Appendix C.2

Area Source Inventory Documentation

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List of Acronyms

Acronym	Definition
CARB	California Air Resource Board
EIIP	Emissions Inventory Improvement Program
E-GAS 5.0	Economic Growth Analysis System version 5.0
LPG	Liquid Petroleum Gas
MSW	Municipal Solid Waste
NAICS	North American Industry Classification System
NCDAQ	North Carolina Division of Air Quality
NCDFR	North Carolina Division of Forest Resources
NCDOT	North Carolina Department of Transportation
NCSU	North Carolina State University
NG	Natural Gas
NOx	Nitrogen Oxides
RDU	Raleigh/Durham International Airport
SAF	Seasonal Adjustment Factor
SIC	Standard Industrial Classification
USEPA	U.S. Environmental Protection Agency
USFA	U.S. Fire Administration
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds

1.0 INTRODUCTION AND SCOPE

Area sources represent a collection of many small, unidentified points of air pollution emissions within a specified geographical area, emitting less than the minimum level prescribed for point sources. Because these sources are too small and/or too numerous to be surveyed and characterized individually, all area source activities are collectively estimated. The county is usually the geographic area for which emissions from area sources are compiled, primarily because counties are the smallest areas for which data used for estimating emissions is readily available.

The area source inventories detailed in this section have been developed for the Raleigh-Durham-Chapel Hill 8-hour ozone nonattainment area, referred to as the Triangle nonattainment area, as part of the process of redesignating them from nonattainment to attainment/maintenance for the 8-hour ozone standard. The Triangle area nonattainment counties include Durham, Franklin, Granville, Johnston, Orange, Person, and Wake Counties and Baldwin, Center, New Hope and Williams Townships in Chatham County. All emissions are calculated on a ton per summer day basis.

2.0 OVERALL METHODOLOGY

2.1 SOURCE CATEGORY IDENTIFICATION

The area source categories were identified from two U. S. Environmental Protection Agency (USEPA) guidance documents: EPA-450/4-91-016, Procedures for the Preparation of Emission Inventories of Carbon Monoxide and Precursors of Ozone, Vol. 1, from this point on this document will be referred to as the Procedures document, and the Emissions Inventory Improvement Program (EIIP) Technical Reports, Vol. 3, Area Sources[1] as of December 2002 (the most current version at the time of the inventory development), from this point on this document will be referred to as EIIP Tech Report.

2.2 EMISSION ESTIMATION APPROACH

Area source emissions are estimated by multiplying an emission factor by some known indicator of collective activity for each source category within the inventory area. An indicator is any parameter associated with the activity level of a source that can be correlated with the air pollutant emissions from that source, such as production, number of employees, or population.

In general, one of the following emissions estimation approaches is used to calculate the area source emissions: per capita emission factors, employment-related emission factors, commodity consumption-related emission factors, and level of activity based emission factors. The emission factors used were obtained from the EIIP Tech Reports, the Procedures document or the USEPA's AP-42 Compilation of Air Pollutant Emission Factors, Fifth Edition, referred to as AP-42.

There are several methods for estimating the activity level for a specific area source category. These are: treating area sources as point sources, surveying local activity levels, apportioning national or statewide activity totals to local inventory areas, using population or employment data. All of these methods were used to estimate area source emissions. Since a complete area source inventory was readily available for the year 2002, often this inventory was grown to the base year 2005 being used in the redesignation demonstration and maintenance plan. This was due to the 2005 activity data not being readily available. For some source categories, 2004 activity data was available so it was used to estimate the emissions inventory, then it was grown to 2005.

The estimated 2002 population data, from the 2000 census, was used in conjunction with per capita emission factors, and 2004 employment data for most source categories, from on-line County Business Patterns[2], was used with per employee emission factors.

Table 2.2-1 contains the estimated population for the Triangle nonattainment area counties for this redesignation demonstration and maintenance plan (2005, 2008, 2011, 2014, 2017) as well as the 2002 estimate used to calculate the emissions. Since only a portion of Chatham County is nonattainment, Table 2.2-1 represent the estimated population in the nonattainment area only for Chatham County. Based on the 2000 census, approximately 43% of Chatham County's population is in the nonattainment area. This percentage was used to estimate the projected population of the nonattainment area for all of the years listed.

Table 2.2-1 Population Data

COUNTY	2002	2005	2008	2011	2014	2017
Chatham*	22,685	24,242	25,714	27,252	28,737	30,285
Durham	232,988	242,207	252,089	262,909	273,417	284,020
Franklin	50,422	54,099	57,756	61,462	65,212	69,197
Granville	51,554	53,360	55,861	58,675	61,384	64,352
Johnston	132,448	146,319	160,637	174,692	188,763	203,820
Orange	119,353	121,992	127,191	132,140	136,629	141,597
Person	36,744	37,131	38,248	39,436	40,560	41,774
Wake	679,785	755,053	832,613	905,667	978,823	1,056,139

* Nonattainment portion's population

For creating future year emission estimates for many source categories, the base year emission inventory was projected with a source category specific growth factor generated with the USEPA's Economic Growth Analysis System[4] version 5.0 beta (E-GAS 5.0) program. Source categories estimated by per-capita emission factors were grown using predicted future year populations provided by the North Carolina Office of State Budget and Management[3] and were based originally on 2000 census data. Population growth factors were calculated to adjust 2002 values to future years by multiplication. These growth factors are listed in Table 2.2-2.

Table 2.2-2 Population Growth Factors

COUNTY	2005	2008	2011	2014	2017
Chatham	1.0687	1.1336	1.2014	1.2668	1.3351
Durham	1.0396	1.0820	1.1284	1.1735	1.2190
Franklin	1.0729	1.1455	1.2190	1.2933	1.3724
Granville	1.0350	1.0835	1.1381	1.1907	1.2482
Johnston	1.1047	1.2128	1.3189	1.4252	1.5389
Orange	1.0221	1.0657	1.1071	1.1447	1.1864
Person	1.0105	1.0409	1.0733	1.1039	1.1369
Wake	1.1107	1.2248	1.3323	1.4399	1.5536

Certain emission categories were adjusted for such things as season or rule effectiveness and rule penetration. These are discussed in the particular source categories descriptions.

For certain categories, there can be overlap between the point source emissions and the area source emissions calculated with emission factors. The 2002 point source emissions in these categories were identified so that they could be subtracted where appropriate.

There are a number of categories where emissions were calculated with emission factors based on employment. These emission factors were developed by the USEPA when employment reports were organized by Standard Industrial Classification (SIC) code. Since 1997 employment statistics are organized by the North American Industry Classification System (NAICS). For the solvent cleaning industries, the SIC codes do not directly correspond to single NAICS code. Sometimes several partial NAICS employment values will relate to a SIC code. A crosswalk was used to determine what percentage of a NAICS employment value would correspond to the SIC codes. The tables from the US Census showing the NAICS-SIC crosswalk are reproduced in Section 5 – Additional Data. It should be noted that the crosswalk is based on national totals and is not specific to any particular state. In Section 5.2, the employment fraction of the NAICS codes used to create the SIC code employment data is tabulated.

The employment numbers were obtained from the on-line 2004 County Business Patterns for the various NAICS codes at the county level for North Carolina. In addition to having employment values (or employment ranges due to confidentiality rules) by NAICS, the County Business Patterns breaks down the number of facilities by employment categories. The employment categories are 1 – 4, 5 – 9, 10 – 19, 20 – 49, 50 – 99, 100 – 249, 250 – 499, 500 – 999, >1000

employees. To account for point sources, it was assumed that facilities with 100 employees or greater were point sources and were not considered in the calculations.

When a NAICS category gave a number of employees and there were no establishments with 100 employees or greater, then the value was used. However, in most cases the County Business Patterns gave a range of total employees in the county instead of the actual number. When this occurred, facility sizes were considered and the mid-range of employees was assumed, in accordance with the EIIP Tech. Report. For example, a NAICS category for a county had a range of employment of 100-249 with two establishments with 1 – 4 employees, one with 20-49 employees, and one with 100-249 employees. Assuming 3 to be the mid-range of 1 –4 and 35 to be the mid-range of 20-49, the employment used for the area source calculation was estimated as:

(2 x 3) + (1 x 35) = 41 employees

The larger establishment was assumed to be a point source and not taken into consideration for the area source calculation.

If a total number of employees was provided and there were establishments with 100 employees or greater, then the mid-range of the smaller facilities were used as described above. The estimated employment was compared to the value given to ensure that remainder would account for the large establishment. In cases where the remainder would not be enough employment to account for the larger establishment, the area source employment was adjusted down. For example, a NAICS category had 250 employees with one establishment with 20 – 49 employees (mid-range 35), two establishments with 50 – 99 employees (mid-range 75), and one establishment with 100 – 249 employees. The employment estimated for the area source and the remainder employment was estimated as:

(1 x 35) + (2 x 75) = 185 employees
250 – 185 = 65 employees

The remainder of 65 employees is not enough to account for an establishment of 100 – 249 employees. Therefore, the area source employment was adjusted down by 35 so that there were 100 employees remaining to account for the large establishment.

3.0 QUALITY ASSURANCE MEASURES

The first issue in quality assurance is that of developing a complete list of area sources. The Procedures document and the EIIP Tech Report were the primary reference used in preparing the list for the inventory. Next, measures to ensure valid emission estimates were adopted using guidance provided by document EPA-450/4-88-023, the EPA Quality Assurance Document for Post-1987 SIP Emission Inventories. Since many are based on AP-42 factors, factors given in the Procedures document or the EIIP Tech Report, sources of error would primarily be associated with the multiplier values and the accuracy of emission calculations.

Under the direction of the quality assurance coordinator, emission sources whose contribution was either at the high or low end of the range of estimates were scrutinized more closely for reasonableness. The accuracy was addressed by performing independent checks of the calculations.

4.0 DISCUSSION OF AREA SOURCE CATEGORIES

There are five major area source categories comprising of a number of individual area source types. Sections 4.1 through 4.5 address each of these categories and include a number of subsections that corresponds to the contributory area sources. The objective of each subsection is to describe each source category and the emission estimation and/or projection procedures.

4.1 GASOLINE DISTRIBUTION

The area source emissions attributed to this category are associated with various operations related to gasoline and aircraft fuel handling and distribution. Since tank farms and bulk plants are specifically addressed in the point source inventory, the area source category is limited to fuel handling, storage, and distribution operations associated with the service stations and in the refueling of aircrafts.

4.1.1 Gasoline Dispensing Facilities

Since service stations are so numerous, they are collectively considered as an area source. The area source emissions that are derived for this subsection involve determining the estimated emissions that occur at each of the following operations: 1) losses during storage tank filling, 2) storage tank breathing and working losses, 3) spillage and 4) truck transit losses. The emissions from vehicle refueling are captured in the mobile source inventory in the emission factors produced by the USEPA's MOBILE6.2 model and therefore are not estimated as part of the area source inventory.

As part of the air toxics program, Stage I controls for gasoline dispensing facilities was adopted by the State, effective May 1990 with final compliance by January 1, 1994. Stage I is the vapor recovery technology on the underground storage tanks and reduces the emissions during the tank filling operations at service stations.

The North Carolina Department of Agriculture, Standards Division is responsible for going to all gasoline dispensing facilities and testing the fuels to ensure that it meets the quality standards of the State. The North Carolina Division of Air Quality (NCDAQ) has worked out an agreement with the Standards Division to also check for Stage I controls. A notice is sent to the NCDAQ for every facility checked by the Standards Division verifying if a facility has properly maintained control equipment. If a facility is not found to be properly maintaining the control equipment, then the NCDAQ sends a notice of violation informing the facility that the controls are required and gives the facility time to correct the violation before fines are accessed. From

this information the rule effectiveness and rule penetration can be estimated. The rule effectiveness is the percentage of facilities complying with the rule, where as the rule penetration is the percentage of facilities requiring Stage I controls. Control efficiency is the expected percent reduction from this control technology. The compliance factors for Stage I controls for the Triangle area are listed in Table 4.1.1-1.

Table 4.1.1-1 Compliance Factors for Stage I Controls

Rule Effectiveness	Rule Penetration	Control Efficiency
0.97	0.99	0.95

The volatile organic compound (VOC) emission factor for underground storage tank filling was calculated by using an equation from AP-42, page 5.2-4 (equation)

$$EF = 12.46 \frac{[SPM]}{[T]} \times [1-(RE \times CE \times RP)]$$

where EF = emission factor in pounds of VOC per 1000 gallons
S = Saturation factor
P = True vapor pressure (in pounds per square inch area)
M = Molecular weight of vapors (lb/lb-mole)
T = Temperature of bulk liquid (^{o} Rankin)
RE = Rule Effectiveness
CE = Control Efficiency
RP = Rule Penetration

The saturation factor was obtained from AP-42, Table 5.2-1 and the true vapor pressure and molecular weight of vapors were obtained from AP-42, Table 7.1-2. For the temperature an average of the June, July and August average monthly temperature for 2002 was used. These temperatures were obtained from the North Carolina Climatological Data[5], a publication of the National Oceanic and Atmospheric Administration. All of the factors used to calculate the emission factor for Stage I, i.e. balanced submerged filling, are listed in Table 4.1.1-2.

Table 4.1.1-2 Factors Used For Calculating Emission Factor

S	P	M	T
1	6.49	67	537.6^{o}R (77.6^{o}F)

$$EF_{EN} = 12.46 \left\lceil \frac{1 \times 6.49 \times 67}{537.6} \right\rceil \times [1 - (.97 \times .95 \times .99)]$$

$$= 0.884 \text{ lb VOC/1000 gal. Gasoline}$$

The emission factors for tank truck transit, breathing losses and spillage were obtained from the EIIP Tech Report, Table 11.3-1 and are listed below in Table 4.1.1-3. The tank truck transit emission factor includes the emission rate for an empty tank plus a full tank and was adjusted by a factor of 1.25 as recommended by the EIIP Tech Report, pg. 11.5-3.

Table 4.1.1-3 Emission Factors For Gasoline Dispensing

Underground Storage Tank Filling	Tank Truck Transit	Breathing	Spillage
0.884 lb/1000gal	0.000075 lb/gal	0.001 lb/gal	0.00068 lb/gal

The activity data needed to calculate the emissions is number of gallons of fuel sold in each county per year. This was obtained from a report from the North Carolina Petroleum Marketers Association. A weighting factor was devised by producing the sum of county population (1000's), county registered vehicles (1000's), and county motor fuel outlets. The factors were summed for the 100 counties and a fractional part of the whole found for each county. This fraction was multiplied by the state total gallons of gasoline and diesel in 2002 to get an estimate of gallons of fuel per county.

Table 4.1.1-4 Fuel Use Data 2002

County	Population in 1000's	Vehicles in 1000's	Motor Fuel Outlets	Add Columns 2, 3, & 4	County Fraction of State	Gasoline Use 1000's gals	Diesel Use 1000's gals
Chatham	52.5	49.1	53	156	0.00697	29,598.87	8,233.56
Durham	233.0	161.2	139	534.4	0.02386	101,395.11	28,205.23
Franklin	50.4	43.1	55	148.5	0.00663	28,175.85	7,837.72
Granville	51.6	41.6	67	159.5	0.00712	30,262.95	8,418.29
Johnston	132.4	113.1	133	379.3	0.01694	71,967.00	20,019.17
Orange	119.3	84.0	62	266.5	0.01190	50,564.74	14,065.67
Person	36.7	35.9	60	132.5	0.00592	25,140.07	6,993.25
Wake	679.8	564.6	382	1622.1	0.07244	307,771.4	85,613.23
State Totals	8,320.0	6,802.0	7,271	22392.7	1	4,248,710	1,181,870

According to the EIIP Tech Report, the activity days per week for truck transit and underground storage tank filling are 6 days per week and for spillage and breathing losses 7 days per week. For the future year inventories the base year emissions were grown using the appropriate E-GAS 5.0 factors listed in Table 4.1.1-5.

Table 4.1.1-5 Growth Factors for Gasoline Dispensing

2005	2008	2011	2014	2017
1.0011	1.0246	1.0375	1.0327	1.0333

Note that diesel fuel used is combined with gasoline for sake of simplification. This will result in some overestimation of VOC emissions because of different volatility.

The following examples show calculations for Wake County for 2005. The other years and other county emissions in the Triangle nonattainment area were done in like manner.

Tank Truck Transit

VOC_{2005} = ((308,000,000 + 85,613,230)gal/yr)*(.000075 lbvoc/gal)*(1 ton/2000 lb)* (1.0011 $EGAS_{05/02}$)*(1/365 yr/day)*(7/6 dayswk/dayswk) = 0.0472 tons/day

Underground Storage Tank Filling

VOC_{2005} = ((308,000,000 + 85,613,230)gal/yr)*(1/1000 1000gal/gal)*(0.764 lbvoc/1000gal)* (1 ton/2000 lb)*(1.0011 $EGAS_{05/02}$)*(1/365 yr/day)*(7/6 dayswk/dayswk) = 0.4811 tons/day

Breathing Loss

VOC_{2005} = ((308,000,000 + 85,613,230)gal/yr)*(0.001 lbvoc/gal)*(1 ton/2000 lb)* (1.0011 $EGAS_{05/02}$)*(1/365 yr/day) = 0.5452 tons/day

Spillage Loss

VOC_{2005} = ((308,000,000 + 85,613,230)gal/yr)*(0.00068 lbvoc/gal)*(1 ton/2000 lb)* (1.0011 $EGAS_{05/02}$)*(1/365 yr/day) = 0.3671 tons/day

The VOC emission estimates, in tons/day, from gasoline service stations for the Triangle nonattainment area are listed in Tables 4.1.1-6 through 4.1.1-9, and are totaled for this source category in Table 4.1.1-10. For Chatham County, the total county emissions were adjusted to the

nonattainment portion of the County by multiplying by the fraction of the population in the nonattainment area, i.e., 43.22%.

Table 4.1.1-6 VOC Emissions From Tank Truck Transit

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.05	0.05	0.05	0.05	0.05
TOTAL	**0.09**	**0.09**	**0.09**	**0.09**	**0.09**

Table 4.1.1-7 VOC emissions From Underground Storage Tank Filling

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.02
Durham	0.16	0.16	0.16	0.16	0.16
Franklin	0.05	0.05	0.05	0.05	0.05
Granville	0.05	0.05	0.05	0.05	0.05
Johnston	0.13	0.13	0.14	0.13	0.13
Orange	0.09	0.09	0.09	0.09	0.09
Person	0.05	0.05	0.05	0.05	0.05
Wake	0.48	0.49	0.50	0.50	0.50
TOTAL	**1.03**	**1.04**	**1.06**	**1.05**	**1.05**

Table 4.1.1-8 VOC Emissions From Breathing Loss

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.02
Durham	0.18	0.18	0.18	0.18	0.18
Franklin	0.05	0.05	0.05	0.05	0.05
Granville	0.05	0.05	0.05	0.05	0.05
Johnston	0.13	0.13	0.13	0.13	0.13
Orange	0.09	0.09	0.09	0.09	0.09
Person	0.04	0.05	0.05	0.05	0.05
Wake	0.54	0.55	0.56	0.56	0.56
TOTAL	**1.10**	**1.12**	**1.13**	**1.13**	**1.13**

Table 4.1.1-9 VOC Emissions From Spillage

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.02
Durham	0.12	0.12	0.13	0.12	0.12
Franklin	0.03	0.03	0.03	0.03	0.03
Granville	0.04	0.04	0.04	0.04	0.04
Johnston	0.09	0.09	0.09	0.09	0.09
Orange	0.06	0.06	0.06	0.06	0.06
Person	0.03	0.03	0.03	0.03	0.03
Wake	0.37	0.38	0.38	0.38	0.38
TOTAL	0.76	0.77	0.78	0.77	0.77

Table 4.1.1-10 Total VOC Emissions From Gasoline Dispensing Facilities

County	2005	2008	2011	2014	2017
Chatham	0.06	0.06	0.06	0.06	0.06
Durham	0.48	0.48	0.49	0.48	0.48
Franklin	0.13	0.13	0.13	0.13	0.13
Granville	0.14	0.14	0.14	0.14	0.14
Johnston	0.36	0.36	0.37	0.36	0.36
Orange	0.25	0.25	0.25	0.25	0.25
Person	0.12	0.13	0.13	0.13	0.13
Wake	1.44	1.47	1.49	1.49	1.49
TOTAL	**2.98**	**3.02**	**3.06**	**3.04**	**3.04**

4.1.2 Aircraft Refueling

Like vehicle refueling, aircraft refueling results in VOC emissions from displacement of the vapor laden air in the aircraft's fuel tank. This source category is generally estimated only for large commercial airports. In the Triangle area, the one major airport is the Raleigh/Durham International Airport (RDU) located in Wake County. There are a few small commuter airports in the Triangle area, however, the amount of the emissions from these are be negligible.

The emissions from aircraft refueling were determined by using the number of gallons of fuel supplied to the airports and multiplying it by the appropriate emission factor. The businesses that supply the fuel to the airports were contacted to determine the amount and type of fuel supplied to each airport during 2002. The information obtained was for the two fuel types supplied, Jet A Kerosene and Aviation Gasoline. Table 4.1.2-1 tabulates the amount of each fuel supplied to each airport.

Table 4.1.2-1 Gallons of Fuel Consumed at Airports

County	Aviation Gasoline	Jet A Kerosene
Wake County (RDU)	536,163	87,104,173

The emission factors used are 11.38 lb VOC/1000 gallons of aviation gasoline and 0.065 lb VOC/1000 gallons of Jet A kerosene. Airport refueling occurs on a daily basis, therefore the activity days per week are 7. For the future year inventories, the base year emissions were grown using growth factors from the EGAS 5.0 projection model. The growth factors for the Triangle area are listed in Table 4.1.2-2.

Table 4.1.2-2 Growth Factors For Aircraft Refueling

County	2005	2008	2011	2014	2017
Wake County (RDU)	1.1083	1.256	1.3874	1.5092	1.6295

The emissions for the base year and future years were calculated using equations 4.1.2-1 and 4.1.2-2, respectively.

$$EM_i = \frac{\text{Gallons} \times EF_i}{(2000 \text{ lbs/ton}) \times (7 \text{ days/week}) \times (52 \text{ weeks/year})} \qquad 4.1.2\text{-}1$$

$$PJ_bEM_i = EM_i \times GF_a \qquad 4.1.2\text{-}2$$

where EM_i = emissions for source category (i)
EF_i = emission factor for source category (i)
PJ_bEM_i = projected future year (b) emissions for source category (i)
GF_a = growth factor for redesignation area (a)

Examples of the emission calculation for Wake County are listed below:

Aviation Gasoline consumed at RDU = 536,163 gallons
Jet A Kerosene consumed at RDU = 87,104,173 gallons
Emission Factor for Aviation Gasoline = 11.38 lb VOC/10^3 gallon
Emission Factor for Jet A Kerosene = 0.065 lb VOC/10^3 gallon
Growth Factor for 2005 = 1.1083

From equation 4.1.2-1:

$$VOC_{2002} = \frac{(536.1\ 10^3 \text{ gallons A.G./year}) \times (11.38 \text{ lb VOC/1000 gallons})}{(2000 \text{ lb/ton}) \times (7 \text{ days/week}) \times (52 \text{ weeks/year})}$$
$$= 0.0084 \text{ tons VOC/day from aviation gasoline}$$

$$VOC_{2002} = \frac{(87{,}104.2\ 10^3 \text{ gallons Jet A kerosene/year}) \times (0.065 \text{ lb VOC/1000 gallons})}{(2000 \text{ lb/ton}) \times (7 \text{ days/week}) \times (52 \text{ weeks/year})}$$
$$= 0.0078 \text{ tons VOC/day from aviation gasoline}$$

Total VOC_{2002} = 0.01 + 0.01
= 0.02 tons VOC/day

For the emission estimates from aircraft refueling for all counties in the Triangle nonattainment area, refer to Table 4.1.2-3.

Table 4.1.2-3 Total VOC Emissions From Aircraft Refueling

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.02	0.02	0.02	0.03
TOTAL	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**

4.2 STATIONARY SOURCE SOLVENT EVAPORATION

There are eleven subcategories that involve stationary source solvent evaporative emissions. They include: dry cleaning, graphic arts, solvent cleaning, automotive refinishing, architectural coatings, traffic markings, industrial surface coating, asphalt paving, roofing operations, pesticide application, and consumer/commercial solvent use. The methodology used to calculate the emissions from these sources are described in detail in each subsection.

4.2.1 Dry Cleaning

The VOC emissions from dry cleaning vary with the type of process and the solvent used. For the most part, dry cleaners (coin-operated and conventional) are small business entities. As a result of their size, dry cleaning emissions are not captured as point sources. However, dry cleaning operations can be a significant emission source for VOC emissions, when taken collectively.

The emissions from dry cleaners are estimated by multiplying the number of employees at dry cleaners by a national per-employee emission factor, 1800 lbs. of VOC/employee/year, found in the EIIP Tech. Report. The number of employees was obtained from the County Business Patterns for NAICS codes 812310 (coin operated) and 812320 (commercial). As previously described, the NAICS employment numbers were previously processed to exclude any facilities with 100 or more employees which were deemed to be point sources. For the Triangle nonattainment area there were no facilities large enough to be considered point sources. Table 4.2.1-1 below shows employment numbers used. The fractional employees for commercial dry cleaners are due to a fractional part of the 812320 NAICS being used to estimate SIC 7216 employment.

Table 4.2.1-1 Employment Data for Dry Cleaners

County	Estimated Number of Coin Operated Employees	Estimated Number of Commercial Employees
Chatham	6	5.71
Durham	29	145.18
Franklin	17	2.45
Granville	44	0.00
Johnston	19	35.07
Orange	3	114.19
Person	3	14.68
Wake	333	622.33

According to the EIIP Tech. Report, the activity days per week is 6 days. For the base year and future years inventories, the 2004 year emissions were grown using E-GAS 5.0 growth factors (Table 4.2.1-2). Coin operated dry cleaning was projected by factors for SCC 2420020000 while commercial dry cleaning was projected by factors for SCC 2420010000. The factors for both are the same.

Table 4.2.1-2 Growth Factors for Dry Cleaning

2005	2008	2011	2014	2017
1.007491	1.024969	1.044944	1.117353	1.189763

The emissions for 2004 were calculated using equation 4.2.1-1 and the emissions for the base year and future years were calculated using equation 4.2.1-2. Note that for Chatham County, the county total was multiplied by 0.4322 to adjust for only part of Chatham being classified nonattainment. This number is the fraction of the population in the nonattainment area based on the 2000 Census.

$$EM = \frac{\text{Employees x EF}}{\text{(2000 lb/tons) x ((6 days/week)/(7 days/week)) x (365 days/year)}} \qquad 4.2.1\text{-}1$$

$$PJ_aEM = EM \times GF_a \qquad 4.2.1\text{-}2$$

where EM = emissions for source category tons/day
EF = emission factor for source category, 1800 lbs VOC/employee/yr
PJ_aEM = projected base year (a) or projected future year (a) emissions
GF_a = growth factor for base year or projected future year (a)

Examples of the emission calculation for commercial dry cleaners in Wake County are listed below:

Number of employees = 622.33
Emission factor = 1800 lbs VOC/employee/year
Projection factor for 2005 = 1.007491

From equation 4.2.1-1 and 4.2.1-2

$$VOC_{2004} = \frac{\text{(622.33 employees) x (1800 lb VOC/employee/yr)}}{\text{(2000 lb/ton) (6 days/wk/7 days/wk) (365 days/yr)}}$$
$$= 1.7903 \text{ tons VOC/day}$$

VOC_{2005} = 1.7903 x 1.007491
= 1.80 tons VOC/day

The VOC emission estimates, in tons/day, from dry cleaning for the Triangle nonattainment area are listed in Table 4.2.1-4.

Table 4.2.1-3 VOC Emissions From Dry Cleaning Operations

County	2005	2008	2011	2014	2017
Coin Operated					
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.08	0.09	0.09	0.09	0.10
Franklin	0.05	0.05	0.05	0.05	0.06
Granville	0.13	0.13	0.13	0.14	0.15
Johnston	0.06	0.06	0.06	0.06	0.07
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.97	0.98	1.00	1.07	1.14
Sub Total	1.32	1.34	1.36	1.44	1.55
Commercial					
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.42	0.43	0.44	0.47	0.50
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.10	0.10	0.11	0.11	0.12
Orange	0.33	0.34	0.34	0.37	0.39
Person	0.04	0.04	0.04	0.05	0.05
Wake	1.80	1.83	1.87	2.00	2.13
Sub Total	2.71	2.76	2.82	3.02	3.21
Total	**4.03**	**4.10**	**4.18**	**4.46**	**4.76**

4.2.2 Graphic Arts/Printing

Graphic arts include operations that are involved in printing of newspapers, magazines, books, and other printed materials, which can be divided into several subsets based upon printing technology. Over the last decade ink-jet and offset lithography have emerged as the dominant technologies. The use of oils as ink solvents and the reduction of alcohols in the fountain

solution and in the cleanup solutions have resulted in notable reductions in emissions for offset lithography. Ink-jet printing results in essentially no VOC emissions.

A number of establishments that generate emissions in this source category are in-house graphic arts operations at plants that are in non-printing industries. Therefore, an employee per SIC code emission factor is not very reliable. The per-capita emission factor of 1.3 lbs VOC/person/year provided by the EIIP Tech. Report was used to calculate the VOC emissions. This emission factor estimates the emissions from facilities less than 100 tons VOC/year. It assumes that facilities greater than 100 tons VOC/year will be in the point source inventory. The population used to calculate the base year emissions is found in Table 2.2-1, 2002 column.

According to the Procedures document, Table 5.8-1, the activity days per week is 5 and there is no seasonal adjustment needed. There were no graphic arts point sources, source classification code 4-05-xxx-xxx, that emit less than 100 tons/year, in the Triangle nonattainment area.

Since the emissions are calculated based on population, the future years inventories were grown using the population growth factors from Table 2.2-2. The emissions for the base year and future years were calculated using equations 4.2.2-1 and 4.2.2-2, respectively.

$$EM_a = ((EF)*(\text{Population}_{2002})*(1\ \text{ton}/2000\ \text{lb})) \qquad 4.2.2\text{-}1$$

$$PJ_bEM_a = EM_a \times GF_a \times (1\ \text{yr}/365\ \text{days}) \times (7\ \text{days}/5\ \text{days}) \qquad 4.2.2\text{-}2$$

where EM = emissions for source category for county (a) ton/yr
EF = emission factor for source category, 1.3 lbs VOC/person/yr
PJ_bEM_a = projected future year (b) emissions for county (a) ton/day
GF_a = growth factor for county (a)

Examples of the emission calculation for Wake County are listed below:

Wake County Population = 679,785 people
Emission factor = 1.3 lbs VOC/person/yr
Point Source Emissions = 0 tons/day
Projection factor for 2005 = 1.1107
From equation 4.2.2-1 and 4.2.2-2

VOC_{2002} = (1.3)*(679,785)*(1/2000)-92.03 = 349.83 Tons/Year

VOC_{2005} = (349.83)*(1.1107)*(1/365)*(7/5) = 1.49 Tons/Day

The VOC emission estimates, in tons/day, from graphic arts operations for the Triangle nonattainment area are listed in Table 4.2.2-1.

Table 4.2.2-1 VOC Emissions From Graphic Arts Operations

County	2005	2008	2011	2014	2017
Chatham	0.06	0.06	0.07	0.07	0.08
Durham	0.61	0.63	0.66	0.68	0.71
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.13	0.14	0.15	0.15	0.16
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.31	0.32	0.33	0.34	0.36
Person	0.09	0.10	0.10	0.10	0.10
Wake	1.49	1.65	1.79	1.93	2.09
TOTAL	**2.69**	**2.90**	**3.10**	**3.27**	**3.50**

4.2.3 Solvent Cleaning and Degreasing

Solvent cleaning operations are integral to many businesses and industries, and are conducted for the purpose of removing grease, oils, waxes, carbon deposits, etc. from metals, plastic, or glass surfaces. Solvent cleaning is usually performed prior to painting, plating, inspection, repair, assembly, etc. The solvents used in the cleaning operations can be either in a liquid or vapor phase. Generally, these solvents have high vapor pressures and are therefore emit VOC emissions.

There are two basic types of solvent cleaning techniques, cold cleaning and vapor cleaning. Cold cleaning machines use solvents in the liquid phase to clean and remove foreign material such as oils and grease from the surface of materials. These machines are batch loaded, and cleaning operations include spraying/flushing solvent or parts agitation, wipe cleaning, brushing, and immersion.

The vapor cleaning technique can be further divided into open top degreasing and in-line cleaning. The open top degreasing machines are tanks designed to generate and contain solvent vapor. The tank is equipped with a heating system that boils the liquid solvent. As the solvent boils, dense solvent vapors rise and displace the air in the tank. Coolant is circulated in condensing coils on the top of the tank to create a controlled vapor zone within the tank. Condensing solvent vapors dissolve the contaminants on the surface of the workload and flush both the dissolved and undissolved contaminants from the workload.

In-line cleaning machines employ automated loading on a continuous basis. These machines are often custom made for large-scale operations. A continuous or multiple-batch loading system greatly reduces or even eliminates the manual parts handling associated with batch cleaning. In-line cleaning machines are enclosed to prevent solvent losses; however, entry and exit openings cannot be sealed.

