

SECTION 4

NON-ROAD MOBILE SOURCES

Non-road mobile sources include recreational vehicles, construction equipment, farm equipment, aircraft, railroad locomotives, etc. The types of sources, which were considered for this inventory, were identified from EPA documents⁶. The non-road mobile source categories, which were included in this inventory, are listed in Table 4-1.

Emissions from all non-road mobile sources addressed in this inventory were calculated using level-of-activity emission factors. For a number of sources, an estimate of vehicle population was required to complete these calculations. Local data were used when available, as with the Aircraft and Railroad emissions; however, for the majority of the other non-road gasoline, compressed natural gas (CNG), diesel and liquefied petroleum gas (LPG) vehicles/equipment, Washoe County utilized the EPA NONROAD 2002 Model to obtain the data.

Table 4-1 shows the methodology and emission factors used for each source category. Local activity data for these sources were obtained, when available, from local agencies. Table 4-2 lists the sources of the activity/commodity data, which were used to estimate emissions.

Once annual emissions were calculated, the peak CO season emissions were determined. If available, an activity distribution representative of local conditions was estimated. The emissions from most non-road mobile sources were apportioned to the peak CO season using the seasonal data calculated from the NONROAD 2002 Model. As previously mentioned, Washoe County's CO season is during the winter season, specifically the months of November, December and January.

The Seasonal Adjustment Factor (SAF) was then calculated using the equations presented in Section 3. Table 4-3 summarizes the SAF and the number of activity days used for each source category. The table also indicates whether the SAF listed was calculated from published or estimated seasonal activity breakdowns.

Non-road mobile sources accounted for approximately 22,053 tons/year of CO within the NAA in 2002. Peak season emissions from these sources totaled 74,553 pounds/CO day in the NAA. Table 4-4 provides a summary of non-road mobile source emissions.

Figure 4-1 shows the relative contribution of each source category to the total. The remainder of this section will describe in greater detail the methods used to calculate the emissions. Supporting documentation is provided in Appendix C.

**TABLE 4-1
NON-ROAD MOBILE SOURCE CATEGORIES**

Source Category	Emission Methodology⁶	Emission Factor Source
<u>Aircraft</u>		
Military Aircraft	1A	VOL. IV
Commercial Aircraft	1A	VOL. IV
Civil Aircraft	1A	VOL. IV
Air Taxis	1A	VOL. IV
<u>Non-Road Gasoline Vehicles</u>		
Agricultural Equipment	1B	NONROAD Model
Airport Equipment	1B	NONROAD Model
Commercial Equipment	1B	NONROAD Model
Construction and Mining Equipment	1B	NONROAD Model
Industrial Equipment	1B	NONROAD Model
Lawn and Garden Equipment (Com)	1B	NONROAD Model
Lawn and Garden Equipment (Res)	1B	NONROAD Model
Pleasure Craft	1B	NONROAD Model
Railroad Equipment	1B	NONROAD Model
Recreational Equipment	1B	NONROAD Model
<u>Non-Road CNG Engines</u>		
Agricultural Equipment	1B	NONROAD Model
Commercial Equipment	1B	NONROAD Model
Construction and Mining Equipment	1B	NONROAD Model
Industrial Equipment	1B	NONROAD Model
<u>Non-Road Diesel Vehicles</u>		
Agricultural Equipment	1B	NONROAD Model
Airport Equipment	1B	NONROAD Model
Commercial Equipment	1B	NONROAD Model
Construction and Mining Equipment	1B	NONROAD Model
Industrial Equipment	1B	NONROAD Model
Lawn and Garden Equipment (Com)	1B	NONROAD Model
Pleasure Craft	1B	NONROAD Model
Railroad Equipment	1B	NONROAD Model
Recreational Equipment	1B	NONROAD Model
<u>Non-Road LPG Engines</u>		
Agricultural Equipment	1B	NONROAD Model
Airport Equipment	1B	NONROAD Model
Commercial Equipment	1B	NONROAD Model
Construction and Mining Equipment	1B	NONROAD Model
Industrial Equipment	1B	NONROAD Model
Lawn and Garden Equipment (Com)	1B	NONROAD Model
Railroad Equipment	1B	NONROAD Model
Recreational Equipment	1B	NONROAD Model
<u>Railroads</u>		
Diesel	1A	VOL. IV

^a - level-of-activity emission factors

A - local vehicle population data

B - Draft EPA NONROAD 2002 Model built-in factors

The abbreviations used above refer to the following reference documents:

NONROAD Model: EPA preferred method, draft, December 2002⁷.

