

NOx SIP Call

Appendix N

Nonroad Mobile Sources

Appendix N.1

Nonroad Sample Calculations

New York State Sample Calculations for 1995 NOx Emissions Estimates from Nonroad Equipment and Vehicles

Equation (1) shows the basic equation for estimating NOx emissions from Nonroad equipment and vehicles:

$$(1) \quad \text{Estimated Emissions}_{(yr,i)} = \text{Emissions}_{(1990,i)} * \text{Growth Factor}_{yr}$$

i = Pollutant (NOx)

yr = 1995

Emissions = 1990 Base Year

Growth Factor = BEA Growth Rate

(Bureau of Economic Analysis data based on Gross State Product)

1995 Estimated NOx Emissions from 2 stroke Chain saws (< 6hp) for New York State (tons/day)

$$\text{Estimated Emissions}_{(1995,NOx)} = \text{Emissions}_{(1990,NOx)} * \text{Growth Factor}_{(1995)}$$

Emissions_(1990,NOx) = 0.029 tons/day

Growth Factor₍₁₉₉₅₎ = 0.926

Estimated Emissions_(1995,NOx) = 0.027 tons/day

New York State Sample Calculations for 2007 NOx Emissions Projections from Nonroad Equipment and Vehicles

Equation (2) shows the basic equation for projecting NOx emissions from Nonroad equipment and vehicles:

$$(2) \text{ Projected Emissions}_{(yr,i)} = \text{Emissions}_{(1990,i)} * \text{Growth Factor}_{yr} * \text{Engine Standards}_{(NOx)}$$

i	=	Pollutant (NOx)
yr	=	2007
Emissions	=	1990 Base Year
Growth Factor	=	BEA Growth Rate (Bureau of Economic Analysis data based on Gross State Product)
Engine Standards _(NOx)	=	Emissions Increase or Reduction (U.S. EPA New Engine Standards for Nonroad Equipment and Vehicles for the years 1990 through 2010)

2007 Projected NOx Emissions from Diesel Powered Rubber Tire Loaders for New York State (tons/day)

$$\text{Projected Emissions}_{(2007,NOx)} = \text{Emissions}_{(1990,NOx)} * \text{Growth Factor}_{(2007)} * \text{Engine Standards}_{(NOx)}$$

Emissions _(1990,NOx)	=	28.136 tons/day
Growth Factor ₍₂₀₀₇₎	=	1.025
Engine Standards _(NOx)	=	0.728 (27.2 % reduction)
Estimated Emissions _(2007,NOx)	=	20.995 tons/day

Appendix N.2

NOx SIP Call - List of Tables Nonroad Equipment & Vehicles

- Table 1 - 1995 and 2007 New York State Ozone Season NOx Emissions for Nonroad Equipment and Vehicles (tons/day)
- Table 2 - Source Code Classification List
- Table 3 - BEA Growth Rates for New York State by SIC - 1990 Base

Table 1
1995 and 2007 (w/control measures) New York State Ozone Season
NOx Emissions for Nonroad Equipment and Vehicles (tons/day)

Source Classification Code	1995	2007 w/Control Measures
2260001010	0.000	0.000
2260001030	0.000	0.000
2260001050	0.001	0.002
2260001060	0.000	0.001
2260002006	0.000	0.000
2260002009	0.000	0.001
2260002021	0.000	0.000
2260002033	0.000	0.000
2260003010	0.283	0.313
2260003020	9.205	10.189
2260003030	0.510	0.565
2260003040	0.000	0.000
2260004010	0.015	0.033
2260004015	0.000	0.000
2260004020	0.027	0.060
2260004025	0.023	0.051
2260004030	0.008	0.017
2260004050	0.000	0.000
2260004075	0.000	0.000
2260006005	0.009	0.020
2260006010	0.041	0.091
2260006020	0.086	0.095
2260007005	0.001	0.003
2260008010	0.031	0.035
2265001010	0.001	0.001
2265001030	0.011	0.012
2265001040	0.000	0.000
2265001050	0.011	0.022
2265001060	0.001	0.001
2265002003	0.011	0.012
2265002006	0.000	0.000
2265002009	0.018	0.040
2265002015	0.027	0.060
2265002021	0.050	0.055
2265002024	0.019	0.043
2265002027	0.000	0.001
2265002030	0.094	0.105
2265002033	0.031	0.034
2265002039	0.089	0.195
2265002042	0.026	0.057
2265002045	0.030	0.034
2265002054	0.010	0.011
2265002057	0.023	0.025
2265002060	0.041	0.046
2265002066	0.017	0.018
2265002072	0.074	0.082
2265002078	0.002	0.005
2265002081	0.027	0.029
2265003010	0.598	0.662
2265003020	2.421	2.680
2265003030	0.273	0.303
2265003040	0.119	0.261
2265003050	0.022	0.024
2265004010	0.304	0.668
2265004015	0.026	0.058

Table 1 (cont'd.)