The VOC emissions for this category are estimated by using the per employee factors (from the EIIP Area Source Document, Chapter 6, Table 6.5-2) listed in Table 4.2.3-1 below:

Table 4.2.3-1 Emission Factors Cleaning & Degreasing

Source Category	lb VOC/employee/yr
Electronic and Other Elec: Open Top Degreasing	29
Miscellaneous Manufacturing: Open Top Degreasing	9.8
Miscellaneous Manufacturing: Cold Cleaning	24
Auto Repair Services: Cold Cleaning	270

Employment data was derived from the 2004 County Business Patterns. For each of these categories, employment in a number of SIC groups is needed. These employment numbers were generated from the NAICS employment numbers for each county and summed as needed. See SIC Codes from NAICS Codes for Employment Based Categories in section 5.0 for the full listing of NAICS and SIC for each source category. The following table shows the employment for each source category and county. Fractional employee numbers are a result of the NAICS to SIC conversion process.

Table 4.2.3-2 Cleaning and Degreasing Employment

	Open Top Degreasing		Cold Cleaning	
County	Electronic & Other Electrical	Miscellaneous Manufacturing:	Miscellaneous Manufacturing	Auto Repair Services
Chatham	15	682.00	307.22	374.79
Durham	248.51	2619.79	945.15	1674.64
Franklin	11.40	769.83	451.94	317.89
Granville	0	565.34	175.36	389.98
Johnston	163.02	1759.60	775.24	984.36
Orange	121.55	865.37	405.47	459.90
Person	3	432.21	77.01	355.20
Wake	674.16	8371.91	3540.07	4831.85

Federal rules are expected to reduce the VOC emission from solvent cleaning in the future years. The USEPA estimates (EPA420-R-00-020) that the federal rules will reduce the emissions from this source category by approximately 31% for open top processes and about 43% from cold cleaning processes. This reduction was applied starting with the 2005 estimated emissions. The work week is 6 days for these categories. The following SCC's were used to assign EGAS derived growth growth factors: electronic open top, 2415130000; miscellaneous open top, 2415100000; auto repair cold cleaning, 2415360000; and miscellaneous manufacturing cold cleaning, 2415300000. The growth factors are shown in Table 4.2.3-3 below.

Table 4.2.3-3 Growth Factors for Solvent Cleaning

SCC	2005	2008	2011	2014	2017
2415100000	1.037797	1.125113	1.176012	1.321639	1.460889
2415130000	1.065846	1.288013	1.490898	1.718909	1.943728
2415300000	1.037797	1.125113	1.176012	1.321639	1.460889
2415360000	1.056942	1.24337	1.401521	1.49961	1.594384

The emissions for the base year and future years were calculated using equations 4.2.3-1 and 4.2.3-2, respectively.

$$EM = \frac{(Employment_{2004}) \times EF}{(2000\ lb/tons)} \qquad 4.2.3\text{-}1$$

$$PJ_bEM_a = EM \times GF_a \times [1 - RF] \times (1/365) \times (7/6) \qquad 4.2.3\text{-}2$$

where EM = emissions for source category t/y
EF = emission factor for source category
PJ_bEM_a = projected future year (b) daily emissions for county in maintenance area (a)
GF_a = growth factor for maintenance area (a)
RF = Reduction factor, 31% or 43%

Examples of the emission calculation for Person County for the "Auto Repair Services: Cold Cleaning" subcategory are listed below:

2004 Category Employment for Person County = 355.20
2005 Growth Factor for SCC 2415360000 = 1.056942
Emission Factor = 270 lb VOC/employee/year
Reduction Factor = 0.43

From Equations 4.2.11-1

$$VOC_{2004} = \frac{(355.20 \text{ employees}) \times (270 \text{ lb VOC/employee year})}{(2000 \text{ lb/ton})}$$

$$= 47.95 \text{ tons VOC/year}$$

$$VOC_{2005} = \frac{(47.95 \text{ t/y}) \times (1.056942 GF_{2005/2002}) \times (7/6) \times [1 - 0.43]}{(365 \text{ days/year})}$$

$$= 0.09 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from the four subcategories and the total for this source category are summarized in the tables below. All emission estimates are in tons/day. Note that Chatham County was reduced to the fraction of the population in the nonattainment area (0.4322).

Table 4.2.3-4 VOC Emissions From Electronic and Other Elec.: Open Top Degreasing

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.00	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.03	0.03	0.04	0.04
TOTAL	**0.04**	**0.06**	**0.06**	**0.07**	**0.08**

Table 4.2.3-5 VOC Emissions From Miscellaneous Manufacturing: Open Top Degreasing

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.03	0.03	0.03	0.04	0.04
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.02	0.02	0.02	0.03	0.03
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.01	0.01	0.01	0.01
Wake	0.09	0.10	0.11	0.12	0.13
TOTAL	**0.17**	**0.19**	**0.20**	**0.23**	**0.24**

Table 4.2.3-6 VOC Emissions From Miscellaneous Manufacturing: Cold Cleaning

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.03	0.03
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.00	0.00	0.00	0.01	0.01
Johnston	0.02	0.02	0.02	0.02	0.02
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.08	0.09	0.09	0.10	0.11
TOTAL	**0.14**	**0.15**	**0.15**	**0.18**	**0.19**

Table 4.2.3-7 VOC Emissions From Auto Repair Services: Cold Cleaning

County	2005	2008	2011	2014	2017
Chatham	0.04	0.05	0.06	0.06	0.06
Durham	0.44	0.51	0.58	0.62	0.66
Franklin	0.08	0.10	0.11	0.12	0.12
Granville	0.10	0.12	0.13	0.14	0.15
Johnston	0.26	0.30	0.34	0.36	0.39
Orange	0.12	0.14	0.16	0.17	0.18
Person	0.09	0.11	0.12	0.13	0.14
Wake	1.26	1.48	1.67	1.78	1.89
TOTAL	**2.39**	**2.81**	**3.17**	**3.38**	**3.59**

Table 4.2.3-8 Total VOC Emissions From Surface Cleaning and Degreasing

County	2005	2008	2011	2014	2017
Chatham	0.04	0.05	0.06	0.06	0.06
Durham	0.50	0.57	0.64	0.70	0.75
Franklin	0.10	0.12	0.13	0.14	0.14
Granville	0.11	0.13	0.14	0.16	0.17
Johnston	0.31	0.35	0.39	0.42	0.45
Orange	0.14	0.17	0.19	0.20	0.21
Person	0.09	0.12	0.13	0.14	0.15
Wake	1.45	1.70	1.90	2.04	2.17
TOTAL	**2.74**	**3.21**	**3.58**	**3.86**	**4.10**

4.2.4 Auto Body Refinishing

Auto body refinishing operations consist of: vehicle preparation, primer application, topcoat application, and spray equipment cleaning. These operations result in significant VOC emissions. The solvent are typically 100% volatile and can constitute up to 6.5 pounds of VOC per gallon of cleaner or paint.

The EIIP methodology for estimating emissions from this source category recommends apportioning a national VOC emission estimate to the county level by the number of employees reported for NAISC code 811121. The national estimate of 79,429.59 tons of VOC per year was based on 1997 data. In order to estimate the emissions for 2004, the national VOC estimate provided by the EIIP Tech. Report was divided by the 1997 national employment data to create a per employee emission factor. See the calculation below:

National Emissions = 79,429.59 tons/year
National Employment = 205,172 employees

EF = (79,429.59)/(205,172) = 0.387 tons/employee/year

This emission factor was used with the 2004 employment data to estimate emissions from auto body refinishing. The employment data was obtained from the 2004 County Business Patterns[2] and is list in Table 4.2.4-1.

Table 4.2.4-1 Employment Values used for Auto Body Refinishing

County	# of Employees
Chatham	35
Durham	109
Franklin	15
Granville	39
Johnston	91
Orange	36
Person	31
Wake	574

According to the EIIP Tech. Report the activity days per week is 5 days. For the base year and future year inventories, the 2004 year emissions were grown using E-GAS 5.0 growth factors for SCC 2401005000 (Table 4.2.4-2).

Table 4.2.4-2 Growth Factors for Auto Body Refinishing

2005	2008	2011	2014	2017
1.026316	1.108746	1.185758	1.273607	1.348684

Federal rules are expected to reduce the VOC emission from auto body refinishing in the future years. The USEPA estimates that the federal rules will reduce the emissions from this source category by approximately 37%. This reduction was applied starting with the 2005 estimated emissions. The emissions for 2004 were calculated using equation 4.2.4-1 and the emissions for the base year and future years were calculated using equation 4.2.4-2.

$$EM = \frac{\text{Employees x EF}}{\text{(365 days/year) x (5 days/week/ 7 days/week)}} \qquad 4.2.4\text{-}1$$

$$PJ_aEM = EM \times GF_a \times [1\text{-}RF] \qquad 4.2.4\text{-}2$$

where EM = emissions for source category
EF = emission factor for source category, 0.387 tons VOC/employee/yr
PJ_aEM = projected base year (a) or projected future year (a) emissions
GF_a = growth factor for base year or projected future year (a)
RF = USEPA's estimated reduction factor

Note that only part of Chatham County is nonattainment so the total county emissions were multiplied by 0.4322, which is the 2000 population fraction in the nonattainment area.

Examples of the emission calculation for Durham County are listed below:

Number of employees = 109
Emission factor = 0.387 tons VOC/employee/year
Projection factor for 2005 = 1.026316
Reduction factor = 0.37

From equation 4.2.3-1 and 4.2.3-2

$$VOC_{2004} = \frac{\text{(109 employees) x (0.387 ton VOC/employee/yr)}}{\text{(365 days/year) x (5 days/week/ 7 days/week)}}$$
$$= 0.1618 \text{ tons VOC/day}$$

$$VOC_{2005} = 0.1618 \times 1.026316 \times [1\text{-}0.37]$$
$$= 0.10 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from auto body refinishing for the Triangle nonattainment area are listed in Table 4.2.4-3.

Table 4.2.4-3 VOC Emissions From Auto Body Refinishing

County	2005	2008	2011	2014	2017
Chatham	0.01	0.02	0.02	0.02	0.02
Durham	0.10	0.11	0.12	0.13	0.14
Franklin	0.01	0.02	0.02	0.02	0.02
Granville	0.04	0.04	0.04	0.05	0.05
Johnston	0.09	0.09	0.10	0.11	0.11
Orange	0.03	0.04	0.04	0.04	0.05
Person	0.03	0.03	0.03	0.04	0.04
Wake	0.55	0.60	0.64	0.68	0.72
TOTAL	**0.86**	**0.95**	**1.01**	**1.09**	**1.15**

4.2.5 Architectural Coatings

This category includes the application of paint, primer, varnish or lacquer to architectural surfaces, and the use of solvents as thinners and for cleanup.

The VOC emissions for this source category were estimated by multiplying county population data by a usage factor for either water or solvent based coatings, an emissions factor for either water or solvent based coatings, and a seasonal adjustment factor (SAF); then dividing by 365 days/year to get a daily number. This method entails gathering national architectural paint usage from the County Business industrial report MA325F and generating per capita usage factors. It is important to be able to differentiate between the water based usage from the solvent based usage since the emission factor for solvent based paints is over 5 times higher than water based paints.

SAF = ((3rd Quarter usage)*12 months)/((total usage)*3 months)

(For 2002) = (189,790,000 gal*12 months)/(718,664,000 gal*3 months) = 1.06

Emissions Factor: Water based = 0.74 lb VOC/gallon;
Solvent Based= 3.87 lb VOC/gallon

$VOC_{ai} = (POP_{ai}*UF_b*EF_b*SAF)/((365 \text{ days/yr})*(2000\text{lbs/ton}))$ -- ton/day

Where: VOC_{ai} = VOC emissions for county (a) in year (i)
POP_{ai} = Population for county (a) in year (i)
EF_b = emission factor for paint type (b)
SAF = Seasonal adjustment factor
UF_b = Usage factor for paint type (b)

The usage factor is found by dividing the national total architectural surface coating quantities for either solvent or water-based coatings by the U.S. population for that year. For 2002, the usage factor for each paint type is estimated below:

UF solvent: (127,703,000 gallons of solvent based) / (287,973,924) = 0.443 gal./person
UF water : (589,527,000 gallons of water based) / (287,973,924) = 2.047 gal./person

The SAF and usage factor calculated for 2002 was assumed to remain constant in future years. Additionally, federal rules are expected to reduce the VOC emission from architectural coatings in the future years. The USEPA estimates that the federal rules will reduce the emissions from this source category by approximately 25%. This reduction was applied starting with the 2005 estimated emissions. Examples of the emission calculations for Wake County are listed below:

Solvent Based Emission Factor = 3.87 lb VOC/gallon
Water Based Emission Factor = 0.74 lb VOC/gallon
Seasonal Adjustment Factor = 1.06
Future Control Factor = (1 - 0.25) or 0.75

For 2005:

$$VOC_{solvent} = \frac{(755{,}053 \text{ people}) \times (0.443 \text{ gal/person}) \times (3.87 \text{ lb VOC/gallon/yr}) \times (1.06) \times (0.75)}{(365 \text{ days/yr}) \times (2000 \text{ lb/ton})}$$

$$= 1.41 \text{ tons VOC/day}$$

$$VOC_{water} = \frac{(755{,}053 \text{ people}) \times (2.047 \text{ gal/person}) \times (0.74 \text{ lb VOC/gallon/yr}) \times (1.06) \times (0.75)}{(365 \text{ days/yr}) \times (2000 \text{ lb/ton})}$$

$$= 1.25 \text{ tons VOC/day}$$

$$VOC_{2005} = (1.41 + 1.25) \text{ tons VOC/day} = 2.65 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from architectural coatings for the Triangle nonattainment area are listed in Table 4.2.5-1.

Table 4.2.5-1 VOC Emissions From Architectural Coatings

County	2005	2008	2011	2014	2017
Chatham	0.09	0.09	0.10	0.10	0.11
Durham	0.85	0.89	0.93	0.96	1.00
Franklin	0.19	0.20	0.22	0.23	0.24
Granville	0.19	0.20	0.21	0.22	0.23
Johnston	0.51	0.56	0.61	0.66	0.72
Orange	0.43	0.45	0.47	0.48	0.50
Person	0.13	0.13	0.14	0.14	0.15
Wake	2.65	2.92	3.18	3.44	3.71
TOTAL	**5.04**	**5.44**	**5.86**	**6.23**	**6.66**

4.2.6 Traffic Markings

The paint used in traffic markings operations (the painting of center lines, shoulders, etc.) emits VOC emissions during the drying process. The extent of emissions is largely a function of the paint being solvent or water based. The North Carolina Department of Transportation (NCDOT) utilizes three general types of paint, which can be classified as water based paint, epoxy paint containing organic solvents, and thermoplastic paint. The use of thermoplastic paint results in negligible VOC emissions and therefore is not included in the emissions inventory.

Although the NCDOT utilizes both water and solvent based paints, there is uncertainty with respect to what percentage of the paint used is organic solvent based. To avoid under estimating the emissions from this source category, it is assumed that all paint, excluding thermoplastic, is organic solvent based.

The NCDOT reported that 854,215 gallons of paint were used statewide in 2002. The gallons of paint by county were apportioned by number of lane miles in the county divided by the state total (Equation 4.2.6-1) and the estimated gallons used are listed in Table 4.2.6-1. The emission factors were obtained from the EIIP Tech. Report, Table-14.4-1 and Table-14.5-2, which gave emission factors as a function of gallons of paint (3.64 lb VOC/gal.). Additionally the EIIP Tech. Report stated that the activity days per week is 5 and the SAF is 1.3.

$$\text{Gallons Paint}_{\text{County}} = (\text{Gallons Paint}_{\text{State}}) \times \frac{(\text{\# Lane Miles})_{\text{County}}}{(\text{\# Lane Miles})_{\text{State}}} \qquad 4.2.6\text{-}1$$

Table 4.2.6-1 Traffic Marking Paint Usage

County	Lane Miles	Paint (gallons)
Chatham	949.09	11306.30
Durham	678.39	8081.51
Franklin	745.67	8883.00
Granville	756.42	9011.06
Johnston	1,62.50	18,613.72
Orange	762.64	9,085.16
Person	589.49	7,022.46
Wake	2,29.09	24,172.10
State Total	71,705.77	854,215.00

For the future years inventories, the base year emissions were grown using growth factors from the E-GAS 5.0 model and are listed in Table 4.2.6-2.

Table 4.2.6-2 Growth Factors for Traffic Marking Emissions

2005	2008	2011	2014	2017
1.0011	1.0246	1.0375	1.0327	1.0333

Additionally, federal rules are expected to reduce the VOC emission from traffic markings in the future years. The USEPA estimates that the federal rules will reduce the emissions from this source category by approximately 25%. This reduction was applied starting with the 2005 estimated emissions. The emissions for the base year and future years were calculated using equations 4.2.6-2 and 4.2.6-3, respectively.

$$EM_P = \frac{\text{(Paint used) x } EF_P \text{ x SAF}}{\text{(5 days/week) x (52 weeks/year) x (2000 lb/ton)}} \qquad 4.2.6\text{-}2$$

$$PJ_bEM_a = EM_P \times GF_a \times [1\text{-}RF] \qquad 4.2.6\text{-}3$$

where EM_P = emissions for reported paint usage
EF_P = emission factor for reported paint usage
SAF = Seasonal adjustment factor, 1.3
PJ_bEM_a = projected future year (b) emissions for county in maintenance area (a)
GF_a = growth factor for maintenance area (a)
RF = Reduction Factor, 0.25

Examples of the emission calculation for Chatham County are listed below:

Gallons of paint used = 11,306.30 gallons/year
Emission factor for gallons = 3.64 lb VOC/gallon

Projection factor for 2005 = 1.0011
Reduction factor = [1 – 0.25] = 0.75
Chatham Partial County Adjustment Factor = 0.4322

From equation 4.2.6-1 and 4.2.6-2

$$VOC_{2002} = \frac{(11{,}306.30 \text{ gallons}) \times (3.64 \text{ lb VOC/gallon/year}) \times 1.3 \times 0.4322}{(5 \text{ days/wk}) \times (52 \text{ wks/yr}) \times (2000 \text{ lb/ton})}$$
$$= 0.044 \text{ tons VOC/day}$$

$$VOC_{2005} = 0.044 \times 1.0011 \times 0.75$$
$$= 0.033 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from traffic markings for the Triangle nonattainment area are listed in Table 4.2.6-3.

Table 4.2.6-3 VOC Emissions From Traffic Markings

County	2005	2008	2011	2014	2017
Chatham	0.03	0.33	0.34	0.35	0.35
Durham	0.06	0.06	0.06	0.06	0.06
Franklin	0.06	0.06	0.06	0.06	0.06
Granville	0.06	0.06	0.06	0.06	0.06
Johnston	0.13	0.13	0.13	0.13	0.13
Orange	0.06	0.06	0.06	0.06	0.06
Person	0.05	0.05	0.05	0.05	0.05
Wake	0.17	0.17	0.17	0.17	0.17
TOTAL	**0.62**	**0.92**	**0.93**	**0.94**	**0.94**

4.2.7 Industrial Surface Coating

Surface coating operations involve applying a thin layer of coating (e.g. paint, lacquer, enamel, varnish, etc.) to the surface of an object for decorative or protective purposes. The coating products, which are solvent based, emit VOC emissions as the result of solvent evaporation during the drying or curing process.

Ideally, the VOC emissions from industrial surface coating activities should be captured as point sources. From a practical standpoint, this is not always accomplished. For example, three of the industrial surface coating subcategories, namely other product coatings, high-performance maintenance, and other special purpose coatings, only utilized per capita emission factors and have no NAICS associated with them. The emission factors, obtained from the EIIP Tech. Report, Table 8.5-2, for these surface coating subcategories are listed in the Table 4.2.7-1 below.

Table 4.2.7-1 Per Capita Emission Factors For Industrial Surface Coating

Subcategory	Per Capita Factor (lb/yr/person)
Other product coatings	0.6
High-performance maintenance.	0.8
Other special purpose coatings	0.8

The emissions for the remaining industrial surface coating subcategories were estimated using per employee emission factors. These emission factors were obtained from the EIIP Tech. Report, Table 8.5-1 and are listed below in Table 4.2.7-2.

Table 4.2.7-2 Per Employee Emission Factors for Industrial Surface Coating

Subcategory	Per Employee Factor (lb VOC/employee/yr)
Furniture & Fixtures	944
Metal Containers	6,029
Automobile (new)	794
Machinery & Equipment	77
Appliances	463
Other Transportation Equipment	35
Sheet, strip & Coil	2,877
Factory Finished Wood	131
Electrical Insulation	290
Marine Coatings	308

The EIIP Tech. Report also listed SIC codes for these industrial surface coating subcategories. As stated earlier, the SIC codes were replaced in 1997 with NAICS. The employment data was estimated using the method outlined in Section 2.2. See Table 4.2.7-3 for the employment numbers used. Note that as a result of the NAICS to SIC employment conversion a fractional

employment value may be generated. In these instances, the employment data was rounded to the nearest whole number.

Table 4.2.7-3 Employment Data for Surface Coating Subcategories

Subcategory	Chatham	Durham	Franklin	Granville	Johnston	Orange	Person	Wake
Furniture & Fixtures	16	24	4	14	69	101	13	273
Metal Containers	0	0	0	0	1	0	0	3
Automobile (new)	0	1	0	0	1	0	0	15
Machinery & Equipment	97	281	164	48	276	14	10	818
Appliances	0	0	0	0	1	0	0	6
Other Transportation Equipment	0	15	0	0	10	0	0	56
Sheet, strip & Coil	0	15	0	7	15	1	0	43
Factory Finished Wood	246	40	314	78	137	28	9	727
Electrical Insulation	75	3	0	0	0	0	0	3
Marine Coatings	0	6	0	0	35	3	0	20

According to the EIIP Tech. Report the activity days per week is 5 days. To estimate the future year emissions from the subcategories that used a per capita emission factor, the population growth factors were used (Table 2.2-2). For the subcategories that used an employment based emission factor, the future year inventories were grown using the E-GAS 5.0 growth factors from Table 4.2.7-4. The SCC's shown are the ones that appeared most appropriate for the particular category.

Table 4.2.7-4 Growth Factors for Employment Based Surface Coating Subcategories

Subcategory & SCC	2005	2008	2011	2014	2017
Furniture and fixtures 2401020000	1.03025	1.06032	1.04503	1.21424	1.37188
Metal Containers 2401040000	1.03597	1.17266	1.30456	1.39808	1.49161
Automobiles (new) 2401070000	1.05065	1.21939	1.36443	1.50180	1.64146
Machinery and Equipment 2401055000	1.11728	1.53911	1.91696	2.10334	2.25274
Appliances 2401060000	1.02500	1.04375	1.02917	1.19687	1.35521
Other Transportation Equipment 2401085000	1.05442	1.19048	1.29252	1.44898	1.61224
Sheet, Strip, and Coil 2401045000	1.04390	1.18110	1.29268	1.42927	1.56829
Factory Finished Wood 2401015000	1.03371	1.13287	1.20575	1.29400	1.38671
Electrical Insulation 2401065000	1.02890	1.10737	1.15573	1.15762	1.14303
Marine Coatings 2401080000	1.00000	0.98723	0.98298	1.05957	1.13617

Federal rules are expected to reduce VOC emission from industrial surface coating operations in the future years with respect to the emission factors used. The USEPA estimates of percent reduction of emissions for the federal rules are listed in Table 4.2.7-5 below. These reductions were applied starting with the 2005 estimated emissions.

Table 4.2.7-5 Industrial Surface Coating Percent Reductions from Federal Rules

Subcategory	Expected Reduction
Furniture & Fixtures	30%
Metal Containers	36%
Automobiles (New)	36%
Machinery & Equipment	36%
Appliances	36%
Other Transportation Equipment	36%
Sheet, Strip, & Coil	36%
Factory Finished Wood	36%
Electrical Insulation	36%
Marine Coatings	24%
Other Product	25%
High-Performance Maintenance	36%
Other Special Purpose Coatings	25%

The following equations demonstrate the calculation of the 2005 emissions for Wake County for the various categories:

Furniture and Fixtures

VOC_{2005} = (944 lb VOC/empl. yr)*(273 empl.)*(1/2000 ton/lb)*(1.03025 $EGAS_{05/04}$)*
(1/365 yr/day)*(7/5 day/wrk day)*(1-(30/100) ton/ton)
= 0.36 ton VOC/day

Metal Containers

VOC_{2005} = (6,029 lb VOC/empl. yr)*(3 empl.)*(1/2000 ton/lb)*
(1.03597 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.02 ton VOC/day

Automobiles (New)

VOC_{2005} = (794 lb VOC/empl. yr)*(15 empl.)*(1/2000 ton/lb)*
(1.05065 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.02 ton VOC/day

Machinery & Equipment

VOC_{2005} = (77 lb VOC/empl. yr)*(818 empl.)*(1/2000 ton/lb)*
(1.11728 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.09 ton VOC/day

Appliances

VOC_{2005} = (463 lb VOC/empl. yr)*(6 empl.)*(1/2000 ton/lb)*
(1.02500 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.00 ton VOC/day

Other Transportation Equipment (Railroad)

VOC_{2005} = (35 lb VOC/empl. yr)*(6 empl.)*(1/2000 ton/lb)*
(1.05442 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.00 ton VOC/day

Sheet, Strip, & Coil

VOC_{2005} = (2,877 lb VOC/empl. yr)*(43 empl.)*(1/2000 ton/lb)*
(1.04390 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.16 ton VOC/day

Factory Finished Wood

VOC_{2005} = (131 lb VOC/empl. yr)*(727 empl.)*(1/2000 ton/lb)*
(1.03371 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.12 ton VOC/day

Electrical Insulation

VOC_{2005} = (290 lb VOC/empl. yr)*(3 empl.)*(1/2000 ton/lb)*
(1.02890 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.00 ton VOC/day

Marine Coatings

VOC_{2005} = (308 lb VOC/empl. yr)*(20 empl.)*(1/2000 ton/lb)*
(1.00000 $EGAS_{05/04}$)* (1/365 yr/day)*(7/5 day/wrk day)*(1-(24/100) ton/ton)
= 0.01 ton VOC/day

Other Product Coatings

VOC_{2005} = (0.6 lb VOC/person yr)*(679,785 person)*(1/2000 ton/lb)*(1.1107 $pop_{05/04}$)*
(1/365 yr/day)*(7/5 day/wrk day)*(1-(25/100) ton/ton)
= 0.65 ton VOC/day

High-Performance Maintenance Coatings

VOC_{2005} = (0.8 lb VOC/person yr)*(679,785 person)*(1/2000 ton/lb)*(1.1107 $pop_{05/04}$)*
(1/365 yr/day)*(7/5 day/wrk day)*(1-(36/100) ton/ton)
= 0.74 ton VOC/day

Other Special Purpose Coatings

VOC_{2005} = (0.8 lb VOC/person yr)*(679,785 person)*(1/2000 ton/lb)*(1.1107 $pop_{05/04}$)*
(1/365 yr/day)*(7/5 day/wrk day)*(1-(25/100) ton/ton)
= 0.87 ton VOC/day

The VOC emission estimates, in tons/day, from all surface coating operations are listed in Tables 4.2.7-6 through 4.2.7-18 and are totaled for this source category in Table 4.2.7-19. All Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.2.7-6 VOC Emissions From Furniture and Fixtures

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.03	0.03	0.03	0.04	0.04
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.02	0.02	0.02	0.02	0.02
Johnston	0.09	0.09	0.09	0.11	0.12
Orange	0.13	0.14	0.13	0.16	0.18
Person	0.02	0.02	0.02	0.02	0.02
Wake	0.36	0.37	0.36	0.42	0.47
TOTAL	0.67	0.69	0.67	0.79	0.87

Table 4.2.7-7 VOC Emissions From Metal Containers

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.03	0.03	0.03	0.03
TOTAL	0.03	0.04	0.04	0.04	0.04

Table 4.2.7-8 VOC Emissions From Automobiles (New)

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.02	0.02	0.02	0.02
TOTAL	0.02	0.02	0.02	0.02	0.02

Table 4.2.7-9 VOC Emissions From Machinery and Equipment

County	2005	2008	2011	2014	2017
Chatham	0.00	0.01	0.01	0.01	0.01
Durham	0.03	0.04	0.05	0.06	0.06
Franklin	0.02	0.02	0.03	0.03	0.03
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.03	0.04	0.05	0.05	0.06
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.09	0.12	0.15	0.16	0.17
TOTAL	0.18	0.24	0.30	0.32	0.34

Table 4.2.7-10 VOC Emissions From Appliances

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	0.00	0.00	0.00	0.00	0.00

Table 4.2.7-11 VOC Emissions From Other Transportation Equipment (Railroad)

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	0.00	0.00	0.00	0.00	0.00

Table 4.2.7-12 VOC Emissions From Sheet, Strip, and Coil

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.06	0.06	0.07	0.08	0.08
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.03	0.03	0.03	0.04	0.04
Johnston	0.06	0.06	0.07	0.08	0.08
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.16	0.18	0.20	0.22	0.24
TOTAL	0.31	0.33	0.37	0.42	0.44

Table 4.2.7-13 VOC Emissions From Factory Finished Wood

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.02
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.05	0.06	0.06	0.07	0.07
Granville	0.01	0.01	0.02	0.02	0.02
Johnston	0.02	0.02	0.03	0.03	0.03
Orange	0.00	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.12	0.13	0.14	0.15	0.16
TOTAL	0.23	0.26	0.29	0.31	0.32

Table 4.2.7-14 VOC Emissions From Electrical Insulation

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	0.01	0.01	0.01	0.01	0.01

Table 4.2.7-15 VOC Emissions From Marine Coatings

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.02	0.02	0.02	0.02	0.02
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	0.03	0.03	0.03	0.03	0.03

Table 4.2.7-16 VOC Emissions From Other Product Coatings

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.02	0.03
Durham	0.21	0.22	0.23	0.24	0.25
Franklin	0.05	0.05	0.05	0.06	0.06
Granville	0.05	0.05	0.05	0.05	0.06
Johnston	0.13	0.14	0.15	0.16	0.18
Orange	0.11	0.11	0.11	0.12	0.12
Person	0.03	0.03	0.03	0.04	0.04
Wake	0.65	0.72	0.78	0.84	0.91
TOTAL	**1.25**	**1.34**	**1.42**	**1.53**	**1.65**

Table 4.2.7-17 VOC Emissions From High-performance Maintenance Coatings

County	2005	2008	2011	2014	2017
Chatham	0.02	0.03	0.03	0.03	0.03
Durham	0.24	0.25	0.26	0.27	0.28
Franklin	0.05	0.06	0.06	0.06	0.07
Granville	0.05	0.05	0.06	0.06	0.06
Johnston	0.14	0.16	0.17	0.19	0.20
Orange	0.12	0.12	0.13	0.13	0.14
Person	0.04	0.04	0.04	0.04	0.04
Wake	0.74	0.82	0.89	0.96	1.04
TOTAL	**1.40**	**1.53**	**1.64**	**1.74**	**1.86**

Table 4.2.7-18 VOC Emissions From Other Special Purpose Coatings

County	2005	2008	2011	2014	2017
Chatham	0.03	0.03	0.03	0.03	0.03
Durham	0.28	0.29	0.30	0.31	0.33
Franklin	0.06	0.07	0.07	0.08	0.08
Granville	0.06	0.06	0.07	0.07	0.07
Johnston	0.17	0.18	0.20	0.22	0.23
Orange	0.14	0.15	0.15	0.16	0.16
Person	0.04	0.04	0.05	0.05	0.05
Wake	0.87	0.96	1.04	1.13	1.22
TOTAL	**1.65**	**1.78**	**1.91**	**2.05**	**2.17**

Table 4.2.7-19 Total VOC Emissions From Industrial Surface Coatings

County	2005	2008	2011	2014	2017
Chatham	0.11	0.13	0.13	0.13	0.14
Durham	0.86	0.90	0.95	1.01	1.05
Franklin	0.24	0.27	0.28	0.31	0.32
Granville	0.23	0.23	0.26	0.27	0.28
Johnston	0.67	0.72	0.79	0.87	0.93
Orange	0.50	0.53	0.53	0.58	0.61
Person	0.13	0.13	0.14	0.15	0.15
Wake	3.04	3.36	3.62	3.94	4.27
TOTAL	5.78	6.27	6.70	7.26	7.75

4.2.8 Asphalt Paving

Two types of asphalt paving are used for road paving and repair; emulsified asphalt and cutback asphalt. Emulsified asphalt is a type of liquefied road surfacing material made from a blend of water with an emulsifier. Cutback asphalt is a type of liquefied road surface that is prepared by blending or "cutting back" asphalt cement with various kinds of petroleum distillates. VOC emissions occur as the asphalt cures.

The NCDOT specification for asphalt in 2002 was hot mix and emulsified asphalt with hot mix but not cutback asphalt. Surrounding states have precluded the use of cut back by statutory provisions; which has driven asphalt manufactures to discontinue cutback production throughout the region. The absence of the use of cutback has resulted in substantial reductions in emissions from asphalt paving operations in North Carolina.

