

**NYSERDA CLEAN DIESEL TECHNOLOGY:
NON-ROAD FIELD DEMONSTRATION PROGRAM
Development of the 2002 Locomotive Survey for New York State**

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ABSTRACT

The primary goal of NYSERDA's Non-Road Clean Diesel Program is to demonstrate and evaluate the feasibility and performance of commercially available emission control technologies for reduction of particulate matter (PM) and oxides of nitrogen (NO_x) emissions. Research and planning activities for these demonstrations included development of current non-road equipment and emissions inventories for New York State (hereafter "NYS") and the New York City Metropolitan Area (hereafter "NYCMA").

As subcontractor to Southern Research Institute (Southern), E.H. Pechan & Associates, Inc. (Pechan) conducted a survey of the national, regional, and local freight railroads, as well as passenger and commuter rail lines operating in NYS. This report presents the approach, rationale, and findings regarding the design and completion of the survey for the development of an updated and more representative locomotive inventory in NYS

Data collection began in July 2005 and was completed in May 2006. Pechan compiled and analyzed the activity data provided by the survey participants and developed fuel consumption estimates for each rail line, where feasible. Pechan then applied EPA emission factors to the annual fuel consumption data by county to estimate county-level criteria pollutant emissions, including NO_x, PM less than or equal to 10 and 2.5 micrometers (PM₁₀, PM_{2.5}), carbon monoxide (CO), sulfur dioxide (SO₂), and volatile organic compounds (VOCs).

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ACRONYMS AND ABBREVIATIONS

AAR	Association of American Railroads
BTS	Bureau of Transportation Statistics
CO	carbon monoxide
EPA	Environmental Protection Agency
GIS	geographic information system
GTM	gross ton-miles (traffic density)
NEI	National Emissions Inventory
NIF	NEI Input Format
NO _x	oxides of nitrogen
NYCMA	New York City Metro Area
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYDOT	New York Department of Transportation
NYSERDA	New York State Energy Research and Development Authority
Pechan	E.H. Pechan & Associates, Inc.
PM	particulate matter
PM ₁₀	particulate matter less than or equal to 10 micrometers
PM _{2.5}	particulate matter less than or equal to 2.5 micrometers
QA	quality assurance
RONY	Railroads of New York
SCC	source classification code
SO ₂	sulfur dioxide
Southern	Southern Research Institute
TPY	total per year
U.S.	United States
VOC	volatile organic compounds

SUMMARY

To address the issues associated with the fleet of diesel engines in NYS, NYSDERDA initiated the Non-Road Clean Diesel Program. The program's goal is to demonstrate and evaluate the feasibility and performance of commercially available emission control technologies in reducing emissions of particulate matter (PM) and oxides of nitrogen (NO_x). To maximize the validity of the study, the program will conduct demonstrations using in-use field testing approaches on major non-road diesel polluters in NYS and the NYCMA. The in-use field demonstration portion of the project will be conducted with the participation of equipment owners and operators in the NYCMA, as well as emission control technology vendors.

An important aspect of the Clean Diesel Program was the development of an inventory of locomotive activity in NYS. Diesel locomotive equipment is a significant contributor to non-road emissions on PM and NO_x and to date, a bottom up inventory of locomotive activity has not been conducted for NYS.

The locomotive inventory is based on a survey conducted of the national, regional, and local freight railroads, as well as passenger and commuter rail lines operating in NYS. The survey collected information on:

- 2002 locomotive fuel use or other available measures of activity, including traffic density, or gross ton-miles (GTM), miles of rail track, and time spent idling; and
- locomotive engines in operation by age, size, and type to assist in fleet characterization and in examining retrofit options.

Data collection began in July 2005 and was completed in May 2006. Fuel consumption was estimated for each rail line, where feasible, by compiling and analyzing activity data provided by the survey participants. EPA emission factors found in the EPA Report AP-42 were then applied to the annual fuel consumption data by county to estimate county-level criteria pollutant emissions, including:

- NO_x;
- PM less than or equal to 10 and 2.5 micrometers (PM₁₀, PM_{2.5});
- carbon monoxide (CO);
- sulfur dioxide (SO₂); and
- volatile organic compounds (VOCs).

Table S-1 lists the freight line haul, passenger/commuter, and switchyard locomotive operations that were contacted for the survey effort, as well as the response obtained from each.

Table S-1. NYS Rail Companies Contacted and Data Obtained in the Survey Effort

Rail Line	Fuel/Activity Data	Fleet Data	No Data	Comments
Class I				
Canadian Pacific Railway	X	X		
CSX Transportation	X			
Norfolk Southern Corporation	X			
Canadian National			X	Only operate 5 miles in NY; not estimating
Class II/III				
Arcade & Attica Railroad			X	
New York & Ogdensburg Railway Co. Claredon & Pittsford Railroad Vermont Railway	X	X		Only provided fuel consumption for NY & Ogdensburg Line
Batten Kill Railroad Co, Inc.			X	
Central New York Railroad			X	
Genesee Valley Transportation Depew, Lancaster & Western Railroad Falls Road Railroad Co., Inc. Lowville & Beaver River Railroad Mohawk, Adirondack & Northern Railroad Finger Lakes Railway Corp.	X	X		
Genesee & Wyoming Railroad	X	X		Provided total fuel consumption and equidistant track length per county
Guilford Rail System			X	
Housatonic Railroad Co., Inc.			X	
Livonia, Avon & Lakeville Railroad Corp. Livonia, Avon & Lakeville Railroad B&H Rail Corp. Ontario Central Railroad Western New York & Pennsylvania Railroad Middletown and New Jersey Rwy. Co. Inc.			X	
New York & Atlantic Railway	X	X		Provided overall fuel consumption; fleet data from Long Island RR survey
New York & Lake Erie Railroad	X			Provided estimate of fuel consumption; operates primarily in Cattaraugus Co.
New York Crossharbor Railroad			X	Carfloat operations- not estimating
New York, Susquehanna & Western Rwy	X			Provided total fuel consumption and track length
Ontario Midland Railroad Corp.	X			Provided total fuel consumption, gross tons, and track length by county
Providence and Worcester Railroad Co.			X	Partial data provided, including track mileage and operating schedule for trains that service NY (most activity outside NYS)
Somerset Railroad Corp.			X	
Wellsboro & Corning Railroad			X	
Passenger/Commuter				
Amtrak	X	X		Provided system wide fuel consumption and fleet data
Adirondack Scenic Rail Lines	X			Provided fuel consumption and track mileage by mile marker.
NJ Transit Rail			X	Main & Bergen County Line and Pascack Valley Line end in NY
Long Island Railroad	X			
Metro-North Railroad	X	X		Provided total fuel consumption and track length
Yard Operations^a				
Albany Port Railroad Corp.			X	
Buffalo Southern Railroad	X			Provided estimate of 2002 fuel consumption by quarter based on fuel purchased
Owego & Hartford Railway, Inc.	X			
New York & Atlantic Railway	X	X		
R.J. Corman Railroad Group Allentown Lines			X	Only operate 5 miles in NY - not estimating

^a Some Class I rail lines also operate several switchyards, but could not provide separate estimates of switchyard fuel consumption.

To estimate emissions, SCC fuel consumption (gallons) was multiplied by the corresponding EPA national emission factor (grams/gallon). Emissions were then converted from grams to tons. NO_x emissions were further adjusted to account for the EPA's phased-in controls for NOX emissions. Table S-2 summarizes NYS 2002 fuel consumption and emissions estimates based on the survey data for the five classes of locomotives.

Table S-2. NYS Survey-Based Fuel Consumption and 2002 Emissions (tpy)

SCC Description	Fuel (gal/year)	CO	NO _x	PM ₁₀	PM _{2.5}	SO ₂	VOC
Class I Line Haul	68,491,497	2,008.3	17,939	505.8	475.6	1,230.6	755.0
Class II/III Line Haul	3,513,863	103.0	1,046	26.0	24.4	63.1	38.7
Line Haul Passenger (Amtrak)	6,430,000	188.5	1,914	47.5	44.7	115.5	70.9
Line Haul Commuter	13,623,376	399.5	4,055	100.6	94.6	244.8	150.2
Yard Locomotive	261,347	11.0	102	2.7	2.4	4.7	6.0

As a reasonableness check, the survey-based emissions estimates were compared to the EPA's 2002 Final National Emission Inventory (NEI). Table S-3 shows the comparison for NO_x emissions by SCC.

Table S-3. Comparison of NYS 2002 NEI with NYS Survey-Based NO_x Emissions (tpy)

Description	NEI	NYS	Difference	Percent Difference
Class I Line Haul	10,520	17,939	7,419	70.5%
Class II/III Line Haul	9	1,046	1,037	11522.2%
Line Haul Passenger (Amtrak)	521	1,914	1,393	267.4%
Line Haul Commuter	85	4,055	3,970	4670.6%
Yard Locomotive ^a	2,979	102	(2,877)	(96.6%)
<i>Total</i>	14,115	25,055	10,942	77.5%

^aIn many cases data was not provided on yard locomotives, especially for Class I Line Haul rail lines. As a result, these emissions are included in the estimate of total Class I Line Haul emissions.

Emissions estimates based on the survey data for all locomotive categories are higher than the NEI estimates, with the exception of switchyards. For the survey effort, the amount of fuel, and thus, emissions, for Class I rail lines attributed to switchyard operations could not be separated from the Class I SCC. Thus, switchyard emission levels may actually be higher than estimated and emissions for Class I line haul locomotives may be lower.

1.0 INTRODUCTION

Diesel engines can be highly energy efficient and durable, yet emissions from diesel engines have historically contributed to a number of serious air pollution problems. Recognizing this, the United States Environmental Protection Agency (EPA) has passed regulations to reduce emissions from *new* diesel engines for on-road and, more recently, off-road applications. These regulations will also require the use of lower sulfur diesel fuel by on- and off-road vehicles, and will be phased in starting in 2006. Existing diesel engines, however, in the on-road and off-road inventory will continue to emit higher levels of pollutants including particulate matter (PM), nitrogen oxides (NO_x), carbon monoxide (CO), and air toxics. Within New York State (NYS), diesel emissions significantly impact ambient air quality, and contribute to non-attainment of air quality standards in areas such as the New York City Metro Area (NYCMA). In fact, in 2002, diesel powered off-road equipment operated in NYS emitted an estimated 91,028 tons per year (tpy) of NO_x and 7,311 tpy of PM, an estimated 77% and 64% of the total statewide off-road NO_x and PM emissions, respectively [1].

To address the issues associated with the fleet of diesel engines, NYSERDA initiated the Non-Road Clean Diesel Program. The program's goal is to demonstrate and evaluate the feasibility and performance of commercially available emission control technologies in reducing emissions of particulate matter (PM) and oxides of nitrogen (NO_x). To maximize the validity of the study, the program will conduct demonstrations using in-use field testing approaches on major non-road diesel polluters in NYS and the NYCMA. The in-use field demonstration portion of the project will be conducted with the participation of equipment owners and operators in the NYCMA, as well as emission control technology vendors.

Diesel locomotive equipment is a significant contributor to off-highway emissions of PM and NO_x. The EPA's draft NONROAD 2004 model estimates that the railroad sector accounts for 6% (410 tpy) of non-road diesel PM and 17% (15,340 tpy) of non-road diesel NO_x emissions in NYS [1]. To date, a bottom-up inventory of locomotive activity has not been conducted for NYS. As subcontractor to Southern Research Institute (Southern), E.H. Pechan & Associates, Inc. (Pechan) conducted a survey of the national, regional, and local freight railroads, as well as passenger and commuter rail lines operating in NYS.

The survey collected information on 2002 locomotive fuel use or other available measures of activity, including traffic density, or gross ton-miles (GTM), miles of rail track, and time spent idling. The survey also requested data on the number of locomotive engines in operation by age, size, and type to assist in fleet characterization and in examining retrofit options. The approach for collecting data is described in Pechan's research plan for the locomotive inventory [2].

Pechan began data collection in July 2005 and completed data collection in May 2006. Pechan compiled and analyzed the activity data provided by the survey participants and developed fuel consumption estimates for each rail line, where feasible. Pechan then applied EPA emission factors to the annual fuel consumption data by county to estimate county-level criteria pollutant emissions, including NO_x, PM less than or equal to 10 and 2.5 micrometers (PM₁₀, PM_{2.5}), carbon monoxide (CO), sulfur dioxide (SO₂), and volatile organic compounds (VOCs).

Goals of the survey were to:

- develop an up-to-date locomotive equipment profile and emission inventory for NYS by collecting data on fuel use, locomotive activity gross tons-mile (GTM), miles traveled per day, idling time, age, size, model, and duty of locomotive engines in NYS; and
- prepare an emissions inventory based on the survey data and EPA emission factors.

2.0 SURVEY OF LOCOMOTIVE ACTIVITY

2.1. SURVEY DESCRIPTION

Distillate oil (diesel fuel) is the primary fuel consumed by railroad locomotives. Locomotives can perform two types of operations: line haul or yard, also known as switch. Line haul locomotives generally travel between distant locations, such as from one city to another. Line haul operations may be further categorized as freight or commuter. Yard, or switch locomotives are primarily responsible for moving railcars within a particular railway yard.

Railroads are classified as Class I, II, or III based on their annual revenues. Class I railroads are large, nationwide, long-distance line haul railroads that are involved in the bulk of railroad commerce in the United States (U.S.). Class II and III railroads consist primarily of regional and local line haul and switching railroads, which operate in a more confined geographic area than the Class I railroads.

Pechan developed a list of survey questions for each of the four categories of locomotives (Class I, Class II/III, switchyard, and commuter/passenger). The questionnaire is provided in Appendix A. The survey requested 2002 estimates of fuel consumption or surrogate data to estimate fuel consumption, as well as information to characterize the railroad's operating fleet. Locomotive activity data are often tracked in different formats and measures, or cover various geographic areas. Because of this, Pechan contacted each rail company and determined the best method for estimating county-level fuel consumption on a case-by-case basis.

Table 2-1 lists the freight line haul, commuter/passenger, and switchyard locomotive operations that Pechan contacted for this effort. This list was based primarily on a report by the Association of American Railroads entitled *2002 Freight Railroads Operating in New York* [3]. Additional railroads were identified through the American Short Line and Regional Railroad Association [4]. For some railroads, track mileage in NYS was negligible and, as such, activity and emissions were not estimated. It should also be noted that additional commuter lines, including Staten Island Rail, the New York City Port Authority Trans-Hudson line, and AirTrain, a light rail system to Kennedy Airport, were established to operate electric-powered railcars only, and were therefore not inventoried.

Pechan's initial efforts to contact the Class II/III and passenger/commuter rail lines by phone did not yield many responses. NYSERDA followed up with a letter to many of the unresponsive rail lines, which yielded more responses. In all, Pechan obtained data from three of the four surveyed Class I rail lines, seven of the 27 surveyed Class II/III lines, four of the five surveyed passenger/commuter lines, and three of the five surveyed switch yards.

