REDESIGNATION DEMONSTRATION FOR THE MISSOULA, MONTANA, CARBON MONOXIDE NONATTAINMENT AREA

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INTRODUCTION

Missoula, Montana (MT), was designated as nonattainment for carbon monoxide (CO) with respect to the 8-hour averaged CO National Ambient Air Quality Standard (NAAQS) on March 3, 1978 by the U.S. Environmental Protection Agency (43 FR 8962).

Upon the enactment of the Clean Air Act (CAA) Amendments of 1990, Missoula was designated as moderate CO nonattainment with a design value of 9.6 parts per million (56 FR 56694, 56 FR 56790, and 40 CFR § 81.327). On November 6, 1991, the Missoula CO nonattainment area (NAA) was designated as moderate-1 (56 RF 56694). This designation required the initiation of a wintertime oxygenated fuel program that commenced on November 1, 1992.

The Missoula CO NAA was defined in the Federal Register, November 6, 1991 (56 FR 56794), as range (R) and township (T) sections (S): R19W T14N Sections 29 and 32; R19W T13N Sections 2, 5, 7, 8, 11, 14 through 24, and 26 through 34; R19W T12N Sections 4 through 7; and R20W T13N Sections 23 through 26, 35, and 36. This area is approximately 27 square miles (mi^2) in size.

The Missoula City-County Health Department (MCCHD) is the air quality regulatory agency responsible for the Missoula CO NAA and the redesignation process as authorized by the 1967 Montana Clean Air Act (Montana Code Annotated §75-2-112). The Montana Department of Environmental Quality (MDEQ) is assisting the MCCHD in this process.

REQUIREMENTS FOR REDESIGNATION TO NAAQS ATTAINMENT

The following conditions must be met before the U.S. Environmental Protection Agency (EPA) can redesignate an area from nonattainment to attainment:

1) The area has attained the NAAQS;
2) The area has a fully approved State Implementation Plan (SIP);
3) The area's improved air quality is due to permanent and enforceable emissions reductions resulting from the implementation of the applicable SIP;
4) The area has developed a maintenance plan that meets the requirements of the CAA section 175A; and
5) The area has met all of the requirements in Section 110 and Part D of the CAA and other applicable sections.

This document addresses the fourth item, the maintenance plan (Plan). A required element of the Plan is a maintenance demonstration showing that the emissions levels will remain below that required to attain the NAAQS for at least ten years beyond the date of the redesignation by the EPA. This maintenance demonstration compares the winter weekday (CO season day) emissions in the Missoula CO NAA between the 2000 base year and the projected emissions for the following years: 2005, 2010, 2015, and 2020. The earliest the EPA is expected to accept the redesignation request for Missoula redesignation is 2005; therefore, the period from 2005 to 2015 represents the maintenance period. To be conservative, the emissions projections for the year 2020 are estimated. All of the CO emission sources in the Missoula CO NAA are included in this analysis and the calculated vehicle emissions also factored the effects of the required wintertime inclusion of oxygen in gasoline (oxyfuel). The Missoula CO NAA contains the following six CO source categories:

- Nonutility Industrial Point Sources
- Natural Gas Combustion (Commercial and Residential)

- Nonroad Gasoline and Diesel Engine Exhaust
- Onroad Gasoline and Diesel Vehicle Exhaust
- Railroad Locomotive Exhaust
- Residential Wood Burning

The procedures to develop the 2000 base year winter weekday CO emissions from these source categories are documented in the *2000 Missoula, Montana, Carbon Monoxide Emission Inventory*.[1] The projected CO emissions are derived from these 2000 base year estimates. The 2000 base year inventory includes another CO source category, aviation exhaust, but this source is located outside the CO nonattainment area. Table 1 summarizes the estimated winter weekday CO emissions for the five years from the six source categories; the period from the year 2005 to 2015 is considered the maintenance period.

TABLE 1: CO SEASON DAY EMISSIONS IN KILOGRAMS FROM 2000 TO 2020 IN THE MISSOULA CO NAA

Source Category	2000 CO Daily Emissions (kg CO/ CO Day)[a, b]	2005 CO Daily Emissions (kg CO/ CO Day)	2010 CO Daily Emissions (kg CO/ CO Day)	2015 CO Daily Emissions (kg CO/ CO Day)	2020 CO Daily Emissions (kg CO/ CO Day)
Nonutility Industrial Point Sources	267.62	297.68	332.05	371.79	416.42
Natural Gas Combustion (Commercial and Residential)	458.12	479.76	508.52	535.55	562.18
Nonroad Gasoline and Diesel Engine Exhaust	4,562.50	5,170.68	5,538.62	5,880.67	6,313.94
Onroad Gasoline and Diesel Vehicle Exhaust	40,697.47	29,695.25	24,587.50	22,654.60	20,849.15
Railroad Locomotive Exhaust	27.56	31.43	34.94	38.92	42.71
Residential Wood Burning	5,542.89	5,296.28	5,027.16	4,796.48	4,598.85
Total	51,556.16	40,971.08	36,028.79	34,278.01	32,783.25
Difference From 2000 Base Year Emissions	0.00	10,585.08	15,527.37	17,278.15	18,617.28
Percentage Difference From 2000 Base Year Emissions (%)	0.00	20.53	30.12	33.51	36.41

a. The emissions for the year 2000 are the emissions attainment budget.
b. kg CO/CO Day = kilograms of CO per CO day (winter weekday).

Compared to the 2000 base year, the estimated CO season day emissions will be reduced by 20.5, 30.1, 33.5, and 36.4% for 2005, 2010, 2015, and 2020 analysis years, respectively. These results indicate the emissions levels will remain below that required attaining and maintaining the relevant NAAQS for at least ten years beyond the date of the redesignation by the EPA. Table 2 lists the percentage contribution from each source category to the CO season day emissions in the Missoula CO NAA for the five analysis years.

TABLE 2: PERCENTAGE CONTRIBUTION BY SOURCE CATEGORY TO THE CO SEASON DAY EMISSIONS FROM 2000 TO 2020 IN THE MISSOULA CO NAA

Source Category	2000 Percentage Contribution to CO Daily Emissions (%)	2005 Percentage Contribution to CO Daily Emissions (%)	2010 Percentage Contribution to CO Daily Emissions (%)[a]	2015 Percentage Contribution to CO Daily Emissions (%)	2020 Percentage Contribution to CO Daily Emissions (%)
Nonutility Industrial Point Sources	0.52	0.72	0.92	1.09	1.27
Natural Gas Combustion (Commercial and Residential)	0.89	1.17	1.41	1.56	1.71
Nonroad Gasoline and Diesel Engine Exhaust	8.85	12.62	15.37	17.16	19.26
Onroad Gasoline and Diesel Vehicle Exhaust	78.94	72.48	68.25	66.09	63.60
Railroad Locomotive Exhaust	0.05	0.08	0.10	0.11	0.13
Residential Wood Burning	10.75	12.93	13.95	13.99	14.03
Total	100.00	100.00	100.00	100.00	100.00

a. Variance may occur due to rounding conventions.