VOL. IV: Procedures for Emission Inventory Preparation Volume IV: Mobile Sources, U.S. Environmental Protection Agency, EPA-450/4-81-026d, October 1991 Draft Revision.⁶

**TABLE 4-2
ACTIVITY/COMMODITY DATA SOURCES**

Source Category	Activity Data Source
Aircraft	Washoe County Airport Authority Stead Airport
Agricultural Equipment	NONROAD Model built-in factor
Airport Equipment	NONROAD Model built-in factor
Commercial Equipment	NONROAD Model built-in factor
Construction and Mining Equipment	NONROAD Model built-in factor
Industrial Equipment	NONROAD Model built-in factor
Lawn and Garden Equipment (Com)	NONROAD Model built-in factor
Lawn and Garden Equipment (Res)	NONROAD Model built-in factor
Pleasure Craft	NONROAD Model built-in factor
Railroad Equipment	NONROAD Model built-in factor
Recreational Equipment	NONROAD Model built-in factor
Railroads	Union Pacific Railway System

**TABLE 4-3
ESTIMATION PROCEDURES FOR NON-ROAD MOBILE SOURCES**

SOURCE CATEGORY	Seasonal Activity Source	SAF	Weekly Activity (days/week)
<u>Aircraft</u>			
Military Aircraft	Calc.	0.96	7
Commercial Aircraft	Calc.	1.01	7
Civil Aircraft	Calc.	1.08	7
Air Taxis	Calc.	1.03	7
<u>Railroads</u>			
Diesel	Calc.	Uniform	7

**TABLE 4-4
2002 NON-ROAD MOBILE SOURCES EMISSIONS SUMMARY FOR
WASHOE COUNTY CO NON-ATTAINMENT AREA**

<i>SOURCE CATEGORY</i>	<i>NAA Annual CO Emissions (tpy)</i>	<i>NAA Peak Season CO Emissions (lbs/day)</i>	<i>County Annual CO Emissions (tpy)</i>	<i>County Peak Season CO Emissions (lbs/day)</i>
<u>Aircraft</u>				
Military Aircraft	60	318	60	318
Commercial Aircraft	398	2,121	398	3,766
Civil Aircraft	328	1,732	635	2,212
Air Taxis	1	4	1	4
Category Total	788	4,175	1,094	6,301
<u>Non-Road Gasoline Engines</u>				
Agricultural Equipment	4	9	18	44
Airport Equipment	36	168	36	168
Commercial Equipment	4,769	22,462	5,961	28,078
Construction and Mining Equipment	414	1,368	828	2,737
Industrial Equipment	291	1,368	363	1,710
Lawn and Garden Equipment (Com)	10,439	28,692	13,049	35,865
Lawn and Garden Equipment (Res)	3,133	8,252	3,917	10,315
Pleasure Craft	0	0	2,590	5,825
Railroad Equipment	6	28	8	36
Recreational Equipment	1,123	2,772	1,404	3,465
Category Total	20,214	65,120	28,172	88,241
<u>Non-Road CNG Engines</u>				
Agricultural Equipment	0	0	0	0
Commercial Equipment	39	212	48	265
Construction and Mining Equipment	0	0	0	0
Industrial Equipment	36	197	45	246
Category Total	74	409	93	512
<u>Non-Road Diesel Engines</u>				
Agricultural Equipment	3	9	15	44
Airport Equipment	15	83	15	83
Commercial Equipment	56	309	70	387
Construction and Mining Equipment	236	926	473	1,852
Industrial Equipment	35	191	44	239
Lawn and Garden Equipment (Com)	35	106	44	133
Pleasure Craft	0	0	5	14
Railroad Equipment	2	14	3	17
Recreational Equipment	2	6	2	7
Category Total	386	1,645	672	2,776
<u>Non-Road LPG Engines</u>				
Agricultural Equipment	0	0	0	0
Airport Equipment	4	24	4	24
Commercial Equipment	47	258	59	323
Construction and Mining Equipment	7	26	14	53
Industrial Equipment	492	2,705	615	3,381
Lawn and Garden Equipment (Com)	12	35	15	44
Railroad Equipment	0	0	0	0
Recreational Equipment	0	1	1	2
Category Total	563	3,049	708	3,826
<u>Railroads</u>				
Diesel	28	155	104	569
TOTAL	22,053	74,553	30,843	102,224