Table 2-1. NYS Rail Companies Contacted and Data Obtained

Rail Line	Fuel/Activity Data	Fleet Data	No Data	Comments
Class I				
Canadian Pacific Railway	X	X		
CSX Transportation	X			
Norfolk Southern Corporation	X			
Canadian National			X	Only operate 5 miles in NY; not estimating
Class II/III				
Arcade & Attica Railroad			X	
New York & Ogdensburg Railway Co. Claredon & Pittsford Railroad Vermont Railway	X	X		Only provided fuel consumption for NY & Ogdensburg Line
Batten Kill Railroad Co, Inc.			X	
Central New York Railroad			X	
Genesee Valley Transportation Depew, Lancaster & Western Railroad Falls Road Railroad Co., Inc. Lowville & Beaver River Railroad Mohawk, Adirondack & Northern Railroad Finger Lakes Railway Corp.	X	X		
Genesee & Wyoming Railroad	X	X		Provided total fuel consumption and equidistant track length per county
Guilford Rail System			X	
Housatonic Railroad Co., Inc.			X	
Livonia, Avon & Lakeville Railroad Corp. Livonia, Avon & Lakeville Railroad B&H Rail Corp. Ontario Central Railroad Western New York & Pennsylvania Railroad Middletown and New Jersey Rwy. Co. Inc.			X	
New York & Atlantic Railway	X	X		Provided overall fuel consumption; fleet data from Long Island RR survey
New York & Lake Erie Railroad	X			Provided estimate of fuel consumption; operates primarily in Cattaraugus Co.
New York Crossharbor Railroad			X	Carfloat operations- not estimating
New York, Susquehanna & Western Rwy	X			Provided total fuel consumption and track length
Ontario Midland Railroad Corp.	X			Provided total fuel consumption, gross tons, and track length by county
Providence and Worcester Railroad Co.			X	Partial data provided, including track mileage and operating schedule for trains that service NY (most activity outside NYS)
Somerset Railroad Corp.			X	
Wellsboro & Corning Railroad			X	
Passenger/Commuter				
Amtrak	X	X		Provided system wide fuel consumption and fleet data
Adirondack Scenic Rail Lines	X			Provided fuel consumption and track mileage by mile marker.
NJ Transit Rail			X	Main & Bergen County Line and Pascack Valley Line end in NY
Long Island Railroad	X			
Metro-North Railroad	X	X		Provided total fuel consumption and track length
Yard Operations^a				
Albany Port Railroad Corp.			X	
Buffalo Southern Railroad	X			Provided estimate of 2002 fuel consumption by quarter based on fuel purchased
Owego & Hartford Railway, Inc.	X			
New York & Atlantic Railway	X	X		
R.J. Corman Railroad Group Allentown Lines			X	Only operate 5 miles in NY - not estimating

^a Some Class I rail lines also operate several switchyards, but could not provide separate estimates of switchyard fuel consumption.

The following sections discuss the fuel and activity information provided by respondents within each locomotive category. The data characterizing each railroad's locomotive fleet are described in Section 2.6

2.2. CLASS I

Class I railroads are large, long-distance line haul railroads that are involved in the bulk of the railroad commerce in the U.S. CSX Corporation and Norfolk Southern are two U.S. owned lines that operate in New York. Canadian Pacific Railway and Canadian National are Canadian-owned lines not affiliated with a U.S. Class I rail subsidiary. With the exception of Canadian National, three of the four Class I lines provided information in response to the survey. Because Canadian National only operates a small fraction of their total track miles in NYS (5 miles), the contribution to activity in New York is minimal and no data were submitted.

Table 2-2 provides a summary of the data submitted by CSX Corporation, Norfolk Southern, and Canadian Pacific for 2002. Both CSX and Norfolk Southern provided county-level estimates of fuel consumed for their operations. Total fuel consumption includes fuel consumed at switchyards operated by these companies. The specific amount of fuel attributed to Class I switchyard operations could not be provided (neither as a value estimate or a fraction estimate), so Pechan could not separate it from the total fuel consumption.

Canadian Pacific provided an estimate of the total fuel consumed by their operations in NYS. County-level fuel data were not provided, so Pechan estimated the fuel consumed by county using track mile data as a surrogate indicator. Canadian Pacific-owned track miles were compiled from a geographic information system (GIS) database available from New York Department of Transportation [5]. Table 2-3 provides the track miles by county as calculated from the GIS shape file. The fraction of miles in each county relative to the total state miles was used to develop county-specific percentages. These percentages were then applied to the total fuel consumption in NYS to estimate county level fuel consumption.

Table 2-2. 2002 Fuel Consumption Data by County for Class I Railroads (gallons)

County	CSX Transportation	Norfolk Southern Corporation	Canadian Pacific Railway^a	Total Class I
Albany	2,014,881	13,093	581,374	2,609,348
Allegany	0	229,018	0	229,018
Bronx	288,167	0	0	288,167
Broome	0	336,253	605,595	941,847
Cattaraugus	0	379,992	0	379,992
Cayuga	753,616	0	0	753,616
Chautauqua	4,248,541	1,091,901	0	5,340,442
Chemung	0	525,303	0	525,303
Chenango	0	61,393	182,261	243,654
Clinton	0	0	593,866	593,866
Columbia	3,109,491	0	0	3,109,491
Cortland	0	0	0	0
Delaware	0	65,030	33,158	98,187
Dutchess	1,773,443	0	0	1,773,443
Erie	6,503,147	1,480,616	0	7,983,763
Essex	0	0	693,602	693,602
Franklin	319,634	0	0	319,634
Fulton	0	0	0	0
Genesee	2,145,019	312,411	0	2,457,430
Greene	799,912	0	0	799,912
Hamilton	0	0	0	0
Herkimer	1,670,549	0	0	1,670,549
Jefferson	2,143,200	0	0	2,143,200
Kings	0	0	0	0
Lewis	0	0	0	0
Livingston	0	193,807	0	193,807
Madison	919,016	0	0	919,016
Monroe	3,450,259	0	0	3,450,259
Montgomery	2,850,294	0	0	2,850,294
Nassau	0	0	0	0
New York	0	0	0	0
Niagara	1,793,066	27,607	0	1,820,673
Oneida	1,908,769	0	0	1,908,769
Onondaga	3,502,459	0	0	3,502,459
Ontario	0	9,028	0	9,028
Orange	867,983	130,273	0	998,256
Orleans	0	0	0	0
Oswego	2,685,226	0	0	2,685,226
Otsego	0	193,212	663,713	856,926
Putnam	0	0	0	0
Queens	265,640	0	0	265,640
Rensselaer	1,773,299	0	27,892	1,801,191
Richmond	0	0	0	0
Rockland	787,560	14,999	0	802,559
St. Lawrence	2,931,363	0	0	2,931,363
Saratoga	0	0	1,176,972	1,176,972
Schenectady	1,531,729	43,883	545,848	2,121,460
Schoharie	0	86,305	254,265	340,570
Schuyler	0	29,473	0	29,473
Seneca	0	358	0	358
Steuben	0	1,065,587	0	1,065,587

County	CSX Transportation	Norfolk Southern Corporation	Canadian Pacific Railway ^a	Total Class I
Suffolk	0	0	0	0
Sullivan	0	50,229	0	50,229
Tioga	0	512,875	0	512,875
Tompkins	0	57,047	0	57,047
Ulster	1,339,084	0	0	1,339,084
Warren	0	0	34,713	34,713
Washington	0	0	718,723	718,723
Wayne	2,470,405	0	0	2,470,405
Westchester	0	0	0	0
Wyoming	0	581,975	0	581,975
Yates	0	42,096	0	42,096
Total	54,845,752	7,533,764	6,111,981	68,491,497

^a County-level fuel consumption estimated based on county track mileage.

Table 2-3. Canadian-Pacific Track Mileage Data by County

County	Miles	Fraction of Total Miles
Albany	50	10%
Broome	52	10%
Chenango	16	3%
Clinton	51	10%
Delaware	3	1%
Essex	59	11%
Otsego	57	11%
Rensselaer	2	0%
Saratoga	100	19%
Schenectady	47	9%
Schoharie	22	4%
Warren	3	1%
Washington	61	12%
Total NYS	522	

2.3. CLASS II/III

Class II and III railroads consist primarily of regional and local railroads, which operate in a more confined geographic area than the Class I railroads. Unlike Class I railroads, Class II/III railroads are not required to track and report traffic and freight density information to the Surface Transportation Board.

Pechan attempted to obtain information for 27 Class II/III rail lines. Pechan made numerous phone calls to all 27 lines, with little response. NYSERDA also sent letters to all non-responding companies to request fuel consumption and fleet data. Overall, Pechan obtained system-wide fuel consumption data for seven rail lines. One Class II/III line provided GTM data to allocate the fuel consumption to counties. Where rail lines operated in more than one county, fuel consumption was allocated to counties using track mileage data, either provided by the survey respondents or compiled from available rail system maps. Rail track

length does not account for traffic density operating along a given segment of rail. However, track mileage was determined to be the best available surrogate for making this allocation. In some cases where reliable track mile data could not be obtained, the fuel consumption was divided equally among operating counties. Table 2-4 shows the fuel consumption estimates for Class II/III rail lines and indicates the source of the data.

Table 2-4. Fuel Consumption Estimates for Class II/III Railroads

Class II/III Rail Line	Fuel Consumption, (gallons / year)	Provided for Survey	Estimated Using Available Carload Data	No Available Carload Data, Not Estimated
Arcade & Attica Railroad				X
New York & Ogdensburg Railway Co.	5,328	X		
Claredon & Pittsford Railroad	19,047		X	
Vermont Railway				X
Batten Kill Railroad Co, Inc.	12,128		X	
Central New York Railroad	43,838		X	
<i>Genesee Valley Transportation</i>				
• <i>Depew, Lancaster & Western Railroad</i>	13,301		X	
• <i>Falls Road Railroad Co., Inc.</i>	31,093		X	
• <i>Lowville & Beaver River Railroad</i>				X
• <i>Mohawk, Adirondack & Northern Railroad</i>	171,790		X	
Finger Lakes Railway Corp.	300,000	X		
Genesee & Wyoming Railroad	800,000	X		
Guilford Rail System				X
Housatonic Railroad Co., Inc.				X
<i>Livonia, Avon & Lakeville Railroad Corp</i>				
• <i>Livonia, Avon & Lakeville Railroad</i>	68,730			
• <i>B&H Rail Corp.</i>	76,235			
• <i>Ontario Central Railroad</i>	1,749			
• <i>Western New York & Pennsylvania Railroad</i>	231,987			
Middletown and New Jersey Rwy. Co. Inc.	1,935		X	
New York & Atlantic Railway	401,447	X		
New York & Lake Erie Railroad	6,000	X		
New York Crossharbor Railroad				X
New York, Susquehanna & Western Rwy	1,010,980	X		
Ontario Midland Railroad Corp.	15,207	X		
Providence and Worcester Railroad Co.	6,605		X	
Somerset Railroad Corp.	294,522		X	
Wellsboro & Corning Railroad	1,941		X	

For those rail lines that did not respond to the survey, Pechan compiled activity information available from Railroads of New York (RONY) [6]. This data included the annual number of carloads and the number of route miles in NYS. These two values were multiplied together to calculate carload-miles, which provides an estimate of how far trains may travel. Ideally, the actual number of miles traveled per train would be used, similar to how train-miles traveled were estimated for commuter lines (see Section 2.1.3). However, schedule information was not available by train, and the number of miles traveled could not be estimated.

Table 2-5 shows the carload-mile data compiled for the seven survey respondents. The 2002 fuel consumption reported by each rail line was then divided by the corresponding carload-miles to estimate fuel consumed per carload-mile.

Table 2-5. Fuel Consumption Factors Calculated from Railroad Survey Respondents

	Carloads	Miles in NY	Carload-Miles	Fuel Cons. (gal)	Fuel Consumed per Carload-Mile
Small Rail Lines					
New York and Lake Erie	250	19.5	4,875	6,000	1.23
New York & Ogdensburg Railway Co.	281	30	8,430	5,328	0.63
Ontario Midland	450	46.4	20,880	15,207	0.73
				<i>Average</i>	<i>0.86</i>
Large Rail Lines					
Finger Lakes Railway	16,252	140	2,275,280	300,000	0.13
New York, Susquehanna & Western Rwy	14,316	330	4,724,300	1,010,980	0.21
Genesee & Wyoming	70,608	333	23,512,395	800,000	0.03
New York and Atlantic	20,720	264	5,470,080	401,447	0.07
				<i>Average</i>	<i>0.11</i>

Pechan divided the survey respondents into small and large rail lines, depending on their carload-mile values. Fuel consumed per carload-mile for the large railroads was lower than for the small rail lines, likely due to a more fuel efficient fleet that traveled farther distances. Rather than applying the same fuel consumption factor to all remaining railroads, Pechan calculated two values: one to apply to small railroads and one to apply to large railroads. Large and small designations were based on system-wide carload-miles. Railroads with an estimated system-wide carload-mile value of less than 2 million were classified as smaller railroads. The fuel consumption factor calculated in Table 2-5 for small railroads (0.86 gallons per carload-mile) was used for these railroads. For railroads with a carload-mile value over 2 million, the fuel consumption factor calculated in Table 2-5 for large railroads (0.11 gallons per carload-mile) was used.

Table 2-6 shows the carload-mile values and resulting fuel consumption estimates for those railroads not responding to the survey. Where rail lines operated in other states, carload-miles were adjusted to account for traffic in NYS only. For several railroads, carload information was not reported by RONY. These are noted "NA" (not available) in the table. As such, Pechan was not able to estimate fuel consumption and emissions for these rail lines. Most of the unavailable data was for small rail lines, with the exception of Guilford Rail System. This is a larger regional railroad, but only operates trains in New York on a small portion of its system-wide route (only 53 out of 1,500 total miles).

Table 2-6. Fuel Consumption (gallons) Estimates for Remaining Class II/III Railroads

	System-Wide Miles	System-Wide Carloads	System-Wide Carload-Miles ^a	Miles Operated in NYS	Carloads (Adjusted for Mileage in NYS) ^a	Carload-Miles in NYS ^a	Fuel Consumption ^a
Small Rail Lines							
Ontario Central Railroad	13.5	150	2,025	13.5	150	2,025	1,749
Middletown and New Jersey Rwy. Co. Inc.	14	160	2,240	14	160	2,240	1,935
Wellsboro & Corning Railroad	35	650	22,750	11	204	2,247	1,941
Batten Kill	34	413	14,042	34	413	14,042	12,128
Depew, Lancaster & Western Railroad	14	1,100	15,400	14	1,100	15,400	13,301
Falls Road Railroad Co., Inc.	45	800	36,000	45	800	36,000	31,093
Livonia, Avon & Lakeville Railroad Corp.	29	2,744	79,576	29	2,744	79,576	68,730
B&H Rail Corp.	47	1,878	88,266	47	1,878	88,266	76,235
Central New York Railroad	123	854	105,042	86	594	50,756	43,838
Mohawk, Adirondack & Northern Railroad	117	1,700	198,900	117	1,700	198,900	171,790
Claredon & Pittsford Railroad	26	12,400	322,400	7	3,243	22,053	19,047
Somerset Railroad Corp.	16	22,000	341,000	16	22,000	341,000	294,522
Arcade & Attica Railroad	15	NA	NA	15	NA	NA	NA
Lowville & Beaver River Railroad	11	NA	NA	11	NA	NA	NA
Housatonic Railroad Co., Inc.	NA	NA	NA	NA	NA	NA	NA
Vermont Railway	3	NA	NA	3	NA	NA	NA
New York Crossharbor RR	4	NA	NA	4	NA	NA	NA
Large Rail Lines							
Western NY & PA Railroad	227	25,126	5,703,602	136	15,053	2,047,271	231,987
Providence and Worcester Railroad Co.	525	34,000	17,850,000	30	1,943	58,286	6,605
Guilford Rail System	1,500	NA	NA	53	NA	NA	NA

^a Some discrepancies may occur due to rounding

The largest of the “small” railroads reported system-wide carload miles of 341,000 and 322,000 (Somerset Railroad Corp. and Claredon & Pittsford Railroad, respectively). This is considerably below 2 million, but also well above 20,880, which is the carload-mile value for the largest “small” railroad for which Pechan obtained actual fuel consumption data (see Table 2-5). This indicates that the 0.86 gal/carload-mile fuel consumption factor may be an overestimate.

2.4. PASSENGER AND COMMUTER LINES

Pechan requested information from Amtrak and several of the commuter rail lines that operate in the New York City Metropolitan Area. Table 2-7 summarizes the fuel consumption estimates obtained from each of the passenger/commuter lines that operate diesel locomotive cars. In general, fuel consumption was allocated by estimating train-miles traveled based on the number of trains, the schedule for each train, and the length of the route traveled. More complete descriptions of how fuel consumption was allocated for each rail line are in the following subsections.

Table 2-7. System-Wide Fuel Consumption for Passenger/Commuter Lines

Rail Line	Fuel, gallons/year	Notes
Amtrak	6,430,000	Provided by rail line
Metro-North Railroad	4,778,405	Provided by rail line
New Jersey Transit Rail	1,909,687	Estimated based on fuel consumed per train-mile traveled
Long Island Railroad	6,901,381	Provided by rail line
Adirondack Scenic Railway	33,903	Provided by rail line

2.4.1. Amtrak

Amtrak provided total system-wide fuel consumption in NYS. Pechan first calculated the number of trains traveling in New York based on schedules available on Amtrak's website [7]. Pechan compiled the miles of track by route and station, and then estimated the miles of track by county using available maps [8]. The train schedule data were annualized and used in combination with the mileage data to calculate train-miles traveled per line and per county, presented in Table 2-8. It should be noted that all of the trains that run on the two Northeast Corridor Lines (DC to NY and Boston to Virginia Beach) are electric. From the train-mile data, Pechan calculated county allocation fractions for those counties where diesel passenger locomotives operate, shown in Table 2-9. System-wide fuel consumption was then distributed accordingly to the counties.