Table 3 lists the same results as Table 1, but in English units (avoirdupois pounds per day) using the 2.2046 as the conversion factor.

TABLE 3: CO SEASON DAY EMISSIONS IN POUNDS FROM 2000 TO 2020 IN THE MISSOULA CO NAA

Source Category	2000[a] CO Daily Emissions (PPD)[b, c]	2005 CO Daily Emissions (PPD)	2010 CO Daily Emissions (PPD)	2015 CO Daily Emissions (PPD)	2020 CO Daily Emissions (PPD)
Nonutility Industrial Point Sources	590.00	656.27	732.04	819.65	918.04
Natural Gas Combustion (Commercial and Residential)	1,009.97	1,057.68	1,121.08	1,180.67	1,239.38
Nonroad Gasoline and Diesel Engine Exhaust	10,058.49	11,399.28	12,210.44	12,964.53	13,919.71
Onroad Gasoline and Diesel Vehicle Exhaust	89,721.64	65,466.15	54,205.60	49,944.33	45,964.04
Railroad Locomotive Exhaust	60.76	69.29	77.03	85.80	94.16
Residential Wood Burning	12,219.86	11,676.18	11,082.88	10,574.32	10,138.62
Total	113,660.72	90,324.85	79,429.07	75,569.30	72,273.95
Difference From 2000 Base Year Emissions	0.00	23,335.87	34,231.65	38,091.42	41,386.77

a. The emissions for the year 2000 are the emissions attainment budget.

[b.] PPD = avoirdupois pounds per day.
[c.] Variance may occur due to rounding conventions.

The following sections describe the procedures used to calculate the CO emissions by the individual sources as outlined in the EPA *National Air Pollutant Emission Trends Procedures Document* (Procedures).[2] Growth factor data to project the 2000 base year CO emissions to the year 2010 are available in this trends document, State of Montana (state code = 30). Since data was not included for the years 2015 and 2020, linear regressions were performed to develop them. The reason linear regression was selected was when the available data was graphed using linear coordinates a straight line was formed. Linear regression is a method of estimating the expected value of one variable (growth factor) given the values of another variable (time).

Both the coefficient of determination (R^2) and adjusted R^2 were included in this report. The coefficient of determination indicates the percentage of the variation explained by the linear regression equation. In other words, it is the proportion of the variation in the dependent variable (growth factor) explained by the independent variable (time), which also measures the goodness of the model fit. A perfect fit would result in a R^2 value of 1.0. The adjusted R^2 is more appropriate than R^2 when comparing models (linear equations) with different numbers of paired data. All regression statistics are included in Appendix A.

NONUTILITY INDUSTRIAL POINT SOURCE CO EMISSIONS PROJECTIONS

1. IDENTIFICATION OF NONUTILITY INDUSTRIAL POINT SOURCES

Two industrial point sources were located in the Missoula CO NAA area during the 2000 base year: Conoco Distribution Facility and Roseburg Forest Products (formally Louisiana-Pacific Corporation). The EPA Aerometric Information Retrieval System (AIRS) codes for these sources were 30-063-0022 and 30-063-0002, respectively. Neither of these industrial sources was classified as a utility industrial point source. The appropriate staff was contacted at the MDEQ Air Resources Management Bureau, previously the Air and Waste Management Bureau, to verify whether these sources were expected to continue to operate through 2020. At this time, no change in the status of these sources was predicted.

2. CO EMISSIONS PROJECTIONS

Actual, not allowable, industrial point emission CO emissions were used for the projections. According to the EPA emission trend procedure document, the following method could be used to project the CO emissions from nonutility industrial sources using gross state product (GSP).[2]

A Bureau of Economic Analysis (BEA) document contained Montana gross state product through the year 2045 in millions of 1987 dollars.[3] However, more current Montana GSP information was available through the Global Insight Web site (http://www.globalinsight.com/) through State contractual agreements (Phil Brooks, Montana State Labor and Industry Department, September 7, 2004). This data was not delineated to the Standard Industrial Classification (SIC) code level, but reflected recent trends and events including “9/11.” Table 4 lists the available Montana GSP for the various years in billions of real 1996 chained-dollars; 1987 GSP was included for comparison.

TABLE 4: EXPECTED GROWTH IN MONTANA GROSS STATE PRODUCT: 2000, 2005, AND 2010

Year	Montana Gross State Product (billions of 1996 dollars)[a]	Montana Gross State Product (billions of 1987 dollars)[b]
2000	20.461	16.196
2005	23.100	17.521
2010	26.500	19.593

a. Obtained from the Global Insight Web site (http://www.globalinsight.com/).
b. Obtained from the Regional Projections to 2045. Volume 1, State; reported for comparison purposes only.[3]

Annual compound growth rates were also obtained for the following periods: 2009 – 2014 (2.6%), 2014 – 2019 (2.6%), and 2019 to 2024 (2.4%). From all of this information, the Montana GSP was calculated for the years 2015 and 2010, which was 30.1 and 34.2 in billions of 1996 dollars, respectively. Using this data, the following equation was used to project the GSP to the years of interest.

$$GF_Y = (GSP_Y)/(GSP_{2000})$$

GF_y	= Growth Factor for Year *y*
y	= Year: 2005, 2010, 2015, or 2020
GSP_y	= Gross State Product for Year *y*
GSP_{2000}	= Gross State Product for Base Year 2000

3. CO EMISSIONS ADJUSTMENTS

Adjustments to the projected emissions were permissible by assuming increased fuel efficiencies in the future.[2] These adjustments could be applied to the combustion sources within the industrial point source facilities. The CO emissions from the Conoco Distribution Facility did not occur from combustion, but during the loading of rail cars and trucks of distillate. Therefore, the future CO season day emissions from this nonutility industrial point source were not adjusted beyond incorporating the Montana GSP increases. The Roseburg Forest Products used wood waste as a combustion source for various boilers with natural gas as an auxiliary fuel source so efficiency adjustment factors (EAFs) were applied to this facility's CO season day emissions for the future years. Using the 2000 as the base year, the following equation was used.

$$EAF_y = CF_y / CF_{2000}$$

EAF_y	= Efficiency Adjustment Factor for Projection Year *y*
CF_y	= Consumption Factor for Projection Year *y*
y	= Year: 2005, 2010, 2015, or 2020
CF_{2000}	= Consumption Factor for Base Year 2000

In order to apply the efficiency factors, the amount of wood waste and natural gas used at this facility had to be determined; the information pertaining to these fuels from 1994 to 2002 are listed in the following table.