Note: The numbers do not add up due to rounding.

2002 CO NAA Emissions for Non-Road Mobile Sources

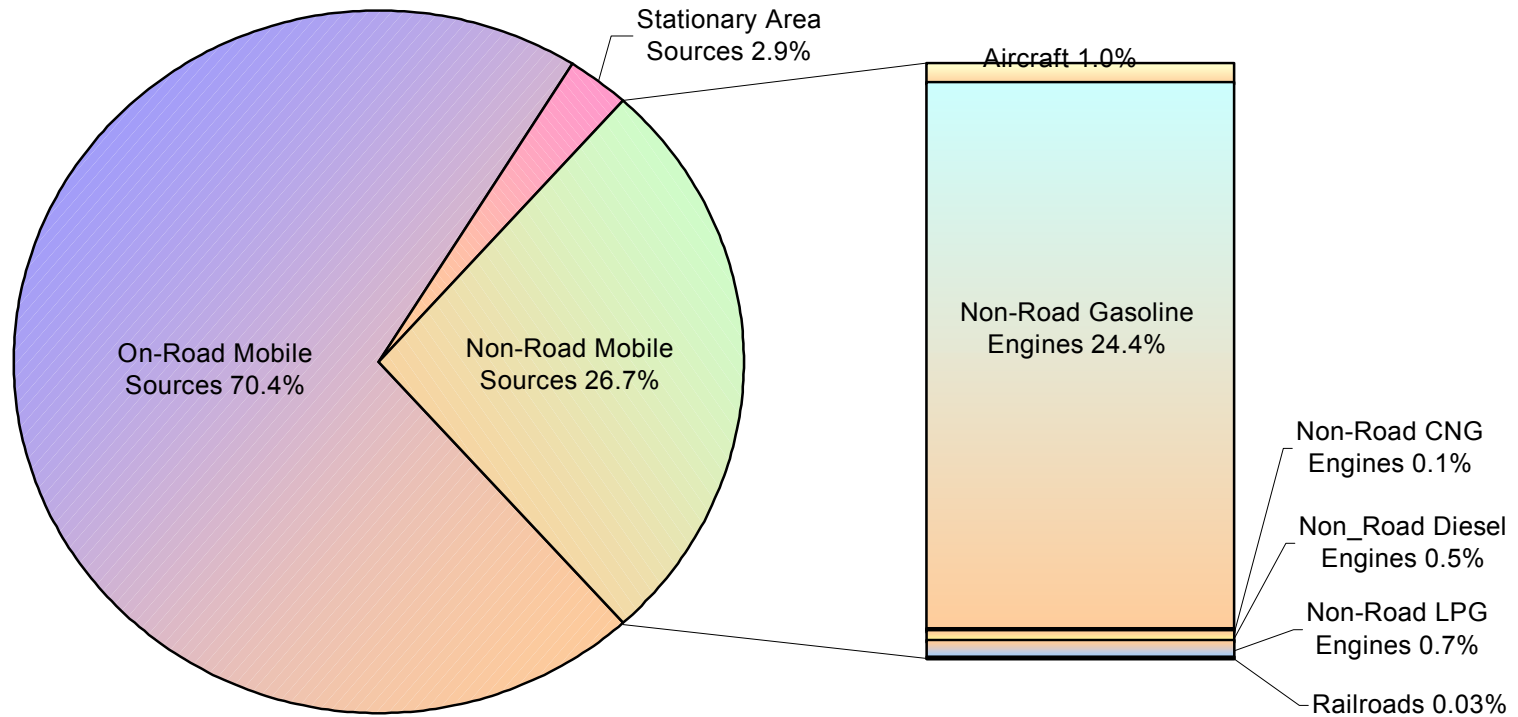


Figure 4-1

AIRCRAFT

Total annual emissions for this source were approximately 788 tons/year of CO within the NAA and 1,094 tons/year of CO countywide in 2002. Within the NAA this accounted for approximately 1% of CO emissions from non-road mobile sources (Figure 4-1). Emissions were subdivided into four classes:

- Air Taxis
- Civil Aircraft
- Commercial Aircraft
- Military Aircraft

Emissions from aircraft are the direct result of the amount of fuel consumed during aircraft activity. Landing/takeoff (LTO) cycles are the common measure of aircraft activity and consist of all normal flight and ground operation modes including descent, approach, touchdown, landing, taxi in, idle, taxi out, takeoff and climbout. The LTO data reported by Washoe County Airport Authority for 2002 are presented in Table 4-5. These data reflect activity at both Reno-Tahoe Airport and Stead Airport. There are no other airports in the Washoe County except for some small private landing strips.

Annual emissions by aircraft class are shown in Table 4-5. Aircraft engines within a specific class, such as commercial aircraft, can have significantly different emission characteristics. The spreadsheet and airport information used to determine emissions are contained in Appendix C.1.

**TABLE 4-5
2002 AIRCRAFT ACTIVITY DATA AND EMISSIONS**

Aircraft Type	LTOs	CO-NAA		LTOs	County	
		Ann. CO Emissions (tons/yr)	CO Season Em (lbs/day)		Ann. CO Emissions (tons/yr)	CO Season Em. (lbs/day)
AIR TAXI	1355	1	4	1355	1	4
CIVIL	38,910	328	1,732	82,910	635	3,766
COMMERCIAL	28,503	398	2,121	28,503	398	2,212
MILITARY	2,323	60	318	2,323	60	318
TOTAL	-	788	4,175	-	1,094	6,301