Table 2-8. Amtrak Route Mileage and Trains Traveled by Line and by County

Rail Line	County	Miles	Trains to NJ				Trains to NY			Total trains per year (to and from NY)	Total diesel train-miles per year
			Weekday trains per year	Weekend trains per year	Extras	Total trains per year	Weekday trains per year	Weekend trains per year	Total trains per year		
Atlantic Coast Service	New York	3				1,825			1,825	3,650	10,950
Northeast Corridor NY-DC	New York	3	8320	2600		10920	8060	2444	10504	21,424	0
	New York	3	3640	624		4264	3640	676	4316	8,580	0
Northeast Corridor Boston-Virginia Beach	New York	8	2860	1092		3952	2912	1040	3952	7,904	0
	Bronx	9	2860	1092		3952	2912	1040	3952	7,904	0
	Westchester	12	2860	1092		3952	2912	1040	3952	7,904	0
	New York	8	2080	312		2392	2080	312	2392	4,784	0
	Bronx	9	2080	312		2392	2080	312	2392	4,784	0
	Westchester	12	2080	312		2392	2080	312	2392	4,784	0
Ethan Allen Express	Washington	29			6	371			365	736	21,344
	Saratoga	33			6	371			365	736	24,288
	Schenectady	7			6	371			365	736	5,152
	Rensselaer	28			6	371			365	736	20,608
	Columbia	29			6	371			365	736	21,344
	Dutchess	47			6	371			365	736	34,592
	Putnam	10			6	371			365	736	7,360
	Westchester	30			6	371			365	736	22,080
	Bronx	3			6	371			365	736	2,208
	New York	9			6	371			365	736	6,624
Vermont	New York	8				365			365	730	5,840
	Bronx	9				365			365	730	6,570
	Westchester	12				365			365	730	8,760
Adirondack	Clinton	36				365			365	730	26,280
	Essex	60				365			365	730	43,800
	Washington	41				365			365	730	29,930
	Saratoga	33				365			365	730	24,090
	Schenectady	7				365			365	730	5,110
	Rensselaer	28				365			365	730	20,440
	Columbia	29				365			365	730	21,170
	Dutchess	47				365			365	730	34,310

Rail Line	County	Miles	Trains to NJ				Trains to NY			Total trains per year (to and from NY)	Total diesel train-miles per year
			Weekday trains per year	Weekend trains per year	Extras	Total trains per year	Weekday trains per year	Weekend trains per year	Total trains per year		
	Putnam	10				365			365	730	7,300
	Westchester	30				365			365	730	21,900
	Bronx	3				365			365	730	2,190
	New York	9				365			365	730	6,570
Lake Shore Limited	New York	9				365			365	730	6,570
	Bronx	3				365			365	730	2,190
	Westchester	31				365			365	730	22,630
	Putnam	10				365			365	730	7,300
	Dutchess	46				365			365	730	33,580
	Columbia	29				365			365	730	21,170
	Rensselaer	28				365			365	730	20,440
	Schenectady	14				365			365	730	10,220
	Montgomery	39				365			365	730	28,470
	Herkimer	25				365			365	730	18,250
	Oneida	28				365			365	730	20,440
	Madison	14				365			365	730	10,220
	Onondaga	32				365			365	730	23,360
	Cayuga	13				365			365	730	9,490
	Wayne	36				365			365	730	26,280
	Monroe	26				365			365	730	18,980
	Livingston	10				365			365	730	7,300
	Genessee	27				365			365	730	19,710
	Erie	45				365			365	730	32,850
	Chatauqua	39				365			365	730	28,470
Cardinal	New York	3				156			156	312	936
Empire Service	Niagara	14	780	312		1092	780	312	1092	2,184	30,576
	Erie	26	780	312		1092	780	312	1092	2,184	56,784
	Genessee	27	780	312		1092	780	312	1092	2,184	58,968
	Livingston	10	780	312		1092	780	312	1092	2,184	21,840
	Monroe	26	780	312		1092	780	312	1092	2,184	56,784
	Wayne	36	780	312		1092	780	312	1092	2,184	78,624

			Trains to NJ				Trains to NY				
Rail Line	County	Miles	Weekday trains per year	Weekend trains per year	Extras	Total trains per year	Weekday trains per year	Weekend trains per year	Total trains per year	Total trains per year (to and from NY)	Total diesel train-miles per year
	Cayuga	13	780	312		1092	780	312	1092	2,184	28,392
	Onondaga	32	780	312		1092	780	312	1092	2,184	69,888
	Madison	14	780	312		1092	780	312	1092	2,184	30,576
	Oneida	28	780	312		1092	780	312	1092	2,184	61,152
	Herkimer	25	780	312		1092	780	312	1092	2,184	54,600
	Montgomery	39	780	312		1092	780	312	1092	2,184	85,176
	Schenectady	14	780	312		1092	780	312	1092	2,184	30,576
	Rensselaer	28	2340	728		3068	2600	832	3432	6,500	182,000
	Columbia	29	2340	728		3068	2600	832	3432	6,500	188,500
	Dutchess	47	2340	728		3068	2600	832	3432	6,500	305,500
	Putnam	10	2340	728		3068	2600	832	3432	6,500	65,000
	Westchester	30	2340	728		3068	2600	832	3432	6,500	195,000
	Bronx	3	2340	728		3068	2600	832	3432	6,500	19,500
	New York	10	2340	728		3068	2600	832	3432	6,500	65,000
Note: Electric service is highlighted in grey											

Table 2-9. Amtrak Diesel Train-Miles and Fuel Consumption per County

County	Total Diesel Train-Miles/Year	Percentage	Fuel (gallons)
Bronx	32,658	1%	84,195
Cayuga	37,882	2%	97,663
Chataqua	28,470	1%	73,398
Clinton	26,280	1%	67,752
Columbia	252,184	10%	650,151
Dutchess	407,982	16%	1,051,811
Erie	89,634	4%	231,084
Essex	43,800	2%	112,920
Genessee	78,678	3%	202,838
Herkimer	72,850	3%	187,813
Livingston	29,140	1%	75,125
Madison	40,796	2%	105,175
Monroe	75,764	3%	195,326
Montgomery	113,646	5%	292,989
New York	102,490	4%	264,228
Niagara	30,576	1%	78,827
Oneida	81,592	3%	210,351
Onondaga	93,248	4%	240,401
Putnam	86,960	3%	224,190
Rensselaer	243,488	10%	627,732
Saratoga	48,378	2%	124,722
Schenectady	51,058	2%	131,632
Washington	51,274	2%	132,189
Wayne	104,904	4%	270,451
Westchester	270,370	11%	697,036
System-wide	2,494,102	100%	6,430,000

2.4.2. Metro-North

Metro-North trains going into Grand Central Terminal are powered by an electric third rail. The Hudson line is powered by the electric third rail until Croton-Harmon in Westchester. The rest of the line is powered by diesel. The Harlem line is powered by the electric third rail until the Southeast stop in Putnam County. The rest of the line is powered by diesel. The entire main line of the New Haven line is electric, using both third rail and overhead catenary wire [9].

Pechan calculated the number of trains based on train schedules and the length of track by route/county that each train travels. Pechan compiled the length of track by route and station (see Table 2-10), calculated the number of trains based on schedules (Table 2-11), and then annualized the schedule data to calculate train-miles traveled per line and per county (Table 2-12). From the train-mile data, county allocation fractions were calculated for the three counties where diesel passenger locomotives operate, shown in Table 2-13. System-wide fuel consumption was then distributed accordingly to the counties. Based on these data, a fuel consumption factor of 3.34 gallons/train-mile traveled was estimated. As described in the next section, this factor was used to estimate fuel consumption for two Metro-North lines originating in New Jersey.

Table 2-10. Metro North Train Station Mileage

Harlem Line			Hudson Line			New Haven Line		
Counties	Stops	Station Mileage	Counties	Stops	Station Mileage	Counties	Stops	Station Mileage
New York	Grand central	0	New York	Grand central	0	New York	Grand central	0
New York	Harlem	4	New York	Harlem	4	New York	Harlem	4
Bronx	Melrose	6	Bronx	Morris Hts	8	Bronx	Fordham	9
Bronx	Tremont	8	Bronx	University Heights	9	Westchester	Mt. Vernon East	14
Bronx	Fordham	9	Bronx	Marble Hill	10	Westchester	Pelham	15
Bronx	Botanical Gardens	10	Bronx	Duyvil	11	Westchester	New Rochelle	17
Bronx	William Bridge	11	Bronx	Spuyten	13	Westchester	Larchmont	19
Bronx	Woodlawn	12	Bronx	Riverdale	14	Westchester	Mamaroneck	21
Bronx	Wakefield	13	Westchester	Ludlow	15	Westchester	Harrison	22
Westchester	MT Vernon West	13	Westchester	Yonkers	16	Westchester	Rye	24
Westchester	Fleetwood	14	Westchester	Glenwood	18	Westchester	Port Chester	26
Westchester	Bronxville	15	Westchester	Greystone	20			
Westchester	Tuckahoe	16	Westchester	Hastings-on-Hudson	21			
Westchester	Crestwood	17	Westchester	Dobbs Ferry	22			
Westchester	Scarsdale	19	Westchester	Ardsley-on-Hudson	23			
Westchester	Hartsdale	21	Westchester	Invington	25			
Westchester	White Plains	22	Westchester	Tarrytown	27			
Westchester	North White Plains	24	Westchester	Phillipse Manor	30			
Westchester	Valhala	25	Westchester	Scarborough	31			
Westchester	Mt. Pleasant	27	Westchester	Ossining	33			
Westchester	Hawthornes	28	Westchester	Croton-Harmon	33			
Westchester	Pleasantville	31	Westchester	Cortlandt	38			
Westchester	Chappaqua	32	Westchester	Peekskill	41			
Westchester	Mount Kisco	37	Putnam	Manitou	46			
Westchester	Bedford Hills	39	Putnam	Garrison	50			
Westchester	Katonah	41	Putnam	Cold Springs	52			
Westchester	Golden's Bridge	44	Putnam	Breakneck Ridge	56			
Westchester	Purdy's	46	Dutchess	Beacon	59			
Westchester	Croton Falls	48	Dutchess	New Hamburg	65			
Putnam	Brewster	52	Dutchess	Poughkeepsie	74			
Putnam	Southeast	53						
Putnam	Patterson	60						
Dutchess	Pawling	64						
Dutchess	Appalachian Trail	66						
Dutchess	Harlem Valley-Wingdale	69						
Dutchess	Dover Plains	77						
Dutchess	Tennille River	80						
Dutchess	Wassac	82						

Table 2-11. Metro-North Train Schedule

Rail Line	County	# of stops	Trains to New York			Trains from New York		
			Per Weekday	Per Weekend Day	Extras	Per Weekday	Per Weekend Day	Extras
Harlem	New York	2	106	57.5	29	111	58.5	32
Harlem	Bronx	7	106	57.5	29	111	58.5	32
Harlem	Westchester	20	106	57.5	29	111	58.5	32
Harlem	Putnam	3	46	31.5	11	49	32.5	15
Harlem	Dutchess	6	13	9	3	13	9	1
Hudson	New York	2	70	42	6	72	42	
Hudson	Bronx	6	70	42	6	72	42	
Hudson	Westchester	15	70	42	6	72	42	
Hudson	Putnam	4	28	19	3	29	20	
Hudson	Dutchess	3	28	19	3	29	20	
New Haven	New York	2	125	59	24	124	61.5	36
New Haven	Bronx	1	125	59	24	124	61.5	36
New Haven	Westchester	8	125	59	24	124	61.5	36

Table 2-12. Metro-North Train-Miles Traveled per Line per County

Rail Line	County	Miles	Trains to New York			Trains from New York			Trains/year (to and from New York)	Train-miles
			Weekday trains/year	Weekend trains/year	Total trains/year	Weekday trains/year	Weekend trains/year	Total trains/year		
Harlem	New York	4	27,560	5,980	33,569	28,860	6,084	34,976	68,545	274,180
Harlem	Bronx	9	27,560	5,980	33,569	28,860	6,084	34,976	68,545	616,905
Harlem	Westchester	35	27,560	5,980	33,569	28,860	6,084	34,976	68,545	2,399,075
Harlem	Putnam	12	11,960	3,276	15,247	12,740	3,380	16,135	31,382	376,584
Harlem	Dutchess	22	3,380	936	4,319	3,380	936	4,317	8,636	189,992
Hudson	New York	4	18,200	4,368	22,574	18,720	4,368	23,088	45,662	182,648
Hudson	Bronx	10	18,200	4,368	22,574	18,720	4,368	23,088	45,662	456,620
Hudson	Westchester	19	18,200	4,368	22,574	18,720	4,368	23,088	45,662	867,578
Hudson	Westchester	8	18,200	4,368	22,574	18,720	4,368	23,088	45,662	365,296
Hudson	Putnam	15	7,280	1,976	9,259	7,540	2,080	9,620	18,879	283,185
Hudson	Dutchess	18	7,280	1,976	9,259	7,540	2,080	9,620	18,879	339,822
New Haven	New York	4	32,500	6,136	38,660	32,240	6,396	38,672	77,332	309,328
New Haven	Bronx	5	32,500	6,136	38,660	32,240	6,396	38,672	77,332	386,660
New Haven	Westchester	17	32,500	6,136	38,660	32,240	6,396	38,672	77,332	1,314,644

Note: Diesel service is highlighted in grey

Table 2-13. Metro-North Diesel Train-Miles and Fuel Consumption per County

County	Train-Miles	% Train-Miles	Fuel, Gallons	Gallons / Train-Mile
New York	0	0%	0	--
Bronx	0	0%	0	--
Westchester	365,296	26%	1,221,206	--
Putnam	534,241	37%	1,785,999	--
Dutchess	529,814	37%	1,771,200	--
System-wide	1,429,351	100%	4,778,405	3.34

2.4.3. New Jersey Transit

Two lines of Metro North service counties in NYS, but the lines originate in New Jersey and are operated by New Jersey Transit. New Jersey Transit contacts were unable to provide fuel consumption information for the portion of the two lines (Main & Bergen County Line and Pascack Valley Line) that run in NYS. As such, Pechan developed a fuel consumption factor from the reported system-wide fuel consumption and the total train-miles traveled for Metro North operations (see previous section). This fuel consumption factor was estimated to be 3.34 gallons per train-mile traveled.

Pechan compiled the length of track by route and station (see Table 2-14), calculated the number of trains based on schedules (Table 2-15), and then annualized the schedule data to calculate train-miles traveled per line and per county (Table 2-16). These indicators were then multiplied by the Metro North fuel consumption factor to estimate fuel by county, shown in Table 2-17.