TABLE 5: ROSEBURG FOREST PRODUCTS WOOD WASTE AND NATURAL GAS CONSUMPTION: 1994 - 2002

Year	Total CO Emissions (tpy)[a, b]	Amount of Wood Consumed (tpy)	Wood CO Emissions (tpy)	Percentage of Total CO Emissions (%)	Amount of Natural Gas Consumed (MMCF)[c]	Natural Gas CO Emissions (tpy)	Percentage of Total CO Emissions (%)
1994	60.66	29,150	58.30	96.11	135.00	2.36	3.89
1995	51.86	24,770	49.54	95.53	131.60	2.32	4.47
1996	60.05	28,851	57.70	96.09	134.00	2.35	3.91
1997	63.47	30,746	61.49	96.88	113.00	1.98	3.12
1998	58.16	28,115	56.23	96.68	110.00	1.93	3.32
1999	65.75	24,869	61.34	93.29	105.00	4.41	6.71
2000	84.73	28,188	64.66	76.31	478.00	20.08	23.69
2001	82.56	27,614	63.68	77.13	459.50	18.88	22.87
2002	92.42	29,842	69.88	75.62	537.00	22.53	24.38

a. tpy = tons per year.
b. Due to rounding conventions, the total CO emissions may be calculated differently.
c. MMCF = One million (10^6) cubic feet.

During the last three years, 2000 to 2002, natural gas consumption dramatically increased from less than 6% in the previous years to more than 20%. The average for the last three years was 23.7%. To reflect this most recent trend, 24% of this industrial point projected CO emissions were multiplied by the natural gas EAFs to represent this fuel consumption and 76% of the emissions were multiplied by the corresponding renewable EAFs. Table 6 displays the available EAFs obtained from the Procedures document.

TABLE 6: AVAILABLE NATURAL GAS AND RENEWABLES EFFICENCY ADJUSTMENT FACTORS: 1999 - 2010

Year	Efficiency Adjustment Factors[a]	
	Natural Gas	Renewables
1999	0.976	0.979
2000	0.970	0.979
2002	0.943	0.979
2005	0.902	0.979
2007	0.879	0.957
2008	0.868	0.957
2010	0.845	0.957

a. Obtained from Table 6.2-4, National Air Pollutant Emission Trends Procedures Document.[2]

Factors were unavailable for the 2015 and 2020 analysis years so a linear regression was performed. The resulting natural gas factors were 0.782 and 0.720 (R^2 = 0.9980; adjusted R^2 = 0.9974) for the 2015 and 2020 analysis years, respectively. For the renewable category, the regression statistics were relatively poor (adjusted R^2 < 0.7000) so as a conservative estimate, the factor for the year 2010 (0.957) was applied for the two outlying years. These efficiency factors were applied after the Roseburg Forest Products CO emissions were projected using the Montana GSP information.

4. CO CONTROLS

No CO controls were applied to the future year CO emissions since none was expected except for the emissions limits regulated by State air quality permits. Exclusion of controls was also recommended by the EPA Procedures document.

NATURAL GAS COMBUSTION CO EMISSIONS PROJECTIONS

1. IDENTIFICATION OF NATURAL GAS COMBUSTION SOURCES

There were three types of natural gas combustion in the Missoula CO NAA during 2000: commercial, industrial, and residential. Commercial natural gas customers were non-manufacturing companies, organizations or agencies primarily involved in the wholesale or retail trade, agriculture, finance, forestry, government, insurance, real estate, transportation, and not directly engaged in other classes of service. Industrial customers were engaged primarily in a manufacturing process that either involved the extraction of raw materials from the earth or a change of raw unfinished materials into another form or product for heat, power, or chemical feedstock. For the 2000 base year Missoula CO emission inventory (E.I.), the industrial and commercial natural gas combustion emissions were combined since the same CO emission factor was used; therefore, the projected CO emissions from these two sources were also pooled.[1]

2. CO EMISSIONS PROJECTIONS

The projected CO emissions from the commercial/industrial natural gas combustion could be based on either commercial/industrial employment or population.[4, 5] Future estimates of the commercial/industrial employment for the State of Montana was only available for the year 2010.[6] As an alternative, the City of Missoula population growth was employed to project these emissions since the growth in the city population reflected local conditions.

The Montana Department of Transportation (MDT) provided the population data. This agency used this information as one of many surrogates to project the traffic volumes in the Missoula urban area. This traffic data was used later in this analysis to estimate the projected CO emissions from vehicle exhaust. The following table lists the City of Missoula population data to the year 2020. It should be noted the data for the 2000 base year was obtained from the U.S. Census Bureau Web site.[7]

TABLE 7: PROJECTIONS OF CITY OF MISSOULA POPULATION: 2000 - 2020

Year	City of Missoula Population	Percentage Growth From 2000 Base Year (%)
2000	57,053[a]	NA[b]
2005[c]	62,621	9.8
2010	68,731	20.5
2020	82,800	45.1

a. Data for this year was obtained from the U.S. Census Bureau Web site (http://factfinder.census.gov/servlet/DatasetMainPageServlet?_ds_name=DEC_1990_STF1_&_program=DEC&_lang=en).[7]
b. NA = Not Applicable.
c. The MDT provided the data for this and subsequent years.

A linear regression was performed on the available data to develop the percentage growth for the 2015 analysis year; the resulting utilized percentage was 32.8% (R^2 = 0.9970; adjusted R^2 = 0.9955).

To project the residential natural gas combustion, estimates could be based on either residential housing units or population growth.[4, 5] For this analysis, the emissions were projected using the growth in residential housing since more detailed information was available.

The MDT provided information pertaining to the growth in residences in the greater Missoula urban area; this data was organized by the U.S. Census Bureau tracts. Table 8 lists the MDT residential growth information for the 2005, 2010, 2015, and 2020 analysis years.

TABLE 8: MISSOULA AREA RESIDENTIAL HOUSING GROWTH FROM 2000 TO 2020 BY U.S. CENSUS BUREAU TRACT

U.S. Census Bureau Tract	Missoula Area Residential Housing Growth			
	2000 to 2005 (%)	2005 to 2010 (%)	2010 to 2015 (%)	2015 to 2020 (%)
1	1.67	1.72	2.36	1.65
2.01	4.13	4.00	4.87	3.66
2.02	20.39	17.58	15.74	12.92
3	0.14	2.12	2.70	2.03
4	4.32	4.14	5.61	3.76
5	0.96	2.58	4.14	2.41
7	0.83	0.82	6.50	0.76
8	3.58	6.74	3.28	6.11
9	8.48	7.82	8.21	6.70
10	2.07	7.57	1.59	6.93
11	0.07	1.33	5.06	1.25
12	1.06	2.96	3.93	2.76
13.01	7.62	6.81	7.70	5.92
13.02	9.74	8.61	8.67	7.29
14	3.79	3.89	5.55	3.55

The 2000 Missoula CO E.I. area contained the Missoula CO NAA, which was organized by a grid system. The Missoula CO NAA contained 27 grids and each grid was about 1 mi^2 in size. By determining the proportion of each Missoula CO NAA grid in each census tract, the MDT growth factors could be applied. These census tracts were irregularly shaped and overlapped more than one grid so these percentages were estimated. The following table lists the Missoula CO NAA grids, U.S. Census Bureau tracts, and the percentages of each CO NAA grid in the various census tracts.