Typical daily peak season emissions (lbs/day) are also given in Table 4-5. The peak season emissions for this source were determined using the seasonal adjustment factors and the number of activity days listed in Table 4-3. Total peak season CO emissions from aircraft were 4,175 lbs/day in the NAA and 6,301 lbs/day countywide.

MISCELLANEOUS NON-ROAD MOTOR VEHICLES/EQUIPMENT

Non-road motor vehicles and equipment accounted for 29,645 tons/year of CO within the NAA and 95,355 tons/year of CO countywide in 2002. This accounts for 97% of total non-road mobile emissions in the NAA.

As stated previously, annual and seasonal emissions for non-road vehicles were calculated using the EPA NONROAD 2002 Model. The NONROAD 2002 Model considered 200 different types of

equipment. Washoe County considered all the same categories as those inventories except for Logging Equipment (Chainsaws >4 HP) because there is no commercial logging within the CO NAA.

Please refer to Table 4-4 for a summary of annual and seasonal emissions. In addition, Appendix C.2 lists the equipment considered in this inventory for 2-stroke Gasoline Equipment, 4-stroke Gasoline Equipment, CNG Equipment, Diesel Equipment and LPG Equipment, along with the Area and Mobile Source (AMS) Source Classification Code (SCC). Unless otherwise noted the NAA emissions are assumed to be 80% of the countywide emissions.

NON-ROAD GASOLINE ENGINES

Non-Road gasoline engines accounted for 22,538 tons/year of CO emissions in the NAA and 28,172 tons/year in Washoe County. Non-Road gasoline vehicles accounted for approximately 91% of the total non-road mobile CO emissions (Figure 4-2). These emissions were subdivided into ten classes:

- Agricultural Equipment
- Airport Equipment
- Commercial Equipment
- Construction and Mining Equipment
- Industrial Equipment
- Lawn and Garden Equipment (Commercial)
- Lawn and Garden Equipment (Residential)
- Pleasure Craft
- Railroad Equipment
- Recreational Equipment

The emissions of each of the non-road gasoline source classes are described in more detail below.