Table 2-14. New Jersey Transit Train Station Mileage

Station	County	Mileage (Between Stations)
<i>Main and Bergen County Line</i>		
Suffern	Rockland	0
Sloatsburg	Rockland	4
Tuxedo	Orange	2.6
Harriman	Orange	7.8
Salisbury Mills-Cornwall	Orange	10.5
Campbell Hall	Orange	10.3
Middletown	Orange	6.2
Otisville	Orange	9.8
Port Jervis	Orange	13.4
<i>NY Systemwide</i>		<i>64.6</i>
<i>Pascack Valley Line</i>		
Pearl River	Rockland	0
Nanuet	Rockland	2.4
Spring Valley	Rockland	3.6
<i>NY Systemwide</i>		<i>6</i>

Table 2-15. NJ Transit Train Schedule

Rail Line	County	# of stops	Trains to New York			Trains to New Jersey		
			Per weekday	Per weekend day	Extras	Per weekday	Per weekend day	Extras
Main & Bergen Cty	Orange	7	13	7	2	13	7	3
Main & Bergen Cty	Rockland	2	13	7	2	13	7	3
Pascack Valley	Rockland	3	13	0	9	13	0	12

Table 2-16. NJ Transit Train-Miles Traveled per Line per County

Rail Line	County	Miles	Trains to NY			Trains to NJ			Trains per year (to and from NY)	Train-miles
			Weekday trains per year	Weekend trains per year	Total trains per year	Weekday trains per year	Weekend trains per year	Total trains per year		
Main & Bergen Cty	Rockland	4	3,380	728	4,110	3,380	728	4,111	8,221	32,884
Main & Bergen Cty	Orange	61	3,380	728	4,110	3,380	728	4,111	8,221	498,193
Pascack Valley	Rockland	6	3,380	0	3,389	3,380	0	3,392	6,781	40,686

Table 2-17. NJ Transit Train-Miles and Fuel Consumption per County

County	Train-miles	Fuel, Gallons ^a
Rockland	73,570	245,724
Orange	498,193	1,663,963
<i>Total</i>	571,763	1,909,687

^aTrain-miles multiplied by fuel consumption of 3.34 gallons/train-mile calculated from the Metro-North Data

2.4.4. Long Island Railroad

Long Island Railroad provided system-wide fuel consumption for 2002. Fuel consumption by county was estimated similar to that of Metro-North Railroad, estimating train-miles traveled between stations and relating this activity to the county boundaries. Third-rail electric service is offered on the lines to Port Washington, Ronkonkoma, Babylon, Hempstead, Huntington, West Hempstead, Long Beach and Far Rockaway, and diesel service is provided on the lines to Oyster Bay, Port Jefferson, Montauk and Greenport. As such, activity for those lines with electric service was discounted in developing allocation factors by which to apportion total fuel consumption to counties.

Table 2-18 shows the Long Island train schedule. Table 2-19 presents the number of trains per year, the diesel line miles, and the train-miles traveled per year. For the Montauk line, not all trains travel the whole route (some only travel as far east as Patchogue or Speonk). This was accounted for in the train-mile calculations. Additionally, some trains do not travel the entire Greenport line. The train-miles by county were then used as surrogate indicators to allocate approximately 87 percent of the total fuel to Suffolk County, and 13 percent to Nassau County (see Table 2-20).

Table 2-18. Long Island Railroad Train Schedule

Rail Line	County	# of stops	Trains to New York City			Trains East		
			Per weekday	Per weekend day	Extras	Per weekday	Per weekend day	Extras
Oyster Bay	Nassau	11	17	11		16	11	
Port Jefferson	Suffolk	8	19	14		21	14	
Greenport- Riverhead	Suffolk	4	1			2		
Greenport	Suffolk	7	3	2		3.8	2	
Montauk- Patchogue	Suffolk	7	10	6		13	6	64
Montauk- Speonk	Suffolk	10	9	7		4	5	32
Montauk	Suffolk	17	5	4	287	6	5	78

Table 2-19. Long Island Railroad Train-Miles Traveled per Diesel Line

Rail Line	County	Diesel Line Miles	Trains to New York City			Trains East			Trains per year (East & West)	Train-miles
			Weekday trains per year	Weekend trains per year	Total trains per year	Weekday trains per year	Weekend trains per year	Total trains per year		
Oyster Bay	Nassau	14	4,420	1,144	5,564	4,160	1,144	5,304	10,868	152,152
Port Jefferson	Suffolk	23	4,940	1,456	6,396	5,460	1,456	6,916	13,312	306,176
Greenport- Riverhead	Suffolk	25	260	0	260	520	0	520	780	19,500
Greenport	Suffolk	46	780	208	988	988	208	1,196	2,184	100,464
Montauk- Patchogue	Suffolk	18	2,600	624	3,224	3,380	624	4,068	7,292	131,256
Montauk- Speonk	Suffolk	35	2,340	728	3,068	1,040	520	1,592	4,660	163,100
Montauk	Suffolk	79	1,300	416	2,003	1,560	520	2,158	4,161	328,719

Table 2-20. Long Island Railroad Train-Miles and Fuel Consumption per County

County	Train-Miles by County	% Train-Miles	Fuel, Gallons
Nassau	152,152	12.7%	874,053
Suffolk	1,049,215	87.3%	6,027,328
Systemwide	1,201,367	100%	6,901,381

2.4.5. Adirondack Scenic Railroad

The Adirondack Scenic Railroad is a scenic tourist excursion railroad. System-wide fuel consumption was reported to be 34,000 gallons per year. Fuel consumption by county was estimated using information provided for the survey on mile-post markers relative to county boundaries. From these data, 13 percent of fuel consumed was allocated to Essex County, eight percent to Herkimer County, and 78 percent to Oneida County.

2.5. YARD LOCOMOTIVES

Table 2-21 summarizes the fuel consumption for switchyard operations, either provided by the rail companies or estimated based on the number of switchers (for Albany Port Railroad). The number of switchers was obtained from the 2005 Locomotive Rosters & News [10]. An average switchyard engine fuel consumption estimate of 82,490 gallons per year was applied to the number of switchyard locomotives in operation [11]. This estimate assumes switchyard locomotive operations run 24 hours per day, 365 days per year, and may be adjusted if operating schedule information is available. Since these data were not available, the fuel consumption for Albany Port Railroad may be an overestimate.

Table 2-21. Switchyard Fuel Consumption

Rail Line	County	Fuel (gallons)	Notes
Albany Port Railroad Corp.	Albany	164,980	Estimated fuel based on 2 operating switch cars (2 x 82,490 gallons year)
Buffalo Southern Railroad	Erie	16,324	Provided by rail line
New York & Atlantic Railway	Queens	70,844	Provided fraction of total fuel used at switchyard (0.15 x 472,290 gallons year)
Owego & Hartford Railway, Inc.	Cortland Tioga	8,364 836	Provided by rail line

As noted in the Class I discussion, all three Class I rail companies operate switchyards, but fuel consumption could not be reported separately from their line-haul fuel consumption. Table 2-22 presents the switchyards for two of the three Class I lines and the location and number of switchers in operation at each rail yard, if known. These data were not used for this inventory effort. However, since switchyards may be important localized emissions sources, the location of yard operations may be useful for future modeling efforts by the NYSDEC.

Table 2-22. Switchyard Activity Reported by Class I Railroads

Yard	County	Street Address	Total Units
<i>Norfolk-Southern</i>			
Binghamton NY	Broome	648 Conklin Avenue	1
Buffalo NY	Erie	300 Kennedy Road	12
Campbell Hall NY	Orange	Rt. 207	1
Corning NY	Steuben	RD #1 Lumber Street	3
Elmira NY	Chemung	100 East Woodlawn	8
Olean NY	Cattaraugus	W. State St. & 24th St.	1
Suffern NY	Rockland	Rt. 202 & Orange Avenue	2
		<i>NYS System-wide</i>	28
<i>Canadian-Pacific</i>			
Albany	Albany		NA
Buffalo	Erie		NA
Binghamton	Broome		NA
Saratoga Springs	Saratoga		NA
		<i>NYS System-wide</i>	20
NA = Not available.			

2.6. FLEET CHARACTERISTICS

In addition to questions concerning traffic/fuel consumption in 2002, Pechan requested data on the locomotives that each rail company operates. Information on the age of the engines will assist in determining the age distribution of the fleet operating in NYS and may be used to potentially evaluate the feasibility and benefits of retrofit technologies for certain classes of locomotives. Upon starting data collection for locomotives, obtaining information to guide retrofit analyses for locomotives was not deemed a priority for this project.

Pechan requested the following data for each rail company's locomotive fleet:

1. Number of locomotives;
2. Age of locomotive(s);
3. Number of years company has owned/operated locomotive(s);
4. Size and type/manufacturer of locomotive engine(s);
5. Use of control technologies, fuel additives
6. Have any engines been remanufactured; and
7. If yes, provide date of the last remanufacture.

Table 2-23 summarizes fleet information, either obtained directly from the survey respondents, or supplemented with information from the Locomotive Rosters & News [10]. The latter source could only be used for those rail lines that operate exclusively in NYS. For larger regional railroads and Class I railroads, the data reported in this source represented the entire fleet, and was not distinguished by state or region. Therefore, the fleet operating in NYS could not be identified unless provided by the company for the survey.

Table 2-24 summarizes the responses obtained for questions relating to control technology and remanufacture. Only a limited number of companies surveyed provided responses with this information.

Table 2-23. Fleet Data by Locomotive Rail Line

Rail Line Name	Number of Locomotives	Make/Model	Year(s)	Horsepower	Comment
Class I					
Canadian Pacific Railway	5	GP9	1958	1750	
	10	GP38-2	1971	2000	
	4	GP40-2	1977	3000	
	1	SD40	1966	3000	
	36	SD40-2	1975	3000	
Class II/III					
Arcade & Attica Railroad	1	ALCO STEAM	1920	280	
	1	GE 44TON	1947	380	
	1	GE 65TON	1945	400	
B&H Rail Corp.	2	ALCO S1	1950	660	
	2	ALCO C424M	1980	2000	
Batten Kill Railroad Co., Inc.	2	ALCO RS3	1950-1952	1600	
Central New York Railroad*	2	GM E8A	1952	2250	
Claredon & Pittsford Railroad	1	GM GP38	1966	2000	
	1	GM GP38-2	1973	2000	
	1	GM GP40-2	1972	3000	
	1	GM GP16	1979	1600	
Depew, Lancaster & Western Railroad	2	ALCO RS11	1956	1800	
	1	MLW RS18	1959	1800	
Falls Road Railroad Co., Inc.	2	ALCO RS11	1959, 1956	1800	
Finger Lakes Railway Corp.	4	GM GP9	1957	1750	
	1	GM GB9	1974	1850	
	5	GE B23-7	1979	2250	
Genesee & Wyoming Railroad	45	EMD	1962-1972	1500-3300	Reported averages supplied by the railroad for their fleet, the specifics are in the Locomotive Roster book
	20	EMD	2002	1500-3300	Approximately 20 engines rebuilt by 2002
Guilford Rail System	NA				Most of the line is not in NY, there are 110 locomotives owned by the rail line
Housatonic Railroad Co., Inc.	1	GM GP9E	1977	1800	
	2	GMGP38	1969	2000	

Rail Line Name	Number of Locomotives	Make/Model	Year(s)	Horsepower	Comment
	2	GM GP35M	1965	2000	
	2	GM GP35	1964-1965	2500	
	1	GM GP35M-3	1965	2000	
	1	GM GP9	1977	1750	
	1	ALCO RS3M	1979	1200	
Livonia, Avon & Lakeville Railroad Corp.	1	ALCO RS1	1950	1000	
	1	ALCO S2	1941	1000	
	1	ALCO C420	1964	2000	
	2	ALCO C424M	1980	2000	
	1	ALCO C425	1965	2500	
Lowville & Beaver River Railroad	3	GE 44TON	1947-1950	380	
Middletown and New Jersey Rwy. Co. Inc.	2	GE 44TON	1946	360	
Mohawk, Adirondack & Northern Railroad	2	MLW C420	1973	2000	
	4	ALCO C425	1964	2500	
New York & Atlantic Railway	4	GM EMD MP-1500	1977	1500	From Long Island RR survey; from whom they lease rail cars
	3	GM EMD SW-1000		1000	
	4	GM GP 38	1976-1977	2000	
New York & Lake Erie Railroad	1				Only 1 of 5 total locomotives runs in NY
New York & Ogdensburg Railway Co.	1	GM SW8	1959	800	
	1	GM SW9	1951	1200	
New York Crossharbor RR	2	GM SW1500		1500	
	1	GM SW1200		1200	
	1	GE U23B		2250	
New York, Susquehanna & Western Rwy	2	GM GP18	1962	1800	Survey indicated 24 locomotives operating and all models, but does not link models to number of cars; where matching, assignments based on Locomotive Roster and News
	1	GM GP38	1967	2000	
	3	GM GP20		2000	
	2	GM E9A	1973	2400	
	4	GM SD40T-2		3000	
	1	GM GP40	1968	3000	
	11	GE Dash 8/SD45/SD40			Survey lists additional models, but not associated number of cars
Ontario Central Railroad	1	ALCO RS36	1962	1800	

Rail Line Name	Number of Locomotives	Make/Model	Year(s)	Horsepower	Comment
Ontario Midland Railroad Corp.	1	ALCO S4	1953	1000	
	1	ALCO RS11	1956	1800	
	1	ALCO RS36	1962	1800	
Providence and Worcester Railroad Co.	3-Feb			3500	Only 2-3 of 30 total locomotives run in NY
Somerset Railroad Corp.	1	GE 50TON	1950	300	
	1	GE 144TON	1983	1100	
	1	GE 95TON	1993	670	
	1	GM SW8	1950	800	
Vermont Railway	2	GM GP38-2	1972-1974	2000	
	2	GM GP40	1966	3000	
	2	GM GP40-2	1977	3000	
	2	GM GP40-2W	1976	3000	
	1	GM GP18	1961	1800	
	1	GM GP38-2	1976	2000	
Wellsboro & Corning Railroad	1	GM SW8	1950	800	
Western New York & Pennsylvania Railroad	1	ALCO C424		2400	
	2	ALCO C430	1967-1968	3000	
	1	MLW M630		3000	
Passenger/Commuter					
Amtrak	18	P-32 AC/DM	1995-1996	3200	
	6	P-42	1996-1997, 2001	4250	Survey lists 6 units PER DAY; likely more than 6 individual units operating
Long Island Railroad	23	GM Diesel Electric EMD	1997-1998	3000	
	23	GM Dual Mode EMD	1998-1999	3000/4000	
	17	GM EMD MP-1500	1977	15000	
	5	GM EMD SW-1000		10000	
Metro-North Railroad	7	FL9	1957	1750	
	8	FL9AC	1957	1750	
	3	FL10	1949	1850	
	6	Genesis	1995	3200	
	12	Genesis	1997	3200	
	13	Genesis	2000	3200	
	6	GP35R	1996		

Rail Line Name	Number of Locomotives	Make/Model	Year(s)	Horsepower	Comment
	2	BL-06	2002	1000	
	3	GP8/9	1955	1500	
NJ Transit Rail	NA				
Adirondack Scenic Railway	1	SW1	1941	600	
	1	F7A	1953	1500	
	1	F7A	1952	1500	
	1	F10A	1979	1850	
	1	C424	1964	2400	
	1	GP9	NA	1750	
	1	RS3	1950	1600	
Switchyard					
Canadian Pacific Railway	1	SW9	1953	1200	
	2	SW1200	1959	1200	
	2	SD40-2	1971	3000	
Albany Port Railroad Corp.	2	GM SW9	1953	1200	
Buffalo Southern Railroad	1	WHIT 35TON	1941	300	
	1	GE 44TON	1946	400	
	1	GE 45TON	1946	300	
	6	ALCO S2	1943-1948	1000	
	1	ALCO C415	1966	1500	
	1	ALCO S1	1948	660	
	1	ALCO C420	1964	2000	
	1	ALCO RS11	1961	1800	
Owego & Hartford Railway, Inc.	1	SW1 EMD	1954		
	1	NW12 EMD	1955		
	1	RS18 ALCO	1959		
New York & Atlantic Railway	2	SW 1200	1958	1200	
	3	GM SW1001	1978	1000	
	4	GM MP15AC	1977	1500	

Table 2-24. Control and Remanufacture Data by Locomotive Rail Line

Rail Line	Control Technologies	Engines Remanufactured
Amtrak	Microprocessor controls and cold flow additive used in winter (Nalco 5838A)	--
Finger Lakes Railway Corp.	Off-road dyed diesel	1 GP9 1801 rebuilt in 1974
Genessee & Wyoming, Inc.	--	20 engines in NY/PA were rebuilt by 2002
Metro-North Railroad	--	GP35R remanufactured in 1993-1994; BL-06 remanufactured in 2000
Ontario Midland Corporation	Winter blend off-road diesel (Oct-Apr)	--

3.0 LOCOMOTIVE EMISSIONS INVENTORY DEVELOPMENT

3.1 ACTIVITY DATA

Fuel consumption for each rail line was estimated at the county level. Within a given locomotive category, activity data for multiple lines operating by county were summed to develop one estimate per source classification code (SCC) at the county level. The list of SCCs for inventory reporting is presented in Table 3-1.