TABLE 9: RELATIONSHIP BETWEEN MISSOULA CO NAA GRIDS AND U.S. CENSUS BUREAU TRACTS

Missoula CO NAA Grid[a, b]	U.S. Census Tract	Percentage of Grid Within Tract	Missoula CO NAA Grid	U.S. Census Tract	Percentage of Grid Within Tract
25	2.02	0.40	89	1	0.40
	14	0.60		2.01	0.10
36	1	0.30		3	0.31
	2.02	0.65		4	0.04
	14	0.05		5	0.15
48	1	0.62	90	1	0.65
	2.01	0.08		4	0.35
	2.02	0.30	91	4	1.00
51	1	0.10	97	9	1.00
	14	0.90	98	9	1.00
60	2.02	1.00	99	9	1.00
61	1	0.10	100	8	0.35
	2.01	0.85		10	0.65
	2.02	0.05	101	11	0.55
64	1	0.88		12	0.45
	14	0.12	102	1	0.03
73	2.02	1.00		4	0.32
74	2.01	0.90		5	0.65
	8	0.10	103	1	0.12
75	1	0.15		4	0.88
	2.01	0.82	110	9	1.00
	3	0.03	111	9	1.00
76	1	0.90	112	9	0.05
	2.01	0.10		13.01	0.95
77	1	1.00	113	10	0.40
84	2.02	0.75		13.01	0.60
	9	0.25	114	12	0.65
85	2.02	0.25		13.02	0.35
	9	0.75	115	4	0.50
86	2.02	0.30		5	0.22
	8	0.15		13.02	0.28
	9	0.55	126	13.01	0.80
87	2.01	0.08		13.02	0.20
	8	0.92	127	13.01	0.10
88	2.01	0.20		13.02	0.90
	3	0.20	128	4	0.20
	7	0.60		13.02	0.80
			139	13.01	0.25
				13.02	0.75

a. Missoula CO NAA = Missoula CO nonattainment area.
b. These grid numbers were developed for the 2000 Missoula E.I.

The CO emissions from residential natural gas consumption in the Missoula CO NAA were extracted from the 2000 base year inventory on a grid basis. These emissions were projected based on the growth of residences in the census tracts and the proportion of the Missoula CO NAA grid in that tract.

3. CO EMISSIONS ADJUSTMENTS

Efficiency adjustments factors (EAFs) were applied to both types of natural gas combustion by assuming increase fuel efficiencies for the future years.[2] Using 2000 as the base year, the following equation was used.

$$EAF_y = CF_y / CF_{2000}$$

EAF_y = Efficiency Adjustment Factor for Projection Year y
CF_y = Consumption Factor for Projection Year y
y = Year: 2005, 2010, 2015, or 2020
CF_{2000} = Consumption Factor for Base Year 2000

The available EAFs for these two CO sources of natural gas combustion are listed in the following table; these values were obtained from Table 6.2-5 from the EPA Procedures document.

TABLE 10: AVAILABLE COMMERCIAL/INDUSTRIAL AND RESIDENTIAL NATURAL GAS EFFICENCY ADJUSTMENT FACTORS: 1999 - 2010

Year	Efficiency Adjustment Factor	
	Commercial/Industrial	Residential
1999	1.017	1.005
2000	1.012	0.995
2002	1.003	0.973
2005	0.993	0.949
2007	0.988	0.933
2008	0.983	0.930
2010	0.981	0.916

Since data were unavailable for the 2015 and 2020 outlying years, a linear regression was performed on both sets of data to develop the appropriate factors. The resulting EAFs for the commercial/industrial were 0.961 and 0.945 (R^2 = 0.9809; adjusted R^2 = 0.9771) for the 2015 and 2020 analysis years, respectively. The corresponding residential natural gas CO growth factors were 0.871 and 0.831 (R^2 = 0.9893; adjusted R^2 = 0.9871). These factors were applied after the CO emissions were projected by the methods described in the previous section.

4. CO CONTROLS

No CO controls were applied to either set of future year CO emissions since none were recommended by the EPA trends procedure document.

NONROAD GASOLINE AND DIESEL ENGINE CO EMISSIONS PROJECTIONS

1. IDENTIFICATION OF NONROAD GASOLINE AND DIESEL ENGINE SOURCES

Ten equipment classes potentially composed the nonroad gasoline and diesel engine CO emissions: Airport Service, Agricultural, Commercial Marine Vessels, Construction, Industrial, Lawn and Garden, Light Commercial, Logging, Recreational, and Recreational Marine. For the 2000 Missoula E.I., two equipment classes, Commercial and Recreational Marine, were not included since no water bodies existed within the area. Winter recreational nonroad (snowmobiles) engine activities also did not occur inside the inventoried area. In the Missoula CO NAA, three nonroad equipment were also removed as sources since these activities did not exist in this urban area of interest: Agricultural, Airport Service, and Logging. Table 11 lists the remaining four classes and corresponding examples of equipment.

TABLE 11: FOUR NONROAD EQUIPMENT CLASSES WITH EXAMPLES IN THE MISSOULA CO NAA

Equipment Class	Examples of Equipment
Construction	Scrapers, Rollers
Industrial	Forklifts, Lifts
Lawn and Garden (Commercial and Residential)	Snowblowers, Lawnmowers
Light Commercial	Air and Gas Compressors, Generators

The CO emissions for this maintenance demonstration focused on a winter weekday so lawnmowers (Lawn and Garden category) were not considered a source.

2. CO EMISSIONS PROJECTIONS

The EPA requested the draft NONROAD2004 emissions model (4/1/2004) be used for this maintenance demonstration. This model was not used for the 2000 Missoula CO E.I. so the 2000 base year CO emissions from this source category documented in this report were not identical to the E.I. The EPA believed the CO emission estimates are more accurate from the NONROAD model for the attainment year (2000) and future projected years than the method used for the E.I. The application of this model was supported by the corresponding user's manual.[8]

The NONROAD model predicts emissions from all nonroad equipment except from commercial marine, locomotive, and aircraft. This model includes more than 80 basic and 260 specific types of nonroad equipment and further delineates the equipment types by horsepower. Four different fuel types are also considered: gasoline, diesel, compressed natural gas, and liquefied petroleum gas.

Numerous emissions reports are available including by county, equipment type, and horsepower. For this demonstration, the CO emissions were calculated for the remaining four equipment classes with all fuel types in the Missoula County for a winter weekday for the five analysis years. Due to lack of time, the default NONRAOD2004 data input files were applied involving the following parameters: equipment population, average load factor, available power (horsepower), activity in hours per year, and emission factor with deterioration and/or new standards.