Hot-mix is composed of high molecular weight organics with minimal vapor pressures; consequently, VOC emissions are negligible. The use of emulsified asphalt does result in VOC emissions; but the emissions are significantly less than cutback. New formulations of emulsified asphalt, such as cationic, continue to result in reduced emissions. The use of emulsified asphalt is primarily for tack coating, which is a surface preparation for the hot-mix layer. The tonnage of hot-mix asphalt is accounted for by the NCDOT districts and not on a county basis. District tonnage was allocated on a county basis by apportioning county paved mileage as reported in the NCDOT 2000 Highway Summary Report. However, the amount of emulsified asphalt used is not tracked by the NCDOT in any useable way. As a consequence, the NCDOT provided the following methodology to predict emulsified usage:

$$\text{Square Yd. of hot-mix} = \frac{(\text{Tons of Hot-mix}) \times (2000 \text{ lbs./Ton})}{(220 \text{ lbs/ Square Yd. of Hot-mix})} \qquad 4.2.8\text{-}1$$

$$\text{Gallons of Emulsified asphalt} = (\text{Sq. Yd. of hot-mix}) \times (0.08 \text{ gal./Sq. Yd. of hot-mix}) \qquad 4.2.8\text{-}2$$

The estimated tonnage of hot-mix asphalt used by a county and the resulting calculated gallons of emulsified asphalt used in 2002 are listed in Table 4.2.8-1.

Table 4.2.8-1 Tons and Gallons of Asphalt used for Paving

County	Tons of Hot-Mix Asphalt	Gallons of Emulsified Asphalt
Chatham	15,546	11,306
Durham	11,112	8,082
Franklin	12,214	8,883
Granville	12,390	9,011
Johnston	25,594	18,614
Orange	12,492	9,085
Person	9,656	7,022
Wake	33,237	24,172

The VOC emissions were calculated using the emissions factor for emulsified asphalt (9.2 lb VOC/barrel) and the number of gallons of emulsified asphalt per barrel (42 gal./barrel) from Table 17.5-2 of the EIIP Tech. Report. A SAF of 1.33 was applied to correct for the majority of paving operations occurring between March and November, as reported by the NCDOT.

For future year inventories, the base year emissions were grown using factors from the E-GAS 5.0 model and are listed in Table 4.2.8-2.

Table 4.2.8-2 Growth Factors for Asphalt Paving Emissions

2005	2008	2011	2014	2017
1.0876	1.2018	1.3001	1.3936	1.4841

The emissions for the base year and the future year inventories were calculated using equations 4.2.8-3 and 4.2.8-4, respectively.

$$EM = \frac{(\text{gallons Emulsified Asphalt}) \times EF \times SAF}{(42\ \text{gal/barrel}) \times (2000\ \text{lb/tons}) \times (365\ \text{days/year})} \qquad 4.2.8\text{-}3$$

$$PJ_bEM_a = EM \times GF_a \qquad 4.2.8\text{-}4$$

where EM = emissions for source category
EF = emission factor for source category
SAF = Seasonal adjustment factor, 1.33
PJ_bEM_a = projected future year (b) emissions for county in redesignation area (a)
GF_a = growth factor for redesignation area (a)

Examples of the emission calculation for Wake County are listed below:

Number of gallons of emulsified asphalt used = 24,172
Emission Factor = 9.2 lb VOC/barrel of asphalt
Seasonal adjustment factor = 1.33
Projection factor for 2005 = 1.0876

From Equation 4.2.8-3 and 4.2.8-4:

$$VOC_{2002} = \frac{(24{,}172 \text{gallons}) \times (9.2 \text{ lb VOC/barrel of asphalt}) \times (1.33)}{(42 \text{ gal/barrel}) \times (2000 \text{ lb/ton}) \times (365 \text{ days/year})}$$
$$= 0.0096 \text{ tons VOC/day}$$

$$VOC_{2005} = 0.0160 \times 1.0876$$
$$= 0.0104 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from asphalt paving for the Triangle nonattainment area are listed in Table 4.2.8-3. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.2.8-3 VOC Emissions From Asphalt Paving

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.01
Granville	0.00	0.00	0.00	0.00	0.01
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.00	0.00	0.00	0.00	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.02**	**0.02**	**0.02**	**0.02**	**0.05**

4.2.9 Roofing Operations

This category covers the installation and repair of asphalt roofs on commercial and industrial buildings. This category includes only hot-applied asphalt roofing, for which the only significant emissions source is the kettle used to heat the asphalt. The amount of asphalt roofing activity is estimated by summing the number of felt, cap, and flashing squares used in North Carolina during the year 2000. This information was ascertained from the Asphalt Roofing

Manufacturing Association. The amount of asphalt used is given by the Equation 4.2.9-1, which uses the default value of 20 lbs. of asphalt / square found in the EIIP Tech. Report. The emissions by county were apportioned by roofing establishments in the county divided by the state total (Equation 4.2.9-2), using the number of establishments from NAISC code 23561 from the 2000 County Business Patterns[2]. See Table 4.2.9-1 for the number of commercial establishments and the estimated tons of asphalt used for each county.

$$\text{Asphalt (Ton/yr)} = \frac{(\text{\# squares}) \times (20 \text{ lbs. of asphalt/square})}{(2000 \text{ lbs./ton})} \qquad 4.2.9\text{-}1$$

$$\text{Asphalt}_{\text{County}} = \frac{(\text{Tons Asphalt}_{\text{State}}) \times (\text{\# Roofing Establishments})_{\text{County}}}{(\text{\# Roofing Establishments})_{\text{State}}} \qquad 4.2.9\text{-}2$$

Table 4.2.9-1 Number of Commercial Establishments & Tons of Asphalt Used

County	# Establishments	Tons of Asphalt
Chatham	3	16.65
Durham	19	105.46
Franklin	3	16.65
Granville	3	16.65
Johnston	28	155.42
Orange	11	61.06
Person	3	16.65
Wake	92	510.66
State Totals	973	5400.80

Asphalt roofing activities are assumed to have uniform operations throughout the year with a 5-day work week per the EIIP Tech. Report. Additionally, the EIIP Tech. Report reported the emissions factor as 6.2 lbs. VOC/ton asphalt for roofing operations. For future year inventories, the base year emissions were grown using growth factors from the E-GAS 5.0 model and are listed in Table 4.2.9-2.

Table 4.2.9-2 Growth Factors for Asphalt Roofing Emissions

2005	2008	2011	2014	2017
1.0876	1.2018	1.3001	1.3936	1.4841

The emissions for the base year and future year inventories were calculated using Equations 4.2.9-3 and 4.2.9-4, respectively.

$$EM = \frac{\text{(tons Asphalt) x EF}}{\text{(2000 lb/tons) x (5 days/week) x (52 weeks/year)}} \qquad 4.2.9\text{-}3$$

$$PJ_bEM_a = EM \times GF_a \qquad 4.2.9\text{-}4$$

where EM = emissions for source category
EF = emission factor for source category
PJ_bEM_a = projected future year (b) emissions for county in redesignation area (a)
GF_a = growth factor for redesignation area (a)

Examples of the emission calculation for Wake County are listed below:

Number of Roofing Establishments in Wake County = 92
Number of Roofing Establishments in State = 973
Tons of Asphalt in State = 5400.8 tons/year
Emission Factor = 6.2 lb VOC/tons of asphalt
Growth Factor = 1.0876

From Equations 4.2.9-2

$$\text{Tons Asphalt}_{Wake} = \frac{(5400.8 \text{ tons/year}) \times (92 \text{ establishments})_{Wake}}{(973 \text{ establishments})_{State}}$$
$$= 510.66 \text{ tons/year}$$

From Equation 4.2.9-3 and 4.2.9-4:

$$VOC_{2000} = \frac{(510.66 \text{ tons/year}) \times (6.2 \text{ lb VOC/ton of asphalt})}{(2000 \text{ lb/ton}) \times (5 \text{ days/week}) \times (52 \text{ weeks/year})}$$
$$= 0.0061 \text{ tons VOC/day}$$

$$VOC_{2005} = 0.0061 \times 1.0876$$
$$= 0.0066 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from asphalt roofing for the Triangle nonattainment area are listed in Table 4.2.9-3.

Table 4.2.9-3 VOC Emissions From Asphalt Roofing

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

4.2.10 Pesticide Application

Pesticides broadly include any substance used to kill or retard the growth of insects, rodents, fungi, weeds, or microorganisms. Formulations of organic pesticides are commonly made by combining synthetic materials with various petroleum products. The petroleum products, or inert ingredients, act as a carrier of the active component and usually evaporate into the atmosphere.

Agricultural Pesticides

Agricultural pesticides are applied in various manners, which directly affect the possible emissions associated with the application, regardless of the amount of solvent contained in the pesticide. There are basically three types of pesticide/herbicide application methods. One is the "incorporated" type, in which the product is applied and immediately incorporated into the soil. It is expected that little if any evaporation of solvent occur in this type of application. The next type, "pre-emergence", is where the product is put on the ground immediately after the crop is planted. This provides a protective layer. Some evaporation of solvent would be expected with this type of application. The largest emissions would occur from "over the top" application of pesticides. These pesticides are sprayed directly on the foliage to kill weeds or insects. This application would provide an opportunity for a great deal of solvent to evaporate.

The overall pesticide usage associated with agricultural crop production continues to slowly decrease in North Carolina driven by conservative pest management practices and the cost of pesticides as reported by the North Carolina State University (NCSU) Extension Center. The large majority of pesticide usage is confined to the production of tobacco and cotton crops. Because of the small crop size and high cash value, significant tobacco acreage is found in North Carolina including the Triangle area counties.

The planted crop acreage from the North Carolina Agricultural Statistic Division and crop profile reports prepared by the NCSU Extension Center, and other university extension services, for the US Department of Agriculture Pest Management Center were used to estimate agricultural pesticide usage. Crop acreage from the North Carolina Agricultural Statistic Division was obtained from http://www.ncagr.com/stats/. Crop profile reports conducted by NCSU are based on surveys; where participation is reported to be as high as 90 percent for the more important cash crops. Crop profile reports for grains and soybeans do not exist for North Carolina, therefore data for these crops were obtained from other state profiles and from discussions with representatives of the NCSU Extension Center.

The individual crop profiles outline the current agricultural pesticide practices, i.e. the pesticide agents (insecticides, herbicides, fungicides), the percentage of acres treated, and the pounds of active ingredient pesticide applied per acre. The crop profiles often reports the application of the active ingredient (pounds of active ingredient per acre) as a range of values. For the worst case scenario, the highest reported value was used. The number of applications of a single pesticide was usually one for all pesticides. The few exceptions to one application are more than accounted for by the conservative practice of using the highest value of application rate.

The pounds of active ingredients for each crop were calculated by using Equation 4.2.10-1 and an example calculation for soybeans follows. Table 4.2.10-1 presents the pesticides associated with a particular crop, the % of treated acres, and the lbs. of active pesticide ingredient per year.

$$(\text{lbs. AI/acre})_{CROP} = \sum (\%\ \text{acres treated}) \times (\text{lb AI/acre})_{PESTICIDE} \qquad 4.2.10\text{-}1$$

where AI = active ingredient.

For soybeans, the pounds of active ingredients for the crop is:

Pesticide	% Acres Treated	Lb AI/acre
Paraquat	20	0.47
Glyphosate	10	4
Sulfusate	5	4
Carbaryl	10	1.5

$$(\text{lbs. AI/acre})_{SOYBEAN} = (0.20 \times 0.47) + (0.10 \times 4) + (0.05 \times 4) + (0.10 \times 1.5)$$
$$= 0.844 \text{ lbs. AI/acre for soybeans}$$

Table 4.2.10-1 Agriculture Pesticides Application Rates

Crop/Agent	% Acres Treated	Lbs. active ingredient/Acre
Soybeans		
Paraquat	20	0.47
Glyphosate	10	4
Sulfusate	5	4
Carbaryl	10	1.5
Cotton		
Tribufos	100	0.75
Aldicarb	91	0.75
Prourgite	0.45	0.73
Dicofol	0.55	1.6
Dicrotophos	0.45	0.2
Acephate	2.1	0.5
M-Parathion	1	0.5
L-cyhalothrin	99	0.145
Thiocarb	40	0.75
Aldicarb	50	0.725
Tobacco		
Acephate	70	1.5
Spinosad	13	0.05
Methomyl	11	0.45
Endosulfan	7	1
Imidacoloprid	62	0.03
Chloropicrin	41	79.8
Dichloropropene	35	89.5
Clomazone	75	1
Metalaxyl	49	0.76
Barley		
M Parathion	0.8	0.5
Irish Potatoes		
Phorate 3	40	1.20
Glyphosate	6	5
Metolachor	8	2
Metribuzin	55	0.5
Sorghum		
MethyParathion	1	0.75
Chlorpyrifus	1	1
Carbaryl	1	2

Crop/Agent	% Acres Treated	Lbs. active ingredient/Acre
Corn Silage		
Terbufos	35	1
Chloropyrifus	10	1
Phorate	10	1
Ethoprop	5	1
Carbofuran	5	1
M Parathion	50	0.75
Thiocarb	90	0.6
Methomyl	50	0.45
Corn Grain		
Terbufos	35	1
Chloropyrifus	10	1
Phorate	10	1
Ethoprop	5	1
Carbofuran	5	1
M Parathion	50	0.75
Thiocarb	90	0.6
Methomyl	50	0.45
Oats		
M Parathion	5	0.5
Wheat		
M Parathion	5	0.5
Sweet Potatoes		
Napropamide	50	1.5
Clomazone	25	0.87
Fluazifop	20	0.17
Carbaryl	25	0.67
Peanuts		
Chlorpyrifus	60	1
Disulfoton	90	0.75
Esfenvalerate	25	0.03
Folicur 1	51	0.51
Vernolate	45	2.5
Dichloropropene	0.16	80

The emission factors for each crop were calculated utilizing information from the EIIP Tech. Report, p 9.5-4, which relates active ingredients to VOC emissions. According to the EIIP Tech. Report, for every pound of active ingredient there are 2.45 pounds of VOC, of this 90% is evaporated. The emission factors for each crop were calculated using Equation 4.2.10-2, with an example calculation for soybean following.

$$EF_{CROP} = (\text{lb } AI_{CROP}/\text{acre}) \times (2.45 \text{ lb. VOC/lb. of AI}) \times (0.90) \qquad 4.2.10\text{-}2$$

Where EF_{CROP} = Emission factor in lbs. VOC/active ingredient for each crop
AI_{CROP} = Active ingredient for each crop

For soybeans the emission factor is:
Lbs. AI/acre for soybean = 0.844 lbs. AI/acre

$$EF_{SOYBEAN} = (0.844 \text{ lb active ingredient/acre}) \times (2.45 \text{ lb VOC/active ingredient}) \times (0.90)$$
$$= 1.861 \text{ lbs. VOC/acre}$$

An exception to the above calculation was for the usage of the following pesticides: chloropicrin and 1,3 dichloropropene. These fumigants are widely used for treating tobacco beds for nematodes and constitute a major portion of the pesticide inventory. They have a moderate vapor pressure of 18.3 and 34 millimeters of mercury (at 77° F), respectively, and their formulation is approximately 96% to 98% of the active ingredient. In light of these properties, the VOC emissions are assumed to be equal to the application per acre, which are 79 pounds/acre for chloropicrin and 89.5 pounds/acre for 1,3 dichloropropene. Table 4.2.10-2 list the pounds of active ingredients per acre and the calculated emission factor for each crop. The number of acres of each crop planted in each county is listed in Table 4.2.10-3.

Table 4.2.10-2 Emission Factors by Crop Type

Crop	Lbs. Active Ingredients/acre	Lbs. VOC/Acre
Soybeans	0.844	1.861
Cotton	2.267	4.999
Barley	0.004	0.009
Corn – Silage	1.79	3.947
Corn – Grain	1.79	3.947
Wheat	0.025	0.055
Oats	0.025	0.055
Sweet Potato	1.169	2.578
Tobacco		
- *Non-fumigant*	2.317	5.109
- *Fumigant*	64.043	64.043
Total Tobacco		69.152
Peanuts		
- *Non-fumigant*	2.9175	6.433
- *Fumigant*	0.128	0.282
Total Peanuts		6.715
Irish Potatoes	1.9350	4.267
Sorghum	0.0375	0.083

Table 4.2.10-3 Acres of Crops Planted

County	Cotton	Tobacco	Soybean	Wheat	Sweet Potato	Oats
Chatham	40	595	1,400	1,000	6	58
Durham	0	850	300	500	1	110
Franklin	300	3,490	13,900	4,900	1	960
Granville	0	4,595	2,600	2,700	1	110
Johnston	17,500	7,950	56,000	7,100	6,090	1,900
Orange	0	1,035	2,000	1,400	1	110
Person	0	3,260	6,000	5,300	1	110
Wake	250	5,910	9,400	3,200	900	1,260

Table 4.2.10-3 Acres of Crops Planted (continued)

County	Barley	Corn -Grain	Corn - Silage	Peanuts	Irish Potatoes	Sorghum
Chatham	50	1,100	1,300	0	7	25
Durham	66	125	150	0	18	69
Franklin	66	950	150	0	4,150	69
Granville	66	800	900	0	7	69
Johnston	36	7,800	58	9	7	73
Orange	300	700	2,200	0	13	69
Person	66	1,800	400	0	7	69
Wake	50	800	0	0	7	25

An SAF of 2.4 is applied to correct for the almost exclusive use of agricultural pesticides from April to August. For base year and future year inventories, the 2002 year emissions were projected using growth factors that were generated by the E-GAS 5.0 model. These growth factors are listed below.

Table 4.2.10-4 Growth Factors for Pesticide Application

2005	2008	2011	2014	2017
1.0980	1.2042	1.3042	1.3847	1.4622

The emissions for 2002 were calculated using equation 4.2.10-3 and the emissions for the base year and future years were calculated using equation 4.2.10-4.

$$EM_a = \frac{(\sum (CROP)_a \times EF_{CROP}) \times SAF}{(2000 \text{ lb/tons}) \times (365 \text{ days/year})} \qquad 4.2.10\text{-}3$$

$$PJ_bEM_a = EM \times GF_b \qquad 4.2.10\text{-}4$$

where EM_a = emissions for source category in county (a)
CROP = acres of specific crop in county (a)
EF_{CROP} = emission factor for specific crop
SAF = Seasonal adjustment factor, 2.4
PJ_bEM_a = projected future year (b) emissions for county (a)
GF_b = growth factor for projected future year (b)

Examples of the emission calculation for Wake County are listed below:

Table 4.2.10-5 Wake County Data and Emission Factors for Sprayed Crops

Crop	Acres	Emission Factor (lbs. VOC/acre)
Cotton	250	4.999
Tobacco	5,910	146.32
Soybean	9,400	1.861
Wheat	3,200	0.055
Sweet Potato	900	2.578
Oats	1,260	0.055
Barley	50	0.009
Corn, Grain	800	3.947
Corn, Silage	0	3.947
Peanuts	0	6.164
Irish Potatoes	7	2.679
Sorghum	25	0.083

SAF = 2.4
Projection factor for 2005 = 1.0980

From Equation 4.2.10-3 and 4.2.10-4:

$$(\sum (CROP)_a \times EF_{CROP}) = [(250 \times 4.999) + (5{,}910 \times 146.32) + (9{,}400 \times 1.861) + (3{,}200 \times 0.055) + (900 \times 2.578) + (1{,}260 \times 0.055) + (50 \times 0.009) + (800 \times 3.947) + (0 \times 3.947) + (0 \times 6.164) + (7 \times 2.679) + (25 \times 0.083)]$$

$$= 889{,}238.7 \text{ lbs VOC/year}$$

$$VOC_{2002} = \frac{(889{,}238.7 \text{lbs. VOC/year}) \times 2.4}{(2000 \text{ lb/ton}) \times (365 \text{ days/year})}$$

$$= 2.92 \text{ ton VOC/day}$$

$$VOC_{2005} = 2.92 \times 1.0980$$

$$= 3.21 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from agricultural pesticides for the Triangle nonattainment area are listed in Table 4.2.10-6. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.2.10-6 VOC Emissions From Agricultural Pesticides

County	2005	2008	2011	2014	2017
Chatham	0.16	0.17	0.18	0.20	0.21
Durham	0.46	0.50	0.54	0.57	0.61
Franklin	2.02	2.22	2.40	2.55	2.69
Granville	2.47	2.71	2.93	3.11	3.29
Johnston	5.06	5.55	6.01	6.38	6.74
Orange	0.60	0.66	0.72	0.76	0.80
Person	1.79	1.97	2.13	2.26	2.39
Wake	3.21	3.52	3.81	4.05	4.28
TOTAL	**15.77**	**17.30**	**18.72**	**19.88**	**21.01**

Nonagricultural Pesticide

Nonagricultural pesticide applications are considered as part of the commercial/consumer solvent use emission factor and no longer a separate subcategory. Please refer to the next section.

4.2.11 Commercial/Consumer Solvent Use

This category includes only non-industrial solvents that are used in commercial or consumer applications. The solvent containing products consist of a diverse grouping, e.g. personal care products, household products, automotive aftermarket products, adhesives and sealants, pesticides, some coatings, and other commercial and consumer products that may emit VOC emissions.

There are seven categories. They are named and their emission factors listed in Table 4.2.11-1 below.

Table 4.2.11-1 Misc. Non-Industrial Consumer-Commercial Emission Factors

Subcategory	lb VOC/yr/person.
All Coatings and Related Products	0.95
All FIFRA Related Products	1.78
Miscellaneous Products (Not Otherwise Covered)	0.07
Personal Care Products	2.32
Household Products	0.079
Automotive Aftermarket Products	1.36
Adhesives and Sealants	0.57

VOC emissions for this category is estimated by using nationally based per capita emissions factors. The county population values listed in Table 2.2-1 and the population growth factors listed in Table 2.2-2 were used to estimate the emissions from this source category.

According to the EIIP Tech. Report, emissions from this source category occur 365 days per year and there is no seasonal adjustment required. Federal rules are expected to reduce the VOC emissions from consumer solvents in the future years. The USEPA estimates that the federal rules will reduce the emissions from this source category by approximately 25%. This reduction was applied starting with 2005 estimated emissions. The emissions for the base year and future year inventories were calculated using Equations 4.2.11-1 and 4.2.11-2, respectively.

$$EM = \frac{(Population_{2002}) \times EF}{(2000 \text{ lb/tons})} \qquad 4.2.11\text{-}1$$

$$PJ_bEM_a = EM \times GF_a \times [1 - RF] \times (1/365) \qquad 4.2.11\text{-}2$$

where EM = emissions for source category t/y
EF = emission factor for source category
PJ_bEM_a = projected future year (b) emissions for county in redesignation area (a)
GF_a = growth factor for redesignation area (a)
RF = Reduction factor, 25%

Examples of the emission calculation for Wake County for the "all coatings and related products" subcategory are listed below:

2002 Population in Wake County = 679,785
2005 Growth Factor for Wake County 1.1107
Emission Factor = 0.95 lb VOC/person/year
Reduction Factor = 0.25

From Equations 4.2.11-1

$$VOC_{2002} = \frac{(679{,}785 \text{ people}) \times (0.95 \text{ lb VOC/person year})}{(2000 \text{ lb/ton})}$$
$$= 322.8979 \text{ tons VOC/year}$$

$$VOC_{2005} = \frac{(322.8979 \text{t/y}) \times (1.1107\ GF_{2005/2002}) \times [1 - 0.25]}{(365 \text{ days/year})}$$
$$= 0.7369 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from commercial/consumer solvents subcategories for the Triangle nonattainment area are listed in Tables 4.2.11-2 through 4.2.11-8, and are totaled for this source category in Table 4.2.11-9.

Table 4.2.11-2 VOC Emissions From All Coatings and Related Products

County	2005	2008	2011	2014	2017
Chatham	0.02	0.03	0.03	0.03	0.03
Durham	0.24	0.25	0.26	0.27	0.28
Franklin	0.05	0.06	0.06	0.06	0.07
Granville	0.05	0.05	0.06	0.06	0.06
Johnston	0.14	0.16	0.17	0.18	0.2
Orange	0.12	0.12	0.13	0.13	0.14
Person	0.04	0.04	0.04	0.04	0.04
Wake	0.74	0.81	0.88	0.96	1.03
TOTAL	**1.40**	**1.52**	**1.63**	**1.73**	**1.85**

Table 4.2.11-3 VOC Emissions From All FIFRA Related Products

County	2005	2008	2011	2014	2017
Chatham	0.04	0.05	0.05	0.05	0.06
Durham	0.44	0.46	0.48	0.50	0.52
Franklin	0.10	0.11	0.11	0.12	0.13
Granville	0.10	0.10	0.11	0.11	0.12
Johnston	0.27	0.29	0.32	0.35	0.37
Orange	0.22	0.23	0.24	0.25	0.26
Person	0.07	0.07	0.07	0.07	0.08
Wake	1.38	1.52	1.66	1.79	1.93
TOTAL	**2.62**	**2.83**	**3.04**	**3.24**	**3.47**

Table 4.2.11-4 VOC Emissions From Miscellaneous Products (Not Otherwise Covered)

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.05	0.06	0.07	0.07	0.08
TOTAL	**0.09**	**0.10**	**0.11**	**0.11**	**0.12**

Table 4.2.11-5 VOC Emissions From Personal Care Products

County	2005	2008	2011	2014	2017
Chatham	0.06	0.06	0.06	0.07	0.07
Durham	0.58	0.60	0.63	0.65	0.68
Franklin	0.13	0.14	0.15	0.16	0.16
Granville	0.13	0.13	0.14	0.15	0.15
Johnston	0.35	0.38	0.42	0.45	0.49
Orange	0.29	0.30	0.31	0.33	0.34
Person	0.09	0.09	0.09	0.10	0.10
Wake	1.80	1.98	2.16	2.33	2.52
TOTAL	**3.43**	**3.68**	**3.96**	**4.24**	**4.51**

Table 4.2.11-6 VOC Emissions From Household Products

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.01	0.01
Granville	0.00	0.00	0.00	0.00	0.01
Johnston	0.01	0.01	0.01	0.02	0.02
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.06	0.07	0.07	0.08	0.09
TOTAL	**0.10**	**0.11**	**0.11**	**0.14**	**0.16**

Table 4.2.11-7 VOC Emissions From Automotive Aftermarket Products

County	2005	2008	2011	2014	2017
Chatham	0.03	0.04	0.04	0.04	0.04
Durham	0.34	0.35	0.37	0.38	0.40
Franklin	0.08	0.08	0.09	0.09	0.10
Granville	0.07	0.08	0.08	0.09	0.09
Johnston	0.20	0.22	0.24	0.26	0.28
Orange	0.17	0.18	0.18	0.19	0.20
Person	0.05	0.05	0.06	0.06	0.06
Wake	1.05	1.16	1.27	1.37	1.48
TOTAL	**1.99**	**2.16**	**2.33**	**2.48**	**2.65**

Table 4.2.11-8 VOC Emissions From Adhesives and Sealants

County	2005	2008	2011	2014	2017
Chatham	0.01	0.02	0.02	0.02	0.02
Durham	0.14	0.15	0.15	0.16	0.17
Franklin	0.03	0.03	0.04	0.04	0.04
Granville	0.03	0.03	0.03	0.04	0.04
Johnston	0.09	0.09	0.10	0.11	0.12
Orange	0.07	0.07	0.08	0.08	0.08
Person	0.02	0.02	0.02	0.02	0.02
Wake	0.44	0.49	0.53	0.57	0.62
TOTAL	**0.83**	**0.90**	**0.97**	**1.04**	**1.11**

Table 4.2.11-9 Total VOC Emissions From Commercial/Consumer Solvent

County	2005	2008	2011	2014	2017
Chatham	0.16	0.20	0.20	0.21	0.22
Durham	1.78	1.85	1.93	2.00	2.09
Franklin	0.39	0.42	0.45	0.48	0.51
Granville	0.38	0.39	0.42	0.45	0.47
Johnston	1.07	1.16	1.27	1.38	1.49
Orange	0.89	0.92	0.96	1.00	1.04
Person	0.27	0.27	0.28	0.29	0.30
Wake	5.52	6.09	6.64	7.17	7.75
TOTAL	**10.46**	**11.30**	**12.15**	**12.98**	**13.87**

4.3 BIOPROCESS EMISSION SOURCES

Bioprocess emission sources include those sources whose emissions result from biological processes (e.g., fermentations). Source categories include bakeries, breweries, wineries and distilleries. The methodology used to calculate the projected emissions from these sources are described in detail in each subsection.

4.3.1 Bakeries

Ethanol, a VOC, is a by-product of fermentation of bread dough. The ethanol emissions from large commercial bakeries are accounted for as point sources; however, ethanol emissions occur from grocery store bakery departments and small business bakeries not accounted for under the point source inventory.

The EIIP Tech. Report prescribes accounting for these emissions by the use of a per capita consumption factor of 70 pounds of bread per person per year and an emission factor of 0.5 pounds of VOC per 1000 pounds of baked bread. The county populations obtained from the 2002 Census (see Table 2.2-1) and growth factors from Table 2.2-2 were used to estimate the emissions from this source category.

According to the EIIP Tech. Report, emissions from this source category occur 365 days per year and therefore no seasonal adjustment required. For future year inventories, the projected future year population was multiplied by the emission factor. The emissions for the base year and future year inventories were calculated using Equation 4.3.1-1.

$$EM_f = \frac{(Population)_b \times CF \times EF \times GF_{f/b}}{(2000\ lb/tons) \times (365\ days/year)} \qquad 4.3.1\text{-}1$$

where EM_f = emissions for source category in future year
$Population_b$ = Population in base year
$GF_{f/b}$ = Growth factor base to future
CF = Consumption factor, 70 lb bread/person/year
EF = emission factor for source category, 0.5 lb VOC/1000 lb bread baked

Examples of the emission calculation for Wake County are listed below:

2002 Population in Wake County = 679,785
Consumption factor = 70 lb bread/person/year
Emission Factor = 0.5 lb VOC/1000 lb bread baked = 0.0005 lb VOC/lb bread baked

From Equations 4.3.1-1

$$VOC_{2005} = \frac{(679{,}785 \text{ per})x(70 \text{ lb br/per year})x(0.0005 \text{ lb VOC/lb br})x(1.1107_{2005/2002})}{(2000 \text{ lb/ton})x(365 \text{ days/year})}$$

$$= 0.0361 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from bakeries for the Triangle nonattainment area are listed in Table 4.3.1-1.

Table 4.3.1-1 VOC Emissions From Bakeries

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.04	0.04	0.04	0.05	0.05
TOTAL	**0.07**	**0.07**	**0.07**	**0.08**	**0.08**

4.4 OTHER MAN MADE AREA SOURCES

Other man made area sources include forest fires, slash burning and prescribed burning, agricultural burning, structure fires, and orchard heaters. Some of these sources, such as orchard heaters and certain kinds of agricultural burning, are not active during the ozone season. The methodology used to calculate the emissions from these sources are described in detail in each subsection.

4.4.1 Forest Fires

There are two types of forest fires; wild fires, which are accidental or felonious fires and prescribed burns, which are intentionally set for the purpose of forest and/or grassland management practice. The number of acres burned in 2002 for each of these categories was ascertained from the North Carolina Division of Forest Resources (NCDFR) and are listed in Table 4.4.1-1.

Table 4.4.1-1 Acres of Land Burned by Fires

	Wild Fires	Prescribed	Total
Chatham	220.2	1067	1287.2
Durham	92.0	36	128.0
Franklin	138.8	198	336.8
Granville	121.7	267	388.7
Johnston	257.5	117	374.5
Orange	55.5	30	85.5
Person	155.7	167	322.7
Wake	107.3	53	160.3

The makeup of the plant life burned in each fire can vary from woodland to brush to grassland. The emission factors for the southern region of the United States from AP42, Table 13.1-2, were used to estimate the emissions from forest burns. These factors are 0.108 tons VOC per acre burned and 0.018 tons nitrogen oxides (NOx) per acre burned.