2265004025	0.000	0.000
2265004030	0.000	0.000
2265004040	0.031	0.067
2265004045	0.009	0.020
2265004050	0.001	0.001
2265004055	0.245	0.538
2265004060	0.007	0.016
2265004065	0.091	0.101
2265004070	0.345	0.382
2265004075	0.001	0.003
2265005010	0.001	0.001
2265005015	0.032	0.035
2265005020	0.002	0.002
2265005030	0.000	0.001
2265005035	0.009	0.020
2265005040	0.003	0.008
2265005045	0.055	0.061
2265005050	0.003	0.006
2265005055	0.002	0.003
2265006005	0.512	1.127
2265006010	0.073	0.161
2265006015	0.049	0.107
2265006025	0.071	0.157
2265006030	0.020	0.044
2265008005	0.061	0.068
2265008010	0.435	0.490
2270001060	0.000	0.000
2270002003	0.795	0.641
2270002009	0.006	0.006
2270002012	0.441	0.488
2270002015	1.811	2.004
2270002018	5.598	4.511
2270002021	2.557	2.061
2270002027	0.110	0.121
2270002030	1.780	1.435
2270002033	1.027	0.828
2270002036	12.805	10.319
2270002039	0.007	0.006
2270002042	0.012	0.013
2270002045	15.506	12.495
2270002048	6.805	5.484
2270002051	14.750	11.886
2270002054	1.353	1.090
2270002057	2.902	2.339
2270002060	26.054	20.995
2270002063	2.954	2.380
2270002066	16.113	12.984
2270002069	39.867	32.126
2270002072	3.871	4.285
2270002075	14.590	11.757
2270002078	0.001	0.001
2270002081	1.486	1.198
2270003010	0.937	1.037
2270003020	10.354	8.344
2270003030	9.165	7.386
2270003040	1.786	1.439
2270003050	0.394	0.318
2270004040	0.002	0.002
2270004055	0.372	0.411

Table 1 (cont'd.)

2270004060	0.000	0.000
2270004065	0.524	0.422
2270004070	0.010	0.008
2270004075	0.000	0.000
2270005015	25.112	20.236
2270005020	1.074	0.865
2270005025	0.014	0.011
2270005035	0.008	0.006
2270005045	0.368	0.297
2270005050	0.006	0.007
2270005055	0.057	0.046
2270006005	2.294	2.539
2270006010	0.512	0.566
2270006015	0.255	0.282
2270006025	1.016	1.125
2270006030	0.003	0.003
2270008005	1.771	1.450
2270008010	22.439	18.362
2275001000	0.943	1.044
2275020000	18.899	20.919
2275050000	0.384	0.425
2275060000	0.098	0.109
2275070000	0.201	0.223
2280002000	1.677	1.645
2280003000	0.404	0.396
2282005010	0.598	0.117
2282005025	0.000	0.000
2282010005	1.444	1.384
2282010010	0.017	0.017
2282010015	2.992	2.868
2282010020	0.001	0.000
2282010025	0.010	0.009
2282020005	1.445	1.386
2282020020	0.312	0.259
2285000000	20.335	17.270
Total	318.112	275.125