AGRICULTURAL EQUIPMENT

Farming activity within Washoe County using gasoline-powered equipment was estimated to produce 4 tons/year of CO within the NAA and 18 tons/year of CO countywide in 2002. Emissions for the NAA are estimated to be only 20% of the County total since most of the agricultural activity is outside of the NAA, and what land is zoned agricultural within the NAA area is slowly being developed. Total peak season emissions were calculated as 9 lbs/day and 44 lbs/day in the NAA and the county, respectively.

AIRPORT EQUIPMENT

Airport Equipment was estimated to produce 36 tons/year of CO in the NAA and countywide in 2002. Peak CO season emissions for this source category were 168 lbs/day in the NAA and countywide.

2002 Annual CO Emissions for Non-Road Mobile, Gasoline Equipment within CO NAA (tons/year)

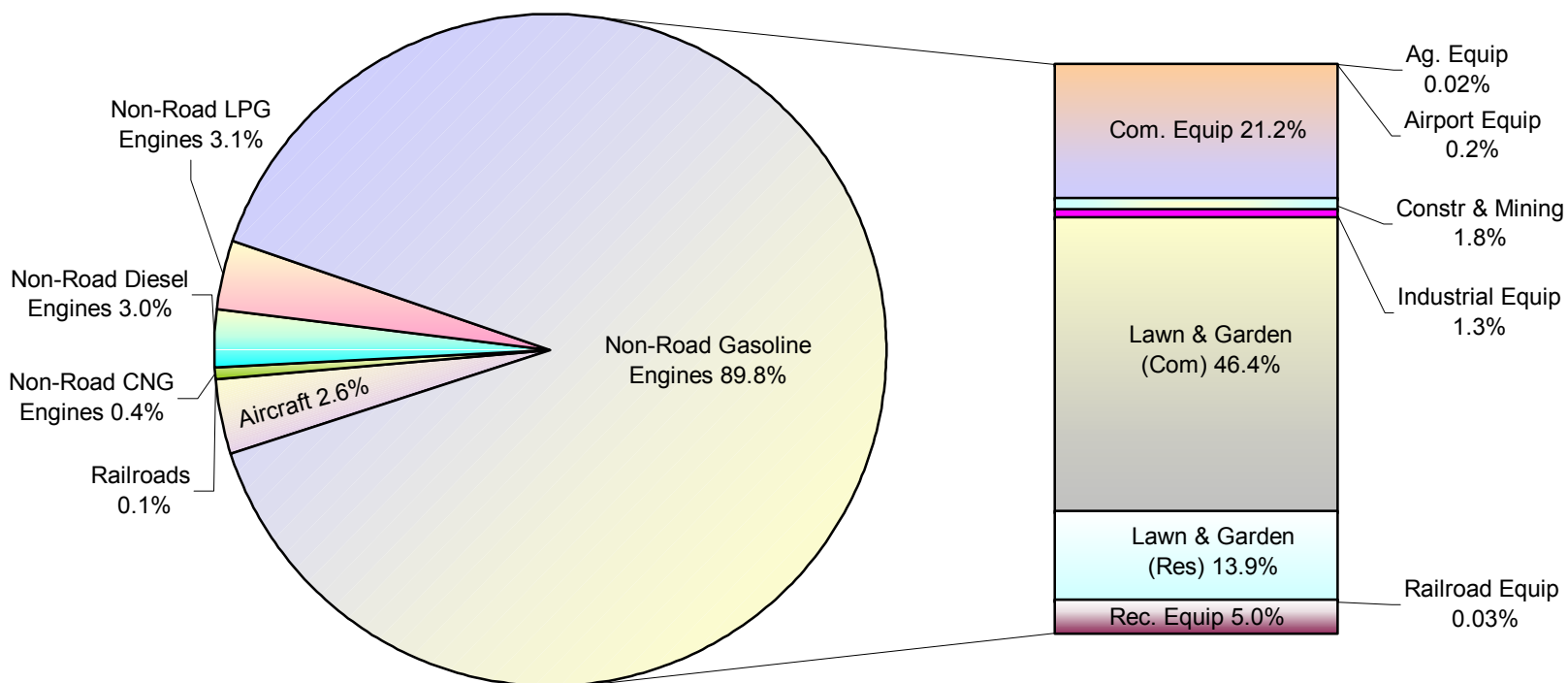


FIGURE 4-2

COMMERCIAL EQUIPMENT

In 2002, this source category produced approximately 4,769 tons/year of CO in the NAA and 5,961 tons/year of CO Countywide. Total peak CO season emissions for this source were 22,462 lbs/day in the NAA and 28,078 lbs/day countywide.

CONSTRUCTION AND MINING EQUIPMENT

Gasoline-fueled construction and mining equipment emitted 663 tons/year of CO in the NAA and 828 tons/year countywide in 2002. Emissions for the NAA were estimated at 50% since a lot of construction and most mining activities occurred outside of the NAA. Total peak season CO emissions for this source category were 1,368 lbs/day in the NAA and 2,737 lbs/day countywide.

INDUSTRIAL EQUIPMENT

In 2002, this source category produced approximately 291 tons/year of CO in the NAA and 363 tons/year of CO Countywide. Total peak CO season emissions for this source were 1368 lbs/day in the NAA and 1710 lbs/day countywide.

LAWN AND GARDEN EQUIPMENT (COMMERCIAL)

Emissions from commercial lawn and garden equipment in 2002 were 10,439 tons/year of CO in the NAA and 13,049 tons/year of CO countywide. Peak CO season emissions for this source were 28,692 lbs/day in the NAA and 35,865 lbs/day countywide.