The NCDFR was not able to provide seasonal numbers, so the daily emissions are estimated by dividing by 365 days per year. The number of acres burned in 2002 provided by the NCDFR was used as an estimate of the number of acres burned in 2005. For the base year 2005 and future year inventories, it is assumed that the number of acres burned remains relatively constant and therefore the emissions do not change from year to year. The emissions for the 2005 year inventory were based on 2002 data and were calculated using Equation 4.4.1-1.

$$EM_P = \frac{(\#\text{ acres burned}) \times EF_P}{(365\text{ days/year})} \qquad 4.4.1\text{-}1$$

where EM_P = emissions for source category for pollutant (P)
EF_P = emission factor for pollutant (P)

Examples of the emission calculation for Wake County are listed below:

Number of acres burned in Wake County = 160.3
VOC Emission Factor = 0.108 tons VOC/acre burned
NOx emission factor = 0.018 tons NOx/acre burned

From Equations 4.4.1-1

$$VOC_{2005} = \frac{(160.3\text{ acres burned}) \times (0.108\text{ tons VOC/acre burned})}{(365\text{ days/year})}$$
$$= 0.0474\text{ tons VOC/day}$$

$$NOx_{2005} = \frac{(160.3 \text{ acres burned}) \times (0.018 \text{ tons NOx/acre burned})}{(365 \text{ days/year})}$$
$$= 0.0079 \text{ tons NOx/day}$$

The VOC and NOx emission estimates, in tons/day, from forest fires for the Triangle nonattainment area are listed in Table 4.4.1-2. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.1-2 Emissions from Forest Fires

County	VOC	NOx
Chatham	0.16	0.03
Durham	0.04	0.01
Franklin	0.10	0.02
Granville	0.12	0.02
Johnston	0.11	0.02
Orange	0.03	0.00
Person	0.10	0.02
Wake	0.05	0.01
TOTAL	**0.71**	**0.13**

4.4.2 Structure Fires

The U.S. Fire Administration (USFA) of the Department of Homeland Security maintains statistics on the number of fires per county. The number of fires per county for 2002 was derived from 2001 and 2002 population statistics and 2001 USFA fire statistics. The USFA fire statistics were obtained from the USFA website at http://www.usfa.fema.gov/safety/. As 2002 fire statistics were not available, a fires per person factor for 2001 was calculated and found to be equal to 0.00184 fires/person. The 2001 county population values were obtained from the North Carolina State Demographics website at http://demog.state.nc.us/. The 0.00184 fires per person was applied to the 2002 population for each county to determine the number of fires in each county for 2002. The population values are listed in Table 2.2-1 in Section 2.

The emission factors and fuel loading factors were obtained from the EIIP Tech. Report, Table 18.4-1 and Table 18.4-2, respectively. The emission factors are 11 pounds of VOC per ton burned and 1.4 pounds of NOx per ton burned. The loading factor is 1.15 tons of material burned per structural fire.

According to the EIIP Tech. Report, emissions from this source category occur 365 days per year and there is no seasonal adjustment required. Base year 2005 emissions and future year inventories were obtained by applying growth factors to 2002 emissions data. Growth factors were provided by the North Carolina Office of State Budget and Management and were based originally on 2000 census data. These growth factors are listed in Table 2.2-2, Population Growth Factors, of Section 2.2 above.

For future year inventories, the base year emissions were grown using the percent growth in population for each county (see Table 2.2-2). The emissions for the 2002 were calculated using Equation 4.4.2-1. Base year 2005 and future year inventories were calculated using Equation 4.4.2-2.

$$EM_P = \frac{(\text{2002 County population}) \times (FPP) \times (CF) \times (EF_P)}{(\text{2000 lb/tons}) \times (\text{365 days/year})} \qquad 4.4.2\text{-}1$$

$$PJ_aEM = EM_P \times GF_a \qquad 4.4.2\text{-}2$$

where EM_P = emissions for structure fires for pollutant (P)
FPP = fires per person in 2001, 0.00184 fires/person
CF = Conversion factor, 1.15 tons burned/structure fire
EF_P = emission factor for pollutant (P)
PJ_aEM = projected future year (a) emissions for county
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

2002 Wake Population = 679,785 persons
Fires per person in 2001 = 0.00184 fires/person
Conversion factor = 1.15 tons burned/structure fire
VOC Emission Factor = 11 lb VOC/tons burned
NOx Emission Factor = 1.4 lb NOx/ton burned
Growth Factor = 1.1107

From Equations 4.4.2-1 and 4.4.2-2

$$VOC_{2002} = \frac{(679{,}785) \times (0.00184 \text{ fires/person}) \times (1.15 \text{ tons burned/fire}) \times (11 \text{ lb VOC/ton burned})}{(\text{2000 lb/ton}) \times (\text{365 days/year})}$$
$$= 0.0217 \text{ tons VOC/day}$$

$$VOC_{2005} = (0.0017 \text{ tons VOC/day}) \times 0.9765$$
$$= 0.0212 \text{ tons VOC/day}$$

NOx_{2002} = (679,785) x (0.00184 fires/person) x (1.15 tons burned/fire) x(1.4 lb NOx/ton burned) / (2000 lb/ton) x (365 days/year)
= 0.0028 tons NOx/day

NOx_{2005} = (0.002 tons NOx/day) x 0.9765
= 0.0027 tons NOx/day

The VOC and NOx emission estimates, in tons/day, from structure fires for the Triangle nonattainment area are listed in Table 4.4.2-2 and Table 4.4.2-3.

Table 4.4.2-2 VOC Emissions From Structure Fire

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.01	0.01	0.01	0.01
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.02	0.03	0.03	0.03	0.03
TOTAL	**0.03**	**0.05**	**0.05**	**0.05**	**0.05**

Table 4.4.2-3 NOx Emissions From Structure Fire

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

4.4.3 Charbroiling

The commercial charbroiling of ground beef emits VOC emissions. According to the methodology in the EIIP Tech. Report, county Health Departments should be able to provide the number of restaurants in a county as well as the percentage of those restaurants that charbroil meat. The NCDAQ was able to ascertain the number of restaurants in each county in 2002 from the North Carolina Division of Environmental Services, Inspection, Statistics, and Fee Branch. To determine the percentage of charbroiling restaurants, the county Health Departments of several counties were surveyed. Three of the seven counties responded. The average percentage of the three responding counties was used to calculate the number of charbroiling restaurants for Triangle nonattainment area counties. See Table 4.4.3-1 for the number of restaurants in each county surveyed and the percentage of charbroiling restaurants. The number of restaurants in the Triangle nonattainment area counties was as follows: 42 in Chatham County, 489 in Durham County, 33 in Franklin County, 74 in Granville County, 143 in Johnston County, 214 in Orange County, 34 in Person County, and 1242 in Wake County.

Table 4.4.3-1 Restaurants in Each County Surveyed

County	# Restaurants	% Charbroiling (as reported)
Davidson	215	--
Davie	62	--
Durham	489	8%
Forsyth	595	--
Granville	74	--
Guilford	937	13%
Wake	1310	19%
Average		**13%**

According to the EIIP Tech. Report, the average throughput of meat per restaurant with a charbroiler is 1160 pounds per week and the emissions factor is 3.94 pounds of VOC per 1000 pounds of meat. Emissions from this source category occur 365 days per year and therefore no seasonal adjustment required. For future year inventories, the base year emissions were projected using E-GAS 5.0 growth factors and are listed in Table 4.4.3-2.

Table 4.4.3-2 Growth Factors for Charbroiling

2005	2008	2011	2014	2017
1.0291	1.0688	1.1061	1.1352	1.1702

The emissions for the base year and future year inventories were calculated using Equations 4.4.3-1 and 4.4.3-2, respectively.

$$EM_a = \frac{(\text{\# Restaurants}) \times (\text{\% Charbroiling}) \times (CF) \times (EF)}{(2000 \text{ lb/tons}) \times (1 \text{ yr}/52 \text{ wks})} \qquad 4.4.3\text{-}1$$

$$PJ_bEM_a = EM_a \times GF_{ab} \times (1 \text{ yr}/365 \text{ days}) \qquad 4.4.3\text{-}2$$

where EM_a = emissions for source category in county (a) ton/yr
CF = conversion factor, 1160 lb meat charbroiled/week
EF = emission factor, 3.94 lb VOC/1000 lb meat charbroiled
PJ_bEM = projected future year (b) emissions for county in redesignation area ton/year
GF_{ab} = growth factor for base year (a) to future year (b)

Examples of the emission calculation for Franklin County are listed below:

Restaurants in County = 33
% of restaurants charbroiling = 13%
Conversion factory = 1160 lb meat/week charbroiled
Emission factor = 3.94 lb VOC/1000 lb meat charbroiled = 0.00394lb VOC/lb meat
Projection factor for 2005 = 1.0291

From Equation 4.4.3-1 and 4.4.3-2:

$$VOC_{2002} = \frac{(33 \text{ restaurants}) \times (0.13) \times (1160 \text{ lb/week}) \times (0.00394 \text{ lb VOC/lb meat})}{(2000 \text{ lb/ton}) \times (1 \text{ yr}/52 \text{weeks})}$$
$$= 0.5098 \text{ ton VOC/year}$$

$$VOC_{2005} = 0.5098 \times 1.0291 \times (1/365)$$
$$= 0.0014 \text{ tons VOC/day}$$

The VOC emission estimates, in tons/day, from charbroiling for the Triangle nonattainment area are listed in Table 4.4.3-3. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.3-3 VOC Emissions From Charbroiling

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.05	0.06	0.06	0.06	0.06
TOTAL	**0.09**	**0.10**	**0.10**	**0.10**	**0.10**

4.4.4 Open Burning – Municipal Solid Waste and Yard Trimmings

It was assumed that all municipal solid waste (MSW) and yard trimmings, were burned in the open for solid waste generated outside the municipal corporate limits. According to the EIIP Tech. Report, Table 16.5-1, it is estimated that 3.77 pounds of MSW is generated per person per day and 0.64 pounds of yard trimmings are generated per person per day. Since it is illegal to burn within the corporate limits, the rural population was estimated by using the same percentage of rural population in each county as what was reported in the 2000 census. The 2000 total and rural population for each county are listed in Table 4.4.4-1. The year 2000 total and rural populations for each county was obtained from the North Carolina Office of State Budget and Management, State Data Center.

Table 4.4.4-1 2000 Total and Rural Populations

County	2000 Population Data		Estimated 2002 Rural Population
	Total	Rural	
Chatham	49,329	39,825	42,374
Durham	223,314	16,763	17,489
Franklin	47,260	43,137	46,023
Granville	48,498	31,802	33,806
Johnston	121,965	83,377	90,543
Orange	118,227	37,782	38,142
Person	35,623	26,131	26,953
Wake	627,846	74,679	80,857

The emission factors for open burning of MSW were obtained from AP42, Table 2.5-1, and are 30 pounds VOC per ton MSW burned and 6 pounds NOx per ton MSW burned. The emission factors for open burning of yard trimmings were obtained from AP42, Table 2.5-1 and EIIP Section 4.1.3, Table 16.4-7, and are 28 pounds VOC per ton yard trimmings burned and 6 pounds NOx per ton yard trimmings burned. Emissions from these source categories occur 365 days per year and therefore no seasonal adjustment required. For the base year and future year inventories, the 2002 year emissions were projected using the percent growth in the total county population. These growth factors are found in Table 2.2-2 in Section 2.2, above. The emissions for the year 2002 were calculated using Equation 4.4.4-1 and the base year and future year inventories were calculated using Equation 4.4.4-2.

$$EM_P = \frac{\text{(Rural Population in 2002) x (CF) x } (EF_P)}{\text{(2000 lb/tons)}} \qquad 4.4.4\text{-}1$$

$$PJ_aEM = EM_P \times GF_a \qquad 4.4.4\text{-}2$$

where EM_P = emissions for pollutant (P)
CF = conversion factor, 3.77 lb MSW/person/day
= 0.001885 ton MSW/person/day
EF_P = emission factor for pollutant (P)
PJ_aEM = projected future year (a) emissions for county
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

Rural Population in County in 2002 = 80,857
Conversion factor = 0.001885 ton MSW/person/day
VOC Emission factor = 30 lb VOC/ton MSW burned
NOx Emission factor = 6 lb NOx/ton MSW burned
Growth factor for 2005 = 1.1107

From Equation 4.4.4-1 and 4.4.4-2:

$$VOC_{2002} = \frac{\text{(80,857people) x (0.001885 ton MSW/person/day) x (30 lb VOC/ton MSW)}}{\text{(2000 lb/ton)}}$$
$$= 2.29 \text{ ton VOC/day}$$

$$VOC_{2005} = 2.29 \text{ ton VOC/day} \times 1.1107$$
$$= 2.54 \text{ ton VOC/day}$$

$$NOx_{2002} = \frac{(80{,}857 \text{people}) \times (0.001885 \text{ ton MSW/person/day}) \times (6 \text{ lb NOx/ton MSW})}{(2000 \text{ lb/ton})}$$
$$= 0.46 \text{ ton NOx/day}$$

$$NOx_{2005} = 0.46 \text{ ton NOx/day} \times 1.1107$$
$$= 0.51 \text{ tons NOx/day}$$

The VOC and NOx emission estimates, in tons/day, from the open burning of MSW and yard trimmings for the Triangle nonattainment area are listed in Table 4.4.4-2 through Table 4.4.4-5. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.4-2 VOC Emissions From MSW Burning

County	2005	2008	2011	2014	2017
Chatham	1.28	1.36	1.44	1.52	1.60
Durham	0.51	0.54	0.56	0.58	0.60
Franklin	1.40	1.49	1.59	1.68	1.79
Granville	0.99	1.04	1.09	1.14	1.19
Johnston	2.83	3.10	3.38	3.65	3.94
Orange	1.10	1.15	1.19	1.23	1.28
Person	0.77	0.79	0.82	0.84	0.87
Wake	2.54	2.80	3.05	3.29	3.55
TOTAL	**11.42**	**12.27**	**13.12**	**13.93**	**14.82**

Table 4.4.4-3 VOC Emissions From Burning of Yard Trimmings

County	2005	2008	2011	2014	2017
Chatham	0.20	0.22	0.23	0.24	0.25
Durham	0.08	0.08	0.09	0.09	0.10
Franklin	0.22	0.24	0.25	0.27	0.28
Granville	0.16	0.16	0.17	0.18	0.19
Johnston	0.45	0.49	0.54	0.58	0.62
Orange	0.17	0.18	0.19	0.20	0.20
Person	0.12	0.13	0.13	0.13	0.14
Wake	0.40	0.44	0.48	0.52	0.56
TOTAL	**1.80**	**1.94**	**2.08**	**2.21**	**2.34**

Table 4.4.4-4 NOx Emissions From MSW Burning

County	2005	2008	2011	2014	2017
Chatham	0.26	0.27	0.29	0.30	0.32
Durham	0.10	0.11	0.11	0.12	0.12
Franklin	0.28	0.30	0.32	0.34	0.36
Granville	0.20	0.21	0.22	0.23	0.24
Johnston	0.57	0.62	0.68	0.73	0.79
Orange	0.22	0.23	0.24	0.25	0.26
Person	0.15	0.16	0.16	0.17	0.17
Wake	0.51	0.56	0.61	0.66	0.71
TOTAL	**2.29**	**2.46**	**2.63**	**2.80**	**2.97**

Table 4.4.4-5 NOx Emissions From Burning of Yard Trimmings

County	2005	2008	2011	2014	2017
Chatham	0.04	0.05	0.05	0.05	0.05
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.05	0.05	0.05	0.06	0.06
Granville	0.03	0.04	0.04	0.04	0.04
Johnston	0.10	0.11	0.11	0.12	0.13
Orange	0.04	0.04	0.04	0.04	0.04
Person	0.03	0.03	0.03	0.03	0.03
Wake	0.09	0.10	0.10	0.11	0.12
TOTAL	**0.40**	**0.44**	**0.44**	**0.47**	**0.49**

4.4.5 Natural Gas, Liquid Petroleum Gas, Oil, Coal, and Wood Combustion

This source category covers emissions from natural gas (NG) and liquid petroleum gas (LPG), oil, coal, and wood combustion in the residential, commercial/institutional (called commercial), and industrial sectors.

Fuel usage data for North Carolina for 2002 was taken from NC Energy Outlook 2003 by Global Insight, Inc. The following table shows the data used.

Table 4.4.5-1 Fuel Use in North Carolina 2002

Fuel	Units	Residential	Commercial	Industrial
NG	10^6 ft^3	64,014	40,580	95,718
LPG	gallons	282,775,596	47,960,199	198,606,965
Oil	gallons	215,804,019	113,088,933	343,414,390
Coal	tons	46,872	85,735	0
Wood	tons	1,625,111	164,327	8,583,778

Emission factors used are shown in Table 4.4.5-2 below.

Table 4.4.5-2 Combustion Emission Factors

Fuel	Units	Res VOC	Res NOx	Com VOC	Com NOx	Ind VOC	Ind NOx
NG	lb/10^6 ft^3	5.5	94	5.5	167.5	4.96	163.33
LPG	lb/gal	0.0003	0.014	0.00035	0.0145	0.00035	0.02
Oil	lb/gal	0.000713	0.018	0.000735	0.037	0.00024	0.039
Coal	lb/ton	0.07	9.1	0.07	15.8	0.07	14.9
Wood	lb/ton	107.6	2.6	0.255326	3.304224	0.255326	3.304224

Residential NG and LPG fuel usage for The Triangle nonattainment area counties was calculated by apportioning the state total fuel usage to a county level. Fuel usage was apportioned by applying the ratio of the number of households heated with NG or LPG in a county to the total households in the State heated with NG or LPG. The number of households heated with NG or LPG was obtained from the 2000 Census and is shown in Table 4.4.5-3.

Table 4.4.5-3 Households Heated with NG or LPG

County	Natural Gas	LPG
Chatham	3,066	5,828
Durham	35,446	4,569
Franklin	497	6,071
Granville	2,756	4,249
Johnston	3,641	14,032
Orange	15,295	5,860
Person	2,716	3,648
Wake	100,902	17,686
North Carolina	757,777	394,275

Commercial and industrial fuel usage was apportioned according to the number of business establishments in the State and counties. The numbers were taken from 1997 (last year of SIC based statistics) County Business Patterns. Establishments with SICs from 50*xx* through 99*xx* were summed. The apportionment numbers are in Table 4.4.5-4 below.

Table 4.4.5-4 Commercial and Industrial Fuel Apportionment

County	Business Establishments
Chatham	645
Durham	4,448
Franklin	448
Granville	555
Johnston	1,626
Orange	2,193
Person	509
Wake	14,564
State	148,762

All emission were calculated and apportioned for 2002 annual basis, grown with E-GAS 5.0 factors (Table 4.4.5-5) and then adjusted for season (Residential and Commercial NG and LPG only) and day. Where point source emissions are indicated in Table 4.4.5-6, these were deducted from the 2002 annual number.

Table 4.4.5-5 Growth Factors for Fuel Combustion

Source Category	2005	2008	2011	2014	2017
Residential Fuel Combustion					
Natural Gas	1.0814	1.1627	1.2341	1.2837	1.3364
Liquid Petroleum Gas	0.9867	1.0435	1.0811	1.1222	1.1608
Commercial Fuel Combustion					
Natural Gas	1.0390	1.1237	1.2415	1.2943	1.3705
Liquid Petroleum Gas	1.0635	1.0455	1.0671	1.0771	1.0982
Oil	1.1711	1.2584	1.3240	1.3846	1.4441
Coal	1.0645	1.0426	1.0503	1.0458	1.0467
Wood	1.0000	1.0000	1.0000	1.0000	1.0000
Industrial Fuel Combustion					
Natural Gas	1.0776	1.1290	1.1746	1.1971	1.2438
Liquid Petroleum Gas	0.9900	1.0395	1.0699	1.1132	1.1620
Oil	0.9970	1.0148	1.0358	1.0937	1.1317

Table 4.4.5-6 Point Source Emissions for Fuel Combustion

County	Commercial Natural Gas		Industrial Fuel Oil		Industrial Natural Gas	
	NOx (tons/yr)	VOC (tons/yr)	NOx (tons/yr)	VOC (tons/yr)	NOx (tons/yr)	VOC (tons/yr)
Chatham	2.28	0.12	58.057	1.755	71.612	2.507
Durham	36.013	2.072	113.501	0.510	14.563	0.744
Franklin	0	0	0.4	0	0.14	0.007
Granville	0	0	0	0	12.123	0.661
Johnston	17.329	0.399	13.3	0.6	13.3	0.6
Orange	296.316	1.579	500.51	2.941	510.094	3.291
Person	0	0	0	0	26.682	1.746
Wake	51.86	2.594	13.361	0.673	71.931	2.771

Residential NG and LPG usage is influenced strongly by seasonal temperatures. During the summer months usage will be confined to cooking, heating water, and possibly heating clothes dryers. Commercial NG and LPG usage is also seasonal but less so. The North Carolina Utilities Commission provided data from the U.S. Department of Energy, Energy Information Administration giving monthly usage of natural gas by residential and commercial customers in North Carolina for 2002. It is assumed that LPG is used seasonally like NG. From this information July adjustment factors were calculated that adjust an average day to a summer day. For residential customers the factor is 0.2027 and for commercial it is 0.4425. Other fuel users were considered to have even fuel usage throughout the year.

It was assumed that during the summer months no residential oil, coal, or wood were used since these are normally used only for heating.

The following equation demonstrates the calculation of residential VOC emissions for Wake County from natural gas in 2005. All residential VOC and NOx emissions for NG and LPG were done in an analogous manner.

$$EM_{2005} = (64{,}014*10^6\ ft^3/yr)*(5.5\ lbVOC/10^6\ ft^3)*(1ton/2000\ lb)*$$
$$(100{,}902\ housholds/757{,}777\ households)*(1\ yr/365days)*$$
$$(0.2027\ July\ day/day)*(1.0814\ \ EGAS_{2005/2002})$$
$$= 0.0141\ tons\ VOC/day$$

The VOC and NOx emission estimates, in tons/day, from residential fuel combustion for the Triangle nonattainment area are listed in Tables 4.4.5-7 and 4.4.5-8. Chatham County emissions

have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-7 VOC Emissions From NG and LPG Residential Fuel Combustion

County	2005	2008	2011	2014	2017
Natural Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.02	0.02	0.02	0.02
TOTAL	**0.01**	**0.03**	**0.03**	**0.03**	**0.03**
Liquid Petroleum Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 4.4.5-8 NOx Emissions From NG and LPG Residential Fuel Combustion

County	2005	2008	2011	2014	2017
Natural Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.08	0.09	0.10	0.10	0.10
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.04	0.04	0.04	0.04	0.05
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.24	0.26	0.27	0.29	0.30
TOTAL	**0.39**	**0.42**	**0.44**	**0.46**	**0.48**
Liquid Petroleum Gas					
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.02	0.02	0.02	0.02	0.02
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.04	0.04	0.04	0.04	0.05
Orange	0.02	0.02	0.02	0.02	0.02
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.05	0.05	0.05	0.06	0.06
TOTAL	**0.17**	**0.17**	**0.17**	**0.18**	**0.19**

The following equation demonstrates the calculation of commercial VOC emissions for Wake County from NG in 2005. All commercial VOC and NOx emissions for NG and LPG were done in an analogous manner.

EM_{2005} = ((40,580*10^6 ft^3/yr)*(5.5 lbVOC/10^6 ft^3)*(1ton/2000 lb)*
(14,564 bus./148,762 bus.) – 2.594 ton/year point adj.)*(1 yr/365days)*
(0.4425 July day/day)*(1.0390 $EGAS_{2005/2002}$)

= 0.0106 tons VOC/day 0.0049

The VOC and NOx emission estimates, in tons/day, from commercial fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-9 VOC Emissions From NG and LPG Commercial Fuel Combustion

County	2005	2008	2011	2014	2017
Natural Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
Liquid Petroleum Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 4.4.5-10 NOx Emissions From NG and LPG Commercial Fuel Combustion

County	2005	2008	2011	2014	2017
Natural Gas					
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.09	0.10	0.11	0.11	0.12
Franklin	0.01	0.01	0.02	0.02	0.02
Granville	0.02	0.02	0.02	0.02	0.02
Johnston	0.03	0.03	0.03	0.03	0.04
Orange	0.06	0.07	0.07	0.08	0.08
Person	0.01	0.02	0.02	0.02	0.02
Wake	0.36	0.39	0.43	0.45	0.47
TOTAL	**0.59**	**0.65**	**0.71**	**0.74**	**0.78**

Table 4.4.5-10 NOx Emissions From NG and LPG Commercial Fuel Combustion (cont.)

County	2005	2008	2011	2014	2017
Liquid Petroleum Gas					
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.01	0.01	0.01	0.01	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.04	0.04	0.04	0.04	0.05
TOTAL	**0.06**	**0.06**	**0.06**	**0.06**	**0.08**

The following equation demonstrates the calculation of commercial VOC emissions for Wake County from oil in 2005. All commercial VOC and NOx emissions for oil were done in an analogous manner.

EM_{2005} = ((113088933 gal/yr)*(0.000735 lb VOC/gal)*(1ton/2000 lb)* (14,564 bus./148,762 bus.) – 0 ton/year point adj)*(1 yr/365days)* (1.1711 $EGAS_{2005/2002}$)
= 0.0131 tons VOC/day

The VOC and NOx emission estimates, in tons/day, from commercial oil fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-11 VOC Emissions From Commercial Oil Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.01
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.02
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.03**

Table 4.4.5-12 NOx Emissions From Commercial Oil Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.02
Durham	0.20	0.22	0.23	0.24	0.25
Franklin	0.02	0.02	0.02	0.02	0.02
Granville	0.03	0.03	0.03	0.03	0.03
Johnston	0.06	0.07	0.07	0.07	0.08
Orange	0.10	0.11	0.11	0.12	0.12
Person	0.02	0.02	0.03	0.03	0.03
Wake	0.64	0.69	0.73	0.76	0.79
TOTAL	**1.08**	**1.17**	**1.23**	**1.28**	**1.34**

The following equation demonstrates the calculation of commercial NOx emissions for Wake County from coal in 2005. All commercial VOC and NOx emissions for coal were done in an analogous manner.

EM_{2005} = ((85,735 ton/year)*(15.8 lb NOx/ton)*(1ton/2000 lb)*
(14,564 bus./148,762 bus.) – 0 ton/year point adj)*(1 yr/365days)*
(1.0645 $EGAS_{2005/2002}$)
= 0.1934 tons NOx/day

The VOC and NOx emission estimates, in tons/day, from commercial coal fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-13 VOC Emissions From Commercial Coal Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 4.4.5-14 NOx Emissions From Commercial Coal Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.06	0.06	0.06	0.06	0.06
Franklin	0.01	0.01	0.01	0.01	0.01
Granville	0.01	0.01	0.01	0.01	0.01
Johnston	0.02	0.02	0.02	0.02	0.02
Orange	0.03	0.03	0.03	0.03	0.03
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.19	0.19	0.19	0.19	0.19
TOTAL	**0.33**	**0.33**	**0.33**	**0.33**	**0.33**

The following equation demonstrates the calculation of commercial NOx emissions for Wake County from wood in 2005. All commercial VOC and NOx emissions for wood were done in an analogous manner.

EM_{2005} = ((164,327 ton/year)*(3.3042 lb NOx/ton)*(1ton/2000 lb)*
(14,564 bus./148,762 bus.) – 0 ton/year point adj)*(1 yr/365days)*
(1.0000 $EGAS_{2005/2002}$)
= 0.0728 tons NOx/day

The VOC and NOx emission estimates, in tons/day, from commercial wood fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-15 VOC Emissions From Commercial Wood Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

Table 4.4.5-16 NOx Emissions From Commercial Wood Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.07	0.07	0.07	0.07	0.07
TOTAL	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**

Industrial sources were calculated in a manner similar to commercial sources burning oil or coal. There were no industrial coal burning sources. It was decided to not report any industrial wood burning as it was thought that any such sources must be captured in the point source inventory.

The VOC and NOx emission estimates, in tons/day, from industrial fuel combustion for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.5-17 VOC Emissions From Industrial NG Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.01	0.01	0.01	0.01	0.01
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.06	0.06	0.07	0.07	0.07
TOTAL	**0.10**	**0.10**	**0.11**	**0.11**	**0.11**

Table 4.4.5-18 NOx Emissions From Industrial NG Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.67	0.70	0.73	0.75	0.78
Franklin	0.07	0.07	0.08	0.08	0.08
Granville	0.05	0.05	0.05	0.05	0.05
Johnston	0.21	0.22	0.23	0.23	0.24
Orange	0.28	0.30	0.31	0.31	0.33
Person	0.00	0.00	0.00	0.00	0.00
Wake	2.11	2.21	2.30	2.35	2.44
TOTAL	**3.39**	**3.55**	**3.70**	**3.77**	**3.92**

Table 4.4.5-19 VOC Emissions From Industrial LPG Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

Table 4.4.5-20 NOx Emissions From Industrial LPG Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.17	0.17	0.18	0.19	0.20
Franklin	0.02	0.02	0.02	0.02	0.02
Granville	0.02	0.02	0.02	0.02	0.02
Johnston	0.06	0.06	0.06	0.07	0.07
Orange	0.08	0.08	0.09	0.09	0.09
Person	0.02	0.02	0.02	0.02	0.02
Wake	0.53	0.55	0.57	0.59	0.62
TOTAL	**0.91**	**0.93**	**0.97**	**1.01**	**1.05**

Table 4.4.5-21 VOC Emissions From Industrial Oil Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.01	0.01	0.01	0.01	0.01
TOTAL	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**

Table 4.4.5-22 NOx Emissions From Industrial Oil Fuel Combustion

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.56	0.57	0.59	0.62	0.64
Franklin	0.05	0.05	0.06	0.06	0.06
Granville	0.07	0.07	0.07	0.07	0.08
Johnston	0.20	0.20	0.20	0.22	0.22
Orange	0.24	0.25	0.25	0.27	0.28
Person	0.06	0.06	0.07	0.07	0.07
Wake	1.79	1.81	1.86	1.96	2.03
TOTAL	**2.97**	**3.01**	**3.10**	**3.27**	**3.38**

4.4.6 Vehicle Fires

Vehicle fire emissions within the nonattainment area are estimated by considering the estimated number vehicles burned in the Triangle area counties, the amount of material burned (the fuel loading) in a vehicle fire, and the emission factors for the open burning of automobile components. The assumptions for amount of material burned and the emission factors were based on the USEPA's AP-42, Section 2.5 Open Burning, 1996.

The estimated number of vehicle fires was determined by apportioning a national fire statistic to a county level. The USFA of the Department of Homeland Security maintains national-level fire statistics. The number of fires nationwide in 2002 was 1,734,500 and was available from the USFA website at http://www.usfa.fema.gov/statistics/national/. The percentage of vehicle fires

was applied to the national-level total number of fires. The number of national-level vehicle fires was then apportioned to a state-level. The ratio of North Carolina vehicle miles traveled (VMT) to U.S. VMT (92,894,000,000 VMT / 2,855,756,000,000 VMT) was applied to the number of national-level vehicle fires to obtain the number of North Carolina vehicle fires. The VMT statistics were obtained from the U.S. Department of Transportation, Federal Highway Administration website at http://www.fhwa.dot.gov/policy/ohim/hs02/vm2.htm. The number of state-level vehicle fires was then apportioned to a county level based on paved mile per county in 2002. Paved mile per county data was obtained from the NCDOT.

Using the above method, 2002 vehicle fire emissions were calculated. Base year 2005 emissions were calculated by applying growth factors to 2002 vehicle fire emissions data. For 2002, the estimated number of vehicle fires in the Triangle nonattainment area counties are listed in Table 4.4.6-1 below.

Table 4.4.6-1 Vehicle Fires in the Triangle Area Counties

County	Estimated Number of Vehicle Fires
Chatham	154
Durham	106
Franklin	114
Granville	123
Johnston	237
Orange	118
Person	96
Wake	310

The amount of vehicle material burned (the fuel loading) in a vehicle fire was estimated by assuming that an average vehicle has 500 pounds of components (.25 tons) that can burn in a fire, based on a 3,700 pounds average vehicle weight (CARB, 1995).

The emission factors were obtained from Table 2.5-1, Emission Factors for Open Burning of Municipal Refuse, of the USEPA's AP-42, Section 2.5 Open Burning, 1996. The emission factors are 32 pounds of VOC per ton burned and 4 pounds of NOx per ton burned.

The 2005 base year and the future year inventories were grown from the 2002 estimated emissions using growth factors generated by the E-GAS 5.0 model. These growth factors are listed in Table 4.4.6-2 below.

Table 4.4.6-2 Growth Factors for Vehicle Fires

2005	2008	2011	2014	2017
1.0541	1.1047	1.1538	1.2035	1.2538

The emissions for the base year and future year inventories were calculated using Equations 4.4.6-1 and 4.4.6-2, respectively.

$$EM_P = \frac{(\text{\# of Vehicle Fires per year}) \times (CF) \times (EF_P)}{(2000\ \text{lb/tons}) \times (365\ \text{days/year})} \qquad 4.4.6\text{-}1$$

$$PJ_aEM = EM_P \times GF_a \qquad 4.4.6\text{-}2$$

where EM_P = emissions for structure fires for pollutant (P)
CF = Conversion factor, 0.25 tons burned/vehicle fire
EF_P = emission factor for pollutant (P)
PJ_aEM = projected future year (a) emissions for county in nonattainment area
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

\# of Vehicle fires in Wake County = 310
Conversion factor = 0.25 tons burned/vehicle fire
VOC Emission Factor = 32 lb VOC/tons burned
NOx Emission Factor = 4 lb NOx/ton burned
Growth Factor $_{(2002\text{-}2005)}$ = 1.0541

From Equations 4.4.6-1 and 4.4.6-2

$$VOC_{2002} = \frac{(310\ \text{fires}) \times (0.25\ \text{tons burned/fire}) \times (32\ \text{lb VOC/ton burned})}{(2000\ \text{lb/ton}) \times (365\ \text{days/year})}$$
$$= 0.0034\ \text{tons VOC/day}$$

$$VOC_{2005} = (0.0034\ \text{tons VOC/day}) \times 1.0541$$
$$= 0.0036\ \text{tons VOC/day}$$

NOx_{2002} = (310 fires) x (0.25 tons burned/fire) x (4 lb VOC/ton burned) / (2000 lb/ton) x (365 days/year)
= 0.0004 tons NOx/day

NOx_{2005} = (0.0004 tons NOx/day) x 1.0541
= 0.0004 tons NOx/day

The VOC and NOx emission estimates, in tons/day, from vehicle fires for the Triangle nonattainment area are listed in Table 4.4.6-3 and Table 4.4.6-4.