Table 3-1. List of SCCs for Reporting Locomotive Emissions

SCC	Descriptor 1	Descriptor 3	Descriptor 6	Descriptor 8
2285002006	Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class I Operations
2285002007	Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class II/Class III Operations
2285002008	Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Passenger Trains (Amtrak)
2285002009	Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Commuter Lines
2285002010	Mobile Sources	Railroad Equipment	Diesel	Yard Locomotives

3.2 EMISSION FACTORS

Emission factors for line haul locomotives and yard locomotives were obtained from EPA’s December 1997 Guidance, *Emission Factors for Locomotives* [12]. Emission factors, expressed in grams per gallon, are presented in Table 3-2 for NO_x, CO, PM₁₀, PM_{2.5}, SO₂, and VOC.

Table 3-2. 2002 Locomotive Emission Factors

Pollutant	Line Haul Emission Factors (grams/gallon)	Switchyard Emission Factors (grams/gallon)
NO _x	270	362
CO	26.6	38.1
PM ₁₀	6.7	9.2
PM _{2.5}	6.3	8.3
SO ₂	16.3	16.3
VOC	10	21

These values represent uncontrolled emission factors. In support of the locomotive emission standards, the EPA developed national emissions factors by railroad class that account for future, phased-in controls for reducing NO_x and PM emissions [13]. Emission reductions, which account for rule penetration due to fleet turnover, were estimated based on the percent change in emissions from the base year to a given projection year. Pechan adjusted the 2002 Class I line haul and yard locomotive emissions for NO_x by the percentages

shown in Table 3-3. Class II/III locomotives are also subject to these standards, but reductions were not expected until 2003.

Table 3-3. 2002 Locomotive NO_x Emissions Reduction

Source Category	Percent Reduction
Class I Line Haul Locomotive	12
Yard Locomotive	2

3.3. EMISSION ESTIMATES

To estimate emissions, Pechan multiplied SCC fuel consumption (gallons) by the corresponding emission factors (grams/gallon) and converted emissions in grams to tons. Pechan also applied NO_x control factors as appropriate. The resulting 2002 annual locomotive emissions by SCC and pollutant are presented in Table 3-4. The 2002 statewide fuel consumption is also reported in this table.

Table 3-4. NYS SCC Fuel Consumption and 2002 Emissions (tpy)

SCC Description	Fuel (gal / year)	CO	NO _x	PM ₁₀ -PRI	PM _{2.5} -PRI	SO ₂	VOC
Class I Line Haul	68,491,497	2,008.3	17,939	505.8	475.6	1,230.6	755.0
Class II/III Line Haul	3,513,863	103.0	1,046	26.0	24.4	63.1	38.7
Line Haul Passenger (Amtrak)	6,430,000	188.5	1,914	47.5	44.7	115.5	70.9
Line Haul Commuter	13,623,376	399.5	4,055	100.6	94.6	244.8	150.2
Yard Locomotive	261,347	11.0	102	2.7	2.4	4.7	6.0

Pechan converted the 2002 emission estimates to the National Emissions Inventory (NEI) Input Format, Version 3.0 (NIF3.0) [14] and then ran the EPA’s Quality Assurance Checker [15] on the NIF3.0 file to check for errors. No errors were detected.

Appendix B shows 2002 annual emissions for each pollutant (CO, PM₁₀, PM_{2.5}, SO₂, VOC, and NO_x) by county for each locomotive category. NO_x emission values are also presented in NYS emission density maps for each of the five categories. Emission density maps for other pollutants show the same relative distribution by county as the NO_x emissions, so they are not provided for all pollutants.

3.4. COMPARISON TO 2002 NATIONAL EMISSIONS INVENTORY

As a reasonableness check, Pechan compared total NYS emissions as estimated by the survey to emission estimates developed for EPA’s 2002 Final NEI [16]. Table 3-5 shows the statewide differences for NO_x by SCC. Emissions estimates based on the survey data for all locomotive categories are higher than the NEI estimates, with the exception of switchyards. For the survey effort, recall that switchyard emissions for Class I railroads could not be separated from overall Class I emissions. Thus, switchyard emissions may actually be higher than the survey estimates and emissions from Class I line haul locomotives may be lower.

Table 3-5. Comparison of 2002 NYS NEI with NYS Survey-Based NO_x Emissions (tpy)

Description	NEI	Survey	Difference	Percent Difference
Class I Line Haul	10,520	17,939	7,419	70.5%
Class II/III Line Haul	9	1,046	1,037	11522.2%
Line Haul Passenger (Amtrak)	521	1,914	1,393	267.4%
Line Haul Commuter	85	4,055	3,970	4670.6%
Yard Locomotive ^a	2,979	102	(2,877)	(96.6%)
<i>Total</i>	14,115	25,055	10,942	77.5%

^aIn many cases data was not provided on yard locomotives especially for Class I Line Haul rail lines, and as a result these emissions are included in the estimate of total class I line Haul emissions

NEI locomotive emissions were allocated to the county level using 1999 county-specific railroad traffic data (ton miles) obtained from the New York Department of Transportation, Bureau of Transportation Statistics (BTS). Using GIS software, county borders were overlaid with the U.S. railroad network to determine the rail activity in each county for the specific SCCs. Each county was then assigned a weighted emissions factor by summing the product of the rail activity and the track-specific loading factor for each track, and then dividing this sum by the national total.

When one compares the counties for which BTS reports rail traffic data with the counties showing activity according to survey (Table 3-5), it appears that there is a great deal of rail activity not being captured by the BTS data. This would explain the higher activity and emissions estimated by the survey effort, especially for the smaller commuter rail lines and the regional Class I rail lines.

4.0 REFERENCES

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APPENDIX A. LOCOMOTIVE QUESTIONNAIRE

CLASS I LOCOMOTIVES

We are requesting annual fuel consumption or other measure of activity to estimate fuel consumption for your rail operations in New York State (NYS). See questions below relating to line haul activity, switch yard activity, and fleet characterization. We are requesting data for calendar year 2002. If you have data for a different calendar year, please indicate how these data should be adjusted to represent 2002, or if the data can be assumed equal to 2002 activity. The information can be provided within this file, or in a separate file or spreadsheet as needed.

I. LINE HAUL ACTIVITY

Please provide the following information for each track or line segment in NYS.

1. Annual traffic density in gross ton-miles by line segment.
2. Track mileage by line segment.
3. Direction.
4. Geographic Location.

OR

1. Annual traffic density for total operations in NYS.
2. County-level track mileage data for each county of operation.

Traffic density expressed in gross tons includes the weight of your locomotives. Please indicate if your estimate of traffic density does not include the weight of the locomotives.

For US Class I rail companies only - We have estimates of ton-miles per gallon of fuel consumed based on information you provided to the Surface Transportation Board's 2002 R-1 Schedule. We will use this fuel consumption index to apply to your traffic density estimates to estimate fuel consumption.

II. SWITCH YARD ACTIVITY

A. Do you operate a switchyard in NYS? If so, please provide the following:

1. Fuel consumption associated with switching operations at the railyard.

OR

1. The number of switch locomotives.
2. Annual hours of operation for specific switch locomotives (or typical schedules for one or more locomotives).

B. Please also provide the following:

1. Estimate of time (in hours) spent idling, or percentage of total time spent idling.
2. Location of the switchyard (street address or coordinates).

III. FLEET CHARACTERIZATION

For your locomotive fleet operating in NYS, please provide:

1. The number of locomotives in operation.
2. Age of the locomotive(s).
3. Size and type/manufacturer of locomotive engine(s).
4. Description of control technology or fuel additives, if applicable.
5. The number of engines that have been remanufactured, and the date of the last remanufacture.

CLASS II / III LOCOMOTIVES

We are requesting annual fuel consumption or other measure of activity to estimate fuel consumption for your rail operations in New York State (NYS). See questions below relating to line haul activity and fleet characterization. We are requesting data for calendar year 2002. If you have data for a different calendar year, please indicate how these data should be adjusted to represent 2002, or if the data can be assumed equal to 2002 activity. The information can be provided within this file, or in a separate file or spreadsheet as needed.

I. LINE HAUL ACTIVITY

Please provide the following information for each track you operate in NYS.

1. System-wide fuel consumption.
2. Traffic density (e.g., in gross tons) or track length by county in NYS.

II. FLEET CHARACTERIZATION

For your locomotive fleet operating in NYS, please provide:

1. The number of locomotives in operation.
2. Age of the locomotive(s).
3. Size and type/manufacturer of locomotive engine(s).
4. Description of control technology or fuel additives, if applicable.
5. The number of engines that have been remanufactured, and the date of the last remanufacture.

SWITCHYARD LOCOMOTIVES

See questions below relating to switch yard activity and fleet characterization. We are requesting annual fuel consumption or other measure of activity to estimate fuel consumption for your rail operations in New York State (NYS). We are requesting data for calendar year 2002. If you have data for a different calendar year, please indicate how these data should be adjusted to represent 2002, or if the data can be assumed equal to 2002 activity. The information can be provided within this file, or in a separate file or spreadsheet as needed.

I. SWITCH YARD ACTIVITY

A. Do you operate a switchyard in NYS? If so, please provide the following:

1. Fuel consumption associated with switching operations at the railyard.

OR

1. The number of switch locomotives.
2. Annual hours of operation for specific switch locomotives (or typical schedules for one or more locomotives).

B. Please also provide the following:

1. Estimate of time (in hours) spent idling, or percentage of total time spent idling.
2. Location of the switchyard (street address or coordinates).

II. FLEET CHARACTERIZATION

For your locomotive fleet operating in NYS, please provide:

1. The number of locomotives in operation.
2. Age of the locomotive(s).
3. Size and type/maker of locomotive engine(s).
4. Description of control technology or fuel additives, if applicable.
5. The number of engines that have been remanufactured, and the date of the last remanufacture.

COMMUTER/PASSENGER RAIL

See questions below relating to fuel consumption and fleet characterization. We are requesting annual fuel consumption or other measure of activity to estimate fuel consumption for your rail operations in New York State (NYS). We are requesting data for calendar year 2002. If you have data for a different calendar year, please indicate how these data should be adjusted to represent 2002, or if the data can be assumed equal to 2002 activity. The information can be provided within this file, or in a separate file or spreadsheet as needed.

I. FUEL CONSUMPTION

Please provide the following information for your rail line operations in NYS.

1. System-wide or line-specific fuel consumption.
2. Track length by county or mile post marker in NYS.

II. FLEET CHARACTERIZATION

For your locomotive fleet operating in NYS, please provide:

1. The number of trains in your fleet.
2. Age of the locomotive(s).
3. Size and type/manufacturer of locomotive engine(s).
4. Description of control technology or fuel additives, if applicable.
5. The number of engines that have been remanufactured, and the date of the last remanufacture.

APPENDIX B. 2002 ANNUAL LOCOMOTIVE EMISSION ESTIMATES BY COUNTY

Table B-1. 2002 CO Emissions by County and by Locomotive Category

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total CO Emissions
36001	Albany	76.51	0.00	0.00	0.00	6.93	83.44
36003	Allegany	6.72	2.45	0.00	0.00	0.00	9.17
36005	Bronx	8.45	0.00	2.47	0.00	0.00	10.92
36007	Broome	27.62	5.31	0.00	0.00	0.00	32.93
36009	Cattaraugus	11.14	6.79	0.00	0.00	0.00	17.93
36011	Cayuga	22.10	1.52	2.86	0.00	0.00	26.48
36013	Chautauqua	156.59	1.40	2.15	0.00	0.00	160.14
36015	Chemung	15.40	0.00	0.00	0.00	0.00	15.40
36017	Chenango	7.14	4.94	0.00	0.00	0.00	12.08
36019	Clinton	17.41	0.00	1.99	0.00	0.00	19.40
36021	Columbia	91.17	0.00	19.06	0.00	0.00	110.23
36023	Cortland	0.00	4.94	0.00	0.00	0.04	4.98
36025	Delaware	2.88	0.42	0.00	0.00	0.00	3.30
36027	Dutchess	52.00	0.00	30.84	51.93	0.00	134.77
36029	Erie	234.10	4.04	6.78	0.00	0.69	245.61
36031	Essex	20.34	0.00	3.31	0.13	0.00	23.78
36033	Franklin	9.37	0.00	0.00	0.00	0.00	9.37
36035	Fulton	0.00	0.00	0.00	0.00	0.00	0.00
36037	Genesee	72.06	4.04	5.95	0.00	0.00	82.05
36039	Greene	23.45	0.00	0.00	0.00	0.00	23.45
36041	Hamilton	0.00	0.00	0.00	0.00	0.00	0.00
36043	Herkimer	48.98	0.00	5.51	0.08	0.00	54.57
36045	Jefferson	62.84	1.26	0.00	0.00	0.00	64.10
36047	Kings	0.00	0.47	0.00	0.00	0.00	0.47
36049	Lewis	0.00	1.26	0.00	0.00	0.00	1.26
36051	Livingston	5.68	4.92	2.20	0.00	0.00	12.80
36053	Madison	26.95	4.94	3.08	0.00	0.00	34.97
36055	Monroe	101.17	5.26	5.73	0.00	0.00	112.16
36057	Montgomery	83.57	0.00	8.59	0.00	0.00	92.16
36059	Nassau	0.00	1.77	0.00	25.63	0.00	27.40
36061	New York	0.00	0.00	7.75	0.00	0.00	7.75
36063	Niagara	53.38	9.07	2.31	0.00	0.00	64.76
36065	Oneida	55.97	6.20	6.17	0.78	0.00	69.12
36067	Onondaga	102.70	7.89	7.05	0.00	0.00	117.64
36069	Ontario	0.26	3.22	0.00	0.00	0.00	3.48
36071	Orange	29.27	0.11	0.00	48.79	0.00	78.17
36073	Orleans	0.00	0.30	0.00	0.00	0.00	0.30

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total CO Emissions
36075	Oswego	78.73	0.00	0.00	0.00	0.00	78.73
36077	Otsego	25.13	0.00	0.00	0.00	0.00	25.13
36079	Putnam	0.00	0.00	6.57	52.37	0.00	58.94
36081	Queens	7.79	0.90	0.00	0.00	2.98	11.67
36083	Rensselaer	52.81	0.02	18.41	0.00	0.00	71.24
36085	Richmond	0.00	0.00	0.00	0.00	0.00	0.00
36087	Rockland	23.53	0.00	0.00	7.20	0.00	30.73
36089	St. Lawrence	85.95	1.42	0.00	0.00	0.00	87.37
36091	Saratoga	34.51	0.00	3.66	0.00	0.00	38.17
36093	Schenectady	62.20	0.00	3.86	0.00	0.00	66.06
36095	Schoharie	9.99	0.00	0.00	0.00	0.00	9.99
36097	Schuyler	0.86	0.85	0.00	0.00	0.00	1.71
36099	Seneca	0.01	0.20	0.00	0.00	0.00	0.21
36101	Steuben	31.24	2.54	0.00	0.00	0.00	33.78
36103	Suffolk	0.00	8.83	0.00	176.73	0.00	185.56
36105	Sullivan	1.47	0.44	0.00	0.00	0.00	1.91
36107	Tioga	15.04	0.00	0.00	0.00	0.35	15.39
36109	Tompkins	1.67	0.00	0.00	0.00	0.00	1.67
36111	Ulster	39.26	0.00	0.00	0.00	0.00	39.26
36113	Warren	1.02	0.00	0.00	0.00	0.00	1.02
36115	Washington	21.07	0.90	3.88	0.00	0.00	25.85
36117	Wayne	72.44	0.41	7.93	0.00	0.00	80.78
36119	Westchester	0.00	0.00	20.44	35.81	0.00	56.25
36121	Wyoming	17.06	3.91	0.00	0.00	0.00	20.97
36123	Yates	1.23	0.11	0.00	0.00	0.00	1.34