These CO emissions were adjusted to the Missoula CO NAA based on an estimated CO NAA population compared to the Missoula County. Through coordination with EPA, the percentage of people in the Missoula CO NAA to the Missoula County was approximately 67.14%; this percentage remained constant with time (personal communications, Tim Russ, EPA Region VIII, October 14, 2004). This fraction was developed using the 2000 U.S. Census Bureau population statistics for the City of Missoula, East Missoula, Orchards Homes, and Missoula County.[1] The Missoula CO NAA contains these three communities although the boundaries of the first two towns are outside the NAA so this is a gross estimate. The projected Missoula County populations were obtained from the Department of Commerce, Census and Economic Information Center Web site (http://www.ceic.commerce.state.mt.us/Demog/project/NPAallcounties90-25_0104.pdf).

3. CO EMISSIONS ADJUSTMENTS

No emissions adjustments were imposed on the nonroad equipment CO emissions in the Missoula CO NAA.

4. CO CONTROLS

No explicit CO controls were applied since the previously listed growth factors already incorporated three nonroad control programs: (1) Phase I of the compression ignition standards for diesel engines; (2) Phase I of the spark ignition standards for gasoline engine; and (3) reformulated gasoline.

ONROAD GASOLINE AND DIESEL MOTOR VEHICLE EXHAUST CO EMISSIONS PROJECTIONS

1. IDENTIFICATION OF ONROAD GASOLINE AND DIESEL MOTOR VEHICLE EXHAUST SOURCES

The origin of the CO emissions from the onroad gasoline and diesel motor vehicle exhaust in the Missoula CO NAA was from the following roads (facilities): paved local, collector, minor arterial, principal arterial, interstate, and interstate ramp. For simplicity, the interstate and interstate ramp data were combined to represent one facility class.

2. CO EMISSIONS PROJECTIONS

Extensive information was required to calculate the amount of CO emitted from vehicles while traveling on the paved roadways in the Missoula CO NAA. For consistency, this information was also utilized for two other projects involving the Missoula urban area: the

Missoula intersection CO hot spot analysis of the Brooks Street, South Avenue, and Russell Street, and the 2004 update of the Missoula transportation conformity.[9, 10]

Mobile carbon monoxide emission factors were developed using the latest EPA mobile emissions model, MOBILE6.2 (dated 09/24/03), supported by the user's guide and technical documentation.[11, 12] The CO emission factors for the 2000 base year were developed for the 2000 Missoula CO E.I. This document also provided the majority of the information to calculate the factors for the outlying years.

The Urban Planning Section, MDT, used a transportation model called TransCAD (version 4.5) to develop most of traffic information for this demonstration. This model stored important characteristics of the Missoula area facility transportation network supported by Geographic Information Systems (GIS) capabilities. For each analysis year except for 2020, the entire area transportation network was incorporated into the model including any changes to the network during the entire analysis period (additional roads, etc.). Unfortunately, data were unavailable for the 2020 analysis year, but the MDT did generate data for the year 2025 that was used for the Missoula transportation conformity analysis. Therefore, the required data was developed as discussed below and the data were carefully reviewed.

The TransCAD model generated the vehicle travel speeds, road lengths, and annual average daily traffic (AADT) for each facility in the Missoula CO NAA for the following years: 2000, 2005, 2010, 2015, and 2025. For simplification, AADT was replaced by the average daily traffic (ADT) acronym. The ADTs and corresponding road lengths (miles) were multiplied together to compute the vehicle miles traveled (VMT). The VMTs were converted into the metric system, vehicle kilometer traveled (VKT).

Traffic volumes vary with the season of the year. To adjust to the winter season, all of the VKTs were adjusted to the winter weekday by multiplying the data with the appropriate CO season day correction factor listed in Table 12. These factors were developed for the 2000 Missoula CO E.I. and applied regardless of the analysis year.

TABLE 12: CO SEASON DAY CORRECTION FACTORS

Facility	CO Season Day Correction Factor
Paved Local	1.0000
Collector	1.0384
Minor Arterial	0.9472
Principal Arterial	0.9530
Interstate + Interstate Ramp	0.7309

After evaluating combined interstate/interstate ramp facility VKTs, the data for the year 2005 was different. This difference was not noticed previously since the hot spot intersection analysis focused only arterials and the transportation conformity investigation did not use 2005 as an analysis year. The VKTs for this combined road class were lower than the corresponding VKTs for the year 2000; the VKTs should have increased with time. Fortunately, this combined facility class contributed less than nine percent of the total CO season day VKTs, regardless of the analysis year. Therefore, due to lack of time, these parameters were estimated.

Two methods were used to determine the VKTs for these two facilities, linear regression and mathematical averaging, and the selection of the VKTs depended upon the outcome of the computations; the MDT supported this approach. The same selection process was also used to derive the VKTs for all of the facilities for the 2020 analysis year.

A linear regression was performed to develop the 2005 interstate VKTs from the available interstate VKT data (2000, 2010, 2015, and 2025) and the regression statistics were relatively poor (R^2 = 0.8420; adjusted R^2 = 0.7630), so the average of the 2000 and 2010 interstate VKTs was calculated and applied in this demonstration. To the determine the ramp VKTs, the regression statistics were better using all of the available ramp VKT data (R^2 = 0.9272; adjusted R^2 = 0.8909) so the calculated 2005 ramp VKTs using the linear regression equation was used.

To estimate the VKTs for the 2020 analysis year, the same methods were employed as used to estimate the invalid VKT data for the 2005 analysis year. A linear regression was performed to develop the VKTs for all of the roads except for the interstate (all R^2 and adjusted R^2 were greater than 0.90 and 0.88, respectively). The interstate VKTs were obtained from the average of the 2015 and 2025 interstate VKTs since the regression statistics were relatively weak (R^2 = 0.8420; adjusted R^2 = 0.7630). Table 13 lists the CO season day VKTs by facility by analysis year; the 2025 VKTs are provided for reference only.

TABLE 13: CO SEASON DAY VKTS BY FACILITY BY YEAR IN THE MISSOULA CO NAA

Facility	Analysis Year					
	2000	2005	2010	2015	2020[a]	2025[b]
Paved Local	257,890.57	258,636.85	310,855.47	336,437.39	372,941.50	410,245.81
Collector	237,684.47	250,778.48	272,093.68	323,665.91	336,284.05	360,311.53
Minor Arterial	309,919.67	330,714.43	349,114.43	359,887.19	416,647.39	465,066.04
Principal Arterial	479,352.53	535,839.14	551,852.40	589,198.64	645,182.30	696,511.17
Interstate	134,003.56	139,892.81[c]	145,782.06	190,116.62	194,128.30[d]	198,139.94
Interstate Ramp	11,978.74	12,764.06[e]	12,910.45	15,706.03	16,488.52	17,890.48
Total	1,430,829.54	1,528,625.77	1,642,608.49	1,815,011.78	1,981,672.06	2,148,164.97

a. For the year 2020, all VKTs were developed using linear regression with all of the available data, except for interstate. In this case, the average of the VKTs for the years 2015 and 2020 was used.
b. Provided for reference purposes only.
c. Average of the 2000 and 2010 interstate VKTs.
d. Computed using linear regression with all of the available data.