Table 4.4.6-3 VOC Emissions From Vehicle Fires

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Table 4.4.6-4 NOx Emissions From Vehicle Fires

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.00	0.00	0.00	0.00	0.00
Franklin	0.00	0.00	0.00	0.00	0.00
Granville	0.00	0.00	0.00	0.00	0.00
Johnston	0.00	0.00	0.00	0.00	0.00
Orange	0.00	0.00	0.00	0.00	0.00
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.00	0.00	0.00	0.00	0.00
TOTAL	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

4.4.7 Agricultural Burning

This source subcategory covers burning practices used to clear and/or prepare land for planting. These operations include stubble burning, burning or agricultural crop residues, and the burning of stand field crops as part of harvesting (e.g., sugar cane). According to the North Carolina Department of Agriculture, when soybeans are double cropped with wheat, the wheat stubble is usually burned back after harvest about one fourth of the time. According to Dr. J. Dunphy, a soybean specialist at North Carolina State University, the acres of soybean double cropped with wheat in North Carolina is approximately equal to the acres of wheat planted. Therefore, one forth of the acreage of wheat planted in 2002 was used to calculate the emissions from agricultural burning practices in North Carolina.

The fuel loading factor and the yield of pollutant for burning wheat stubble was obtained from AP-42, Table 2.4.2. The fuel loading factor is 1.9 tons of fuel consumed per acre burned. The yield of pollutant was dependent upon whether the field was head-fire burned or back-fire burned. The percentage of each burning type used was not available, therefore, the assumption was made that each type was used 50 percent of the time. The yield of pollutant used, 11 pounds of VOC per ton of fuel consumed, is and average of the two types of burning. To calculate the emission factor for VOC emissions, the fuel loading factor is multiplied by the yield of pollutant.

$$EF_{VOC} = (1.9 \text{ tons/acre})\ (11 \text{ lb VOC/ton burned})$$
$$= 20.9 \text{ lb VOC/acre burned}$$

The annual emissions were calculated using the number of acres burned and the per acre emission factor. According to the North Carolina Department of Agriculture, field burning occurs only during June and July. Therefore, the daily emissions for agricultural burning were calculated by dividing the annual emissions by 61 days. No seasonal adjustment is needed since all of the burning occurs during the ozone season.

The number of acres of wheat planted was obtained from the North Carolina Agriculture Statistic Division and is tabulated in Table 4.4.7-1 below.

Table 4.4.7-1 Acres of Land Burned by Agricultural Burning

County	Acres
Chatham	1000
Durham	500
Franklin	4900
Granville	2700
Johnston	7100
Orange	1400
Person	5300
Wake	3200

For the base year and future years inventories, the 2002 year emissions were grown using E-GAS 5.0 growth factors and are listed in Table 4.4.7-2 below. The emissions for 2002 were calculated using equation 4.4.7-1 and the emissions for the base year and future years were calculated using equation 4.4.7-2.

Table 4.4.7-2 Growth Factors for Agricultural Burning

2005	2008	2011	2014	2017
1.0980	1.2042	1.3042	1.3847	1.4622

$$EM = \frac{(¼ \times (\text{wheat acreage})) \times EF}{(2000 \text{ lb/ton}) \times (61 \text{ days/year})} \qquad 4.4.7\text{-}1$$

where EM = emissions for source category for VOC
EF = emission factor for VOC

$$PJ_aEM = EM \times GF_a \qquad 4.4.7\text{-}2$$

where EM = emissions for agricultural burning for VOC
PJ_aEM = projected future year (a) emissions for county in nonattainment area
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

Number of wheat acres in Wake County = 3200
VOC Emission Factor = 20.9 lbs. VOC/acre burned

From Equations 4.4.7-1

VOC_{2002} = (¼ x (3200 acres burned)) x (20.9 lbs. VOC/acre burned) / (2000 lb/ton) x (61 days/year)
= 0.137 tons VOC/day

VOC_{2005} = (0.137 tons VOC/day) x 1.0980
= 0.150 tons VOC/day

The VOC emission estimates, in tons/day, from agricultural burning for the Triangle nonattainment area are listed in Table 4.4.7-3. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.7-3 VOC Emissions From Agricultural Burning

County	2005	2008	2011	2014	2017
Chatham	0.02	0.02	0.02	0.03	0.03
Durham	0.02	0.03	0.03	0.03	0.03
Franklin	0.23	0.25	0.27	0.29	0.31
Granville	0.13	0.14	0.15	0.16	0.17
Johnston	0.33	0.37	0.40	0.42	0.44
Orange	0.07	0.07	0.08	0.08	0.09
Person	0.25	0.27	0.30	0.31	0.33
Wake	0.15	0.17	0.18	0.19	0.20
TOTAL	**1.20**	**1.32**	**1.43**	**1.51**	**1.60**

4.4.8 On Site Incineration

On site incineration occurs at industrial and commercial facilities. Normally these facilities would be captured in the point source inventory. Emissions from this source category have been included to account for any smaller facilities that may not be captured in the point source inventory.

Emissions are calculated and projected based on population of the county (Table 2.2-1 and Table 2.2-2). The emission factors are 8.556 lb VOC/ton waste and 2.5 lb NOx/ton waste. Waste fuel loading factor is 0.023 tons refuse per person per year. Industrial and commercial facilities have the same emission factors.

The emissions for 2002 were calculated using equation 4.4.8-1 and the emissions for the base year and future years were calculated using equation 4.4.8-2.

$$EM_P = \frac{(2002\ \text{population}) \times (LF) \times (EF_P)}{(2000\ \text{lb/tons}) \times (365\ \text{days/year})} \qquad 4.4.8\text{-}1$$

$$PJ_aEM = EM_P \times GF_a \qquad 4.4.8\text{-}2$$

where EM_P = emissions for on site incineration for pollutant (P)
LF = Fuel loading Factory, 0.023 tons refuse burned/person/year
EF_P = emission factor for pollutant (P)
PJ_aEM = projected future year (a) emissions for county in nonattainment area
GF_a = growth factor for future year (a)

Examples of the emission calculation for Wake County are listed below:

Population of Wake County = 679,785 people
Fuel loading factor = 0.023 tons refuse burned/person/year
VOC Emission Factor = 8.556 lb VOC/tons burned
NOx Emission Factor = 2.5 lb NOx/ton burned
Growth Factor $_{(2002\text{-}2005)}$ = 1.1107

From Equations 4.4.8-1 and 4.4.8-2

$$VOC_{2002} = \frac{(679{,}785\ \text{people}) \times (0.023\ \text{tons refuse burned/person/yr}) \times (8.556\ \text{lb VOC/ton burned})}{(2000\ \text{lb/ton}) \times (365\ \text{days/year})}$$
$$= 0.183\ \text{tons VOC/day}$$

$$VOC_{2005} = (0.183\ \text{tons VOC/day}) \times 1.1107$$
$$= 0.203\ \text{tons VOC/day}$$

$$NOx_{2002} = \frac{(679{,}785\ \text{people}) \times (0.023\ \text{tons refuse burned/person/yr}) \times (2.5\ \text{lb NOx/ton burned})}{(2000\ \text{lb/ton}) \times (365\ \text{days/year})}$$

$$= 0.054\ \text{tons NOx/day}$$

$$NOx_{2005} = (0.054\ \text{tons NOx/day}) \times 1.1107$$
$$= 0.060\ \text{tons NOx/day}$$

The VOC and NOx emission estimates, in tons/day, from on-site incineration for the Triangle nonattainment area are listed in the tables below. Chatham County emissions have been adjusted by the fraction of the 2000 population in the nonattainment area (i.e., 0.4322).

Table 4.4.8-1 VOC Emissions From Commercial On Site Incineration

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.07	0.07	0.07	0.07	0.08
Franklin	0.01	0.02	0.02	0.02	0.02
Granville	0.01	0.02	0.02	0.02	0.02
Johnston	0.04	0.04	0.05	0.05	0.05
Orange	0.03	0.03	0.04	0.04	0.04
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.20	0.22	0.24	0.26	0.28
TOTAL	**0.38**	**0.42**	**0.46**	**0.48**	**0.51**

Table 4.4.8-2 NOx Emissions From Commercial On Site Incineration

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.01	0.01
Granville	0.00	0.00	0.00	0.00	0.01
Johnston	0.01	0.01	0.01	0.01	0.02
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.06	0.07	0.07	0.08	0.08
TOTAL	**0.10**	**0.11**	**0.11**	**0.13**	**0.15**

Table 4.4.8-3 VOC Emissions From Industrial On Site Incineration

County	2005	2008	2011	2014	2017
Chatham	0.01	0.01	0.01	0.01	0.01
Durham	0.07	0.07	0.07	0.07	0.08
Franklin	0.01	0.02	0.02	0.02	0.02
Granville	0.01	0.02	0.02	0.02	0.02
Johnston	0.04	0.04	0.05	0.05	0.05
Orange	0.03	0.03	0.04	0.04	0.04
Person	0.01	0.01	0.01	0.01	0.01
Wake	0.20	0.22	0.24	0.26	0.28
TOTAL	**0.38**	**0.42**	**0.46**	**0.48**	**0.51**

Table 4.4.8-4 NOx Emissions From Industrial On Site Incineration

County	2005	2008	2011	2014	2017
Chatham	0.00	0.00	0.00	0.00	0.00
Durham	0.02	0.02	0.02	0.02	0.02
Franklin	0.00	0.00	0.00	0.01	0.01
Granville	0.00	0.00	0.00	0.00	0.01
Johnston	0.01	0.01	0.01	0.01	0.02
Orange	0.01	0.01	0.01	0.01	0.01
Person	0.00	0.00	0.00	0.00	0.00
Wake	0.06	0.07	0.07	0.08	0.08
TOTAL	**0.10**	**0.11**	**0.11**	**0.13**	**0.15**

4.5 BIOGENIC EMISSIONS

Biogenic emissions are primarily VOC emissions from vegetation and are kept constant through all years when modeling ozone. Since the redesignation plan is a comparison of future year to base year emissions and the biogenic emissions are kept constant, the biogenic emissions do not play a part in the redesignation demonstration. Upon discussions with the USEPA Region 4, it was agreed that the biogenic emissions did not need to be estimated for the redesignation demonstration and maintenance plan.

4.6 SUMMARY OF AREA SOURCE EMISSIONS

The total area source emissions for the Triangle nonattainment area are summarized in the tables below. These emissions are in tons per day.

Table 4.6-1 Total Area Source VOC Emissions

County	2005	2008	2011	2014	2017
Chatham	2.42	2.91	3.05	3.19	3.33
Durham	7.05	7.41	7.78	8.1	8.5
Franklin	5.17	5.62	6	6.36	6.71
Granville	5.3	5.67	6.05	6.39	6.72
Johnston	12.2	13.28	14.42	15.39	16.38
Orange	5.01	5.27	5.5	5.74	6
Person	4.01	4.29	4.55	4.76	4.98
Wake	26.1	28.49	30.66	32.87	35.18
TOTAL	**67.26**	**72.94**	**78.01**	**82.80**	**87.80**

Table 4.6-2 Total Area Source NOx Emissions

County	2005	2008	2011	2014	2017
Chatham	0.37	0.39	0.41	0.42	0.45
Durham	2.04	2.13	2.22	2.30	2.38
Franklin	0.55	0.57	0.62	0.67	0.69
Granville	0.47	0.49	0.50	0.51	0.55
Johnston	1.35	1.43	1.50	1.59	1.73
Orange	1.15	1.21	1.24	1.29	1.34
Person	0.34	0.36	0.38	0.39	0.39
Wake	6.75	7.07	7.37	7.70	8.02
TOTAL	**13.02**	**13.65**	**14.24**	**14.87**	**15.55**

5.0 ADDITIONAL DATA

5.1 SIC TO NAICS CROSSWALK

U.S. Census Bureau

ECONOMIC CENSUS 1997

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 24: Lumber and wood products - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	24	Lumber and wood products	36,735	111,930,684	757,267	18,668,558
	241	Logging	13,533	13,625,734	83,212	2,014,254
	242	Sawmills and planing mills	6,270	32,750,181	178,575	4,477,618
	243	Millwork, plywood, and structural members	9,373	33,200,977	260,726	6,599,370
	244	Wood containers	2,922	4,332,491	49,580	936,731
	245	Wood buildings and mobile homes	1,028	13,179,370	91,234	2,362,873
	249	Miscellaneous wood products	3,609	14,841,931	93,940	2,277,712

N=Comparable data not available D=Withheld to avoid disclosure

SIC 24: Lumber and wood products - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
241	97/92		**Logging**	**13,533**	**13,625,734**	**83,212**	**2,014,254**
2411			Logging	13,533	13,625,734	83,212	2,014,254
0% of	113310	10	Logging	13,533	13,625,734	83,212	2,014,254

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
242	97/92		**Sawmills and planing mills**	**6,270**	**32,750,181**	**178,575**	**4,477,618**
2421							

			Sawmills & planing mills, general	5,176	29,414,116	143,292	3,741,583
100% of	321113	10	Sawmills (pt)	4,334	24,743,160	119,456	3,191,780
74% of	321912	10	Cut stock, resawing lumber, & planing (pt)	761	4,447,045	22,105	515,145
0% of	321918	10	Other millwork (including flooring) (pt)	5	19,285	91	2,695
5% of	321999	10	All other miscellaneous wood product mfg (pt)	76	204,626	1,640	31,963
2426			Hardwood dimension & flooring mills	992	3,206,954	33,940	708,100
24% of	321912	20	Cut stock, resawing lumber, & planing (pt)	619	1,455,914	17,109	357,168
30% of	321918	20	Other millwork (including flooring) (pt)	127	1,368,123	10,521	235,924
5% of	337215	10	Showcase, partition, shelving, & locker mfg (pt)	246	382,917	6,310	115,008
2429			Special product sawmills, n.e.c.	102	129,111	1,343	27,935
0% of	321113	20	Sawmills (pt)	70	26,457	304	5,750
2% of	321920	10	Wood container & pallet mfg (pt)	24	68,695	684	14,493
1% of	321999	20	All other miscellaneous wood product mfg (pt)	8	33,959	355	7,692

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
243	97/92		**Millwork, plywood, and structural members**	**9,373**	**33,200,977**	**260,726**	**6,599,370**
2431			Millwork	2,745	12,013,383	92,259	2,344,586
	321911		Wood window & door mfg	1,409	8,896,734	64,771	1,714,686
69% of	321918	30	Other millwork (including flooring) (pt)	1,336	3,116,649	27,488	629,900
2434			Wood kitchen cabinets	5,096	7,483,209	79,579	1,866,940
82% of	337110	10	Wood kitchen cabinet & counter top mfg (pt)	5,096	7,483,209	79,579	1,866,940
2435			Hardwood veneer & plywood	332	2,856,487	22,151	525,887
	321211		Hardwood veneer & plywood mfg	332	2,856,487	22,151	525,887
2436			Softwood veneer & plywood	155	5,762,664	28,843	912,613
	321212		Softwood veneer & plywood mfg	155	5,762,664	28,843	912,613
2439			Structural wood members, n.e.c.	1,045	5,085,234	37,894	949,344
0% of	321113	30	Sawmills (pt)	0	0	0	0
	321213		Engineered wood member (except truss) mfg	53	1,431,123	5,372	154,564
	321214		Truss mfg	992	3,654,111	32,522	794,780
0% of	321912	30	Cut stock, resawing lumber, & planing (pt)	0	0	0	0

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
244			**Wood containers**	**2,922**	**4,332,491**	**49,580**	**936,731**
2441			Nailed wood boxes & shook	318	405,966	4,885	108,629
9% of	321920	20	Wood container & pallet mfg (pt)	318	405,966	4,885	108,629
2448			Wood pallets & skids	2,347	3,449,491	38,994	717,863
77% of	321920	30	Wood container & pallet mfg (pt)	2,347	3,449,491	38,994	717,863
2449			Wood containers, n.e.c.	257	477,034	5,701	110,239
11% of	321920	40	Wood container & pallet mfg (pt)	257	477,034	5,701	110,239

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
245			**Wood buildings and mobile homes**	**1,028**	**13,179,370**	**91,234**	**2,362,873**
2451			Mobile homes	319	10,167,746	68,269	1,788,646
	321991		Manufactured home (mobile home) mfg	319	10,167,746	68,269	1,788,646
2452			Prefabricated wood buildings	709	3,011,624	22,965	574,227
	321992		Prefabricated wood building mfg	709	3,011,624	22,965	574,227

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
249			**Miscellaneous wood products**	**3,609**	**14,841,931**	**93,940**	**2,277,712**
2491			Wood preserving	451	4,461,521	11,668	298,123
	321114		Wood preservation	451	4,461,521	11,668	298,123
2493			Reconstituted wood products	316	5,273,794	25,269	797,838
	321219		Reconstituted wood product mfg	316	5,273,794	25,269	797,838
2499			Wood products, n.e.c.	2,842	5,106,616	57,003	1,181,751
1% of	321912	40	Cut stock, resawing lumber, & planing (pt)	20	73,251	549	12,847
2% of	321920	50	Wood container & pallet mfg (pt)	49	65,184	870	18,727
94% of	321999	30	All other miscellaneous wood product mfg (pt)	2,324	3,740,920	41,844	879,178
0% of	332321	10	Metal window & door mfg (pt)	0	0	0	0
15% of	339999	10	All other miscellaneous mfg (pt)	449	1,227,261	13,740	270,999

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

(Drawbridge open.) Not comparable SIC sales or receipts cannot be estimated within 3% from NAICS data.

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U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 25: Furniture and fixtures - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	25	Furniture and fixtures	12,095	61,527,902	523,872	13,344,344
	251	Household furniture	5,609	26,334,791	265,115	5,861,109
	252	Office furniture	1,036	11,340,955	74,863	2,402,387
	253	Public building and related furniture	468	7,869,175	36,979	1,022,978
	254	Partitions and fixtures	3,751	10,637,959	101,925	2,899,667
	259	Miscellaneous furniture and fixtures	1,231	5,345,022	44,990	1,158,203

N=Comparable data not available D=Withheld to avoid disclosure

SIC 25: Furniture and fixtures - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
251	97/92		**Household furniture**	**5,609**	**26,334,791**	**265,115**	**5,861,109**
2511			Wood household furniture	3,035	10,940,684	123,368	2,587,446
97% of	337122	10	Nonupholstered wood household furniture mfg (pt)	3,035	10,940,684	123,368	2,587,446
2512			Upholstered household furniture	1,095	8,034,017	85,258	1,930,167
96% of	337121	10	Upholstered household furniture mfg (pt)	1,095	8,034,017	85,258	1,930,167
2514			Metal household furniture	420	2,422,853	22,835	503,957
	337124		Metal household furniture mfg	420	2,422,853	22,835	503,957

SIC		NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
2515				Mattresses & bedsprings	742	4,067,225	24,673	643,390
	2% of	337121	20	Upholstered household furniture mfg (pt)	35	159,199	1,601	31,760
		337910		Mattress mfg	707	3,908,026	23,072	611,630
2517				Wood TV & radio cabinets	100	320,714	4,273	84,391
		337129		Wood television, radio, & sewing machine cabinet mfg	100	320,714	4,273	84,391
2519				Household furniture, n.e.c.	217	549,298	4,708	111,758
		337125		Household furniture (except wood & metal) mfg	217	549,298	4,708	111,758

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
252	97/92		**Office furniture**	**1,036**	**11,340,955**	**74,863**	**2,402,387**
2521			Wood office furniture	677	3,110,020	30,641	781,220
	337211		Wood office furniture mfg	677	3,110,020	30,641	781,220
2522			Office furniture, except wood	359	8,230,935	44,222	1,621,167
	337214		Office furniture (except wood) mfg	359	8,230,935	44,222	1,621,167

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
253	97/92		**Public building and related furniture**	**468**	**7,869,175**	**36,979**	**1,022,978**
2531			Public building & related furniture	468	7,869,175	36,979	1,022,978
	57% of 336360	30	Motor vehicle seating & interior trim mfg (pt)	184	6,060,320	20,784	610,043
	42% of 337127	10	Institutional furniture mfg (pt)	267	1,697,870	15,254	385,680
	9% of 339942	10	Lead pencil & art good mfg (pt)	17	110,985	941	27,255

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
254	97/92		**Partitions and fixtures**	**3,751**	**10,637,959**	**101,925**	**2,899,667**
2541			Wood partitions & fixtures	2,825	5,388,485	57,453	1,624,792
	10% of 337110	20	Wood kitchen cabinet & counter top mfg (pt)	812	938,353	9,785	254,585
	337212		Custom architectural woodwork & millwork mfg	1,105	2,197,493	24,363	715,011
	28% of 337215	20	Showcase, partition, shelving, & locker mfg (pt)	908	2,252,639	23,305	655,196
2542			Partitions & fixtures, except wood	926	5,249,474	44,472	1,274,875
	66% of 337215	30	Showcase, partition, shelving, & locker mfg (pt)	926	5,249,474	44,472	1,274,875

SIC	NAICS	Pt	Description	Establish-	Value of Shipments	Paid	Annual payroll

			ments	($1,000)	employees	($1,000)
259	97/92	**Miscellaneous furniture and fixtures**	**1,231**	**5,345,022**	**44,990**	**1,158,203**
2591		Drapery hardware, blinds, & shades	488	2,393,564	19,617	436,757
	337920	Blind & shade mfg	488	2,393,564	19,617	436,757
2599		Furniture & fixtures, n.e.c.	743	2,951,458	25,373	721,446
57% of	337127 20	Institutional furniture mfg (pt)	727	2,305,770	22,448	605,971
4% of	339113 10	Surgical appliance & supplies mfg (pt)	16	645,688	2,925	115,475

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Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
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Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 33: Primary metal industries - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	33	Primary metal industries	6,275	188,774,795	692,175	26,829,622
	331	Blast furnace and basic steel products	954	77,532,783	217,679	10,059,589
	332	Iron and steel foundries	1,144	17,533,215	132,853	4,666,674
	333	Primary nonferrous metals	179	16,320,560	33,255	1,404,870
	334	Secondary nonferrous metals	256	6,977,168	13,479	468,021
	335	Nonferrous rolling and drawing	1,011	52,863,733	166,344	6,093,518
	336	Nonferrous foundries (castings)	1,676	11,598,177	94,496	2,897,629
	339	Miscellaneous primary metal products	1,055	5,949,159	34,069	1,239,321

N=Comparable data not available D=Withheld to avoid disclosure

SIC 33: Primary metal industries - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97 92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
331	97 92		**Blast furnace and basic steel products**	**954**	**77,532,783**	**217,679**	**10,059,589**
3312			Blast furnaces & steel mills	201	56,796,871	145,805	7,446,304
25% of	324199	20	All other petroleum & coal products mfg (pt)	8	438,107	1,731	74,553
99% of	331111	10	Iron & steel mills (pt)	193	56,358,764	144,074	7,371,751
3313			Electrometallurgical products	28	1,535,779	4,035	168,728

	331112		Electrometallurgical ferroalloy product mfg	24	1,409,834	3,724	156,946
3% of	331492	10	Other nonferrous metal secondary smelting, refining, & alloying (	4	125,945	311	11,782
3315			Steel wire & related products	304	5,291,290	25,754	799,508
	331222		Steel wire drawing	273	4,920,798	23,489	733,281
7% of	332618	10	Other fabricated wire product mfg (pt)	31	370,492	2,265	66,227
3316			Cold finishing of steel shapes	186	6,343,466	14,362	639,349
	331221		Cold-rolled steel shape mfg	186	6,343,466	14,362	639,349
3317			Steel pipe & tubes	235	7,565,377	27,723	1,005,700
	331210		Iron & steel pipes & tubes mfg from purchased steel	235	7,565,377	27,723	1,005,700

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
332	9/92		**Iron and steel foundries**	**1,144**	**17,533,215**	**132,853**	**4,666,674**
3321			Gray iron foundries	669	11,911,623	83,570	3,120,450
97% of	331511	10	Iron foundries (pt)	669	11,911,623	83,570	3,120,450
3322			Malleable iron foundries	28	352,615	2,628	113,937
3% of	331511	20	Iron foundries (pt)	28	352,615	2,628	113,937
3324			Steel investment foundries	159	2,341,737	22,673	669,452
	331512		Steel investment foundries	159	2,341,737	22,673	669,452
3325			Steel foundries, n.e.c.	288	2,927,240	23,982	762,835
	331513		Steel foundries (except investment)	288	2,927,240	23,982	762,835

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
333	9/92		**Primary nonferrous metals**	**179**	**16,320,560**	**33,255**	**1,404,870**
3331			Primary copper	16	6,540,441	7,360	287,382
	331411		Primary smelting & refining of copper	16	6,540,441	7,360	287,382
3334			Primary aluminum	21	6,224,610	15,763	707,402
	331312		Primary aluminum production	21	6,224,610	15,763	707,402
3339			Primary nonferrous metals, n.e.c.	142	3,555,509	10,132	410,086
	331419		Other nonferrous metal primary smelting & refining	142	3,555,509	10,132	410,086

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
334	9/92		**Secondary nonferrous metals**	**256**	**6,977,168**	**13,479**	**468,021**
3341			Secondary nonferrous metals	256	6,977,168	13,479	468,021

95% of	331314	10	Secondary smelting & alloying of aluminum (pt)	101	3,478,625	6,226	210,318
85% of	331423	10	Secondary smelting, refining, & alloying of copper (pt)	24	1,082,052	1,768	69,988
64% of	331492	20	Other nonferrous metal secondary smelting, refining, & alloying (	131	2,416,491	5,485	187,715

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
335	97/92		**Nonferrous rolling and drawing**	**1,011**	**52,863,733**	**166,344**	**6,093,518**
3351			Copper rolling & drawing	129	7,679,080	21,150	786,621
	331421		Copper rolling, drawing, & extruding	129	7,679,080	21,150	786,621
3353			Aluminum sheet, plate, & foil	70	13,755,566	25,111	1,199,382
	331315		Aluminum sheet, plate, & foil mfg	70	13,755,566	25,111	1,199,382
0% of	332996	10	Fabricated pipe & pipe fitting mfg (pt)	0	0	0	0
3354			Aluminum extruded products	160	6,177,701	30,357	944,829
	331316		Aluminum extruded product mfg	160	6,177,701	30,357	944,829
3355			Aluminum rolling & drawing, n.e.c.	20	1,295,284	2,657	97,537
78% of	331319	10	Other aluminum rolling & drawing (pt)	20	1,295,284	2,657	97,537
3356			Nonferrous rolling & drawing, n.e.c.	184	4,839,547	17,237	709,102
66% of	331491	10	Other nonferrous metal rolling, drawing, & extruding (pt)	184	4,839,547	17,237	709,102
3357			Nonferrous wire drawing & insulating	448	19,116,555	69,832	2,356,047
22% of	331319	20	Other aluminum rolling & drawing (pt)	16	361,323	1,649	46,377
	331422		Copper wire (except mechanical) drawing	36	1,029,653	4,692	131,549
34% of	331491	20	Other nonferrous metal rolling, drawing, & extruding (pt)	83	2,475,702	8,635	280,606
	335921		Fiber optic cable mfg	38	2,767,017	8,589	364,654
	335929		Other communication & energy wire mfg	275	12,482,860	46,267	1,532,861

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
336	97/92		**Nonferrous foundries (castings)**	**1,676**	**11,598,177**	**94,496**	**2,897,629**
3363			Aluminum die-castings	318	3,791,717	27,717	906,108
	331521		Aluminum die-casting foundries	318	3,791,717	27,717	906,108
3364			Nonferrous die-casting, except aluminum	279	2,055,264	17,243	502,552
	331522		Nonferrous (except aluminum) die-casting foundries	279	2,055,264	17,243	502,552
3365			Aluminum foundries	626	3,937,406	34,098	1,013,843
	331524		Aluminum foundries (except die-casting)	626	3,937,406	34,098	1,013,843

3366		Copper foundries	312	854,704	8,909	260,340
	331525	Copper foundries (except die-casting)	312	854,704	8,909	260,340
3369		Nonferrous foundries, n.e.c.	141	959,086	6,529	214,786
	331528	Other nonferrous foundries (except die-casting)	141	959,086	6,529	214,786

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
339	97/92		**Miscellaneous primary metal products**	**1,055**	**5,949,159**	**34,069**	**1,239,321**
3398			Metal heat treating	808	3,485,459	22,674	802,930
	332811		Metal heat treating	808	3,485,459	22,674	802,930
3399			Primary metal products, n.e.c.	247	2,463,700	11,395	436,391
1% of	331111	20	Iron & steel mills (pt)	82	596,791	2,440	95,739
5% of	331314	20	Secondary smelting & alloying of aluminum (pt)	10	172,555	488	18,975
15% of	331423	20	Secondary smelting, refining, & alloying of copper (pt)	11	187,036	565	21,117
32% of	331492	30	Other nonferrous metal secondary smelting, refining, & alloying (	117	1,207,951	5,814	225,722
6% of	332618	20	Other fabricated wire product mfg (pt)	27	299,367	2,088	74,838

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Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 34: Fabricated metal products - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	34	Fabricated metal products	37,985	231,704,012	1,549,494	50,904,372
	341	Metal cans and shipping containers	425	13,352,606	33,634	1,377,932
	342	Cutlery, handtools, and hardware	2,494	D	(100,000+)	D
	343	Plumbing and heating, except electric	662	8,671,083	49,165	1,501,147
	344	Fabricated structural metal products	13,959	65,206,295	459,789	14,111,998
	345	Screw machine products, bolts, etc.	3,785	16,460,738	133,399	4,573,452
	346	Metal forgings and stampings	3,625	44,832,778	267,958	10,486,353
	347	Metal services, n.e.c.	5,610	14,454,652	130,755	3,722,220
	348	Ordnance and accessories, n.e.c.	434	5,438,140	38,482	1,489,257
	349	Miscellaneous fabricated metal products	6,991	D	(100,000+)	D

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SIC 34: Fabricated metal products - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97%92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
341	97%92		**Metal cans and shipping containers**	**425**	**13,352,606**	**33,634**	**1,377,932**
3411			Metal cans	274	12,042,011	27,316	1,185,705

	332431		Metal can mfg	274	12,042,011	27,316	1,185,705
3412			Metal barrels, drums, & pails	151	1,310,595	6,318	192,227
58% of	332439	10	Other metal container mfg (pt)	151	1,310,595	6,318	192,227

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
342	97/92		**Cutlery, handtools, and hardware**	**2,494**	**D**	**(100,000+)**	**D**
3421			Cutlery	164	2,198,365	11,129	357,283
100% of	332211	10	Cutlery & flatware (except precious) mfg (pt)	164	2,198,365	11,129	357,283
3423			Hand & edge tools, n.e.c.	1,069	5,677,903	42,947	1,329,593
86% of	332212	10	Hand & edge tool mfg (pt)	1,069	5,677,903	42,947	1,329,593
3425			Hand saws & saw blades	176	1,452,540	9,149	300,538
	332213		Saw blade & handsaw mfg	176	1,452,540	9,149	300,538
3429			Hardware, n.e.c.	1,085	D	(50k-99999)	D
18% of	332439	20	Other metal container mfg (pt)	117	402,378	4,135	116,588
96% of	332510	10	Hardware mfg (pt)	952	10,359,952	70,884	2,186,800
D	332919	10	Other metal valve & pipe fitting mfg (pt)	16	D	(500-999)	D

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
343	97/92		**Plumbing and heating, except electric**	**662**	**8,671,083**	**49,165**	**1,501,147**
3431			Metal sanitary ware	88	1,575,505	9,994	280,462
	332998		Enameled iron & metal sanitary ware mfg	88	1,575,505	9,994	280,462
3432			Plumbing fittings & brass goods	121	3,708,187	16,676	510,498
	332913		Plumbing fixture fitting & trim mfg	116	3,590,128	16,202	499,675
1% of	332999	20	All other miscellaneous fabricated metal product mfg (pt)	5	118,059	474	10,823
3433			Heating equipment, except electric	453	3,387,391	22,495	710,187
91% of	333414	10	Heating equipment (except warm air furnaces) mfg (pt)	453	3,387,391	22,495	710,187

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
344	97/92		**Fabricated structural metal products**	**13,959**	**65,206,295**	**459,789**	**14,111,998**
3441			Fabricated structural metal	2,900	14,200,270	84,704	2,672,087
87% of	332312	10	Fabricated structural metal mfg (pt)	2,900	14,200,270	84,704	2,672,087
3442			Metal doors, sash, & trim	1,384	9,876,049	72,970	1,896,135