Table B-2. 2002 PM₁₀ Emissions by County and by Locomotive Category

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total PM ₁₀ Emissions
36001	Albany	19.27	0.00	0.00	0.00	1.67	20.94
36003	Allegany	1.69	0.62	0.00	0.00	0.00	2.31
36005	Bronx	2.13	0.00	0.62	0.00	0.00	2.75
36007	Broome	6.96	1.34	0.00	0.00	0.00	8.30
36009	Cattaraugus	2.81	1.71	0.00	0.00	0.00	4.52
36011	Cayuga	5.57	0.38	0.72	0.00	0.00	6.67
36013	Chautauqua	39.44	0.35	0.54	0.00	0.00	40.33
36015	Chemung	3.88	0.00	0.00	0.00	0.00	3.88
36017	Chenango	1.80	1.24	0.00	0.00	0.00	3.04
36019	Clinton	4.39	0.00	0.50	0.00	0.00	4.89
36021	Columbia	22.97	0.00	4.80	0.00	0.00	27.77
36023	Cortland	0.00	1.24	0.00	0.00	0.01	1.25
36025	Delaware	0.73	0.11	0.00	0.00	0.00	0.84
36027	Dutchess	13.10	0.00	7.77	13.08	0.00	33.95
36029	Erie	58.96	1.02	1.71	0.00	0.17	61.86
36031	Essex	5.12	0.00	0.83	0.03	0.00	5.98
36033	Franklin	2.36	0.00	0.00	0.00	0.00	2.36
36035	Fulton	0.00	0.00	0.00	0.00	0.00	0.00
36037	Genesee	18.15	1.02	1.50	0.00	0.00	20.67
36039	Greene	5.91	0.00	0.00	0.00	0.00	5.91
36041	Hamilton	0.00	0.00	0.00	0.00	0.00	0.00
36043	Herkimer	12.34	0.00	1.39	0.02	0.00	13.75
36045	Jefferson	15.83	0.32	0.00	0.00	0.00	16.15
36047	Kings	0.00	0.12	0.00	0.00	0.00	0.12
36049	Lewis	0.00	0.32	0.00	0.00	0.00	0.32
36051	Livingston	1.43	1.24	0.55	0.00	0.00	3.22
36053	Madison	6.79	1.24	0.78	0.00	0.00	8.81
36055	Monroe	25.48	1.32	1.44	0.00	0.00	28.24
36057	Montgomery	21.05	0.00	2.16	0.00	0.00	23.21
36059	Nassau	0.00	0.44	0.00	6.46	0.00	6.90
36061	New York	0.00	0.00	1.95	0.00	0.00	1.95
36063	Niagara	13.45	2.28	0.58	0.00	0.00	16.31
36065	Oneida	14.10	1.56	1.55	0.20	0.00	17.41
36067	Onondaga	25.87	1.99	1.78	0.00	0.00	29.64
36069	Ontario	0.07	0.81	0.00	0.00	0.00	0.88

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total PM ₁₀ Emissions
36071	Orange	7.37	0.03	0.00	12.29	0.00	19.69
36073	Orleans	0.00	0.08	0.00	0.00	0.00	0.08
36075	Oswego	19.83	0.00	0.00	0.00	0.00	19.83
36077	Otsego	6.33	0.00	0.00	0.00	0.00	6.33
36079	Putnam	0.00	0.00	1.66	13.19	0.00	14.85
36081	Queens	1.96	0.23	0.00	0.00	0.72	2.91
36083	Rensselaer	13.30	0.00	4.64	0.00	0.00	17.94
36085	Richmond	0.00	0.00	0.00	0.00	0.00	0.00
36087	Rockland	5.93	0.00	0.00	1.81	0.00	7.74
36089	St. Lawrence	21.65	0.36	0.00	0.00	0.00	22.01
36091	Saratoga	8.69	0.00	0.92	0.00	0.00	9.61
36093	Schenectady	15.67	0.00	0.97	0.00	0.00	16.64
36095	Schoharie	2.52	0.00	0.00	0.00	0.00	2.52
36097	Schuyler	0.22	0.21	0.00	0.00	0.00	0.43
36099	Seneca	0.00	0.05	0.00	0.00	0.00	0.05
36101	Steuben	7.87	0.64	0.00	0.00	0.00	8.51
36103	Suffolk	0.00	2.22	0.00	44.51	0.00	46.73
36105	Sullivan	0.37	0.11	0.00	0.00	0.00	0.48
36107	Tioga	3.79	0.00	0.00	0.00	0.08	3.87
36109	Tompkins	0.42	0.00	0.00	0.00	0.00	0.42
36111	Ulster	9.89	0.00	0.00	0.00	0.00	9.89
36113	Warren	0.26	0.00	0.00	0.00	0.00	0.26
36115	Washington	5.31	0.23	0.98	0.00	0.00	6.52
36117	Wayne	18.25	0.10	2.00	0.00	0.00	20.35
36119	Westchester	0.00	0.00	5.15	9.02	0.00	14.17
36121	Wyoming	4.30	0.98	0.00	0.00	0.00	5.28
36123	Yates	0.31	0.03	0.00	0.00	0.00	0.34

Table B-3. 2002 PM_{2.5} Emissions by County and by Locomotive Category

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total PM _{2.5} Emissions
36001	Albany	18.12	0.00	0.00	0.00	1.51	19.63
36003	Allegany	1.59	0.58	0.00	0.00	0.00	2.17
36005	Bronx	2.00	0.00	0.58	0.00	0.00	2.58
36007	Broome	6.54	1.26	0.00	0.00	0.00	7.80
36009	Cattaraugus	2.64	1.61	0.00	0.00	0.00	4.25
36011	Cayuga	5.23	0.36	0.68	0.00	0.00	6.27
36013	Chautauqua	37.09	0.33	0.51	0.00	0.00	37.93
36015	Chemung	3.65	0.00	0.00	0.00	0.00	3.65
36017	Chenango	1.69	1.17	0.00	0.00	0.00	2.86
36019	Clinton	4.12	0.00	0.47	0.00	0.00	4.59
36021	Columbia	21.59	0.00	4.52	0.00	0.00	26.11
36023	Cortland	0.00	1.17	0.00	0.00	0.01	1.18
36025	Delaware	0.68	0.10	0.00	0.00	0.00	0.78
36027	Dutchess	12.32	0.00	7.30	12.30	0.00	31.92
36029	Erie	55.44	0.96	1.60	0.00	0.15	58.15
36031	Essex	4.82	0.00	0.78	0.03	0.00	5.63
36033	Franklin	2.22	0.00	0.00	0.00	0.00	2.22
36035	Fulton	0.00	0.00	0.00	0.00	0.00	0.00
36037	Genesee	17.07	0.96	1.41	0.00	0.00	19.44
36039	Greene	5.56	0.00	0.00	0.00	0.00	5.56
36041	Hamilton	0.00	0.00	0.00	0.00	0.00	0.00
36043	Herkimer	11.60	0.00	1.30	0.02	0.00	12.92
36045	Jefferson	14.88	0.30	0.00	0.00	0.00	15.18
36047	Kings	0.00	0.11	0.00	0.00	0.00	0.11
36049	Lewis	0.00	0.30	0.00	0.00	0.00	0.30
36051	Livingston	1.35	1.16	0.52	0.00	0.00	3.03
36053	Madison	6.38	1.17	0.73	0.00	0.00	8.28
36055	Monroe	23.96	1.25	1.36	0.00	0.00	26.57
36057	Montgomery	19.79	0.00	2.03	0.00	0.00	21.82
36059	Nassau	0.00	0.42	0.00	6.07	0.00	6.49
36061	New York	0.00	0.00	1.83	0.00	0.00	1.83
36063	Niagara	12.64	2.15	0.55	0.00	0.00	15.34
36065	Oneida	13.26	1.47	1.46	0.18	0.00	16.37
36067	Onondaga	24.32	1.87	1.67	0.00	0.00	27.86
36069	Ontario	0.06	0.76	0.00	0.00	0.00	0.82

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total PM _{2.5} Emissions
36071	Orange	6.93	0.03	0.00	11.56	0.00	18.52
36073	Orleans	0.00	0.07	0.00	0.00	0.00	0.07
36075	Oswego	18.65	0.00	0.00	0.00	0.00	18.65
36077	Otsego	5.95	0.00	0.00	0.00	0.00	5.95
36079	Putnam	0.00	0.00	1.56	12.40	0.00	13.96
36081	Queens	1.84	0.21	0.00	0.00	0.65	2.70
36083	Rensselaer	12.51	0.00	4.36	0.00	0.00	16.87
36085	Richmond	0.00	0.00	0.00	0.00	0.00	0.00
36087	Rockland	5.57	0.00	0.00	1.71	0.00	7.28
36089	St. Lawrence	20.36	0.34	0.00	0.00	0.00	20.70
36091	Saratoga	8.17	0.00	0.87	0.00	0.00	9.04
36093	Schenectady	14.73	0.00	0.91	0.00	0.00	15.64
36095	Schoharie	2.37	0.00	0.00	0.00	0.00	2.37
36097	Schuyler	0.20	0.20	0.00	0.00	0.00	0.40
36099	Seneca	0.00	0.05	0.00	0.00	0.00	0.05
36101	Steuben	7.40	0.60	0.00	0.00	0.00	8.00
36103	Suffolk	0.00	2.09	0.00	41.86	0.00	43.95
36105	Sullivan	0.35	0.10	0.00	0.00	0.00	0.45
36107	Tioga	3.56	0.00	0.00	0.00	0.08	3.64
36109	Tompkins	0.40	0.00	0.00	0.00	0.00	0.40
36111	Ulster	9.30	0.00	0.00	0.00	0.00	9.30
36113	Warren	0.24	0.00	0.00	0.00	0.00	0.24
36115	Washington	4.99	0.21	0.92	0.00	0.00	6.12
36117	Wayne	17.16	0.10	1.88	0.00	0.00	19.14
36119	Westchester	0.00	0.00	4.84	8.48	0.00	13.32
36121	Wyoming	4.04	0.93	0.00	0.00	0.00	4.97
36123	Yates	0.29	0.03	0.00	0.00	0.00	0.32

Table B-4. 2002 SO₂ Emissions by County and by Locomotive Category

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total SO ₂ Emissions
36001	Albany	46.88	0.00	0.00	0.00	2.96	49.84
36003	Allegany	4.11	1.50	0.00	0.00	0.00	5.61
36005	Bronx	5.18	0.00	1.51	0.00	0.00	6.69
36007	Broome	16.92	3.25	0.00	0.00	0.00	20.17
36009	Cattaraugus	6.83	4.16	0.00	0.00	0.00	10.99
36011	Cayuga	13.54	0.93	1.75	0.00	0.00	16.22
36013	Chautauqua	95.96	0.86	1.32	0.00	0.00	98.14
36015	Chemung	9.44	0.00	0.00	0.00	0.00	9.44
36017	Chenango	4.38	3.03	0.00	0.00	0.00	7.41
36019	Clinton	10.67	0.00	1.22	0.00	0.00	11.89
36021	Columbia	55.87	0.00	11.68	0.00	0.00	67.55
36023	Cortland	0.00	3.03	0.00	0.00	0.02	3.05
36025	Delaware	1.76	0.26	0.00	0.00	0.00	2.02
36027	Dutchess	31.86	0.00	18.90	31.82	0.00	82.58
36029	Erie	143.45	2.48	4.15	0.00	0.29	150.37
36031	Essex	12.46	0.00	2.03	0.08	0.00	14.57
36033	Franklin	5.74	0.00	0.00	0.00	0.00	5.74
36035	Fulton	0.00	0.00	0.00	0.00	0.00	0.00
36037	Genesee	44.15	2.48	3.64	0.00	0.00	50.27
36039	Greene	14.37	0.00	0.00	0.00	0.00	14.37
36041	Hamilton	0.00	0.00	0.00	0.00	0.00	0.00
36043	Herkimer	30.02	0.00	3.37	0.05	0.00	33.44
36045	Jefferson	38.51	0.77	0.00	0.00	0.00	39.28
36047	Kings	0.00	0.29	0.00	0.00	0.00	0.29
36049	Lewis	0.00	0.77	0.00	0.00	0.00	0.77
36051	Livingston	3.48	3.01	1.35	0.00	0.00	7.84
36053	Madison	16.51	3.03	1.89	0.00	0.00	21.43
36055	Monroe	61.99	3.22	3.51	0.00	0.00	68.72
36057	Montgomery	51.21	0.00	5.26	0.00	0.00	56.47
36059	Nassau	0.00	1.08	0.00	15.70	0.00	16.78
36061	New York	0.00	0.00	4.75	0.00	0.00	4.75
36063	Niagara	32.71	5.56	1.42	0.00	0.00	39.69
36065	Oneida	34.30	3.80	3.78	0.48	0.00	42.36
36067	Onondaga	62.93	4.84	4.32	0.00	0.00	72.09
36069	Ontario	0.16	1.97	0.00	0.00	0.00	2.13

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total SO ₂ Emissions
36071	Orange	17.94	0.07	0.00	29.90	0.00	47.91
36073	Orleans	0.00	0.19	0.00	0.00	0.00	0.19
36075	Oswego	48.25	0.00	0.00	0.00	0.00	48.25
36077	Otsego	15.40	0.00	0.00	0.00	0.00	15.40
36079	Putnam	0.00	0.00	4.03	32.09	0.00	36.12
36081	Queens	4.77	0.55	0.00	0.00	1.27	6.59
36083	Rensselaer	32.36	0.01	11.28	0.00	0.00	43.65
36085	Richmond	0.00	0.00	0.00	0.00	0.00	0.00
36087	Rockland	14.42	0.00	0.00	4.42	0.00	18.84
36089	St. Lawrence	52.67	0.87	0.00	0.00	0.00	53.54
36091	Saratoga	21.15	0.00	2.24	0.00	0.00	23.39
36093	Schenectady	38.12	0.00	2.37	0.00	0.00	40.49
36095	Schoharie	6.12	0.00	0.00	0.00	0.00	6.12
36097	Schuyler	0.53	0.52	0.00	0.00	0.00	1.05
36099	Seneca	0.01	0.12	0.00	0.00	0.00	0.13
36101	Steuben	19.15	1.56	0.00	0.00	0.00	20.71
36103	Suffolk	0.00	5.41	0.00	108.30	0.00	113.71
36105	Sullivan	0.90	0.27	0.00	0.00	0.00	1.17
36107	Tioga	9.22	0.00	0.00	0.00	0.15	9.37
36109	Tompkins	1.03	0.00	0.00	0.00	0.00	1.03
36111	Ulster	24.06	0.00	0.00	0.00	0.00	24.06
36113	Warren	0.62	0.00	0.00	0.00	0.00	0.62
36115	Washington	12.91	0.55	2.38	0.00	0.00	15.84
36117	Wayne	44.39	0.25	4.86	0.00	0.00	49.50
36119	Westchester	0.00	0.00	12.52	21.94	0.00	34.46
36121	Wyoming	10.46	2.40	0.00	0.00	0.00	12.86
36123	Yates	0.76	0.07	0.00	0.00	0.00	0.83

Table B-5. 2002 VOC Emissions by County and by Locomotive Category

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total VOC Emissions
36001	Albany	28.76	0.00	0.00	0.00	3.82	32.58
36003	Allegany	2.52	0.92	0.00	0.00	0.00	3.44
36005	Bronx	3.18	0.00	0.93	0.00	0.00	4.11
36007	Broome	10.38	2.00	0.00	0.00	0.00	12.38
36009	Cattaraugus	4.19	2.55	0.00	0.00	0.00	6.74
36011	Cayuga	8.31	0.57	1.08	0.00	0.00	9.96
36013	Chautauqua	58.87	0.53	0.81	0.00	0.00	60.21
36015	Chemung	5.79	0.00	0.00	0.00	0.00	5.79
36017	Chenango	2.69	1.86	0.00	0.00	0.00	4.55
36019	Clinton	6.55	0.00	0.75	0.00	0.00	7.30
36021	Columbia	34.28	0.00	7.17	0.00	0.00	41.45
36023	Cortland	0.00	1.86	0.00	0.00	0.02	1.88
36025	Delaware	1.08	0.16	0.00	0.00	0.00	1.24
36027	Dutchess	19.55	0.00	11.59	19.52	0.00	50.66
36029	Erie	88.01	1.52	2.55	0.00	0.38	92.46
36031	Essex	7.65	0.00	1.24	0.05	0.00	8.94
36033	Franklin	3.52	0.00	0.00	0.00	0.00	3.52
36035	Fulton	0.00	0.00	0.00	0.00	0.00	0.00
36037	Genesee	27.09	1.52	2.24	0.00	0.00	30.85
36039	Greene	8.82	0.00	0.00	0.00	0.00	8.82
36041	Hamilton	0.00	0.00	0.00	0.00	0.00	0.00
36043	Herkimer	18.41	0.00	2.07	0.03	0.00	20.51
36045	Jefferson	23.62	0.47	0.00	0.00	0.00	24.09
36047	Kings	0.00	0.18	0.00	0.00	0.00	0.18
36049	Lewis	0.00	0.47	0.00	0.00	0.00	0.47
36051	Livingston	2.14	1.85	0.83	0.00	0.00	4.82
36053	Madison	10.13	1.86	1.16	0.00	0.00	13.15
36055	Monroe	38.03	1.98	2.15	0.00	0.00	42.16
36057	Montgomery	31.42	0.00	3.23	0.00	0.00	34.65
36059	Nassau	0.00	0.66	0.00	9.63	0.00	10.29
36061	New York	0.00	0.00	2.91	0.00	0.00	2.91
36063	Niagara	20.07	3.41	0.87	0.00	0.00	24.35
36065	Oneida	21.04	2.33	2.32	0.29	0.00	25.98
36067	Onondaga	38.61	2.97	2.65	0.00	0.00	44.23
36069	Ontario	0.10	1.21	0.00	0.00	0.00	1.31