LAWN AND GARDEN EQUIPMENT (RESIDENTIAL)

Emissions from residential lawn and garden equipment in 2002 were 3,133 tons/year of CO in the NAA and 3,917 tons/year of CO countywide. Peak CO season emissions for this source were 8,252 lbs/day in the NAA and 10,315 lbs/day countywide.

PLEASURE CRAFT

There are two major lakes in Washoe County where pleasure craft are used: Pyramid Lake and Lake Tahoe. Since the NAA does not contain a major lake, CO emissions from this source category in the NAA are estimated to be 0 tons/year. The countywide emissions are estimated at 2,590 tons/year. Peak CO emissions for this class were 0 lbs/day in the NAA and 5,828 lbs/day countywide.

RAILROAD EQUIPMENT

Railroad Equipment produced 6 tons/yr of CO in the NAA and 8 tons/yr of CO countywide in 2002. Peak ozone season emissions for this source category were 28 lbs/day in the NAA and 36 lbs/day countywide.

RECREATIONAL EQUIPMENT

Recreational equipment emissions were estimated at 1,123 tons/year of CO within the NAA and 1,404 tons/year countywide. This source class was further subdivided into six groups: off-road motorcycles, minibikes, ATVs, golf carts, snowmobiles and specialty vehicles. The Emissions for the NAA are 80% of the total county emissions minus the snowmobile emissions since there is

nowhere within the NAA to ride a snowmobile. The data for all recreational vehicles and the total annual emissions are listed in Appendix C.2.

Total peak season CO emissions for these sources were 2,772 lbs/day within the NAA and 3,465 lbs/day within the County.

NON-ROAD CNG ENGINES

Non-road CNG engines accounted for 74 tons/year of CO emissions in the NAA and 93 tons/year of CO countywide in 2002. These emissions were subdivided into four classes:

- Agricultural Equipment
- Commercial Equipment
- Construction and Mining Equipment
- Industrial Equipment

AGRICULTURAL EQUIPMENT

There was no farming activity within Washoe County using CNG-powered equipment in 2002.