96% of	332321	20	Metal window & door mfg (pt)	1,384	9,876,049	72,970	1,896,135
3443			Fabricated plate work, boiler shops	2,130	11,463,395	87,038	2,886,191
	332313		Plate work mfg	1,035	2,806,913	25,453	797,131
	332410		Power boiler & heat exchanger mfg	472	3,849,100	27,542	946,401
	332420		Metal tank (heavy gauge) mfg	614	4,764,118	33,704	1,134,441
0% of	333415	10	AC & warm air heating & commercial/industrial refrig equip mfg (p	9	43,264	339	8,218
3444			Sheet metal work	4,605	16,233,432	131,900	4,128,514
	332322		Sheet metal work mfg	4,479	15,957,992	129,826	4,068,484
12% of	332439	30	Other metal container mfg (pt)	126	275,440	2,074	60,030
3446			Architectural metal work	1,744	3,536,413	30,960	875,174
88% of	332323	10	Ornamental & architectural metal work mfg (pt)	1,744	3,536,413	30,960	875,174
3448			Prefabricated metal buildings	604	4,199,550	25,946	776,575
	332311		Prefabricated metal building & component mfg	604	4,199,550	25,946	776,575
3449			Miscellaneous metal work	592	5,697,186	26,271	877,322
	332114		Custom roll forming	401	3,074,662	15,219	500,899
13% of	332312	20	Fabricated structural metal mfg (pt)	152	2,166,021	8,729	302,853
4% of	332321	30	Metal window & door mfg (pt)	33	364,564	1,974	64,115
2% of	332323	20	Ornamental & architectural metal work mfg (pt)	6	91,939	349	9,455

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
345	9⅞2		**Screw machine products, bolts, etc.**	**3,785**	**16,460,738**	**133,399**	**4,573,452**
3451			Screw machine products	2,745	8,326,077	80,404	2,634,075
	332721		Precision turned product mfg	2,745	8,326,077	80,404	2,634,075
3452			Bolts, nuts, rivets, & washers	1,040	8,134,661	52,995	1,939,377
	332722		Bolt, nut, screw, rivet, & washer mfg	1,040	8,134,661	52,995	1,939,377

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
346	9⅞2		**Metal forgings and stampings**	**3,625**	**44,832,778**	**267,958**	**10,486,353**
3462			Iron & steel forgings	421	4,924,426	26,432	1,035,345
	332111		Iron & steel forging	421	4,924,426	26,432	1,035,345
3463			Nonferrous forgings	84	1,858,708	9,129	366,879
	332112		Nonferrous forging	84	1,858,708	9,129	366,879
3465			Automotive stampings	810	23,668,110	126,905	5,647,964

	336370		Motor vehicle metal stamping	810	23,668,110	126,905	5,647,964
3466			Crowns & closures	67	969,982	4,682	167,443
	332115		Crown & closure mfg	67	969,982	4,682	167,443
3469			Metal stampings, n.e.c.	2,243	13,411,552	100,810	3,268,722
	332116		Metal stamping	2,166	12,041,638	93,086	3,039,459
	332214		Kitchen utensil, pot, & pan mfg	77	1,369,914	7,724	229,263

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
347	9/92		**Metal services, n.e.c.**	**5,610**	**14,454,652**	**130,755**	**3,722,220**
3471			Plating & polishing	3,404	5,979,405	74,640	2,089,261
	332813		Electroplating, plating, polishing, anodizing, & coloring	3,404	5,979,405	74,640	2,089,261
3479			Metal coating & allied services	2,206	8,475,247	56,115	1,632,959
	332812		Metal coating/engraving (exc jewelry/silverware)/allied services	2,156	8,460,896	55,904	1,628,585
0% of	339911	10	Jewelry (except costume) mfg (pt)	22	5,798	79	1,620
1% of	339912	10	Silverware & plated ware mfg (pt)	12	6,296	103	2,091
0% of	339914	10	Costume jewelry & novelty mfg (pt)	16	2,257	29	663

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
348	9/92		**Ordnance and accessories, n.e.c.**	**434**	**5,438,140**	**38,482**	**1,489,257**
3482			Small arms ammunition	113	938,818	6,863	242,068
	332992		Small arms ammunition mfg	113	938,818	6,863	242,068
3483			Ammunition, except small arms, n.e.c.	53	1,497,045	9,427	379,450
	332993		Ammunition (except small arms) mfg	53	1,497,045	9,427	379,450
3484			Small arms	198	1,251,792	9,907	320,614
	332994		Small arms mfg	198	1,251,792	9,907	320,614
3489			Ordnance & accessories, n.e.c.	70	1,750,485	12,285	547,125
	332995		Other ordnance & accessories mfg	70	1,750,485	12,285	547,125

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
349	9/92		**Miscellaneous fabricated metal products**	**6,991**	**D**	**(100,000+)**	**D**
3491			Industrial valves	538	8,699,300	53,459	1,904,134
	332911		Industrial valve mfg	538	8,699,300	53,459	1,904,134

3492			Fluid power valves & hose fittings	424	6,602,909	37,132	1,324,392
100% of	332912	10	Fluid power valve & hose fitting mfg (pt)	424	6,602,909	37,132	1,324,392
3493			Steel springs, except wire	129	761,711	5,381	174,467
	332611		Spring (heavy gauge) mfg	129	761,711	5,381	174,467
3494			Valves & pipe fittings, n.e.c.	245	2,827,380	18,216	576,136
94% of	332919	20	Other metal valve & pipe fitting mfg (pt)	222	2,753,397	17,652	558,712
1% of	332999	30	All other miscellaneous fabricated metal product mfg (pt)	23	73,983	564	17,424
3495			Wire springs	396	D	(10k-24999)	D
	332612		Spring (light gauge) mfg	394	2,481,151	18,798	564,372
D	334518	10	Watch, clock, & part mfg (pt)	2	D	(100-249)	D
3496			Miscellaneous fabricated wire products	1,253	4,587,656	41,821	1,025,279
87% of	332618	30	Other fabricated wire product mfg (pt)	1,253	4,587,656	41,821	1,025,279
3497			Metal foil & leaf	107	3,257,743	10,615	418,574
	322225		Laminated aluminum foil mfg for flexible packaging uses	43	1,546,143	4,967	211,497
16% of	332999	40	All other miscellaneous fabricated metal product mfg (pt)	64	1,711,600	5,648	207,077
3498			Fabricated pipe & fittings	856	4,024,999	29,364	870,291
100% of	332996	20	Fabricated pipe & pipe fitting mfg (pt)	856	4,024,999	29,364	870,291
3499			Fabricated metal products, n.e.c.	3,043	D	(50k-99999)	D
	332117		Powder metallurgy part mfg	128	1,317,301	10,760	367,623
12% of	332439	40	Other metal container mfg (pt)	98	273,541	2,331	70,293
4% of	332510	20	Hardware mfg (pt)	58	435,815	3,401	93,516
D	332919	30	Other metal valve & pipe fitting mfg (pt)	7	D	(250-499)	D
72% of	332999	50	All other miscellaneous fabricated metal product mfg (pt)	2,592	7,558,137	63,736	1,870,813
2% of	337215	40	Showcase, partition, shelving, & locker mfg (pt)	78	123,057	1,295	35,369
4% of	339914	20	Costume jewelry & novelty mfg (pt)	82	49,953	568	10,912

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

(Drawbridge open.) Not comparable SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu | Menu of all 2-digit SICs | Data in formats for downloading | PDF report

Source: 1997 Economic Census, Comparative Statistics

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 35: Industrial machinery and equipment - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	35	Industrial machinery and equipment	56,383	407,393,276	1,978,226	74,550,422
	351	Engines and turbines	390	D	(50k-99999)	D
	352	Farm and garden machinery	1,656	D	(50k-99999)	D
	353	Construction and related machinery	3,523	47,935,156	213,334	8,081,030
	354	Metalworking machinery	11,706	39,692,950	296,489	11,812,262
	355	Special industry machinery	4,781	D	(100,000+)	D
	356	General industrial machinery	4,479	44,080,890	265,359	9,752,818
	357	Computer and office equipment	2,181	D	(100,000+)	D
	358	Refrigeration and service machinery	2,277	39,317,539	204,675	6,800,658
	359	Industrial machinery, n.e.c.	25,390	38,647,841	368,481	12,360,014

N=Comparable data not available D=Withheld to avoid disclosure

SIC 35: Industrial machinery and equipment - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
351	97/92		**Engines and turbines**	**390**	**D**	**(50k-99999)**	**D**
3511			Turbines & turbine generator sets	86	5,783,057	19,529	910,316

	333611		Turbine & turbine generator set unit mfg	86	5,783,057	19,529	910,316
3519			Internal combustion engines, n.e.c.	304	D	(50k-99999)	D
D	333618	10	Other engine equipment mfg (pt)	297	D	(50k-99999)	D
0% of	336399	10	All other motor vehicle parts mfg (pt)	7	123,954	896	24,247

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
352			**Farm and garden machinery**	**1,656**	**D**	**(50k-99999)**	**D**
3523			Farm machinery & equipment	1,508	D	(50k-99999)	D
D	332212	20	Hand & edge tool mfg (pt)	1	D	(20-99)	D
10% of	332323	30	Ornamental & architectural metal work mfg (pt)	140	380,152	3,082	86,294
	333111		Farm machinery & equipment mfg	1,339	15,921,455	66,370	2,370,599
1% of	333922	10	Conveyor & conveying equipment mfg (pt)	28	33,377	320	6,663
3524			Lawn & garden equipment	148	D	(25k-49999)	D
D	332212	30	Hand & edge tool mfg (pt)	3	D	(20-99)	D
	333112		Lawn & garden tractor & home lawn & garden equipment mfg	145	7,454,511	28,617	739,727

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
353			**Construction and related machinery**	**3,523**	**47,935,156**	**213,334**	**8,081,030**
3531			Construction machinery	897	24,117,413	87,607	3,374,527
	333120		Construction machinery mfg	785	21,965,455	74,965	2,998,967
57% of	333923	10	Overhead traveling crane, hoist, & monorail system mfg (pt)	87	1,805,198	10,263	290,989
4% of	336510	10	Railroad rolling stock mfg (pt)	25	346,760	2,379	84,571
3532			Mining machinery	292	2,710,923	13,547	486,496
	333131		Mining machinery & equipment mfg	292	2,710,923	13,547	486,496
3533			Oil field machinery	563	6,240,079	29,451	1,166,759
	333132		Oil & gas field machinery & equipment mfg	563	6,240,079	29,451	1,166,759
3534			Elevators & moving stairways	196	1,607,066	9,442	340,525
	333921		Elevator & moving stairway mfg	196	1,607,066	9,442	340,525
3535			Conveyors & conveying equipment	871	6,346,525	39,279	1,531,625
100% of	333922	20	Conveyor & conveying equipment mfg (pt)	871	6,346,525	39,279	1,531,625
3536			Hoists, cranes, & monorails	220	1,340,561	7,751	278,899

SIC	NAICS	Pt	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
43% of	333923	20	Overhead traveling crane, hoist, & monorail system mfg (pt)	220	1,340,561	7,751	278,899
3537			Industrial trucks & tractors	484	5,572,589	26,257	902,199
0% of	332439	50	Other metal container mfg (pt)	4	6,775	64	1,492
0% of	332999	60	All other miscellaneous fabricated metal product mfg (pt)	19	27,488	240	6,939
	333924		Industrial truck, tractor, trailer, & stacker machinery mfg	461	5,538,326	25,953	893,768
SIC	**NAICS**	**Pt**	**Description**	**Establishments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
354	**97%92**		**Metalworking machinery**	**11,706**	**39,692,950**	**296,489**	**11,812,262**
3541			Machine tools, metal cutting types	393	5,183,521	28,849	1,241,372
97% of	333512	10	Machine tool (metal cutting types) mfg (pt)	393	5,183,521	28,849	1,241,372
3542			Machine tools, metal forming types	225	2,255,011	14,185	598,606
	333513		Machine tool (metal forming types) mfg	225	2,255,011	14,185	598,606
3543			Industrial patterns	673	623,927	7,959	285,038
	332997		Industrial pattern mfg	673	623,927	7,959	285,038
3544			Special dies, tools, jigs, & fixtures	7,275	13,361,490	128,770	5,318,715
	333511		Industrial mold mfg	2,529	5,116,635	48,657	2,088,950
	333514		Special die & tool, die set, jig, & fixture mfg	4,746	8,244,855	80,113	3,229,765
3545			Machine tool accessories	2,105	6,061,450	54,304	1,897,399
11% of	332212	40	Hand & edge tool mfg (pt)	185	714,277	6,379	254,257
	333515		Cutting tool & machine tool accessory mfg	1,920	5,347,173	47,925	1,643,142
3546			Power-driven handtools	217	3,609,779	16,816	531,378
	333991		Power-driven handtool mfg	217	3,609,779	16,816	531,378
3547			Rolling mill machinery	100	700,084	4,149	167,312
	333516		Rolling mill machinery & equipment mfg	100	700,084	4,149	167,312
3548			Welding apparatus	244	4,433,877	22,434	915,152
100% of	333992	10	Welding & soldering equipment mfg (pt)	244	4,433,877	22,434	915,152
0% of	335311	10	Power, distribution, & specialty transformer mfg (pt)	0	0	0	0
3549			Metalworking machinery, n.e.c.	474	3,463,811	19,023	857,290
	333518		Other metalworking machinery mfg	474	3,463,811	19,023	857,290
SIC	**NAICS**	**Pt**	**Description**	**Establishments**	**Value of Shipments**	**Paid employees**	**Annual payroll**

					($1,000)		($1,000)
355		97/92	**Special industry machinery**	4,781	D	(100,000+)	D
3552			Textile machinery	478	1,779,034	13,600	449,014
100% of	333292	10	Textile machinery mfg (pt)	478	1,779,034	13,600	449,014
3553			Woodworking machinery	327	1,321,752	9,117	302,233
	333210		Sawmill & woodworking machinery mfg	327	1,321,752	9,117	302,233
3554			Paper industries machinery	366	3,438,235	18,594	772,659
	333291		Paper industry machinery mfg	366	3,438,235	18,594	772,659
3555			Printing trades machinery	546	D	(10k-24999)	D
D	333293	10	Printing machinery & equipment mfg (pt)	546	D	(10k-24999)	D
3556			Food products machinery	597	2,877,841	19,026	715,068
	333294		Food product machinery mfg	597	2,877,841	19,026	715,068
3559			Special industry machinery, n.e.c.	2,467	D	(100,000+)	D
	333220		Plastics & rubber industry machinery mfg	455	3,584,992	18,574	743,901
	333295		Semiconductor machinery mfg	257	11,158,627	40,087	1,701,669
D	333298	10	All other industrial machinery mfg (pt)	1,677	D	(50k-99999)	D
7% of	333319	10	Other commercial & service industry machinery mfg (pt)	78	644,019	2,890	96,069
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
356		97/92	**General industrial machinery**	**4,479**	**44,080,890**	**265,359**	**9,752,818**
3561			Pumps & pumping equipment	489	6,826,043	36,552	1,422,919
100% of	333911	10	Pump & pumping equipment mfg (pt)	489	6,826,043	36,552	1,422,919
3562			Ball & roller bearings	185	6,120,940	36,991	1,386,126
	332991		Ball & roller bearing mfg	185	6,120,940	36,991	1,386,126
3563			Air & gas compressors	314	5,633,008	24,821	940,349
	333912		Air & gas compressor mfg	314	5,633,008	24,821	940,349
3564			Blowers & fans	574	4,075,925	29,906	902,298
	333411		Air purification equipment mfg	370	2,174,729	16,183	470,103
	333412		Industrial & commercial fan & blower mfg	204	1,901,196	13,723	432,195
3565			Packaging machinery	689	4,858,270	31,581	1,255,960
	333993		Packaging machinery mfg	689	4,858,270	31,581	1,255,960
3566			Speed changers, drives, & gears	268	2,402,392	16,231	597,248

	333612		Speed changer, industrial high-speed drive, & gear mfg	268	2,402,392	16,231	597,248
3567			Industrial furnaces & ovens	404	2,871,475	17,585	657,191
	333994		Industrial process furnace & oven mfg	404	2,871,475	17,585	657,191
3568			Power transmission equipment, n.e.c.	299	3,301,091	21,604	770,962
	333613		Mechanical power transmission equipment mfg	299	3,301,091	21,604	770,962
3569			General industrial machinery, n.e.c.	1,257	7,991,746	50,088	1,819,765
88% of	333999	10	All other miscellaneous general-purpose machinery mfg (pt)	1,257	7,991,746	50,088	1,819,765

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
357	9/92		**Computer and office equipment**	**2,181**	**D**	**(100,000+)**	**D**
3571			Electronic computers	563	66,331,909	100,115	4,282,451
	334111		Electronic computer mfg	563	66,331,909	100,115	4,282,451
3572			Computer storage devices	211	13,907,367	42,364	1,950,230
	334112		Computer storage device mfg	211	13,907,367	42,364	1,950,230
3575			Computer terminals	142	1,483,460	5,764	253,087
	334113		Computer terminal mfg	142	1,483,460	5,764	253,087
3577			Computer peripheral equipment, n.e.c.	1,006	25,130,308	87,253	4,337,970
93% of	334119	10	Other computer peripheral equipment mfg (pt)	1,006	25,130,308	87,253	4,337,970
3578			Calculating & accounting equipment	96	2,014,806	7,683	275,962
5% of	333313	10	Office machinery mfg (pt)	35	144,380	966	30,889
7% of	334119	20	Other computer peripheral equipment mfg (pt)	61	1,870,426	6,717	245,073
3579			Office machines, n.e.c.	163	D	(10k-24999)	D
96% of	333313	20	Office machinery mfg (pt)	134	3,047,549	13,865	427,315
D	334518	20	Watch, clock, & part mfg (pt)	16	D	(500-999)	D
21% of	339942	20	Lead pencil & art good mfg (pt)	13	257,020	1,234	30,572

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
358	9/92		**Refrigeration and service machinery**	**2,277**	**39,317,539**	**204,675**	**6,800,658**
3581			Automatic merchandising machines	121	1,325,960	8,178	215,627
	333311		Automatic vending machine mfg	121	1,325,960	8,178	215,627
3582							

			Commercial laundry equipment	68	604,966	4,523	136,783
	333312		Commercial laundry, drycleaning, & pressing machine mfg	68	604,966	4,523	136,783
3585			Refrigeration & heating equipment	852	28,473,461	140,978	4,736,239
100% of	333415	20	AC & warm air heating & commercial/industrial refrig equip mfg (p	792	22,846,865	119,456	3,682,296
	336391		Motor vehicle air-conditioning mfg	60	5,626,596	21,522	1,053,943
3586			Measuring & dispensing pumps	71	1,316,899	6,824	251,438
	333913		Measuring & dispensing pump mfg	71	1,316,899	6,824	251,438
3589			Service industry machinery, n.e.c.	1,165	7,596,253	44,172	1,460,571
81% of	333319	20	Other commercial & service industry machinery mfg (pt)	1,165	7,596,253	44,172	1,460,571
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
359	97/92		**Industrial machinery, n.e.c.**	**25,390**	**38,647,841**	**368,481**	**12,360,014**
3592			Carburetors, pistons, rings, & valves	141	2,755,311	17,518	672,786
	336311		Carburetor, piston, piston ring, & valve mfg	141	2,755,311	17,518	672,786
3593			Fluid power cylinders & actuators	320	3,528,906	23,062	900,438
100% of	333995	10	Fluid power cylinder & actuator mfg (pt)	320	3,528,906	23,062	900,438
3594			Fluid power pumps & motors	170	2,712,058	15,482	605,485
100% of	333996	10	Fluid power pump & motor mfg (pt)	170	2,712,058	15,482	605,485
3596			Scales & balances, except laboratory	122	682,940	4,871	148,755
	333997		Scale & balance (except laboratory) mfg	122	682,940	4,871	148,755
3599			Industrial machinery, n.e.c.	24,637	28,968,626	307,548	10,032,550
	332710		Machine shops	23,619	27,143,131	290,951	9,497,047
5% of	332999	70	All other miscellaneous fabricated metal product mfg (pt)	132	506,611	4,199	136,429
2% of	333319	30	Other commercial & service industry machinery mfg (pt)	50	172,536	1,335	35,719
13% of	333999	20	All other miscellaneous general-purpose machinery mfg (pt)	836	1,146,348	11,063	363,355

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Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

(Drawbridge open.) Not comparable SIC sales or receipts cannot be estimated within 3% from NAICS data.

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 36: Electronic and other electric equipment - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	36	Electronic and other electric equipment	17,104	348,559,508	1,582,348	58,256,420
⇩	361	Electric distribution equipment	901	12,325,326	67,929	2,276,264
⇩	362	Electrical industrial apparatus	2,388	28,643,846	169,046	5,474,383
⇩	363	Household appliances	356		D (100,000+)	D
⇩	364	Electric lighting and wiring equipment	2,106	26,197,139	158,615	4,888,856
⇩	365	Household audio and video equipment	834	10,699,568	48,325	1,438,451
⇩	366	Communications equipment	2,213	80,949,148	283,751	13,272,409
⇩	367	Electronic components and accessories	6,605	141,997,578	611,693	22,958,642
⇩	369	Miscellaneous electrical equipment and supplies	1,701		D (100,000+)	D

N=Comparable data not available D=Withheld to avoid disclosure

SIC 36: Electronic and other electric equipment - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
361	9/92		**Electric distribution equipment**	**901**	**12,325,326**	**67,929**	**2,276,264**
3612			Transformers	318	4,716,162	26,638	822,096
100% of	335311	20	Power, distribution, & specialty transformer mfg (pt)	318	4,716,162	26,638	822,096
3613			Switchgear & switchboard apparatus	583	7,609,164	41,291	1,454,168
	335313		Switchgear & switchboard apparatus mfg	583	7,609,164	41,291	1,454,168

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
362	9/92		**Electrical industrial apparatus**	**2,388**	**28,643,846**	**169,046**	**5,474,383**
3621			Motors & generators	528	11,788,281	71,112	2,072,046
96% of	335312	10	Motor & generator mfg (pt)	528	11,788,281	71,112	2,072,046
3624			Carbon & graphite products	126	2,254,410	10,887	407,987
	335991		Carbon & graphite product mfg	126	2,254,410	10,887	407,987
3625			Relays & industrial controls	1,321	11,762,789	68,365	2,429,039
	335314		Relay & industrial control mfg	1,321	11,762,789	68,365	2,429,039
3629			Electrical industrial apparatus, n.e.c.	413	2,838,366	18,682	565,311
41% of	335999	10	All other miscellaneous electrical equipment & component mfg (pt)	413	2,838,366	18,682	565,311

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
363	9/92		**Household appliances**	**356**	**D**	**(100,000+)**	**D**
3631			Household cooking equipment	84	3,543,231	17,543	480,836
	335221		Household cooking appliance mfg	84	3,543,231	17,543	480,836
3632			Household refrigerators & freezers	27	4,887,364	24,597	801,717
	335222		Household refrigerator & home freezer mfg	27	4,887,364	24,597	801,717
3633			Household laundry equipment	17	3,723,375	14,801	480,076
	335224		Household laundry equipment mfg	17	3,723,375	14,801	480,076
3634			Electric housewares & fans	154	3,817,521	19,229	458,176
9% of	333414	20	Heating equipment (except warm air furnaces) mfg (pt)	16	329,270	2,171	46,787
	335211		Electric housewares & household fan mfg	138	3,488,251	17,058	411,389
3635			Household vacuum cleaners	34	2,399,206	10,537	340,498
100% of	335212	10	Household vacuum cleaner mfg (pt)	34	2,399,206	10,537	340,498
3639			Household appliances, n.e.c.	40	D	(10k-	D

						24999)	
D	333298	20	All other industrial machinery mfg (pt)	4	D	(20-99)	D
0% of	335212	20	Household vacuum cleaner mfg (pt)	0	0	0	0
	335228		Other major household appliance mfg	36	3,300,662	13,309	425,991

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
364	97% of 332		**Electric lighting and wiring equipment**	**2,106**	**26,197,139**	**158,615**	**4,888,856**
3641			Electric lamps	82	3,306,009	15,903	574,696
	335110		Electric lamp bulb & part mfg	82	3,306,009	15,903	574,696
3643			Current-carrying wiring devices	519	5,877,522	44,907	1,293,583
	335931		Current-carrying wiring device mfg	519	5,877,522	44,907	1,293,583
3644			Noncurrent-carrying wiring devices	219	4,451,186	23,540	787,075
	335932		Noncurrent-carrying wiring device mfg	219	4,451,186	23,540	787,075
3645			Residential lighting fixtures	497	2,177,355	16,395	406,444
97% of	335121	20	Residential electric lighting fixture mfg (pt)	497	2,177,355	16,395	406,444
3646			Commercial lighting fixtures	356	4,047,437	23,090	657,341
	335122		Commercial/industrial/institutional electric lighting fixture mfg	356	4,047,437	23,090	657,341
3647			Vehicular lighting equipment	106	3,282,824	16,506	628,534
	336321		Vehicular lighting equipment mfg	106	3,282,824	16,506	628,534
3648			Lighting equipment, n.e.c.	327	3,054,806	18,274	541,183
100% of	335129	10	Other lighting equipment mfg (pt)	327	3,054,806	18,274	541,183

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
365	97% of 334		**Household audio and video equipment**	**834**	**10,699,568**	**48,325**	**1,438,451**
3651			Household audio & video equipment	554	8,454,194	31,727	944,647
	334310		Audio & video equipment mfg	554	8,454,194	31,727	944,647
3652			Prerecorded records & tapes	280	2,245,374	16,598	493,804
58% of	334612	10	Prerecorded CD (except software), tape, & record reproducing (pt)	280	2,245,374	16,598	493,804

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
366	97% of 334		**Communications equipment**	**2,213**	**80,949,148**	**283,751**	**13,272,409**
3661			Telephone & telegraph apparatus	625	39,673,619	110,408	5,591,933

	334210		Telephone apparatus mfg	598	38,300,044	104,262	5,329,203
1% of	334416	10	Electronic coil, transformer, & other inductor mfg (pt)	7	8,904	63	1,836
5% of	334418	10	Printed circuit assembly (electronic assembly) mfg (pt)	20	1,364,671	6,083	260,894
3663			Radio & TV communications equipment	1,091	37,042,241	148,156	6,765,352
94% of	334220	10	Radio & TV broadcasting & wireless communications equipment mfg (	1,091	37,042,241	148,156	6,765,352
3669			Communications equipment, n.e.c.	497	4,233,288	25,187	915,124
	334290		Other communications equipment mfg	497	4,233,288	25,187	915,124

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
367	9792		**Electronic components and accessories**	**6,605**	**141,997,578**	**611,693**	**22,958,642**
3671			Electron tubes	159	3,858,499	21,976	742,074
	334411		Electron tube mfg	159	3,858,499	21,976	742,074
3672			Printed circuit boards	1,401	9,787,576	76,702	2,313,578
	334412		Bare printed circuit board mfg	1,401	9,787,576	76,702	2,313,578
3674			Semiconductors & related devices	1,099	78,539,562	199,497	10,112,757
	334413		Semiconductor & related device mfg	1,099	78,539,562	199,497	10,112,757
3675			Electronic capacitors	129	2,482,163	18,882	531,259
	334414		Electronic capacitor mfg	129	2,482,163	18,882	531,259
3676			Electronic resistors	119	1,280,527	11,964	314,045
	334415		Electronic resistor mfg	119	1,280,527	11,964	314,045
3677			Electronic coils & transformers	426	1,512,232	19,178	450,160
98% of	334416	20	Electronic coil, transformer, & other inductor mfg (pt)	426	1,512,232	19,178	450,160
3678			Electronic connectors	347	5,598,906	37,232	1,172,969
	334417		Electronic connector mfg	347	5,598,906	37,232	1,172,969
3679			Electronic components, n.e.c.	2,925	38,938,113	226,262	7,321,800
6% of	334220	20	Radio & TV broadcasting & wireless communications equipment mfg (	126	2,265,873	16,305	606,528
95% of	334418	20	Printed circuit assembly (electronic assembly) mfg (pt)	695	24,704,154	104,971	3,582,172
	334419		Other electronic component mfg	1,851	10,547,090	92,200	2,769,216
8% of	336322	10	Other motor vehicle electrical & electronic equipment mfg (pt)	253	1,420,996	12,786	363,884

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)

369	97/92	**Miscellaneous electrical equipment and supplies**	**1,701**	**D**	**(100,000+)**	**D**
3691		Storage batteries	137	4,432,112	23,288	789,579
	335911	Storage battery mfg	137	4,432,112	23,288	789,579
3692		Primary batteries, dry & wet	45	2,322,896	8,917	281,467
	335912	Primary battery mfg	45	2,322,896	8,917	281,467
3694		Engine electrical equipment	569	9,074,335	52,216	1,642,014
54% of	336322 20	Other motor vehicle electrical & electronic equipment mfg (pt)	569	9,074,335	52,216	1,642,014
3695		Magnetic & optical recording media	259	4,726,363	21,345	815,970
	334613	Magnetic & optical recording media mfg	259	4,726,363	21,345	815,970
3699		Electrical equipment & supplies, n.e.c.	691	D	(25k-49999)	D
2% of	332212 50	Hand & edge tool mfg (pt)	4	140,811	424	32,361
0% of	333292 20	Textile machinery mfg (pt)	0	0	0	0
D	333293 20	Printing machinery & equipment mfg (pt)	5	D	(100-249)	D
0% of	333314 10	Optical instrument & lens mfg (pt)	5	7,320	56	1,871
0% of	333315 10	Photographic & photocopying equipment mfg (pt)	0	0	0	0
10% of	333319 40	Other commercial & service industry machinery mfg (pt)	57	934,728	8,513	382,013
3% of	333512 20	Machine tool (metal cutting types) mfg (pt)	8	151,363	522	27,050
D	333618 20	Other engine equipment mfg (pt)	2	D	(1-19)	D
0% of	333992 20	Welding & soldering equipment mfg (pt)	6	11,101	71	3,028
0% of	334119 30	Other computer peripheral equipment mfg (pt)	0	0	0	0
1% of	334510 10	Electromedical & electrotherapeutic apparatus mfg (pt)	11	52,855	542	20,770
0% of	334511 10	Search, detection, navigation, & guidance instrument mfg (pt)	7	77,832	604	24,725
1% of	334516 10	Analytical laboratory instrument mfg (pt)	10	36,473	159	7,518
0% of	334519 10	Other measuring & controlling device mfg (pt)	5	6,174	29	1,621
0% of	335129 20	Other lighting equipment mfg (pt)	4	859	8	180
59% of	335999 20	All other miscellaneous electrical equipment & component mfg (pt)	567	4,051,267	26,072	923,183
0% of	339114 10	Dental equipment & supplies mfg (pt)	0	0	0	0

N=Comparable data not available D=Withheld to avoid disclosure

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

(Drawbridge open.) Not comparable SIC sales or receipts cannot be estimated within 3% from NAICS data.