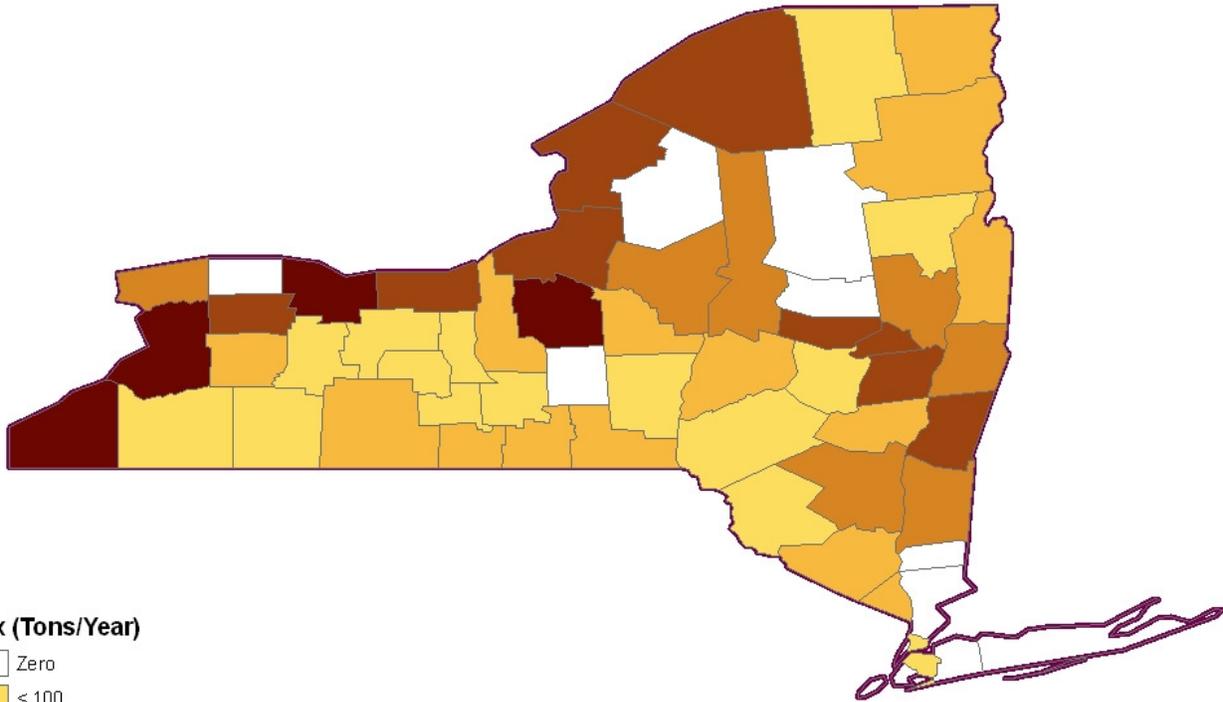
State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total VOC Emissions
36071	Orange	11.00	0.04	0.00	18.34	0.00	29.38
36073	Orleans	0.00	0.11	0.00	0.00	0.00	0.11
36075	Oswego	29.60	0.00	0.00	0.00	0.00	29.60
36077	Otsego	9.45	0.00	0.00	0.00	0.00	9.45
36079	Putnam	0.00	0.00	2.47	19.69	0.00	22.16
36081	Queens	2.93	0.34	0.00	0.00	1.64	4.91
36083	Rensselaer	19.85	0.01	6.92	0.00	0.00	26.78
36085	Richmond	0.00	0.00	0.00	0.00	0.00	0.00
36087	Rockland	8.85	0.00	0.00	2.71	0.00	11.56
36089	St. Lawrence	32.31	0.53	0.00	0.00	0.00	32.84
36091	Saratoga	12.97	0.00	1.37	0.00	0.00	14.34
36093	Schenectady	23.39	0.00	1.45	0.00	0.00	24.84
36095	Schoharie	3.75	0.00	0.00	0.00	0.00	3.75
36097	Schuyler	0.32	0.32	0.00	0.00	0.00	0.64
36099	Seneca	0.00	0.08	0.00	0.00	0.00	0.08
36101	Steuben	11.75	0.96	0.00	0.00	0.00	12.71
36103	Suffolk	0.00	3.32	0.00	66.44	0.00	69.76
36105	Sullivan	0.55	0.17	0.00	0.00	0.00	0.72
36107	Tioga	5.65	0.00	0.00	0.00	0.19	5.84
36109	Tompkins	0.63	0.00	0.00	0.00	0.00	0.63
36111	Ulster	14.76	0.00	0.00	0.00	0.00	14.76
36113	Warren	0.38	0.00	0.00	0.00	0.00	0.38
36115	Washington	7.92	0.34	1.46	0.00	0.00	9.72
36117	Wayne	27.23	0.15	2.98	0.00	0.00	30.36
36119	Westchester	0.00	0.00	7.68	13.46	0.00	21.14
36121	Wyoming	6.42	1.47	0.00	0.00	0.00	7.89
36123	Yates	0.46	0.04	0.00	0.00	0.00	0.50

Table B-6. 2002 NO_x Emissions by County and by Locomotive Category

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total NO _x Emissions
36001	Albany	683.41	0.00	0.00	0.00	64.52	747.93
36003	Allegany	59.98	24.88	0.00	0.00	0.00	84.86
36005	Bronx	75.47	0.00	25.06	0.00	0.00	100.53
36007	Broome	246.68	53.88	0.00	0.00	0.00	300.56
36009	Cattaraugus	99.52	68.88	0.00	0.00	0.00	168.40
36011	Cayuga	197.38	15.46	29.07	0.00	0.00	241.91
36013	Chautauqua	1,398.71	14.22	21.85	0.00	0.00	1434.78
36015	Chemung	137.58	0.00	0.00	0.00	0.00	137.58
36017	Chenango	63.82	50.15	0.00	0.00	0.00	113.97
36019	Clinton	155.54	0.00	20.16	0.00	0.00	175.70
36021	Columbia	814.40	0.00	193.50	0.00	0.00	1007.90
36023	Cortland	0.00	50.15	0.00	0.00	0.33	50.48
36025	Delaware	25.72	4.29	0.00	0.00	0.00	30.01
36027	Dutchess	464.48	0.00	313.04	527.15	0.00	1304.67
36029	Erie	2,091.02	41.00	68.78	0.00	6.38	2207.18
36031	Essex	181.66	0.00	33.61	1.36	0.00	216.63
36033	Franklin	83.72	0.00	0.00	0.00	0.00	83.72
36035	Fulton	0.00	0.00	0.00	0.00	0.00	0.00
36037	Genesee	643.62	41.00	60.37	0.00	0.00	744.99
36039	Greene	209.50	0.00	0.00	0.00	0.00	209.50
36041	Hamilton	0.00	0.00	0.00	0.00	0.00	0.00
36043	Herkimer	437.53	0.00	55.90	0.85	0.00	494.28
36045	Jefferson	561.32	12.78	0.00	0.00	0.00	574.10
36047	Kings	0.00	4.78	0.00	0.00	0.00	4.78
36049	Lewis	0.00	12.78	0.00	0.00	0.00	12.78
36051	Livingston	50.76	49.91	22.36	0.00	0.00	123.03
36053	Madison	240.70	50.15	31.30	0.00	0.00	322.15
36055	Monroe	903.65	53.39	58.13	0.00	0.00	1015.17
36057	Montgomery	746.52	0.00	87.20	0.00	0.00	833.72
36059	Nassau	0.00	17.92	0.00	260.14	0.00	278.06
36061	New York	0.00	0.00	78.64	0.00	0.00	78.64
36063	Niagara	476.85	92.06	23.46	0.00	0.00	592.37
36065	Oneida	499.92	62.93	62.61	7.89	0.00	633.35
36067	Onondaga	917.33	80.09	71.55	0.00	0.00	1068.97
36069	Ontario	2.36	32.68	0.00	0.00	0.00	35.04
36071	Orange	261.45	1.13	0.00	495.24	0.00	757.82
36073	Orleans	0.00	3.08	0.00	0.00	0.00	3.08

State County FIPS	County Name	Class I	Class II/III	Passenger (Amtrak)	Commuter	Yard	Total NO _x Emissions
36075	Oswego	703.29	0.00	0.00	0.00	0.00	703.29
36077	Otsego	224.44	0.00	0.00	0.00	0.00	224.44
36079	Putnam	0.00	0.00	66.72	531.56	0.00	598.28
36081	Queens	69.57	9.13	0.00	0.00	27.70	106.40
36083	Rensselaer	471.75	0.18	186.83	0.00	0.00	658.76
36085	Richmond	0.00	0.00	0.00	0.00	0.00	0.00
36087	Rockland	210.20	0.00	0.00	73.13	0.00	283.33
36089	St. Lawrence	767.75	14.37	0.00	0.00	0.00	782.12
36091	Saratoga	308.26	0.00	37.12	0.00	0.00	345.38
36093	Schenectady	555.63	0.00	39.18	0.00	0.00	594.81
36095	Schoharie	89.20	0.00	0.00	0.00	0.00	89.20
36097	Schuyler	7.72	8.59	0.00	0.00	0.00	16.31
36099	Seneca	0.09	2.05	0.00	0.00	0.00	2.14
36101	Steuben	279.09	25.81	0.00	0.00	0.00	304.90
36103	Suffolk	0.00	89.61	0.00	1,793.88	0.00	1883.49
36105	Sullivan	13.16	4.47	0.00	0.00	0.00	17.63
36107	Tioga	134.33	0.00	0.00	0.00	3.27	137.60
36109	Tompkins	14.94	0.00	0.00	0.00	0.00	14.94
36111	Ulster	350.72	0.00	0.00	0.00	0.00	350.72
36113	Warren	9.09	0.00	0.00	0.00	0.00	9.09
36115	Washington	188.24	9.10	39.34	0.00	0.00	236.68
36117	Wayne	647.02	4.14	80.49	0.00	0.00	731.65
36119	Westchester	0.00	0.00	207.45	363.46	0.00	570.91
36121	Wyoming	152.42	39.68	0.00	0.00	0.00	192.10
36123	Yates	11.03	1.09	0.00	0.00	0.00	12.12

Figure B-1. 2002 Annual NO_x Emissions by County for Class I Rail Lines



NO_x (Tons/Year)