COMMERCIAL EQUIPMENT

Commercial Equipment produced 39 tons/yr of CO in the NAA and 48 tons/year in Washoe County in 2002. Peak ozone season emissions for this source category were 212 and 265 lbs/day of CO in the NAA and countywide, respectively.

CONSTRUCTION AND MINING EQUIPMENT

There was no construction and mining activity within Washoe County using CNG-powered equipment in 2002.

INDUSTRIAL EQUIPMENT

Industrial Equipment produced 36 tons/year of CO in the NAA and 45 tons/year countywide. Total peak ozone season emissions for this source were 197 and 246 lbs/day of CO in the NAA and countywide, respectively.

NON-ROAD DIESEL ENGINES

Non-road diesel engines produced approximately 386 tons/year of CO in the NAA and 682 tons/year countywide in 2002. Within the NAA, approximately 4 percent of the total non-road mobile CO emissions are from non-road diesel vehicles and equipment (Figure 4-2). These emissions were subdivided into nine classes:

- Agricultural Equipment
- Airport Equipment
- Commercial Equipment
- Construction and Mining Equipment
- Industrial Equipment
- Lawn and Garden Equipment (Commercial)
- Pleasure Craft
- Railroad Equipment

■ Recreational Equipment

AGRICULTURAL EQUIPMENT

Emissions from this source category were approximately 3 tons/year of CO in the NAA and 15 tons/year of CO countywide in 2002. Only 20% of the entire county emissions for agricultural activity are considered to occur within the NAA. Total peak season emissions were 9 lbs/day in the NAA and 44 lbs/day countywide.

AIRPORT EQUIPMENT

Airport Equipment was estimated to produce 15 tons/year of CO in the NAA and countywide in 2002. Peak CO season emissions for this source category were 83 lbs/day in the NAA and countywide.

COMMERCIAL EQUIPMENT

In 2002, this source category produced approximately 56 tons/year of CO in the NAA and 70 tons/year of CO Countywide. Total peak CO season emissions for this source were 309 lbs/day in the NAA and 387 lbs/day countywide.

CONSTRUCTION AND MINING EQUIPMENT

Emissions of CO from diesel-fueled construction and mining equipment accounted for approximately 1 percent of all NAA emissions from the non-road mobile source category, and were estimated at 236 tons/year in the NAA and 473 tons/year for the entire county. The peak season emissions were estimated at 926 lbs/day in the NAA and 1,852 lbs/day countywide.

INDUSTRIAL EQUIPMENT

Emissions from diesel-fueled industrial equipment totaled 35 tons/year of CO in the NAA and 44 tons/year countywide. Total peak ozone season emissions for this source were 191 and 239 lbs/day of CO in the NAA and countywide, respectively.

LAWN AND GARDEN EQUIPMENT (COMMERCIAL)

Emissions from diesel lawn and garden equipment in 2002 were estimated at 35 tons/year of CO in the NAA and 44 tons/year countywide. Total peak season emissions for this category were 106 lbs/day in the NAA and 133 tons/year countywide.

PLEASURE CRAFT

There are two major lakes in Washoe County where pleasure craft are used: Pyramid Lake and Lake Tahoe. Since the NAA does not contain a major lake, CO emissions from this source category in the NAA are estimated to be 0 tons/year. The countywide emissions are estimated at 5 tons/year. Peak CO emissions for this class were 0 lbs/day in the NAA and 14 lbs/day countywide.

RAILROAD EQUIPMENT

Railroad Equipment produced 2 tons/yr of CO in the NAA and 3 tons/yr of CO countywide in 2002. Peak ozone season emissions for this source category were 14 lbs/day in the NAA and 17

lbs/day countywide.

RECREATIONAL EQUIPMENT

Recreational equipment emissions were estimated at 2 tons/year of CO within the NAA and 2 tons/year countywide. This source class was further subdivided into six groups: off-road motorcycles, minibikes, ATVs, golf carts, snowmobiles and specialty vehicles. The Emissions for the NAA are 80% of the total county emissions minus the snowmobile emissions since there is nowhere within the NAA to ride a snowmobile. The data for all recreational vehicles and the total annual emissions are listed in Appendix C.2.