Data in formats for

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 37: Transportation equipment - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	37	Transportation equipment	12,387	515,881,602	1,561,662	68,298,623
	371	Motor vehicles and equipment	5,274	D	(100,000+)	D
	372	Aircraft and parts	1,711	98,963,996	411,247	20,703,396
	373	Ship and boat building and repairing	3,482	17,015,123	148,261	4,641,293
	374	Railroad equipment	207	7,916,635	31,633	1,234,564
	375	Motorcycles, bicycles, and parts	385	D	(10k-24999)	D
	376	Guided missiles, space vehicles, parts	99	18,929,257	76,808	4,500,660
	379	Miscellaneous transportation equipment	1,229	D	(50k-99999)	D

N=Comparable data not available D=Withheld to avoid disclosure

SIC 37: Transportation equipment - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establishments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
371		97/92	**Motor vehicles and equipment**	**5,274**	**D**	**(100,000+)**	**D**
3711			Motor vehicles & car bodies	472	D	(100,000+)	D
	336111		Automobile mfg	194	95,385,563	114,060	6,411,952
	336112		Light truck & utility vehicle mfg	112	110,400,169	94,033	5,361,980
	336120		Heavy duty truck mfg	84	14,490,344	28,214	1,212,651

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
1% of	336211	10	Motor vehicle body mfg (pt)	76	82,633	404	10,503
D	336992	10	Military armored vehicle, tank, & tank component mfg (pt)	6	D	(250-499)	D
3713			Truck & bus bodies	715	8,719,326	41,779	1,189,519
96% of	336211	20	Motor vehicle body mfg (pt)	715	8,719,326	41,779	1,189,519
3714			Motor vehicle parts & accessories	3,609	120,951,593	490,657	19,565,925
3% of	336211	30	Motor vehicle body mfg (pt)	23	265,552	1,201	40,558
	336312		Gasoline engine & engine parts mfg	881	25,974,369	81,368	3,555,964
38% of	336322	30	Other motor vehicle electrical & electronic equipment mfg (pt)	193	6,446,681	30,489	1,054,750
	336330		Motor vehicle steering & suspension component (except spring) mfg	212	10,750,312	48,944	2,336,212
100% of	336340	20	Motor vehicle brake system mfg (pt)	269	10,033,288	43,132	1,486,119
	336350		Motor vehicle transmission & power train parts mfg	523	33,288,093	111,954	5,564,722
100% of	336399	20	All other motor vehicle parts mfg (pt)	1,508	34,193,298	173,569	5,527,600
3715			Truck trailers	390	5,507,768	30,678	836,590
	336212		Truck trailer mfg	390	5,507,768	30,678	836,590
3716			Motor homes	88	3,943,709	18,086	507,700
	336213		Motor home mfg	88	3,943,709	18,086	507,700

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
372	97/92		**Aircraft and parts**	**1,711**	**98,963,996**	**411,247**	**20,703,396**
3721			Aircraft	204	56,273,651	200,961	10,733,030
	336411		Aircraft mfg	204	56,273,651	200,961	10,733,030
3724			Aircraft engines & engine parts	369	22,617,284	82,557	4,223,020
	336412		Aircraft engine & engine parts mfg	369	22,617,284	82,557	4,223,020
3728			Aircraft parts & equipment, n.e.c.	1,138	20,073,061	127,729	5,747,346
0% of	332912	20	Fluid power valve & hose fitting mfg (pt)	0	0	0	0
0% of	333995	20	Fluid power cylinder & actuator mfg (pt)	0	0	0	0
0% of	333996	20	Fluid power pump & motor mfg (pt)	0	0	0	0
	336413		Other aircraft part & auxiliary equipment mfg	1,138	20,073,061	127,729	5,747,346

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
373	97/92		**Ship and boat building and repairing**	**3,482**	**17,015,123**	**148,261**	**4,641,293**
3731			Ship building & repairing	700	10,571,810	97,385	3,366,404
	336611		Ship building & repairing	700	10,571,810	97,385	3,366,404

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
3732			Boat building & repairing	2,782	6,443,313	50,876	1,274,889
	336612		Boat building	1,043	5,622,040	41,422	1,033,974
18% of	811490	20	Boat repair	1,739	821,273	9,454	240,915

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
374			**Railroad equipment**	**207**	**7,916,635**	**31,633**	**1,234,564**
3743			Railroad equipment	207	7,916,635	31,633	1,234,564
0% of	333911	20	Pump & pumping equipment mfg (pt)	0	0	0	0
96% of	336510	20	Railroad rolling stock mfg (pt)	207	7,916,635	31,633	1,234,564

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
375			**Motorcycles, bicycles, and parts**	**385**	**D**	**(10k-24999)**	**D**
3751			Motorcycles, bicycles, & parts	385	D	(10k-24999)	D
D	336991	10	Motorcycle, bicycle, & parts mfg (pt)	385	D	(10k-24999)	D

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
376			**Guided missiles, space vehicles, parts**	**99**	**18,929,257**	**76,808**	**4,500,660**
3761			Guided missiles & space vehicles	22	14,791,466	52,158	3,156,221
	336414		Guided missile & space vehicle mfg	22	14,791,466	52,158	3,156,221
3764			Space propulsion units & parts	28	3,239,033	18,540	1,066,084
	336415		Guided missile & space vehicle propulsion unit & parts mfg	28	3,239,033	18,540	1,066,084
3769			Space vehicle equipment, n.e.c.	49	898,758	6,110	278,355
	336419		Other guided missile & space vehicle parts & auxiliary equip mfg	49	898,758	6,110	278,355

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
379			**Miscellaneous transportation equipment**	**1,229**	**D**	**(50k-99999)**	**D**
3792			Travel trailer & campers	315	3,076,049	20,112	506,058
67% of	336214	10	Travel trailer & camper mfg (pt)	315	3,076,049	20,112	506,058
3795			Tanks & tank components	37	D	(5000-9999)	D
D	336992	20	Military armored vehicle, tank, & tank component mfg (pt)	37	D	(5000-9999)	D
3799			Transportation equipment, n.e.c.	877	D	(25k-49999)	D

D	332212 60	Hand & edge tool mfg (pt)	1	D	(20-99)	D
33% of	336214 20	Travel trailer & camper mfg (pt)	498	1,485,367	13,240	299,845
	336999	All other transportation equipment mfg	378	4,557,989	19,466	512,362

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Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

All-sector menu | Menu of all 2-digit SICs | Data in formats for downloading | PDF report

Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 38: Instruments and related products - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	38	Instruments and related products	11,727	D	(100,000+)	D
	381	Search and navigation equipment	680	32,497,776	187,557	9,958,084
	382	Measuring and controlling devices	4,787	46,449,122	263,237	11,037,829
	384	Medical instruments and supplies	4,818	D	(100,000+)	D
	385	Ophthalmic goods	575	3,607,813	26,366	814,242
	386	Photographic equipment and supplies	739	21,305,761	63,642	2,928,089
	387	Watches, clocks, watchcases, and parts	128	718,191	5,646	155,180

N=Comparable data not available D=Withheld to avoid disclosure

SIC 38: Instruments and related products - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
381	97/92		**Search and navigation equipment**	**680**	**32,497,776**	**187,557**	**9,958,084**
3812			Search & navigation equipment	680	32,497,776	187,557	9,958,084
100% of	334511	20	Search, detection, navigation, & guidance instrument mfg (pt)	680	32,497,776	187,557	9,958,084

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
382	97/92		**Measuring and controlling devices**	**4,787**	**46,449,122**	**263,237**	**11,037,829**
3821							

			Laboratory apparatus & furniture	385	2,471,153	18,253	686,742
	339111		Laboratory apparatus & furniture mfg	385	2,471,153	18,253	686,742
3822			Environmental controls	317	2,935,692	21,450	664,820
	334512		Automatic environmental control mfg	317	2,935,692	21,450	664,820
3823			Process control instruments	1,002	7,890,923	49,196	2,004,259
	334513		Industrial process control instrument mfg	1,002	7,890,923	49,196	2,004,259
3824			Fluid meters & counting devices	222	3,765,769	17,390	683,294
	334514		Totalizing fluid meter & counting device mfg	222	3,765,769	17,390	683,294
3825			Instruments to measure electricity	843	13,877,200	63,522	3,008,675
2% of	334416	30	Electronic coil, transformer, & other inductor mfg (pt)	17	24,303	190	6,985
	334515		Electricity measuring & testing instrument mfg	826	13,852,897	63,332	3,001,690
3826			Analytical instruments	664	7,157,038	38,200	1,782,600
100% of	334516	20	Analytical laboratory instrument mfg (pt)	664	7,157,038	38,200	1,782,600
3827			Optical instruments & lenses	495	3,174,652	20,801	833,784
100% of	333314	20	Optical instrument & lens mfg (pt)	495	3,174,652	20,801	833,784
3829			Measuring & controlling devices, n.e.c.	859	5,176,695	34,425	1,373,655
100% of	334519	20	Other measuring & controlling device mfg (pt)	853	5,114,547	33,904	1,356,368
0% of	339112	10	Surgical & medical instrument mfg (pt)	6	62,148	521	17,287
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
384	97/92		**Medical instruments and supplies**	**4,818**	**D**	**(100,000+)**	**D**
3841			Surgical & medical instruments	1,598	18,450,024	107,298	4,139,100
100% of	339112	20	Surgical & medical instrument mfg (pt)	1,598	18,450,024	107,298	4,139,100
3842			Surgical appliances & supplies	1,728	D	(50k-99999)	D
D	322121	30	Paper (except newsprint) mills (pt)	2	D	(250-499)	D
7% of	322291	20	Sanitary paper product mfg (pt)	16	651,398	2,236	68,411
7% of	334510	20	Electromedical & electrotherapeutic apparatus mfg (pt)	74	807,427	6,722	224,883
96% of	339113	20	Surgical appliance & supplies mfg (pt)	1,636	14,743,779	82,390	2,865,055
3843			Dental equipment & supplies	877	2,699,867	18,072	613,286
100% of	339114	20	Dental equipment & supplies mfg (pt)	877	2,699,867	18,072	613,286
3844			X-ray apparatus & tubes	155	3,942,256	14,276	664,233
	334517		Irradiation apparatus mfg	155	3,942,256	14,276	664,233

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
3845			Electromedical equipment	460	10,567,566	47,121	2,372,703
92% of	334510	30	Electromedical & electrotherapeutic apparatus mfg (pt)	460	10,567,566	47,121	2,372,703

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
385	9/92		**Ophthalmic goods**	**575**	**3,607,813**	**26,366**	**814,242**
3851			Ophthalmic goods	575	3,607,813	26,366	814,242
	339115		Ophthalmic goods mfg	575	3,607,813	26,366	814,242

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
386	9/92		**Photographic equipment and supplies**	**739**	**21,305,761**	**63,642**	**2,928,089**
3861			Photographic equipment & supplies	739	21,305,761	63,642	2,928,089
	325992		Photographic film, paper, plate, & chemical mfg	311	12,895,637	38,935	1,828,139
100% of	333315	20	Photographic & photocopying equipment mfg (pt)	428	8,410,124	24,707	1,099,950

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
387	9/92		**Watches, clocks, watchcases, and parts**	**128**	**718,191**	**5,646**	**155,180**
3873			Watches, clocks, & watchcases	128	718,191	5,646	155,180
78% of	334518	30	Watch, clock, & part mfg (pt)	128	718,191	5,646	155,180

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(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
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Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Manufacturing

SIC 39: Miscellaneous manufacturing industries - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
	39	Miscellaneous manufacturing industries	18,043	50,997,838	393,972	10,563,481
	391	Jewelry, silverware, and plated ware	2,828	7,243,618	46,547	1,208,070
	393	Musical instruments	576	1,356,651	13,411	363,022
	394	Toys and sporting goods	3,600	D	(100,000+)	D
	395	Pens, pencils, office, and art supplies	1,017	3,987,200	28,150	738,265
	396	Costume jewelry and notions	1,075	D	(10k-24999)	D
	399	Miscellaneous manufactures	8,947	D	(100,000+)	D

N=Comparable data not available D=Withheld to avoid disclosure

SIC 39: Miscellaneous manufacturing industries - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
391	97/92		**Jewelry, silverware, and plated ware**	**2,828**	**7,243,618**	**46,547**	**1,208,070**
3911			Jewelry, precious metal	2,272	5,416,836	34,694	884,942
100% of	339911	20	Jewelry (except costume) mfg (pt)	2,272	5,416,836	34,694	884,942
3914			Silverware & plated ware	162	907,716	6,457	187,774
0% of	332211	20	Cutlery & flatware (except precious) mfg (pt)	11	8,032	101	2,699
99% of	339912	20	Silverware & plated ware mfg (pt)	151	899,684	6,356	185,075

3915			Jewelers' materials & lapidary work	394	919,066	5,396	135,354
	339913		Jewelers' material & lapidary work mfg	394	919,066	5,396	135,354
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
393	97/92		**Musical instruments**	**576**	**1,356,651**	**13,411**	**363,022**
3931			Musical instruments	576	1,356,651	13,411	363,022
	339992		Musical instrument mfg	576	1,356,651	13,411	363,022
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
394	97/92		**Toys and sporting goods**	**3,600**	**D**	**(100,000+)**	**D**
3942			Dolls	240	299,821	3,393	63,722
	339931		Doll & stuffed toy mfg	240	299,821	3,393	63,722
3944			Games, toys, & children's vehicles	789	D	(25k-49999)	D
D	336991	20	Motorcycle, bicycle, & parts mfg (pt)	4	D	(20-99)	D
	339932		Game, toy, & children's vehicle mfg	785	4,534,497	29,622	773,459
3949			Sporting & athletic goods, n.e.c.	2,571	10,591,160	69,664	1,831,218
	339920		Sporting & athletic goods mfg	2,571	10,591,160	69,664	1,831,218
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
395	97/92		**Pens, pencils, office, and art supplies**	**1,017**	**3,987,200**	**28,150**	**738,265**
3951			Pens & mechanical pencils	112	1,590,770	8,394	261,580
	339941		Pen & mechanical pencil mfg	112	1,590,770	8,394	261,580
3952			Lead pencils & art goods	152	883,200	6,002	143,660
0% of	325998	30	All other miscellaneous chemical product & preparation mfg (pt)	0	0	0	0
0% of	337127	30	Institutional furniture mfg (pt)	9	16,749	187	5,901
70% of	339942	30	Lead pencil & art good mfg (pt)	143	866,451	5,815	137,759
3953			Marking devices	634	643,007	7,831	185,316
	339943		Marking device mfg	634	643,007	7,831	185,316
3955			Carbon paper & inked ribbons	119	870,223	5,923	147,709
	339944		Carbon paper & inked ribbon mfg	119	870,223	5,923	147,709
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Value of Shipments ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
396	97/92		**Costume jewelry and notions**	**1,075**	**D**	**(10k-24999)**	**D**
3961			Costume jewelry	826	1,223,475	13,976	314,581

96% of	339914	30	Costume jewelry & novelty mfg (pt)	826	1,223,475	13,976	314,581
3965			Fasteners, buttons, needles, & pins	249	D	(5000-9999)	D
D	339993	20	Fastener, button, needle, & pin mfg (pt)	249	D	(5000-9999)	D

SIC	NAICS	Pt	Description	Establish-ments	Value of Shipments ($1,000)	Paid employees	Annual payroll ($1,000)
399	97%92		**Miscellaneous manufactures**	**8,947**	**D**	**(100,000+)**	**D**
3991			Brooms & brushes	274	1,703,139	13,882	372,010
84% of	339994	20	Broom, brush, & mop mfg (pt)	274	1,703,139	13,882	372,010
3993			Signs & advertising displays	5,709	7,910,809	82,956	2,382,461
	339950		Sign mfg	5,709	7,910,809	82,956	2,382,461
3995			Burial caskets	177	1,271,184	6,962	212,491
	339995		Burial casket mfg	177	1,271,184	6,962	212,491
3996			Hard surface floor coverings	26	1,819,931	5,614	255,635
97% of	326192	20	Resilient floor covering mfg (pt)	26	1,819,931	5,614	255,635
3999			Mfg industries, n.e.c.	2,761	D	(50k-99999)	D
3% of	314999	50	All other miscellaneous textile product mills (pt)	52	173,353	2,167	42,673
1% of	316110	20	Leather & hide tanning & finishing (pt)	26	24,625	329	7,616
0% of	321999	50	All other miscellaneous wood product mfg (pt)	0	0	0	0
0% of	322299	30	All other converted paper product mfg (pt)	0	0	0	0
0% of	323110	30	Commercial lithographic printing (pt)	0	0	0	0
0% of	323111	30	Commercial gravure printing (pt)	0	0	0	0
0% of	323112	30	Commercial flexographic printing (pt)	0	0	0	0
0% of	323113	40	Commercial screen printing (pt)	0	0	0	0
0% of	323119	30	Other commercial printing (pt)	0	0	0	0
1% of	325998	40	All other miscellaneous chemical product & preparation mfg (pt)	9	80,624	572	18,596
1% of	326199	20	All other plastics product mfg (pt)	140	319,241	3,141	77,397
D	332212	70	Hand & edge tool mfg (pt)	7	D	(500-999)	D
3% of	332999	80	All other miscellaneous fabricated metal product mfg (pt)	185	285,362	3,231	85,799
3% of	335121	30	Residential electric lighting fixture mfg (pt)	53	69,864	1,216	22,121
1% of	337127	40	Institutional furniture mfg (pt)	5	28,296	329	8,183
85% of	339999	20	All other miscellaneous mfg (pt)	2,284	7,183,815	60,397	1,563,790

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(Bridge complete.) Comparable SIC derivable from NAICS data.

(Drawbridge slightly open.) Almost comparable Sales or receipts from NAICS are within 3% of SIC sales or receipts.

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS SIC: Transportation, communications, and utilities %% **

SIC 41: Local and interurban passenger transportation - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
	41	Local and interurban passenger transportation	19,621	D	(100,000+)	D
	411	Local and suburban passenger transportation	10,147	D	(100,000+)	D
	412	Taxi service	3,184	1,280,597	27,850	392,759
	413	Interurban and rural bus transportation	407	1,147,432	19,900	549,727
	414	Charter bus service	1,531	1,768,199	31,483	548,026
	415	School bus service	4,326	4,233,836	147,441	1,810,695
	417	Bus terminal and service facilities	26	15,253	220	5,190

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%% Data do not include large certificated passenger carriers that report to the Office of Airline Statistics, U.S. Department of Transportation

** Railroad transportation and U.S. Postal Service industries are out of scope for the 1997 Economic Ce

SIC 41: Local and interurban passenger transportation - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
411		97/92	**Local and suburban passenger transportation**	**10,147**	**D**	**(100,000+)**	**D**
4111			Local & suburban transit	1,152	D	(25k-49999)	D
	485111		Mixed mode transit systems	28	51,567	759	24,112
	485112		Commuter rail systems	16	D	(2500-	D

							4999)	
	485113		Bus & motor vehicle transit systems	542	1,152,525	27,448	744,397
	485119		Other urban transit systems	32	D	(500-999)	D
90% of	485999	10	Scheduled airport shuttle service	534	601,988	13,435	217,633
4119			Other local passenger transportation	8,995	8,147,039	179,736	3,183,251
	485320		Limousine service	3,234	1,873,924	29,432	487,867
4% of	485410	20	Employee bus service	158	158,947	4,223	67,261
	485991		Special needs transportation	1,789	1,141,413	31,791	486,676
10% of	485999	20	All other passenger transportation	232	67,395	1,078	15,557
83% of	487110	10	Sightseeing buses	307	462,186	6,858	145,734
88% of	621910	90	Ambulance or rescue service (except by air)	3,275	4,443,174	106,354	1,980,156

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
412	97/92		**Taxi service**	**3,184**	**1,280,597**	**27,850**	**392,759**
4121			Taxi service	3,184	1,280,597	27,850	392,759
	485310		Taxi service	3,184	1,280,597	27,850	392,759

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
413	97/92		**Interurban and rural bus transportation**	**407**	**1,147,432**	**19,900**	**549,727**
4131			Interurban & rural bus transportation	407	1,147,432	19,900	549,727
	485210		Interurban & rural bus transportation	407	1,147,432	19,900	549,727

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
414	97/92		**Charter bus service**	**1,531**	**1,768,199**	**31,483**	**548,026**
4141			Charter bus service, local	482	459,953	8,694	143,572
26% of	485510	10	Charter bus service, local	482	459,953	8,694	143,572
4142			Charter bus service, interstate/interurban	1,049	1,308,246	22,789	404,454
74% of	485510	20	Charter bus service, interstate/interurban	1,049	1,308,246	22,789	404,454

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
415	97/92		**School bus service**	**4,326**	**4,233,836**	**147,441**	**1,810,695**
4151			School bus service	4,326	4,233,836	147,441	1,810,695
96% of	485410	10	School bus service	4,326	4,233,836	147,441	1,810,695

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
417	97/92		**Bus terminal and service facilities**	**26**	**15,253**	**220**	**5,190**
4173			Bus terminal & service facilities	26	15,253	220	5,190

4% of 488490 10	Terminal or maintenance facilities for motor vehicle pass trans	26	15,253	220	5,190

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** Railroad transportation and U.S. Postal Service industries are out of scope for the 1997 Economic Ce

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Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS SIC: Transportation, communications, and utilities %% **

SIC 42: Motor freight transportation and warehousing - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
	42	Motor freight transportation and warehousing	133,373	197,375,341	1,960,130	55,739,452
	421	Trucking and courier services, except air	119,868	184,178,773	1,831,577	52,513,343
	422	Public warehousing and storage	13,491	13,183,579	128,433	3,222,154
	423	Trucking terminal facilities	14	12,989	120	3,955

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** Railroad transportation and U.S. Postal Service industries are out of scope for the 1997 Economic Ce

SIC 42: Motor freight transportation and warehousing - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
421	97/92		**Trucking and courier services, except air**	**119,868**	**184,178,773**	**1,831,577**	**52,513,343**
4212			Local trucking without storage	61,063	51,384,852	473,694	12,642,812
90% of	484110	Σ	General freight trucking, local	14,545	11,108,345	73,967	3,166,529
	484110	10	General freight trucking without storage, local, truckload	10,296	7,783,545	73,967	1,934,702
	484110	20	General freight trucking w/o storage, local, less than truckload	4,249	3,324,800	47,246	1,231,827
10% of	484210	10	Used household & office goods moving, local, without storage	3,259	1,198,983	20,858	395,383
96% of	484220	Σ	Specialized freight (except used goods) trucking, local	34,935	18,932,851	10,951	4,514,945

	484220	10	Hazardous materials trucking (except waste), local	1,434	1,267,441	10,951	366,278
	484220	20	Agricultural products trucking without storage, local	8,065	2,785,495	29,925	629,234
	484220	30	Dump trucking	17,440	9,748,351	81,553	2,083,930
	484220	40	Specialized trucking without storage, local	7,996	5,131,564	56,450	1,435,503
	562111		Solid waste collection	7,083	18,211,495	137,049	4,048,032
	562112		Hazardous waste collection	414	1,095,553	8,468	317,464
	562119		Other waste collection	827	837,625	7,227	200,459
4213			Trucking, except local	47,315	105,764,108	915,091	28,992,807
	484121		General freight trucking, long-distance, truckload	23,111	51,142,148	425,758	12,690,093
	484122		General freight trucking, long-distance, less than truckload	6,210	25,010,091	258,972	9,509,916
72% of	484210	20	Used household & office goods moving, long-distance	3,555	9,111,477	65,734	1,741,891
100% of	484230	Σ	Specialized freight (except used goods) trucking, long-distance	14,439	20,500,392	28,396	5,050,907
	484230	10	Hazardous materials trucking (except waste), long-distance	2,043	3,840,724	28,396	918,360
	484230	20	Agricultural products trucking, long-distance	5,389	3,693,332	32,371	789,921
	484230	30	Other specialized trucking, long-distance	7,007	12,966,336	103,860	3,342,626
4214			Local trucking with storage	3,744	4,221,111	57,749	1,401,608
10% of	484110	Σ	General freight trucking, local	915	1,164,931	7,468	355,591
	484110	30	General freight trucking with storage, local, truckload	542	678,272	7,468	199,953
	484110	40	General freight trucking with storage, local, less than truckload	373	486,659	6,096	155,638
18% of	484210	30	Used household & office goods moving, local, with storage	2,286	2,273,241	34,958	806,674
4% of	484220	50	Specialized trucking with storage, local	543	782,939	9,227	239,343
4215			Courier services, except by air	7,746	22,808,702	385,043	9,476,116
53% of	492110	10	Courier services (except by air)	2,362	19,289,602	317,630	8,234,379
	492210		Local messengers & local delivery	5,384	3,519,100	67,413	1,241,737
SIC	**NAICS**	**Pt**	**Description**	**Establish-ments**	**Revenue ($1,000)**	**Paid employees**	**Annual payroll ($1,000)**
422	3/92		**Public warehousing and storage**	**13,491**	**13,183,579**	**128,433**	**3,222,154**
4221			Farm product warehousing & storage facilities	486	673,198	5,280	118,542
	493130		Farm product warehousing & storage	486	673,198	5,280	118,542
4222			Refrigerated products warehousing	872	2,268,823	22,109	609,335
100% of	493120	10	Refrigerated products warehousing	872	2,268,823	22,109	609,335

4225			General warehousing & storage	10,912	7,846,325	81,450	1,918,952
100% of	493110	10	General warehousing & storage (except in foreign trade zones)	3,918	5,320,671	62,777	1,622,917
	531130		Lessors of miniwarehouses & self storage units	6,994	2,525,654	18,673	296,035
4226			Other special warehousing & storage	1,221	2,395,233	19,594	575,325
0% of	493110	20	General warehousing & storage in foreign trade zones	3	718	7	111
0% of	493120	20	Fur storage	5	1,504	12	249
100% of	493190	Σ	Other warehousing & storage	1,213	2,393,011	6,158	574,965
	493190	10	Household goods warehousing & storage	317	451,574	6,158	141,630
	493190	20	Specialized goods warehousing & storage	896	1,941,437	13,417	433,335

SIC	NAICS	Pt	Description	Establish-ments	Revenue ($1,000)	Paid employees	Annual payroll ($1,000)
423	97/92		**Trucking terminal facilities**	**14**	**12,989**	**120**	**3,955**
4231			Trucking terminal facilities	14	12,989	120	3,955
3% of	488490	20	Motor freight terminal & joint terminal maint facility trans	14	12,989	120	3,955

N=Comparable data not available D=Withheld to avoid disclosure
%% Data do not include large certificated passenger carriers that report to the Office of Airline Statistics, U.S. Department of Transportation
** Railroad transportation and U.S. Postal Service industries are out of scope for the 1997 Economic Ce

Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

(Bridge complete.)	Comparable	SIC derivable from NAICS data.
(Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
(Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

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Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Retail trade

SIC 55: Automotive dealers and gasoline service stations - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
	55	Automotive dealers and gasoline service stations	202,237	788,231,182	2,283,756	55,502,391
	551	Motor vehicle dealers (new and used)	25,897	518,971,824	1,046,243	35,202,751
	552	Motor vehicle dealers (used only)	23,340	34,680,468	92,752	2,197,396
	553	Auto and home supply stores	40,565	35,028,316	300,953	6,044,147
	554	Gasoline service stations	98,846	170,660,068	741,040	9,488,181
	555	Boat dealers	5,262	8,934,230	35,134	839,296
	556	Recreational vehicle dealers	3,014	10,069,749	29,463	813,962
	557	Motorcycle dealers	3,635	7,369,260	29,026	712,065
	559	Automotive dealers, not elsewhere classified	1,678	2,517,267	9,145	204,593

N=Comparable data not available D=Withheld to avoid disclosure

SIC 55: Automotive dealers and gasoline service stations - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
551		97/92	**Motor vehicle dealers (new and used)**	**25,897**	**518,971,824**	**1,046,243**	**35,202,751**
5511			Motor vehicle dealers (new & used)	25,897	518,971,824	1,046,243	35,202,751
	441110		New car dealers	25,897	518,971,824	1,046,243	35,202,751

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
552	97%32		**Motor vehicle dealers (used only)**	**23,340**	**34,680,468**	**92,752**	**2,197,396**
5521			Motor vehicle dealers (used only)	23,340	34,680,468	92,752	2,197,396
	441120		Used car dealers	23,340	34,680,468	92,752	2,197,396

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
553	97%32		**Auto and home supply stores**	**40,565**	**35,028,316**	**300,953**	**6,044,147**
5531			Auto & home supply stores	40,565	35,028,316	300,953	6,044,147
47% of	441310	10	Auto supplies stores	24,508	20,143,722	175,587	3,096,231
68% of	441320	10	New tire dealers	14,814	13,312,367	113,807	2,761,880
6% of	452990	32	Other auto & home supplies stores	1,243	1,572,227	11,559	186,036

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
554	97%32		**Gasoline service stations**	**98,846**	**170,660,068**	**741,040**	**9,488,181**
5541			Gasoline service stations	98,846	170,660,068	741,040	9,488,181
78% of	447110	20	Gasoline stations with convenience stores	53,641	100,103,399	432,935	5,234,676
100% of	447190	Σ	Other gasoline stations	45,205	70,556,669	238,465	4,253,505
	447190	10	Gasoline stations with no convenience stores	42,270	55,523,140	238,465	3,338,637
	447190	20	Truck stops	2,935	15,033,529	69,640	914,868

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
555	97%32		**Boat dealers**	**5,262**	**8,934,230**	**35,134**	**839,296**
5551			Boat dealers	5,262	8,934,230	35,134	839,296
	441222		Boat dealers	5,262	8,934,230	35,134	839,296

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
556	97%32		**Recreational vehicle dealers**	**3,014**	**10,069,749**	**29,463**	**813,962**
5561			Recreational vehicle dealers	3,014	10,069,749	29,463	813,962
	441210		Recreational vehicle dealers	3,014	10,069,749	29,463	813,962

SIC	NAICS	Pt	Description	Establish-ments	Sales ($1,000)	Paid employees	Annual payroll ($1,000)
557	97%32		**Motorcycle dealers**	**3,635**	**7,369,260**	**29,026**	**712,065**
5571			Motorcycle dealers	3,635	7,369,260	29,026	712,065
	441221		Motorcycle dealers	3,635	7,369,260	29,026	712,065

SIC	NAICS	Pt	Description	Establish-	Sales	Paid	Annual payroll

			ments	($1,000)	employees	($1,000)
559	97/92	**Automotive dealers, not elsewhere classified**	**1,678**	**2,517,267**	**9,145**	**204,593**
5599		Automotive dealers, not elsewhere classified	1,678	2,517,267	9,145	204,593
	441229	All other motor vehicle dealers	1,678	2,517,267	9,145	204,593

N=Comparable data not available D=Withheld to avoid disclosure

$$ 1992 sales data include sales from catalog order desks. 1997 sales data exclude sales from catalog order des
Σ=sum of NAICS parts listed below the symbol 97/92 links to Comparative Statistics for 1992 and 1997

 (Bridge complete.)	Comparable	SIC derivable from NAICS data.
 (Drawbridge slightly open.)	Almost comparable	Sales or receipts from NAICS are within 3% of SIC sales or receipts.
 (Drawbridge open.)	Not comparable	SIC sales or receipts cannot be estimated within 3% from NAICS data.

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Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

U.S. Census Bureau

1997 Economic Census: Bridge Between SIC and NAICS

SIC: Service industries

SIC 75: Truck rental services, without drivers - Finder by 3-digit SIC

Includes only establishments with payroll. Introductory text includes scope and methodology.

Go to bridge	SIC	Description		Establish-ments	Receipts ($1,000)	Paid employees	Annual payroll ($1,000)
	75	Automotive repair, services, and parking	Taxable	191,907	99,574,966	1,094,161	22,643,253
	751	Automotive rental and leasing, without drivers	Taxable	10,542	28,921,850	158,062	3,870,601
	752	Automobile parking	Taxable	10,358	5,174,724	76,166	967,701
	753	Automotive repair shops	Taxable	142,372	55,685,916	630,614	14,808,177
	754	Automotive services, except repair	Taxable	28,635	9,792,476	229,319	2,996,774

N=Comparable data not available D=Withheld to avoid disclosure

SIC 75: Truck rental services, without drivers - 4-digit SIC to 6-digit NAICS

Includes only establishments with payroll. Introductory text includes scope and methodology. Figures to the left of NAICS codes indicate the percent of NAICS receipts represented by this part; and link to Table 1 where other parts of the NAICS are shown. 97/92 links to 1997 and 1992 Comparative Statistics for whole SICs.