From the 2000 base year, the CO season day VKTs increased about 6.8, 14.8, 26.9 and 38.5% for the 2005, 2010, 2015, and 2020 analysis years, respectively.

In order to use MOBILE6.2 model, characterization of the vehicle mix was required. The same 2000 Missoula County registration data used for the 2000 Missoula CO E.I. was used for all future year vehicle mix. Other MOBILE6.2 model commands were the VMT BY FACILITY, AVERAGE SPEED, and VMT FRACTIONS. This model defined a facility as interstate, interstate ramp, arterial/collector or local. The AVERAGE SPEED command was used so the VMT BY FACILITY and SPEED VMT commands were unnecessary.

An overall average vehicle speed was computed for each road type and year for the entire Missoula CO NAA. These facility speeds were used with the AVERAGE SPEED command to calculate the CO emission factors. It should be noted that the MOBILE6.2 model ignored the inputted local road speeds with the AVERAGE SPEED command and applied a default 12.9 miles per hour (mph) model to compute the local road CO emission factors. The vehicle speeds for the combined interstate/ramp facility had to be computed for MOLBILE6.2 input using the following equation.

$$Interstate\ Non\text{-}Ramp = \left(\frac{1 - Ramp\ \ VKT\ Fraction}{(1/Freeway\ Speed - Ramp\ \ VKT\ Fraction/Average\ Ramp\ Speed)}\right)$$

After evaluating the resulting interstate/ramp speed, the data for the year 2005 was again different. This combined facility class travel speeds were unusually high. To estimate the 2005 interstate/interstate ramp travel speed, the average of the data from the 2000 and 2010 analysis years was used. The application of linear regression would have been inappropriate since the vehicle speed is not linear with time. Vehicle speeds are affected by the amount of traffic (VKTs), but also influenced by the road network that changed with time due to the implementation of transportation projects.

As conservative estimates, the 2020 travels speeds for each facility were the average of the corresponding facility 2015 and 2025 travel speeds. Appendix A contains all of the regression statistics. The following table lists the vehicle speeds; the 2025 speeds are listed for informational purposes only.

TABLE 14: AVERAGE TRAVEL SPEED BY FACILITY AND ANALYSIS YEAR IN THE MISSOULA CO NAA

Facility	Analysis Year					
	2000 (kph, mph)[a]	2005 (kph, mph)	2010 (kph, mph)	2015 (kph, mph)	2020 (kph, mph)	2025 (kph, mph)[b]
Local[c]	31.1, 19.3	31.2, 19.4	30.1, 18.7	29.5, 18.3	28.5, 17.7[d]	27.5, 17.1
Collector	40.2, 25.0	39.1, 24.3	38.1, 23.7	35.2, 21.9	34.1, 21.2	32.8, 20.4
Minor Arterial	41.0, 25.5	40.4, 25.1	38.3, 23.8	37.3, 23.2	34.8, 21.6	32.0, 19.9
Principal Arterial	43.3, 26.9	42.8, 26.6	39.6, 24.6	37.2, 23.1	34.3, 21.3	31.2, 19.4
Interstate + Interstate Ramp	56.7, 35.2	NA[e]	48.1, 29.9	61.2, 38.0	NA	56.2, 34.9
Interstate Ramp	44.4, 27.6	NA	43.9, 27.3	42.3, 26.3	NA	40.9, 25.4
Resulting Interstate[f]	58.1, 36.1	53.3, 33.1[g]	48.4, 30.1	63.6, 39.5	60.8, 37.8[g]	58.1, 36.1

a. kph = kilometers per hour, mph = miles per hour.
b. The 2025 travel speeds were listed in this table for informational purposes only.
c. MOBILE6.2 used a 12.9 default vehicle speed for the Local roads with the AVERAGE SPEED command.
d. Estimated by averaging the travel speeds from 2015 and 2025 analysis years.
e. The MDT speed data for the interstate and ramp facilities were questionable for 2005 and replaced (refer to footnote "g").
f. Calculated using the previous equation.
g. Estimated by averaging the Resulting Interstate travel speeds from bracketed analysis years.

The CO emission factors developed by the MOBILE6.2 model were dependent on the vehicle travel speeds, but were also affected by other factors such as the sulfur content in gasoline. This parameter changed with time due to the Tier II/sulfur regulations.[13] Any change in the oxygen content in gasoline would require changes to the air pollution control regulations, an unlikely event.[14] The FUEL PROGRAM and OXYGENATED FUELS commands were included and the "Conventional Gasoline West" category was selected as the fuel program. The change in the gasoline sulfur content over time is listed in Table 15 in addition to other gasoline parameters.

TABLE 15: OXYGENATED FUEL MARKET SHARE WITH OXYGEN CONTENT, AND SULFUR CONTENT OF GASOLINE USED IN THE MOBILE6.2 MODELING

Analysis Year	Oxygenated Fuels				Sulfur Content Tier 2 (ppm)[a]
	Ether Blend Market Share (%)	Alcohol Blend Market Share (%)	Average Oxygen Content Of Ether Blend Fuels (%)	Average Oxygen Content Of Alcohol Blend Fuels (%)	
2000	0.0	100.0	0.0	2.7	300
2005	0.0	100.0	0.0	2.7	160
2010	0.0	100.0	0.0	2.7	30
2015	0.0	100.0	0.0	2.7	30
2020	0.0	100.0	0.0	2.7	30

a. ppm = parts per million.

The input to the command, VMT FRACTION, for each facility and analysis year were developed from the data obtained from the EPA national defaults and the MDT Traffic Data Collection Section for the Missoula urban area. The Table 4.1.2 in the EPA technical guidance was applied for the light-duty vehicles categories (LDV, LDVT1, LDT2, LVDT, and LTDV4). These national defaults represented the month of January and varied by year. Values were selected based on the analysis year (2000, 2005, 2010, 2015 or 2020). The MDT Traffic Data Collection Section developed heavy-duty vehicle fractions representative for 2000 for all of the facilities in the Missoula urban area except for interstate ramps. By incorporating both sets of the data, the VMT fractions were developed for the all analysis years. This procedure was reviewed and accepted by a Federal Highway Administration (FHWA) employee (Jim Carlin, MDEQ Air Quality Specialist, personal communications, Jeff Houk, FHWA, February 19, 2004). It should be noted that the motorcycle fraction for all of the analysis years was set to zero since climatic conditions in Missoula during the wintertime are rarely conducive towards this mode of transportation.