Table 2
Source Code Classification List

SCC Code	Classification	Equipment Type	Engine Type
2260001010	Recreational Equipment	Motorcycles: Off-Road	2 Stroke
2260001030	Recreational Equipment	All Terrain Vehicles	2 Stroke
2260001050	Recreational Equipment	Golf Carts	2 Stroke
2260001060	Recreational Equipment	Specialty Vehicle Carts	2 Stroke
2260002006	Construction and Mining Equipment	Tampers/Rammers	2 Stroke
2260002009	Construction and Mining Equipment	Plate Compactors	2 Stroke
2260002021	Construction and Mining Equipment	Paving Equipment	2 Stroke
2260002033	Construction and Mining Equipment	Bore/Drill Rigs	2 Stroke
2260003010	Industrial Equipment	Aerial Lifts	2 Stroke
2260003020	Industrial Equipment	Forklifts	2 Stroke
2260003030	Industrial Equipment	Sweepers/Scrubbers	2 Stroke
2260003040	Industrial Equipment	Other General Industrial Equipment	2 Stroke
2260004010	Lawn and Garden Equipment	Lawn mowers	2 Stroke
2260004015	Lawn and Garden Equipment	Rotary Tillers < 6 hp	2 Stroke
2260004020	Lawn and Garden Equipment	Chain saws < 6 hp	2 Stroke
2260004025	Lawn and Garden Equipment	Trimmers/Edgers/Brush Cutter	2 Stroke
2260004030	Lawn and Garden Equipment	Leafblowers/Vacuums	2 Stroke
2260004050	Lawn and Garden Equipment	Shredders < 6 hp	2 Stroke
2260004075	Lawn and Garden Equipment	Other Lawn and Garden Equipment	2 Stroke
2260006005	Commercial Equipment	Generator Sets	2 Stroke
2260006010	Commercial Equipment	Pumps	2 Stroke
2260006020	Commercial Equipment	Gas Compressors	2 Stroke
2260007005	Logging Equipment	Chain saws > 6 hp	2 Stroke
2260008010	Airport Ground Support Equipment	Terminal Tractors	2 Stroke
2265001010	Recreational Equipment	Motorcycles: Off-Road	4 Stroke
2265001030	Recreational Equipment	All Terrain Vehicles	4 Stroke
2265001040	Recreational Equipment	Minibikes	4 Stroke
2265001050	Recreational Equipment	Golf Carts	4 Stroke
2265001060	Recreational Equipment	Specialty Vehicle Carts	4 Stroke
2265002003	Construction and Mining Equipment	Pavers	4 Stroke
2265002006	Construction and Mining Equipment	Tampers/Rammers	4 Stroke
2265002009	Construction and Mining Equipment	Plate Compactors	4 Stroke
2265002015	Construction and Mining Equipment	Rollers	4 Stroke
2265002021	Construction and Mining Equipment	Paving Equipment	4 Stroke
2265002024	Construction and Mining Equipment	Surfacing Equipment	4 Stroke
2265002027	Construction and Mining Equipment	Signal Boards/Light Plants	4 Stroke
2265002030	Construction and Mining Equipment	Trenchers	4 Stroke
2265002033	Construction and Mining Equipment	Bore/Drill Rigs	4 Stroke
2265002039	Construction and Mining Equipment	Concrete/Industrial Saws	4 Stroke
2265002042	Construction and Mining Equipment	Cement & Mortar Mixers	4 Stroke
2265002045	Construction and Mining Equipment	Cranes	4 Stroke
2265002054	Construction and Mining Equipment	Crushing/Proc. Equipment	4 Stroke
2265002057	Construction and Mining Equipment	Rough Terrain Forklifts	4 Stroke
2265002060	Construction and Mining Equipment	Rubber Tire Loaders	4 Stroke
2265002066	Construction and Mining Equipment	Tractors/Loaders/Backhoes	4 Stroke
2265002072	Construction and Mining Equipment	Skid Steer Loaders	4 Stroke
2265002078	Construction and Mining Equipment	Dumpers/Tenders	4 Stroke
2265002081	Construction and Mining Equipment	Other Construction Equipment	4 Stroke
2265003010	Industrial Equipment	Aerial Lifts	4 Stroke
2265003020	Industrial Equipment	Forklifts	4 Stroke
2265003030	Industrial Equipment	Sweepers/Scrubbers	4 Stroke
2265003040	Industrial Equipment	Other General Industrial Equipment	4 Stroke
2265003050	Industrial Equipment	Other Material Handling Equipment	4 Stroke
2265004010	Lawn and Garden Equipment	Lawn mowers	4 Stroke
2265004015	Lawn and Garden Equipment	Rotary Tillers < 6 hp	4 Stroke
2265004025	Lawn and Garden Equipment	Trimmers/Edgers/Brush Cutter	4 Stroke
2265004030	Lawn and Garden Equipment	Leafblowers/Vacuums	4 Stroke
2265004040	Lawn and Garden Equipment	Rear Engine Riding Mowers	4 Stroke
2265004045	Lawn and Garden Equipment	Front Mowers	4 Stroke

Table 2 (cont'd.)