-  Zero
-  < 100
-  100 - 300
-  300 - 550
-  550 - 900
-  900 - 2100

Figure B-2. 2002 Annual NO_x Emissions by County for Class II/III Rail Lines

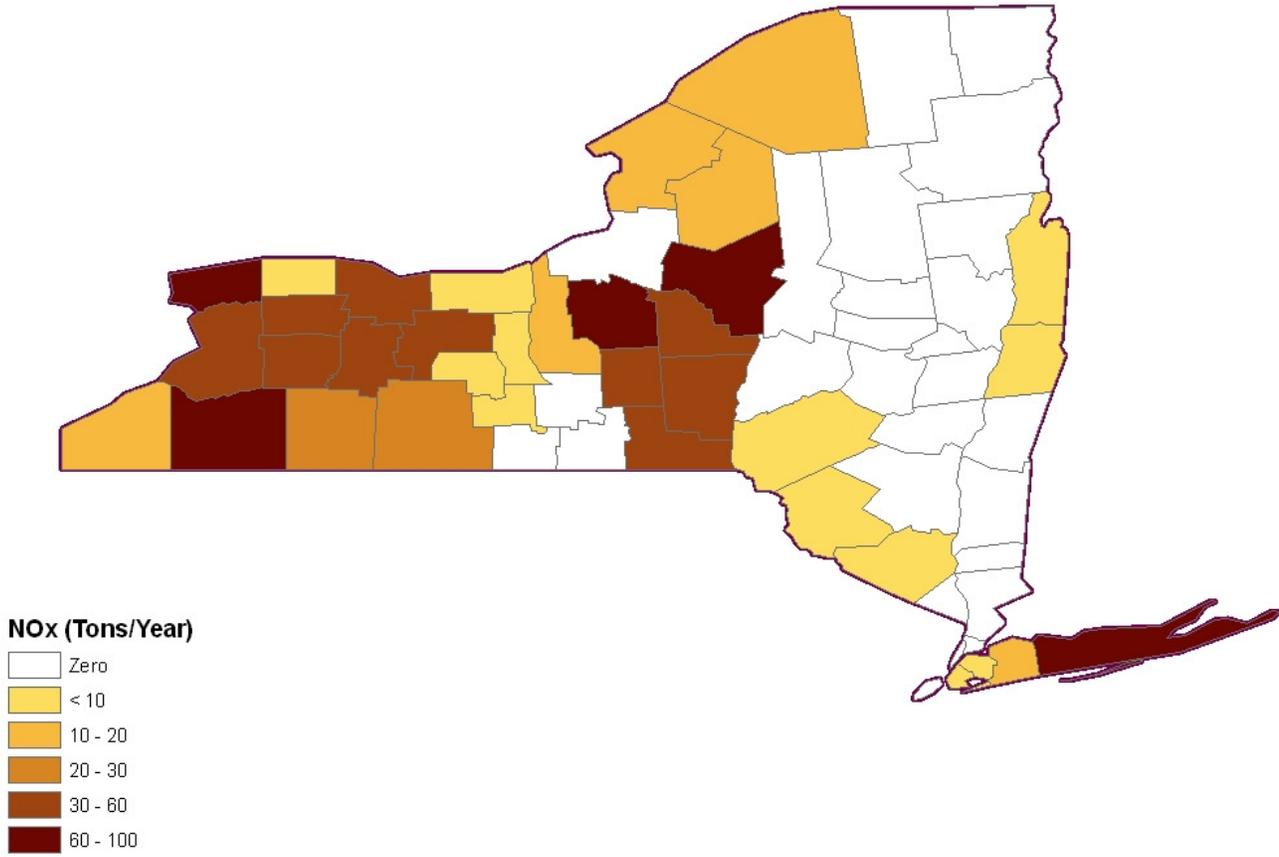


Figure B-3. 2002 Annual NO_x Emissions by County for Passenger Rail Lines

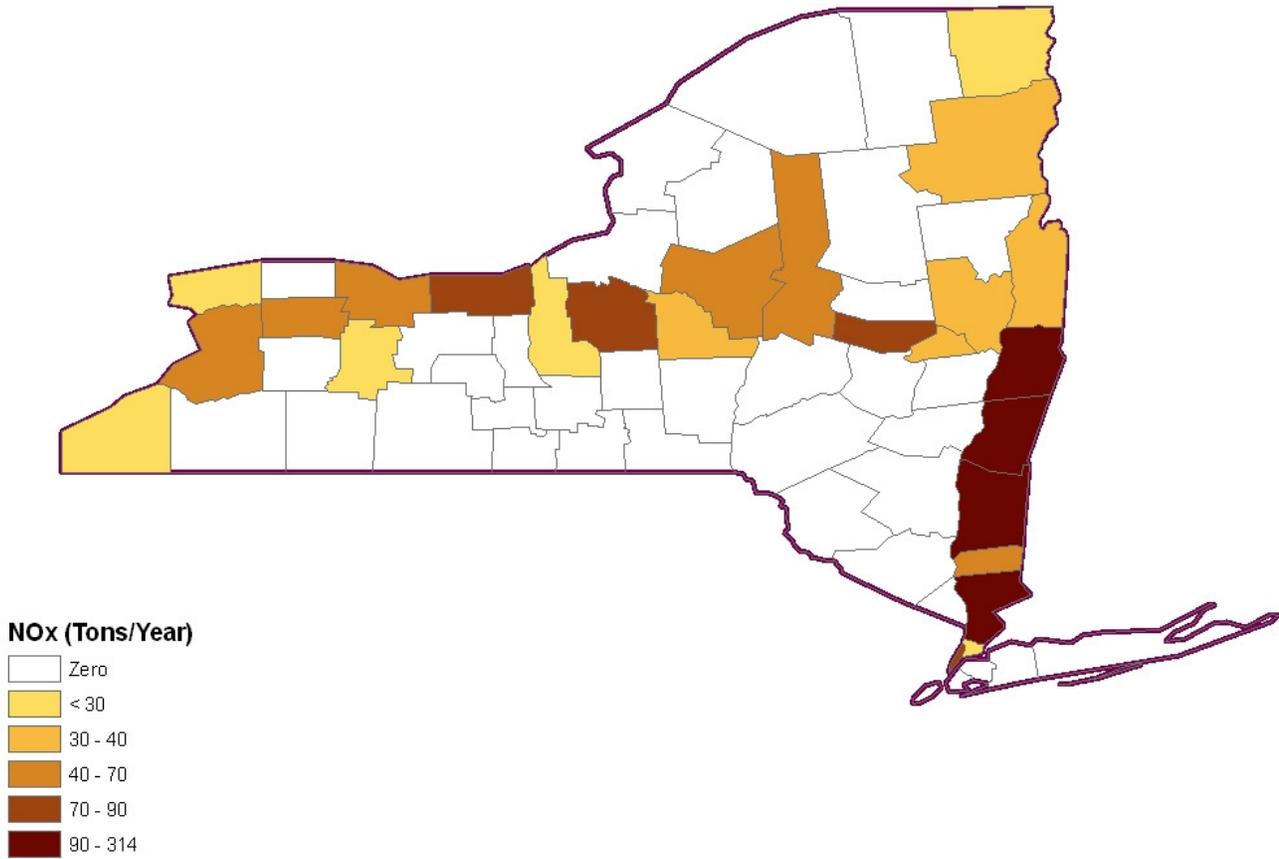


Figure B-4. 2002 Annual NO_x Emissions by County for Commuter Rail Lines

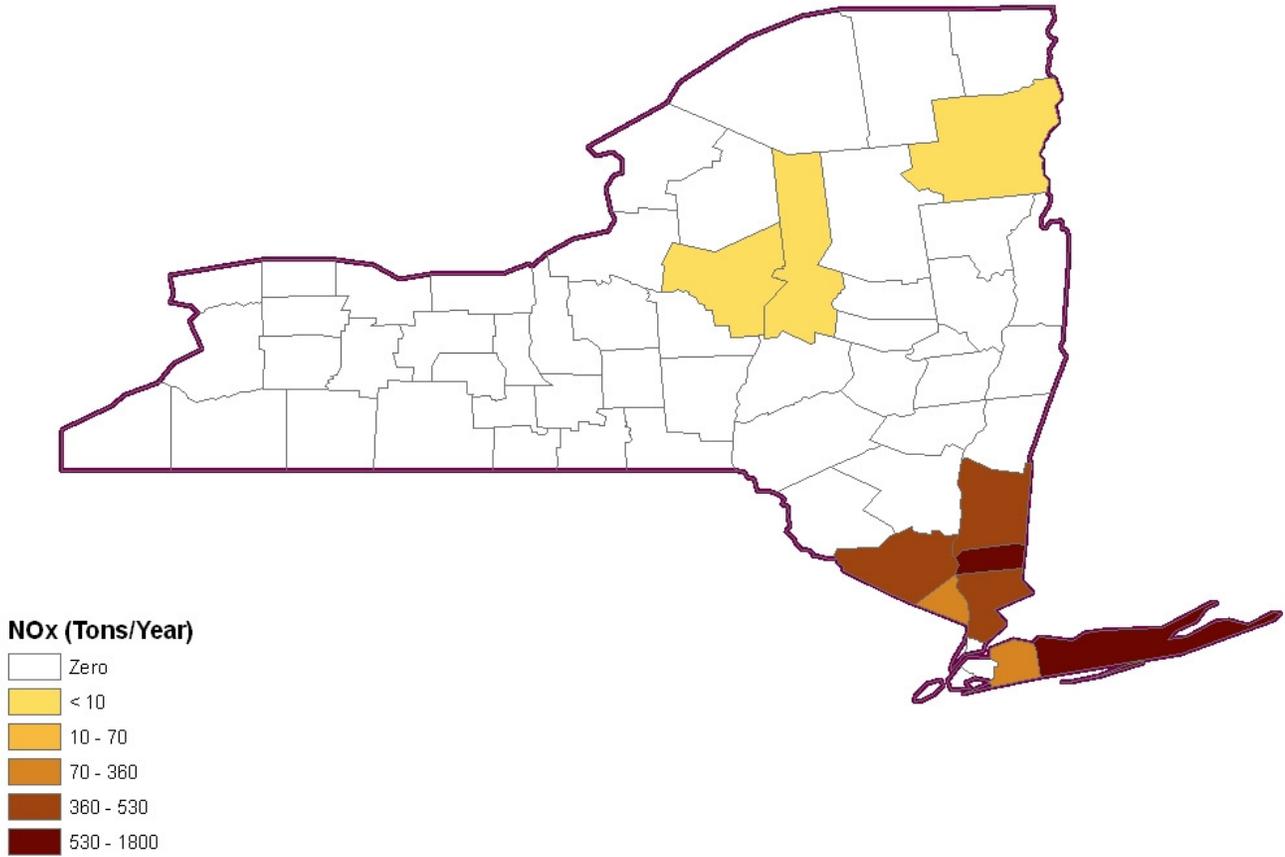


Figure B-5. 2002 Annual NO_x Emissions by County for Switchyard

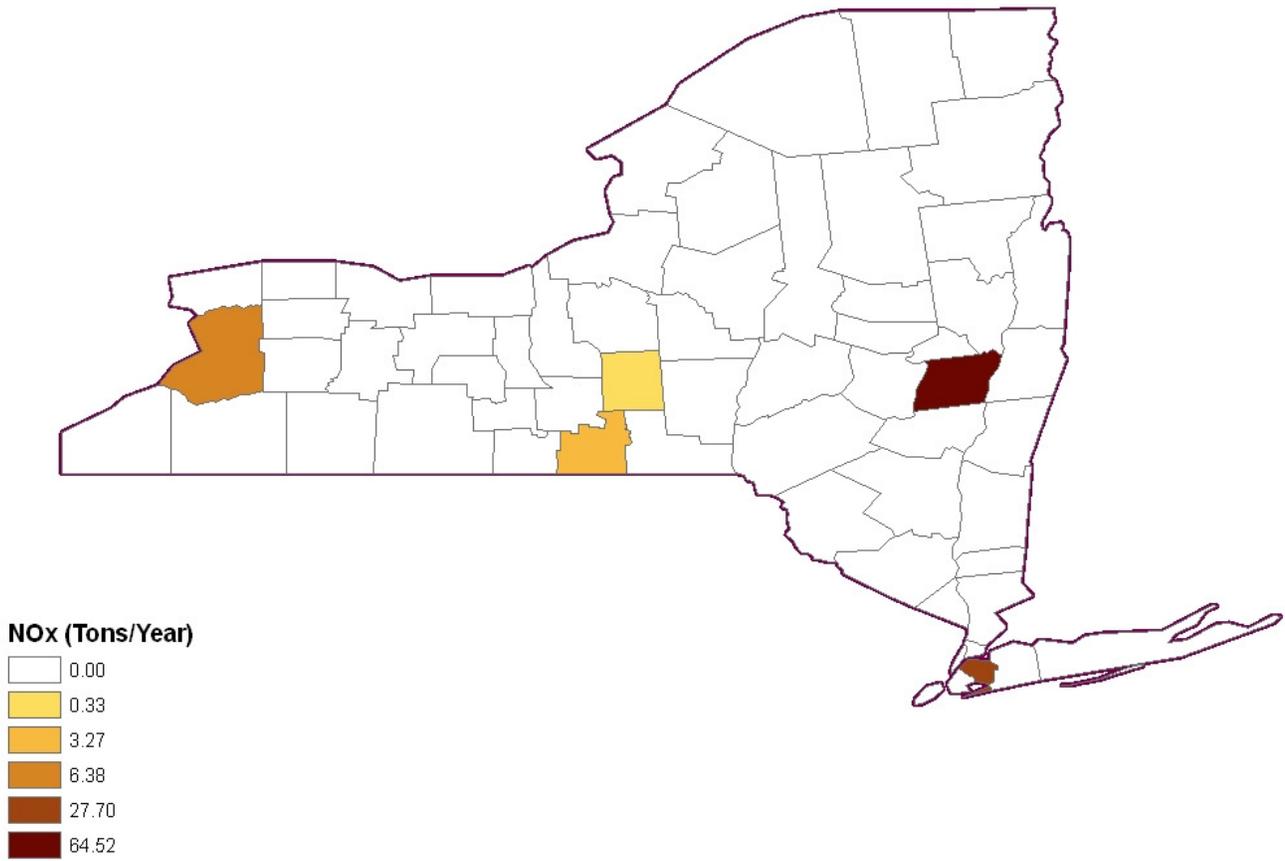
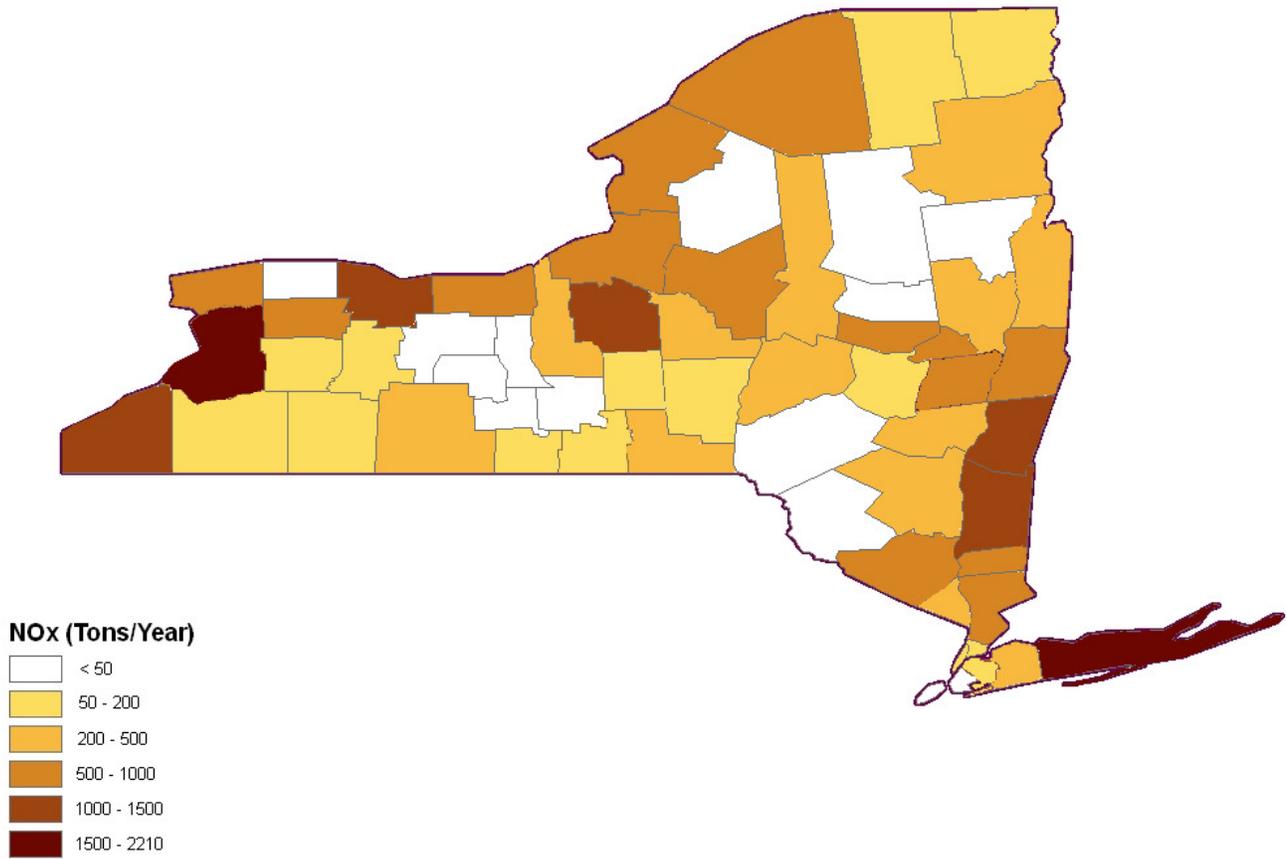


Figure B-6. 2002 Total Annual NO_x Emissions by County



**APPENDIX C. COMPARISON OF 2002 NYS SURVEY-BASED EMISSION ESTIMATES WITH
NEI EMISSION ESTIMATES**

Note: Yard locomotive emissions for Class I railroads could not be separated from overall Class I emissions. Thus, yard locomotive emissions may actually be higher than the survey estimates and emissions from Class I line haul locomotives may be lower.

Table C-1. Comparison of 2002 NYS NEI with NYS Survey-Based CO Emissions

Description	NEI	Survey	Difference
Class I Line Haul	1,036	2,008	972
Class II/III Line Haul	1	103	102
Line Haul Passenger (Amtrak)	51	189	137
Line Haul Commuter	8	399	391
Yard Locomotive	314	11	-303
<i>Total</i>	1,411	2,710	1,300

Table C-2. Comparison of 2002 NYS NEI with NYS Survey-Based PM₁₀ Emissions

Description	NEI	Survey	Difference
Class I Line Haul	261	506	245
Class II/III Line Haul	0	26	26
Line Haul Passenger (Amtrak)	13	47	35
Line Haul Commuter	2	101	98
Yard Locomotive	76	3	-73
<i>Total</i>	352	683	331

Table C-3. Comparison of 2002 NYS NEI with NYS Survey-Based PM_{2.5} Emissions

Description	NEI	Survey	Difference
Class I Line Haul	235	476	241
Class II/III Line Haul	0	24	24
Line Haul Passenger (Amtrak)	12	45	33
Line Haul Commuter	2	95	93
Yard Locomotive	68	2	-66
<i>Total</i>	317	642	325

Table C-4. Comparison of 2002 NYS NEI with NYS Survey-Based SO₂ Emissions

Description	NEI	Survey	Difference
Class I Line Haul	599	1,231	631
Class II/III Line Haul	1	63	63
Line Haul Passenger (Amtrak)	30	116	86
Line Haul Commuter	5	245	240
Yard Locomotive	127	5	-122
<i>Total</i>	761	1,659	898

Table C-5. Comparison of 2002 NYS NEI with NYS Survey-Based VOC Emissions

Description	NEI	Survey	Difference
Class I Line Haul	392	755	363
Class II/III Line Haul	0	39	38
Line Haul Passenger (Amtrak)	19	71	51
Line Haul Commuter	3	150	147
Yard Locomotive	174	6	-168
<i>Total</i>	588	1,021	433

Table C-6. Comparison of 2002 NYS NEI with NYS Survey-Based NOx Emissions

Description	NEI	Survey	Difference
Class I Line Haul	10,520	17,939	7,418
Class II/III Line Haul	9	1,046	1,036
Line Haul Passenger (Amtrak)	521	1,914	1,393
Line Haul Commuter	85	4,055	3,969
Yard Locomotive	2,979	102	-2,876
<i>Total</i>	14,115	25,055	10,940