The effects of the weekday and weekend vehicle activities such as the number of starts per day were unknown, and the daily and diurnal activities such as the soak distribution/activity were also not included as model inputs due to lack of data. In these cases, the model defaults were applied.

State vehicle emissions programs also had to be considered including inspection and maintenance, and anti-tampering. Neither of these programs existed in Montana during 2000 nor projected to be established in the future.[15]

External environmental conditions were also required for model input including the month of analysis, absolute humidity, and altitude. The month of January was selected to present the CO season. The model defaults were applied for the absolute humidity in addition to other parameters such as the solar load that influenced the use of the vehicle air-conditioner since the period of interest was the wintertime. For clarification, high humidity during periods of high temperatures increases the use of air-conditioning. For the altitude command, the low altitude was selected since the EPA does not consider the altitude of the Missoula County as high (40 CFR § 86.091-30).

The ambient temperature data had to be calculated from the period selected for the attainment demonstration. The MCCHD selected the time period from 1999 through 2002 for the Missoula CO maintenance demonstration. This period contained eight quarters of CO monitoring data since monitoring was conducted from January to March, and October through December. The minimum and maximum temperatures were determined from the days within this period that had the ten highest 8-hour CO concentrations. An EPA Region VIII staff was contacted for verification of the dataset (personal communications, Kerri Fielder, EPA Region VIII, March 3, 2004). If the 8-hour CO concentration occurred over two consecutive days, the ambient temperature data from both days were included for the final calculations. Table 16 lists the dates, CO concentrations, and daily minimum and maximum ambient temperatures measured coinciding with the Missoula CO maintenance demonstration at the Missoula International Airport (MIA) collected by the National Weather Service (NWS).[16]

TABLE 16: TEN HIGHEST 8-HOUR CO CONCENTRATIONS, AND DAILY MINIMUM AND MAXIMUM AMBIENT TEMPERATURES RECORDED AT MIA DURING THE 1999 TO 2002 MISSOULA CO MONITORING PERIOD

Year	Month	Day (Sampling Period)[a]	8-Hour Averaged CO Concentration (ppm)[b]	Daily Minimum Temp. (F)[c]	Daily Maximum Temp. (F)
2001	January	4 (1800 – 0000)	5.5	20.0	38.0
		5 (0100)		27.0	47.0[d]
1999	January	6 (1700 – 0000)	4.9	31.0	39.0
2002	November	7 (1700 – 0000)	4.6	20.0	49.0
1999	January	11 (1300 – 2000)	4.4	31.0	44.0
2000	December	27 (1500 – 2200)	3.9	20.0	35.0
2001	January	3 (1800 – 0000)	3.9	14.0	28.0
		4 (0100)		20.0	38.0
2001	November	14 (1800 – 0000)	3.9	33.0	56.0[d]
		15 (0100)		26.0	53.0
2001	November	16 (1800 – 0000)	3.8	30.0	50.0
		17 (0100)		35.0	46.0
1999	November	11 (1900 – 0000)	3.8	35.0	56.0
		12 (0100 - 0200)		33.0	73.0[d]
2001	January	10 (1800 – 0000)	3.7	15.0	30.0
		11 (0100)		12.0	27.0

a. Sampling period in military hours: midnight = 0000.
b. ppm = parts per million.
c. F = Fahrenheit.
d. Temperature extreme for the month.

The overall average minimum and maximum temperatures were 25.1 and 44.3 degrees Fahrenheit (F), respectively. Table 17 lists the MOBILE6.2 commands and corresponding model inputs. The application of MOBILE6.2 defaults listed in this table generally indicated the 2000 Missoula County vehicle registration data did not contain sufficient information pertaining to those parameters and the corresponding MOBILE6 guidance recommended the use of defaults in these cases.

TABLE 17: MOBILE6.2 COMMANDS AND INPUTS TO CALCULATE THE CO EMISSION FACTORS

MOBILE6.2 Command	User Input Command	MOBILE6.2 Input
Absolute Humidity (& Other Air-conditioner Variables)	No	Defaults; Unimportant for Wintertime Conditions
Altitude	Yes	User Input: Low (1)
Anti-Tampering Program	No	Not Used
Average Speed	Yes	User Input; Varied
Calendar Year	Yes	User Input: 2000, 2005, 2010, 2015, and 2020
Diesel Sales Fractions	No	Defaults
Distribution of Vehicle Registration	Yes	2000 Missoula County Vehicle Registration; MOBILE5b Utility Assisted
Evaluation Month	Yes	User Input; January
Fuel Program	Yes	User Input; Conventional Gasoline West (3)
Fuel Reid Vapor Pressure (RVP)	Yes	User Input; 12.5
Inspection/Maintenance Program	No	Not Used; None Existed and None Expected
Mileage Accumulation Rates	No	Defaults
Minimum/Maximum Temperature	Yes	User Input: 25.1 44.3
Natural Gas Fraction	No	Defaults; Very Insignificant Fraction
Oxygenated Fuels	Yes	User Input; Variable Depending on Year (Table 15)
Soak Distribution/Activity	No	Defaults
Speed VMT[a]	No	Replaced by AVERAGE SPEED Command
Starts/Day or Distribution During the Day	No	Defaults
Sulfur Content	Yes	Defaults
VMT By Facility	No	Replaced by AVERAGE SPEED Command
VMT Fractions	Yes	User Input
Weekday/Weekend Information	No	Defaults

a. VMT = vehicle miles traveled.

The resulting CO emission factors were in grams per mile (g/mi.) and were converted into grams per kilometer (g/km) as listed in Table 18. Each factor was multiplied with the applicable VKT data and the amount of CO (kilograms) emitted by the vehicles for a CO season day was determined on each road type for each analysis year within the Missoula CO NAA.

TABLE 18: MOBILE CO EMISSION FACTORS BY FACILITY BY YEAR

Facility	Analysis Year									
	2000		2005		2010		2015		2020	
	(g/mi.)[a]	(g/km)[b]	(g/mi.)	(g/km)	(g/mi.)	(g/km)	(g/mi.)	(g/km)	(g/mi.)	(g/km)
Local[c]	46.855	29.115	31.712	19.706	24.623	15.300	20.607	12.805	17.387	10.804
Collector	46.483	28.884	31.921	19.835	24.490	15.218	20.516	12.748	17.236	10.710
Minor Arterial	46.363	28.809	31.714	19.707	24.398	15.161	20.272	12.597	17.117	10.636
Principal Arterial	45.802	28.461	31.351	19.481	24.244	15.065	20.253	12.585	17.124	10.641
Interstate + Interstate Ramp	41.366	25.704	28.129	17.479	21.135	13.133	17.764	11.038	14.681	9.123

a. g/mi. = grams per mile.
b. g/km = grams per kilometer.