Total peak season CO emissions for these sources were 6 lbs/day within the NAA and 7 lbs/day within the County.

NON-ROAD LPG ENGINES

Non-road LPG engines produced approximately 386 tons/year of CO in the NAA and 682 tons/year countywide in 2002. Within the NAA, approximately 4 percent of the total non-road mobile CO emissions are from non-road diesel vehicles and equipment (Figure 4-2). These emissions were subdivided into eight classes:

- Agricultural Equipment
- Airport Equipment
- Commercial Equipment
- Construction and Mining Equipment
- Industrial Equipment
- Lawn and Garden Equipment (Commercial)
- Railroad Equipment
- Recreational Equipment

AGRICULTURAL EQUIPMENT

There were no agricultural activities utilizing LPG engines in the NAA or the Washoe County in 2002.

AIRPORT EQUIPMENT

Airport Equipment was estimated to produce 4 tons/year of CO in the NAA and countywide in 2002. Peak CO season emissions for this source category were 24 lbs/day in the NAA and countywide.

COMMERCIAL EQUIPMENT

In 2002, this source category produced approximately 47 tons/year of CO in the NAA and 59 tons/year of CO Countywide. Total peak CO season emissions for this source were 258 lbs/day in the NAA and 323 lbs/day countywide.

CONSTRUCTION AND MINING EQUIPMENT

Emissions of CO from LPG-fueled construction and mining equipment accounted for less than 1 percent of all NAA emissions from the non-road mobile source category, and were estimated at 7

tons/year in the NAA and 14 tons/year for the entire county. The peak season emissions were estimated at 26 lbs/day in the NAA and 53 lbs/day countywide.

INDUSTRIAL EQUIPMENT

Emissions from LPG-fueled industrial equipment totaled 492 tons/year of CO in the NAA and 615 tons/year countywide. Total peak ozone season emissions for this source were 2,705 and 3,381 lbs/day of CO in the NAA and countywide, respectively.

LAWN AND GARDEN EQUIPMENT (COMMERCIAL)

Emissions from LPG lawn and garden equipment in 2002 were estimated at 12 tons/year of CO in the NAA and 15 tons/year countywide. Total peak season emissions for this category were 35 lbs/day in the NAA and 44 tons/year countywide.

RAILROAD EQUIPMENT

There was no LPG-fueled railroad equipment in use in the NAA and Washoe County in 2002.

RECREATIONAL EQUIPMENT

Recreational equipment emissions were estimated at 0 tons/year of CO within the NAA and 1 tons/year countywide. This source class was further subdivided into six groups: off-road motorcycles, minibikes, ATVs, golf carts, snowmobiles and specialty vehicles. The Emissions for the NAA are 80% of the total county emissions minus the snowmobile emissions since there is nowhere within the NAA to ride a snowmobile. The data for all recreational vehicles and the total annual emissions are listed in Appendix C.2.

Total peak season CO emissions for these sources were 1 lbs/day within the NAA and 2 lbs/day within the County.

RAILROADS

It is estimated that railroad operations in 2002 produced 28 tons/year of CO within the NAA, and 104 tons/year of CO countywide. Within the NAA, Railroad emissions account for approximately 0.1 percent of the total non-road mobile sources CO emissions. Railroad activity levels were obtained from Union Pacific Railroad. There are no coal-powered locomotives active in Washoe County. The activity data reported for diesel locomotives and emission calculations are contained in Appendix C.3. Annual emissions of CO are summarized in Table 4-6.

The peak season emissions for this source were determined using a uniform seasonal adjustment factor and number of activity days listed in Table 4-3. Total peak season emissions were 155 lbs/day in the NAA and 569 lbs/day countywide.

**TABLE 4-6
EMISSIONS DATA FOR DIESEL RAILROAD LOCOMOTIVES**

	Annual CO Emissions (tons/yr)	
	NAA	County
Union Pacific Railroad		
Freight Trains	11.8	87.1
Yard Locomotives	11.1	11.1
AMTRAK - Passenger Trains	5.4	5.4
TOTAL	28.3	103.6