SIC	NAICS	Pt	Description		Establish-ments	Receipts ($1,000)	Paid employees	Annual payroll ($1,000)
751	97/92		**Automotive rental and leasing, without drivers**	Taxable	**10,542**	**28,921,850**	**158,062**	**3,870,601**
7513			Truck rental services, without drivers	Taxable	4,936	10,081,603	45,224	1,377,581
98% of	532120	Σ	Truck, utility trailer, & RV rental & leasing	Taxable	4,936	10,081,603	13,138	1,377,581
	532120	10	Truck rental	Taxable	2,498	2,420,548	13,138	296,754
	532120	20	Truck leasing	Taxable	2,438	7,661,055	32,086	1,080,827
7514			Passenger car rental	Taxable	4,367	14,783,704	102,623	2,129,602

	532111		Passenger car rental	Taxable	4,367	14,783,704	102,623	2,129,602
7515			Passenger car leasing	Taxable	879	3,800,424	8,325	315,960
	532112		Passenger car leasing	Taxable	879	3,800,424	8,325	315,960
7519			Utility trailer & recreational vehicle rental	Taxable	360	256,119	1,890	47,458
3% of	532120	90	Utility trailer & RV (recreational vehicle) rental & leasing	Taxable	360	256,119	1,890	47,458

SIC	NAICS	Pt	Description		Establish-ments	Receipts ($1,000)	Paid employees	Annual payroll ($1,000)
752	9%2		**Automobile parking**	Taxable	**10,358**	**5,174,724**	**76,166**	**967,701**
7521			Automobile parking	Taxable	10,358	5,174,724	76,166	967,701
	812930		Parking lots & garages	Taxable	10,358	5,174,724	76,166	967,701

SIC	NAICS	Pt	Description		Establish-ments	Receipts ($1,000)	Paid employees	Annual payroll ($1,000)
753	9%2		**Automotive repair shops**	Taxable	**142,372**	**55,685,916**	**630,614**	**14,808,177**
7532			Top, body, & upholstery repair shops & paint shops	Taxable	35,569	17,755,296	205,172	5,172,206
100% of	811121	Σ	Automotive body, paint, & interior repair & maintenance	Taxable	35,569	17,755,296	192,853	5,172,206
	811121	10	Paint or body repair shops	Taxable	33,144	16,645,229	192,853	4,899,276
	811121	20	Van conversion services	Taxable	639	723,189	6,507	156,778
	811121	30	Upholstery & interior repair shops	Taxable	1,786	386,878	5,812	116,152
7533			Automotive exhaust system repair shops	Taxable	5,251	1,985,377	23,015	524,940
	811112		Automotive exhaust system repair	Taxable	5,251	1,985,377	23,015	524,940
7534			Tire retreading & repair shops	Taxable	1,760	1,270,577	10,930	248,727
	326212		Tire retreading	Taxable	754	982,607	7,939	192,387
27% of	811198	10	Tire repair shops	Taxable	1,006	287,970	2,991	56,340
7536			Automotive glass replacement shops	Taxable	5,599	3,149,984	29,187	753,574
	811122		Automotive glass replacement shops	Taxable	5,599	3,149,984	29,187	753,574
7537			Automotive transmission repair shops	Taxable	6,768	2,431,584	29,442	709,254
	811113		Automotive transmission repair	Taxable	6,768	2,431,584	29,442	709,254
7538			General automotive repair shops	Taxable	77,751	25,598,455	290,634	6,438,842
	811111		General automotive repair	Taxable	77,751	25,598,455	290,634	6,438,842
7539			Automotive repair shops, n.e.c.	Taxable	9,674	3,494,643	42,234	960,634
100% of	811118	Σ	Other automotive mechanical & electrical repair & maintenance	Taxable	9,674	3,494,643	4,802	960,634
	811118	10	Carburetor repair shops	Taxable	1,091	363,763	4,802	106,409

	811118	20	Brake, front end, & wheel alignment	Taxable	3,741	1,553,732	18,216	449,563
	811118	30	Electrical repair shops, motor vehicle	Taxable	1,679	494,744	6,890	135,846
	811118	40	Radiator repair	Taxable	2,295	728,297	8,372	174,076
	811118	90	All other motor vehicle repair shops	Taxable	868	354,107	3,954	94,740

SIC	NAICS	Pt	Description		Establish-ments	Receipts ($1,000)	Paid employees	Annual payroll ($1,000)
754	97%92		**Automotive services, except repair**	Taxable	**28,635**	**9,792,476**	**229,319**	**2,996,774**
7542			Carwashes	Taxable	13,683	3,911,344	123,602	1,252,587
	811192		Carwashes	Taxable	13,683	3,911,344	123,602	1,252,587
7549			Automotive services, except repair & carwashes	Taxable	14,952	5,881,132	105,717	1,744,187
	488410		Motor vehicle towing	Taxable	5,893	2,295,188	36,845	747,355
	811191		Automotive oil change & lubrication shops	Taxable	7,413	2,787,318	57,083	778,632
74% of	811198	20	All other motor vehicle services (except repair & carwashes)	Taxable	1,646	798,626	11,789	218,200

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% Comparability may be limited because of changes in assignment of tax status by industry.
Σ=sum of NAICS parts listed below the symbol 97%92 links to Comparative Statistics for 1992 and 1997

 (Bridge complete.)	Comparable	SIC derivable from NAICS data.
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Source: 1997 Economic Census, Comparative Statistics

Last modified: 6/27/00

5.2 FRACTION OF NAICS CODE EMPLOYMENT USED TO CREATE SIC EMPLOYMENT

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
Factory Finished Wood Surface Coating					
2426	321918	10521	38100	0.276	Other millwork (including flooring)
2426	337215	6310	75382	0.084	Showcase, partition, shelving, & locker mfg
2426	321912	17109	39763	0.430	Cut stock, resawing lumber, & planing
2429	321113	304	119760	0.003	Sawmills
2429	321920	684	51134	0.013	Wood container & pallet mfg
2429	321999	355	43839	0.008	All other miscellaneous wood product mfg
2431	321911	64771	64771	1.000	Wood window & door mfg
2431	321918	27488	38100	0.721	Other millwork (including flooring)
2434	337110	79579	99257	0.802	Wood kitchen cabinet & counter top mfg
2435	321211	22151	22151	1.000	Hardwood veneer & plywood mfg
2436	321212	28843	28843	1.000	Softwood veneer & plywood mfg
2439	321912	0	39763	0.000	Cut stock, resawing lumber, & planing
2439	321214	32522	32522	1.000	Truss mfg
2439	321113	0	119760	0.000	Sawmills
2439	321213	5372	5372	1.000	Engineered wood member (except truss) mfg
2441	321920	4885	51134	0.096	Wood container & pallet mfg
2448	321920	38994	51134	0.763	Wood container & pallet mfg
2449	321920	5701	51134	0.111	Wood container & pallet mfg
2451	321991	68269	68269	1.000	Manufactured home (mobile home) mfg
2452	321992	22965	22965	1.000	Prefabricated wood building mfg
2493	321219	25269	25269	1.000	Reconstituted wood product mfg
2499	339999	13740	74137	0.185	All other miscellaneous mfg
2499	332321	0	74944	0.000	Metal window & door mfg
2499	321920	870	51134	0.017	Wood container & pallet mfg
2499	321912	549	39763	0.014	Cut stock, resawing lumber, & planing
2499	321999	41844	43839	0.954	All other miscellaneous wood product mfg
Furniture & Fixtures Surface Coating and Part of Miscellaneous Degreasing					
2511	337122	123368	128248	0.962	Nonupholstered wood household furniture mfg
2512	337121	85258	90009	0.947	Upholstered household furniture mfg
2514	337124	22835	22835	1.000	Metal household furniture mfg
2515	337121	1601	90009	0.018	Upholstered household furniture mfg
2515	337910	23072	23072	1.000	Mattress mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
2517	337129	4273	4273	1.000	Wood television, radio, & sewing machine cabinet mfg
2519	337125	4708	4708	1.000	Household furniture (except wood & metal) mfg
2521	337211	30641	30641	1.000	Wood office furniture mfg
2522	337214	44222	44222	1.000	Office furniture (except wood) mfg
2531	336360	20784	45600	0.456	Motor vehicle seating & interior trim mfg
2531	337127	15254	38218	0.399	Institutional furniture mfg
2531	339942	941	7990	0.118	Lead pencil & art good mfg
2541	337110	9785	99257	0.099	Wood kitchen cabinet & counter top mfg
2541	337212	24363	24363	1.000	Custom architectural woodwork & millwork mfg
2541	337215	23305	75382	0.309	Showcase, partition, shelving, & locker mfg
2542	337215	44472	75382	0.590	Showcase, partition, shelving, & locker mfg
2591	337920	19617	19617	1.000	Blind & shade mfg
2599	337127	22448	38218	0.587	Institutional furniture mfg
2599	339113	2925	85315	0.034	Surgical appliance & supplies mfg
Part of Misc. Degreasing					
3312	324199	1731	3671	0.472	All other petroleum & coal products mfg
3312	331111	144074	146514	0.983	Iron & steel mills
3313	331112	3724	3724	1.000	Electrometallurgical ferroalloy product mfg
3313	331492	311	11610	0.027	Other nonferrous metal secondary smelting, refining, & alloying
3315	331222	23489	23489	1.000	Steel wire drawing
3315	332618	2265	46174	0.049	Other fabricated wire product mfg
3316	331221	14362	14362	1.000	Cold-rolled steel shape mfg
3317	331210	27723	27723	1.000	Iron & steel pipes & tubes mfg from purchased steel
3321	331511	83570	86198	0.970	Iron foundries
3322	331511	2628	86198	0.030	Iron foundries
3324	331512	22673	22673	1.000	Steel investment foundries
3325	331513	23982	23982	1.000	Steel foundries (except investment)
3331	331411	7360	7360	1.000	Primary smelting & refining of copper
3334	331312	15763	15763	1.000	Primary aluminum production
3339	331419	10132	10132	1.000	Other nonferrous metal primary smelting & refining
3341	331423	1768	2333	0.758	Secondary smelting, refining, & alloying of copper

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3341	331492	5485	11610	0.472	Other nonferrous metal secondary smelting, refining, & alloying
3341	331314	6226	6714	0.927	Secondary smelting & alloying of aluminum
3351	331421	21150	21150	1.000	Copper rolling, drawing, & extruding
3353	331315	25111	25111	1.000	Aluminum sheet, plate, & foil mfg
3353	332996	0	29364	0.000	Fabricated pipe & pipe fitting mfg
3354	331316	30357	30357	1.000	Aluminum extruded product mfg
3355	331319	2657	4306	0.617	Other aluminum rolling & drawing
3356	331491	17237	25872	0.666	Other nonferrous metal rolling, drawing, & extruding
Part of Misc. Degreasing and Part of Electrical Insulation Surface Coating					
3357	331319	1649	4306	0.383	Other aluminum rolling & drawing
3357	331422	4692	4692	1.000	Copper wire (except mechanical) drawing
3357	331491	8635	25872	0.334	Other nonferrous metal rolling, drawing, & extruding
3357	335921	8589	8589	1.000	Fiber optic cable mfg
3357	335929	46267	46267	1.000	Other communication & energy wire mfg
Part of Misc. Degreasing					
3363	331521	27717	27717	1.000	Aluminum die-casting foundries
3364	331522	17243	17243	1.000	Nonferrous (except aluminum) die-casting foundries
3365	331524	34098	34098	1.000	Aluminum foundries (except die-casting)
3366	331525	8909	8909	1.000	Copper foundries (except die-casting)
3369	331528	6529	6529	1.000	Other nonferrous foundries (except die-casting)
3398	332811	22674	22674	1.000	Metal heat treating
3399	331111	2440	146514	0.017	Iron & steel mills
3399	331314	488	6714	0.073	Secondary smelting & alloying of aluminum
3399	331423	565	2333	0.242	Secondary smelting, refining, & alloying of copper
3399	331492	5814	11610	0.501	Other nonferrous metal secondary smelting, refining, & alloying
3399	332618	2088	46174	0.045	Other fabricated wire product mfg
Part of Misc. Degreasing and Metal Containers Surface Coating					
3411	332431	27316	27316	1.000	Metal can mfg
3412	332439	6318	14922	0.423	Other metal container mfg
Part of Misc. Degreasing					
3421	332211	11129	11230	0.991	Cutlery & flatware (except precious) mfg
3423	332212	42947	50388	0.852	Hand & edge tool mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3425	332213	9149	9149	1.000	Saw blade & handsaw mfg
3429	332439	4135	14922	0.277	Other metal container mfg
3429	332510	70884	74285	0.954	Hardware mfg
3429	332919	750	18739	0.040	Other metal valve & pipe fitting mfg
3431	332998	9994	9994	1.000	Enameled iron & metal sanitary ware mfg
3432	332913	16202	16202	1.000	Plumbing fixture fitting & trim mfg
3432	332999	474	79070	0.006	All other miscellaneous fabricated metal product mfg
3433	333414	22495	24666	0.912	Heating equipment (except warm air furnaces) mfg
3441	332312	84704	93433	0.907	Fabricated structural metal mfg
3442	332321	72970	74944	0.974	Metal window & door mfg
3443	333415	339	119795	0.003	AC & warm air heating & commercial/industrial refrig equip mfg
3443	332420	33704	33704	1.000	Metal tank (heavy gauge) mfg
3443	332313	25453	25453	1.000	Plate work mfg
3443	332410	27542	27542	1.000	Power boiler & heat exchanger mfg
3444	332322	129826	129826	1.000	Sheet metal work mfg
3444	332439	2074	14922	0.139	Other metal container mfg
3446	332323	30960	34391	0.900	Ornamental & architectural metal work mfg
3448	332311	25946	25946	1.000	Prefabricated metal building & component mfg
3449	332114	15219	15219	1.000	Custom roll forming
3449	332312	8729	93433	0.093	Fabricated structural metal mfg
3449	332321	1974	74944	0.026	Metal window & door mfg
3449	332323	349	34391	0.010	Ornamental & architectural metal work mfg
3451	332721	80404	80404	1.000	Precision turned product mfg
3452	332722	52995	52995	1.000	Bolt, nut, screw, rivet, & washer mfg
3462	332111	26432	26432	1.000	Iron & steel forging
3463	332112	9129	9129	1.000	Nonferrous forging
3465	336370	126905	126905	1.000	Motor vehicle metal stamping
3466	332115	4682	4682	1.000	Crown & closure mfg
3469	332116	93086	93086	1.000	Metal stamping
3469	332214	7724	7724	1.000	Kitchen utensil, pot, & pan mfg
3471	332813	74640	74640	1.000	Electroplating, plating, polishing, anodizing, & coloring

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
Part of Misc. Degreasing and Sheet, Strip & Coil Surface Coating					
3479	332812	55904	55904	1.000	Metal coating/engraving (exc jewelry/silverware)/allied services
3479	339911	79	34773	0.002	Jewelry (except costume) mfg
3479	339912	103	6459	0.016	Silverware & plated ware mfg
3479	339914	29	14573	0.002	Costume jewelry & novelty mfg
Part of Misc. Degreasing					
3482	332992	6863	6863	1.000	Small arms ammunition mfg
3483	332993	9427	9427	1.000	Ammunition (except small arms) mfg
3484	332994	9907	9907	1.000	Small arms mfg
3489	332995	12285	12285	1.000	Other ordnance & accessories mfg
3491	332911	53459	53459	1.000	Industrial valve mfg
3492	332912	37132	37132	1.000	Fluid power valve & hose fitting mfg
3493	332611	5381	5381	1.000	Spring (heavy gauge) mfg
3494	332919	17652	18739	0.942	Other metal valve & pipe fitting mfg
3494	332999	564	79070	0.007	All other miscellaneous fabricated metal product mfg
3495	332612	18798	18798	1.000	Spring (light gauge) mfg
3495	334518	175	6333	0.028	Watch, clock, & part mfg
3496	332618	41821	46174	0.906	Other fabricated wire product mfg
3497	332999	5648	79070	0.071	All other miscellaneous fabricated metal product mfg
3497	322225	4967	4967	1.000	Laminated aluminum foil mfg for flexible packaging uses
3498	332996	29364	29364	1.000	Fabricated pipe & pipe fitting mfg
3499	332439	2331	14922	0.156	Other metal container mfg
3499	332510	3401	74285	0.046	Hardware mfg
3499	332919	375	18739	0.020	Other metal valve & pipe fitting mfg
3499	332999	63736	79070	0.806	All other miscellaneous fabricated metal product mfg
3499	337215	1295	75382	0.017	Showcase, partition, shelving, & locker mfg
3499	339914	568	14573	0.039	Costume jewelry & novelty mfg
3499	332117	10760	10760	1.000	Powder metallurgy part mfg
Part of Misc. Degreasing and Machinery & Equipment Surface Coating					
3511	333611	19529	19529	1.000	Turbine & turbine generator set unit mfg
3519	333618	56338	56348	1.000	Other engine equipment mfg
3519	336399	896	174465	0.005	All other motor vehicle parts mfg
3523	332212	60	50388	0.001	Hand & edge tool mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3523	333922	320	39599	0.008	Conveyor & conveying equipment mfg
3523	333111	66370	66370	1.000	Farm machinery & equipment mfg
3523	332323	3082	34391	0.090	Ornamental & architectural metal work mfg
3524	332212	60	50388	0.001	Hand & edge tool mfg
3524	333112	28617	28617	1.000	Lawn & garden tractor & home lawn & garden equipment mfg
3531	333120	74965	74965	1.000	Construction machinery mfg
3531	333923	10263	18014	0.570	Overhead traveling crane, hoist, & monorail system mfg
3531	336510	2379	34012	0.070	Railroad rolling stock mfg
3532	333131	13547	13547	1.000	Mining machinery & equipment mfg
3533	333132	29451	29451	1.000	Oil & gas field machinery & equipment mfg
3534	333921	9442	9442	1.000	Elevator & moving stairway mfg
3535	333922	39279	39599	0.992	Conveyor & conveying equipment mfg
3536	333923	7751	18014	0.430	Overhead traveling crane, hoist, & monorail system mfg
3537	333924	25953	25953	1.000	Industrial truck, tractor, trailer, & stacker machinery mfg
3537	332439	64	14922	0.004	Other metal container mfg
3537	332999	240	79070	0.003	All other miscellaneous fabricated metal product mfg
3541	333512	28849	29371	0.982	Machine tool (metal cutting types) mfg
3542	333513	14185	14185	1.000	Machine tool (metal forming types) mfg
3543	332997	7959	7959	1.000	Industrial pattern mfg
3544	333511	48657	48657	1.000	Industrial mold mfg
3544	333514	80113	80113	1.000	Special die & tool, die set, jig, & fixture mfg
3545	332212	6379	50388	0.127	Hand & edge tool mfg
3545	333515	47925	47925	1.000	Cutting tool & machine tool accessory mfg
3546	333991	16816	16816	1.000	Power-driven handtool mfg
3547	333516	4149	4149	1.000	Rolling mill machinery & equipment mfg
3548	335311	0	26638	0.000	Power, distribution, & specialty transformer mfg
3548	333992	22434	22505	0.997	Welding & soldering equipment mfg
3549	333518	19023	19023	1.000	Other metalworking machinery mfg
3552	333292	13600	13600	1.000	Textile machinery mfg
3553	333210	9117	9117	1.000	Sawmill & woodworking machinery mfg
3554	333291	18594	18594	1.000	Paper industry machinery mfg
3555	333293	17500	21000	0.833	Printing machinery & equipment mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3556	333294	19026	19026	1.000	Food product machinery mfg
3559	333319	2890	56910	0.051	Other commercial & service industry machinery mfg
3559	333220	18574	18574	1.000	Plastics & rubber industry machinery mfg
3559	333295	40087	40087	1.000	Semiconductor machinery mfg
3559	333298	53046	53106	0.999	All other industrial machinery mfg
3561	333911	36552	36552	1.000	Pump & pumping equipment mfg
3562	332991	36991	36991	1.000	Ball & roller bearing mfg
3563	333912	24821	24821	1.000	Air & gas compressor mfg
3564	333411	16183	16183	1.000	Air purification equipment mfg
3564	333412	13723	13723	1.000	Industrial & commercial fan & blower mfg
3565	333993	31581	31581	1.000	Packaging machinery mfg
3566	333612	16231	16231	1.000	Speed changer, industrial high-speed drive, & gear mfg
3567	333994	17585	17585	1.000	Industrial process furnace & oven mfg
3568	333613	21604	21604	1.000	Mechanical power transmission equipment mfg
3569	333999	50088	61151	0.819	All other miscellaneous general-purpose machinery mfg
3571	334111	100115	100115	1.000	Electronic computer mfg
3572	334112	42364	42364	1.000	Computer storage device mfg
3575	334113	5764	5764	1.000	Computer terminal mfg
3577	334119	87253	93970	0.929	Other computer peripheral equipment mfg
3578	333313	966	14831	0.065	Office machinery mfg
3578	334119	6717	93970	0.071	Other computer peripheral equipment mfg
3579	333313	13865	14831	0.935	Office machinery mfg
3579	334518	750	6333	0.118	Watch, clock, & part mfg
3579	339942	1234	7990	0.154	Lead pencil & art good mfg
3581	333311	8178	8178	1.000	Automatic vending machine mfg
3582	333312	4523	4523	1.000	Commercial laundry, drycleaning, & pressing machine mfg
3585	333415	119456	119795	0.997	AC & warm air heating & commercial/industrial refrig equip mfg
3585	336391	21522	21522	1.000	Motor vehicle air-conditioning mfg
3586	333913	6824	6824	1.000	Measuring & dispensing pump mfg
3589	333319	44172	56910	0.776	Other commercial & service industry machinery mfg
3592	336311	17518	17518	1.000	Carburetor, piston, piston ring, & valve mfg
3593	333995	23062	23062	1.000	Fluid power cylinder & actuator mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3594	333996	15482	15482	1.000	Fluid power pump & motor mfg
3596	333997	4871	4871	1.000	Scale & balance (except laboratory) mfg
3599	332710	290951	290951	1.000	Machine shops
3599	332999	4199	79070	0.053	All other miscellaneous fabricated metal product mfg
3599	333319	1335	56910	0.023	Other commercial & service industry machinery mfg
3599	333999	11063	61151	0.181	All other miscellaneous general-purpose machinery mfg
Part of Misc. & Electronic Degreasing and Part of Electrical Insulation Surface Coating					
3612	335311	26638	26638	1.000	Power, distribution, & specialty transformer mfg
Part of Misc. & Electronic Degreasing					
3613	335313	41291	41291	1.000	Switchgear & switchboard apparatus mfg
3621	335312	71112	74666	0.952	Motor & generator mfg
3624	335991	10887	10887	1.000	Carbon & graphite product mfg
3625	335314	68365	68365	1.000	Relay & industrial control mfg
3629	335999	18682	44754	0.417	All other miscellaneous electrical equipment & component mfg
Part of Misc. & Electronic Degreasing and Appliance Surface Coating					
3631	335221	17543	17543	1.000	Household cooking appliance mfg
3632	335222	24597	24597	1.000	Household refrigerator & home freezer mfg
3633	335224	14801	14801	1.000	Household laundry equipment mfg
3634	333414	2171	24666	0.088	Heating equipment (except warm air furnaces) mfg
3634	335211	17058	17058	1.000	Electric housewares & household fan mfg
3635	335212	10537	10537	1.000	Household vacuum cleaner mfg
3639	333298	60	53106	0.001	All other industrial machinery mfg
3639	335212	0	10537	0.000	Household vacuum cleaner mfg
3639	335228	13309	13309	1.000	Other major household appliance mfg
Part of Misc. & Electronic Degreasing					
3641	335110	15903	15903	1.000	Electric lamp bulb & part mfg
3643	335931	44907	44907	1.000	Current-carrying wiring device mfg
3644	335932	23540	23540	1.000	Noncurrent-carrying wiring device mfg
3645	335121	16395	17685	0.927	Residential electric lighting fixture mfg
3646	335122	23090	23090	1.000	Commercial/industrial/institutional electric lighting fixture mfg
3647	336321	16506	16506	1.000	Vehicular lighting equipment mfg
3648	335129	18274	18282	1.000	Other lighting equipment mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3651	334310	31727	31727	1.000	Audio & video equipment mfg
3652	334612	16598	25554	0.650	Prerecorded CD (except software), tape, & record reproducing
3661	334210	104262	104262	1.000	Telephone apparatus mfg
3661	334416	63	19431	0.003	Electronic coil, transformer, & other inductor mfg
3661	334418	6083	111054	0.055	Printed circuit assembly (electronic assembly) mfg
3663	334220	148156	164461	0.901	Radio & TV broadcasting & wireless communications equipment mfg
3669	334290	25187	25187	1.000	Other communications equipment mfg
3671	334411	21976	21976	1.000	Electron tube mfg
3672	334412	76702	76702	1.000	Bare printed circuit board mfg
3674	334413	199497	199497	1.000	Semiconductor & related device mfg
3675	334414	18882	18882	1.000	Electronic capacitor mfg
3676	334415	11964	11964	1.000	Electronic resistor mfg
3677	334416	19178	19431	0.987	Electronic coil, transformer, & other inductor mfg
3678	334417	37232	37232	1.000	Electronic connector mfg
3679	336322	12786	95491	0.134	Other motor vehicle electrical & electronic equipment mfg
3679	334220	16305	164461	0.099	Radio & TV broadcasting & wireless communications equipment mfg
3679	334418	104971	111054	0.945	Printed circuit assembly (electronic assembly) mfg
3679	334419	92200	92200	1.000	Other electronic component mfg
3691	335911	23288	23288	1.000	Storage battery mfg
3692	335912	8917	8917	1.000	Primary battery mfg
3694	336322	52216	95491	0.547	Other motor vehicle electrical & electronic equipment mfg
3695	334613	21345	21345	1.000	Magnetic & optical recording media mfg
3699	333992	71	22505	0.003	Welding & soldering equipment mfg
3699	335999	26072	44754	0.583	All other miscellaneous electrical equipment & component mfg
3699	335129	8	18282	0.000	Other lighting equipment mfg
3699	334519	29	33933	0.001	Other measuring & controlling device mfg
3699	334516	159	38359	0.004	Analytical laboratory instrument mfg
3699	334119	0	93970	0.000	Other computer peripheral equipment mfg
3699	334510	542	54385	0.010	Electromedical & electrotherapeutic apparatus mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3699	339114	0	18072	0.000	Dental equipment & supplies mfg
3699	333512	522	29371	0.018	Machine tool (metal cutting types) mfg
3699	333319	8513	56910	0.150	Other commercial & service industry machinery mfg
3699	333315	0	24707	0.000	Photographic & photocopying equipment mfg
3699	333314	56	20857	0.003	Optical instrument & lens mfg
3699	333293	175	21000	0.008	Printing machinery & equipment mfg
3699	333292	0	13600	0.000	Textile machinery mfg
3699	332212	424	50388	0.008	Hand & edge tool mfg
3699	334511	604	188161	0.003	Search, detection, navigation, & guidance instrument mfg
3699	333618	10	56348	0.000	Other engine equipment mfg
Part of Misc. Degreasing and New Automobile Surface Coating					
3711	336992	375	5788	0.065	Military armored vehicle, tank, & tank component mfg
3711	336111	114060	114060	1.000	Automobile mfg
3711	336112	94033	94033	1.000	Light truck & utility vehicle mfg
3711	336120	28214	28214	1.000	Heavy duty truck mfg
3711	336211	404	43384	0.009	Motor vehicle body mfg
Part of Misc. Degreasing and Part of Other Transportation Equipment Surface Coating					
3713	336211	41779	43384	0.963	Motor vehicle body mfg
3714	336312	81368	81368	1.000	Gasoline engine & engine parts mfg
3714	336322	30489	95491	0.319	Other motor vehicle electrical & electronic equipment mfg
3714	336330	48944	48944	1.000	Motor vehicle steering & suspension component (except spring) mfg
3714	336340	43132	43132	1.000	Motor vehicle brake system mfg
3714	336350	111954	111954	1.000	Motor vehicle transmission & power train parts mfg
3714	336399	173569	174465	0.995	All other motor vehicle parts mfg
3714	336211	1201	43384	0.028	Motor vehicle body mfg
3715	336212	30678	30678	1.000	Truck trailer mfg
3716	336213	18086	18086	1.000	Motor home mfg
3721	336411	200961	200961	1.000	Aircraft mfg
3724	336412	82557	82557	1.000	Aircraft engine & engine parts mfg
3728	332912	0	37132	0.000	Fluid power valve & hose fitting mfg
3728	336413	127729	127729	1.000	Other aircraft part & auxiliary equipment mfg
3728	333995	0	23062	0.000	Fluid power cylinder & actuator mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3728	333996	0	15482	0.000	Fluid power pump & motor mfg
Part of Misc. Degreasing and Marine Surface Coating					
3731	336611	97385	97385	1.000	Ship building & repairing
3732	336612	41422	41422	1.000	Boat building
3732	811490	9454	65213	0.145	Other personal & household goods repair & maintenance
Part of Misc. Degreasing and Part of Other Transportation Equipment Surface Coating					
3743	333911	0	36552	0.000	Pump & pumping equipment mfg
3743	336510	31633	34012	0.930	Railroad rolling stock mfg
3751	336991	17158	17218	0.997	Motorcycle, bicycle, & parts mfg
3761	336414	52158	52158	1.000	Guided missile & space vehicle mfg
3764	336415	18540	18540	1.000	Guided missile & space vehicle propulsion unit & parts mfg
3769	336419	6110	6110	1.000	Other guided missile & space vehicle parts & auxiliary equip mfg
3792	336214	20112	33352	0.603	Travel trailer & camper mfg
3795	336992	5415	5788	0.936	Military armored vehicle, tank, & tank component mfg
3799	336214	13240	33352	0.397	Travel trailer & camper mfg
3799	336999	19466	19466	1.000	All other transportation equipment mfg
3799	332212	60	50388	0.001	Hand & edge tool mfg
Part of Misc. Degreasing					
3812	334511	187557	188161	0.997	Search, detection, navigation, & guidance instrument mfg
3821	339111	18253	18253	1.000	Laboratory apparatus & furniture mfg
3822	334512	21450	21450	1.000	Automatic environmental control mfg
3823	334513	49196	49196	1.000	Industrial process control instrument mfg
3824	334514	17390	17390	1.000	Totalizing fluid meter & counting device mfg
3825	334416	190	19431	0.010	Electronic coil, transformer, & other inductor mfg
3825	334515	63332	63332	1.000	Electricity measuring & testing instrument mfg
3826	334516	38200	38359	0.996	Analytical laboratory instrument mfg
3827	333314	20801	20857	0.997	Optical instrument & lens mfg
3829	339112	521	107819	0.005	Surgical & medical instrument mfg
3829	334519	33904	33933	0.999	Other measuring & controlling device mfg
3841	339112	107298	107819	0.995	Surgical & medical instrument mfg
3842	322121	375	120176	0.003	Paper (except newsprint) mills
3842	322291	2236	21791	0.103	Sanitary paper product mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3842	334510	6722	54385	0.124	Electromedical & electrotherapeutic apparatus mfg
3842	339113	82390	85315	0.966	Surgical appliance & supplies mfg
3843	339114	18072	18072	1.000	Dental equipment & supplies mfg
3844	334517	14276	14276	1.000	Irradiation apparatus mfg
3845	334510	47121	54385	0.866	Electromedical & electrotherapeutic apparatus mfg
3851	339115	26366	26366	1.000	Ophthalmic goods mfg
3861	325992	38935	38935	1.000	Photographic film, paper, plate, & chemical mfg
3861	333315	24707	24707	1.000	Photographic & photocopying equipment mfg
3873	334518	5646	6333	0.892	Watch, clock, & part mfg
3911	339911	34694	34773	0.998	Jewelry (except costume) mfg
3914	332211	101	11230	0.009	Cutlery & flatware (except precious) mfg
3914	339912	6356	6459	0.984	Silverware & plated ware mfg
3915	339913	5396	5396	1.000	Jewelers' material & lapidary work mfg
3931	339992	13411	13411	1.000	Musical instrument mfg
3942	339931	3393	3393	1.000	Doll & stuffed toy mfg
3944	336991	60	17218	0.003	Motorcycle, bicycle, & parts mfg
3944	339932	29622	29622	1.000	Game, toy, & children's vehicle mfg
3949	339920	69664	69664	1.000	Sporting & athletic goods mfg
3951	339941	8394	8394	1.000	Pen & mechanical pencil mfg
3952	339942	5815	7990	0.728	Lead pencil & art good mfg
3952	337127	187	38218	0.005	Institutional furniture mfg
3952	325998	0	35915	0.000	All other miscellaneous chemical product & preparation mfg
3953	339943	7831	7831	1.000	Marking device mfg
3955	339944	5923	5923	1.000	Carbon paper & inked ribbon mfg
3961	339914	13976	14573	0.959	Costume jewelry & novelty mfg
3965	339993	7500	7842	0.956	Fastener, button, needle, & pin mfg
3991	339994	13882	16826	0.825	Broom, brush, & mop mfg
3993	339950	82956	82956	1.000	Sign mfg
3995	339995	6962	6962	1.000	Burial casket mfg
3996	326192	5614	6070	0.925	Resilient floor covering mfg
3999	323119	0	33016	0.000	Other commercial printing
3999	337127	329	38218	0.009	Institutional furniture mfg
3999	335121	1216	17685	0.069	Residential electric lighting fixture mfg

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
3999	332999	3231	79070	0.041	All other miscellaneous fabricated metal product mfg
3999	332212	750	50388	0.015	Hand & edge tool mfg
3999	326199	3141	526382	0.006	All other plastics product mfg
3999	325998	572	35915	0.016	All other miscellaneous chemical product & preparation mfg
3999	314999	2167	64480	0.034	All other miscellaneous textile product mills
3999	323113	0	72221	0.000	Commercial screen printing
3999	339999	60397	74137	0.815	All other miscellaneous mfg
3999	316110	329	15317	0.021	Leather & hide tanning & finishing
3999	321999	0	43839	0.000	All other miscellaneous wood product mfg
3999	322299	0	24302	0.000	All other converted paper product mfg
3999	323110	0	415117	0.000	Commercial lithographic printing
3999	323111	0	23260	0.000	Commercial gravure printing
3999	323112	0	30588	0.000	Commercial flexographic printing
Part of Misc. Open Top Degreasing & Auto Repair Cold Cleaning					
4173	488490	220	7480	0.029	Other support activities for road transportation
4231	488490	120	7480	0.016	Other support activities for road transportation
5511	441110	1046243	1046243	1.000	New car dealers
5521	441120	92752	92752	1.000	Used car dealers
5541	447190	69640	308105	0.226	Other gasoline stations
5541	447110	432935	613957	0.705	Gasoline stations with convenience stores
5541	447190	238465	308105	0.774	Other gasoline stations
5551	441222	35134	35134	1.000	Boat dealers
5561	441210	29463	29463	1.000	Recreational vehicle dealers
7532	811121	192853	205172	0.940	Automotive body, paint, & interior repair & maintenance
7532	811121	6507	205172	0.032	Automotive body, paint, & interior repair & maintenance
7532	811121	5812	205172	0.028	Automotive body, paint, & interior repair & maintenance
7533	811112	23015	23015	1.000	Automotive exhaust system repair
7534	811198	2991	14780	0.202	All other automotive repair & maintenance
7534	326212	7939	7939	1.000	Tire retreading
7536	811122	29187	29187	1.000	Automotive glass replacement shops
7537	811113	29442	29442	1.000	Automotive transmission repair
7538	811111	290634	290634	1.000	General automotive repair

SIC	NAICS	SIC Employees 1997	NAICS Employees '1997	Employee Fraction	NAICS description
7539	811118	3954	42234	0.094	Other automotive mechanical & electrical repair & maintenance
7539	811118	4802	42234	0.114	Other automotive mechanical & electrical repair & maintenance
7539	811118	18216	42234	0.431	Other automotive mechanical & electrical repair & maintenance
7539	811118	6890	42234	0.163	Other automotive mechanical & electrical repair & maintenance
7539	811118	8372	42234	0.198	Other automotive mechanical & electrical repair & maintenance
Dry Cleaning					
7215	812310	53023	53023	1.000	Dry cleaning, coin operated
7216	812320	166208	203777	0.816	Dry cleaning, commercial

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