2265004050	Lawn and Garden Equipment	Shredders < 6 hp	4 Stroke
2265004055	Lawn and Garden Equipment	Lawn & Garden Tractors	4 Stroke
2265004060	Lawn and Garden Equipment	Wood Splitters	4 Stroke
2265004065	Lawn and Garden Equipment	Chippers/Stump Grinders	4 Stroke
2265004070	Lawn and Garden Equipment	Commercial Turf Equipment	4 Stroke
2265004075	Lawn and Garden Equipment	Other Lawn and Garden Equipment	4 Stroke
2265005010	Agricultural Equipment	2-Wheel Tractors	4 Stroke
2265005015	Agricultural Equipment	Agricultural Tractors	4 Stroke
2265005020	Agricultural Equipment	Combines	4 Stroke
2265005030	Agricultural Equipment	Agricultural Mowers	4 Stroke
2265005035	Agricultural Equipment	Sprayers	4 Stroke
2265005040	Agricultural Equipment	Tillers > 6 hp	4 Stroke
2265005045	Agricultural Equipment	Swathers	4 Stroke
2265005050	Agricultural Equipment	Hydro Power Units	4 Stroke
2265005055	Agricultural Equipment	Other Agricultural Equipment	4 Stroke
2265006005	Commercial Equipment	Generator Sets	4 Stroke
2265006010	Commercial Equipment	Pumps	4 Stroke
2265006015	Commercial Equipment	Air Compressors	4 Stroke
2265006025	Commercial Equipment	Welders	4 Stroke
2265006030	Commercial Equipment	Pressure Washers	4 Stroke
2265008005	Airport Ground Support Equipment	Airport Support Equipment	4 Stroke
2265008010	Airport Ground Support Equipment	Terminal Tractors	4 Stroke
2270001060	Recreational Equipment	Specialty Vehicle Carts	Diesel
2270002003	Construction and Mining Equipment	Pavers	Diesel
2270002009	Construction and Mining Equipment	Plate Compactors	Diesel
2270002012	Construction and Mining Equipment	Concrete Pavers	Diesel
2270002015	Construction and Mining Equipment	Rollers	Diesel
2270002018	Construction and Mining Equipment	Scrapers	Diesel
2270002021	Construction and Mining Equipment	Paving Equipment	Diesel
2270002027	Construction and Mining Equipment	Signal Boards/Light Plants	Diesel
2270002030	Construction and Mining Equipment	Trenchers	Diesel
2270002033	Construction and Mining Equipment	Bore/Drill Rigs	Diesel
2270002036	Construction and Mining Equipment	Excavators	Diesel
2270002039	Construction and Mining Equipment	Concrete/Industrial Saws	Diesel
2270002042	Construction and Mining Equipment	Cement & Mortar Mixers	Diesel
2270002045	Construction and Mining Equipment	Cranes	Diesel
2270002048	Construction and Mining Equipment	Graders	Diesel
2270002051	Construction and Mining Equipment	Off-highway Trucks	Diesel
2270002054	Construction and Mining Equipment	Crushing/Proc. Equipment	Diesel
2270002057	Construction and Mining Equipment	Rough Terrain Forklifts	Diesel
2270002060	Construction and Mining Equipment	Rubber Tire Loaders	Diesel
2270002063	Construction and Mining Equipment	Rubber Tire Dozers	Diesel
2270002066	Construction and Mining Equipment	Tractors/Loaders/Backhoes	Diesel
2270002069	Construction and Mining Equipment	Crawler Tractors	Diesel
2270002072	Construction and Mining Equipment	Skid Steer Loaders	Diesel
2270002075	Construction and Mining Equipment	Off-highway Tractors	Diesel
2270002078	Construction and Mining Equipment	Dumpers/Tenders	Diesel
2270002081	Construction and Mining Equipment	Other Construction Equipment	Diesel
2270003010	Industrial Equipment	Aerial Lifts	Diesel
2270003020	Industrial Equipment	Forklifts	Diesel
2270003030	Industrial Equipment	Sweepers/Scrubbers	Diesel
2270003040	Industrial Equipment	Other General Industrial Equipment	Diesel
2270003050	Industrial Equipment	Other Material Handling Equipment	Diesel
2270004040	Lawn and Garden Equipment	Rear Engine Riding Mowers	Diesel
2270004055	Lawn and Garden Equipment	Lawn & Garden Tractors	Diesel
2270004065	Lawn and Garden Equipment	Chippers/Stump Grinders	Diesel
2270004060	Lawn and Garden Equipment	Wood Splitters	Diesel
2270004070	Lawn and Garden Equipment	Commercial Turf Equipment	Diesel
2270004075	Lawn and Garden Equipment	Other Lawn and Garden Equipment	Diesel
2270005015	Agricultural Equipment	Agricultural Tractors	Diesel
2270005020	Agricultural Equipment	Combines	Diesel

Table 2 (cont'd.)

