**2008**	**2022**	**2008**	**2022**
Franklin	2.93	1.81	3.59	1.55	23.56	19.76
Jefferson	2.89	1.27	3.64	2.06	38.72	34.77
St. Charles	7.61	3.33	7.49	3.95	85.2	73.93
St. Louis CO	20.55	9.08	27.22	17.85	424.3	388.64
St. Louis City	2.86	1.19	3.97	2.2	65.9	56.28
Total	36.84	16.68	45.91	27.61	637.7	573.38

Table B-30

Direct PM2.5 and PM2.5 Precursor Pollutant County Totals (Tons per Year)										
County	**$PM_{2.5}$**		**PM_{10}**		**SO_2**		**NO_X**		**VOC**	
	2008	**2022**	**2008**	**2022**	**2008**	**2022**	**2008**	**2022**	**2008**	**2022**
Franklin	64.73	39.04	67.91	34.72	11.8	10.75	665.82	233.09	945.16	386.31
Jefferson	73.6	52.26	77.19	55.05	14.6	15.33	726.68	319.36	929.83	544.67
St. Charles	171.98	120.7	179.8	126.8	37.1	39.01	1893.6	827.95	1948.52	1031.57
St. Louis	530.64	444.8	558.1	471.3	99.3	106.99	5354.4	2323.2	6470.16	4457.23
St. Louis City	53.25	46.35	55.98	49.02	9.74	10.93	794.9	341.3	1066	628.57

Modeling File Naming Convention
Ozone: pollutant-county-year
PM2.5: pollutant-county-year-season

OZONE Modeling Files Example: 03Frnk08 = **(Ozone Franklin County 2008)**
O3 = Ozone
08 = 2008
22 = 2022
Frnk = Franklin County
Jeff = Jefferson County
StCh = St. Charles County
StLC = St. Louis County
StCi = St. Louis City

<u>PM2.5 Modeling Files</u> Example: PMFr22wi = **(PM2.5 Franklin County 2022 winter)**
PM = PM2.5
08 = 2008
wi = winter
sp = spring
su = summer
au = autumn
Fr = Franklin County
Je = Jefferson County
Ch = St. Charles County
SL = St. Louis County
SC = St. Louis City