2270005025	Agricultural Equipment	Balers	Diesel
2270005035	Agricultural Equipment	Sprayers	Diesel
2270005045	Agricultural Equipment	Swathers	Diesel
2270005050	Agricultural Equipment	Hydro Power Units	Diesel
2270005055	Agricultural Equipment	Other Agricultural Equipment	Diesel
2270006005	Commercial Equipment	Generator Sets	Diesel
2270006010	Commercial Equipment	Pumps	Diesel
2270006015	Commercial Equipment	Air Compressors	Diesel
2270006025	Commercial Equipment	Welders	Diesel
2270006030	Commercial Equipment	Pressure Washers	Diesel
2270008005	Airport Ground Support Equipment	Airport Support Equipment	Diesel
2270008010	Airport Ground Support Equipment	Terminal Tractors	Diesel
2275001000	Aircraft, Military	Military Transport	Aviation
2275020000	Aircraft, Commercial	Medium Range Jet	Aviation
2275050000	Aircraft, General Aviation	General Aviation	Aviation
2275060000	Aircraft	Piston Transport	Aviation
2275070000	Aircraft	Auxiliary Power Units	Aviation
2280002000	Marine Vessels	Total, All Vessel Types	Diesel
2280003000	Marine Vessels	Total, All Vessel Types	Residual
2282005010	Pleasure Craft	Outboard	2 Stroke
2282005025	Pleasure Craft	Sailboat/Auxiliary Outboard	2 Stroke
2282010005	Pleasure Craft	Inboard/Stern drive	4 Stroke
2282010010	Pleasure Craft	Outboard	4 Stroke
2282010015	Pleasure Craft	Inboard/Stern drive	4 Stroke
2282010020	Pleasure Craft	Sailboat/Auxiliary Inboard	4 Stroke
2282010025	Pleasure Craft	Sailboat/Auxiliary Outboard	4 Stroke
2282020005	Pleasure Craft	Inboard/Stern drive	Diesel
2282020020	Pleasure Craft	Sailboat/Auxiliary Inboard	Diesel
2285000000	Railroad Equipment	All	All

Table 3
BEA GROWTH RATES FOR NEW YORK STATE BY SIC
1990 BASE

SIC	Source	1995	2007
01,02	Farm	0.795	1.084
07,08,09	Agricultural Services	1.162	1.472
11,12	Coal mining	1.000	1.330
13	Oil & Gas Extraction	0.437	1.191
10	Metal mining	1.824	0.779
14	Nonmetal mining	1.101	1.277
15,16,17	Construction	0.916	1.190
	Total manufacturing	1.025	1.088
	Nondurable manufacturing	1.088	1.115
20	Food manufacturing	1.050	0.929
22	Textile mill	0.882	0.936
23	Apparel manufacturing	0.860	0.959
26	Paper manufacturing	1.222	1.153
27	Printing & Publishing	1.334	1.281
28	Chemical manufacturing	1.090	1.106
29	Petroleum production	1.029	0.812
21	Tobacco manufacturing	2.206	0.848
30	Rubber and Plastics	1.160	1.306
31	Leather manufacturing	1.104	0.846
32	Durables manufacturing	0.970	1.067
24	Lumber production	1.010	1.361
25	Furniture	0.995	1.164
33	Primary metal	1.025	0.869
34	Fabricated metal	1.180	1.140
35	Nonelectric machinery	0.926	1.025
36	Electronic machinery	0.942	1.069
37	Transportation equipment	0.705	1.101
38	Instruments	0.829	1.113
39	Miscellaneous mfg.	1.026	0.951
	TI transportation + utilities	1.152	1.169
40	Railroad transportation	0.975	0.828
42	Trucking	1.078	1.267
44	Water transportation	0.846	0.830
41	Local transportation	1.273	1.245
45	Air transportation	1.064	1.196
46	Pipelines	1.083	1.139
47	Transportation services	0.962	1.110
48	Communications	1.228	1.130
49	Utilities	1.137	1.245
50,51	Wholesale Trade	1.069	1.185
52-59	Retail trade	1.138	1.256
	TI F.I.R.E	1.326	1.229
60-61	Banks, credit	1.477	1.292
62	Investment	1.947	1.152
63,64	Insurance	1.412	1.342
65	Real Estate	1.190	1.150
	TI Services	1.221	1.412
70	Hotels	1.273	1.328
72	Personal services	1.106	1.272
	Private household	1.206	1.040
73,76	Business services	1.150	1.499
75	Auto repair	1.029	1.407
78,79	Amusements	1.075	1.331
80	Health services	1.384	1.418
81,92	Legal services	1.112	1.506
82	Educational services	1.231	1.303
83	Social services	1.431	1.311
84,87,95	Miscellaneous services	0.860	1.348