Compared to the 2000 base year, the mobile CO season day emission factors decreased over 30, 47, 55 and 62% by the 2005, 2010, 2015, and 2020 analysis years, respectively.

3. CO EMISSIONS ADJUSTMENTS

No CO emissions adjustments were applied to the future year CO emissions besides those integrated into the MOBILE6.2 modeling as imposed by the Tier II/sulfur regulations.

4. CO CONTROLS

No CO controls were applied to the future year CO emissions besides those integrated into the MOBILE6.2 modeling such as the Tier II/sulfur regulations.

RAILROAD LOCOMOTIVE EXHAUST CO EMISSIONS PROJECTIONS

1. IDENTIFICATION OF RAILROAD LOCOMOTIVE EXHAUST SOURCES

During 2000, the Burlington Northern and Santa Fe Railway Company (BNSF) generated the primary rail activity in the Missoula CO NAA. However, the Montana Rail Link (MRL) managed all of the trains including those operating under the BNSF through contract agreements. The Smurfit-Stone Container Corporation also used the MRL railroads to transfer materials in the NAA during the same year. Two locomotive activities occurred in the Missoula CO NAA: line haul and yard (or switch).

2. CO EMISSIONS PROJECTIONS

The MRL was contacted to provide the projected locomotive activities from both line haul and switch yard locomotives for the 2005, 2010, 2015, and 2020 future years; however, this company was unable to provide any information. Therefore, the growth factors for the railroad transportation in the EPA Procedures document was used as listed in the following table; these data were applicable for both haul line and switch yard activities.

TABLE 19: AVAILABLE MONTANA RAILROAD TRANSPORTATION GROWTH FACTORS: 1999 - 2010

Year	Montana Railroad Transportation Growth Factors
1999	1.199
2000	1.249
2002	1.322
2005	1.433
2007	1.500
2008	1.533
2010	1.600

Data was unavailable for the 2015 and 2020 outlying years so a linear regression was performed with the existing data to derive the data for this year. The resulting growth factors were 1.787 and 1.967 (R^2 = 0.9983; adjusted R^2 = 0.9980) for the 2015 and 2020 analysis years, respectively. To determine the growth of the CO emissions from the 2000 base year, the following equation was applied.

$$GAF_Y = (GF_Y)/(GF_{2000})$$

GAF_y	= Growth Adjustment Factor for Year *y*
y	= Year: 2005, 2010, 2015, and 2020
GF_y	= Growth Factor for Year *y*
GF_{2000}	= Growth Factor for Base Year 2000

For each outlying year (*y*), the resulting GAF_y was multiplied to the 2000 CO season day emissions for each railroad locomotive activity within the Missoula CO NAA to derive the projected emissions for the outlying years, regardless of the locomotive activity.

To determine the CO emissions from the Smurfit-Stone activity, the appropriate Missoula staff was contacted to provide the relevant information. Due to the uncertainties of the future for the Missoula mill, the same activities and CO emissions documented in the 2000 Missoula CO E.I. were applied to represent all future analysis years since the demand for corrugated packaging continues to decline.

3. CO EMISSIONS ADJUSTMENTS

No emissions adjustments were made to the projected CO emissions from any of the locomotive functions.

4. CO CONTROLS

In 2003, the MRL employed less than 1,000 employees according to the company Web site (http://www.montanarail.com/inside_mrl.htm). This defined the MRL as a small railroad and therefore, exempt from the emissions standards for locomotives.[17, 18] Emissions standards would have been enforceable if the MRL employed more than 500 and 1,500 people on their switch yard and line haul railroads, respectively. Employment was not projected to increase to force the implementation of the locomotive standards through the 2020 analysis year (Claude Van Winkle, personal communications, December 8, 2003).

RESIDENTIAL WOOD BURNING CO EMISSIONS PROJECTIONS

1. IDENTIFICATION OF WOOD BURNING COMBUSTION SOURCES

The MCCHD initiated the regulation of residential wood burning in the Missoula urban area through the amendments and revisions of the Missoula City-County Air Pollution Control Program.[13] The 2000 Missoula CO E.I. calculated the CO emissions from eight types of wood burning devices: Fireplace, Catalytic Phase II, Conventional (pre-1986), Non-catalytic Pre-phase I (pre-1988), Non-catalytic Phase I, Non-catalytic Phase II, Masonry Heater, and Pellet Stove. According to the MCCHD regulations, Conventional and Non-catalytic Pre-phase devices had to removed when a residence was sold since these devices did not meet the emissions requirements.[14]

2. CO EMISSIONS PROJECTION

The amount of dry wood burned (activity) by each type of wood burning device in the Missoula CO NAA was extracted from the 2000 Missoula CO E.I. This quantity of wood burned was based upon the heating degree days (HDD) data for the year 2000 and number of days in the 2000 CO season. For comparison purposes, it was assumed these two parameters were identical for the other analysis years.

To calculate the heating degree days for a particular day, find the average temperature (Fahrenheit) for the day. If the number is above 65, there are no HDD for that day. If the number is less than 65, subtract it from 65 to find the number of heating degree days. The higher the heating degree days, more heating fuel is used.

From the E.I., the number of each type of device was determined; a study conducted on the woodburning behavior in Missoula established the amount of wood burned by each device.[19] The number of residences in the Missoula CO NAA was also extracted from the 2000 E.I. on a grid basis. The increase in the residential housing over time from the 2000 base year was determined for two reasons: (1) Due to the MCCHD regulations, some wood burning devices had to be removed upon sale of the residential property so the number of annual sales of residences had to be established and (2) the installation of pellet stoves was permissible. Both of these events had to be tracked. As an assumption, residences that had wood burning devices were either single or 2-unit occupied structures, and approximately 96% of these residences were also occupied.[1]

Real estate trends and sales of residential property in the Missoula urban area from 1993 to 2004 were available from the Missoula County Web site (http: //www.co.missoula.mt.us/measures/HousingShelter.htm) and the Missoula County Association of Realtors™ Web site (http://www.missoularealestate.com). Based on this information, approximately 3.0% of the Missoula urban area residential housing was sold annually. As a best estimate, this percentage was also representative of the Missoula CO NAA and remained constant through the year 2020. Since residential sales occurred annually, the number of residences with wood burning devices also had to be tracked concurrently.

Concerning pellet stoves, the MCCHD has issued between one and four pellet stove permits per year in the entire E.I. area during the last several years. To be conservative, three (3) pellet stoves were added annually to the residential housing population in the Missoula CO NAA.

The MDT provided the growth in housing units in the greater Missoula urban area. This data were organized by the U.S. Census Bureau tracts (Table 8) and it was assumed that the growth was linear between the periods noted in this table. The proportion of each Missoula CO NAA grid within each tract was established so the growth factors could be applied (Table 9). Using this information from both tables, the number of housing units on a grid basis was increased. The following equation using hypothetical data shows the overall approach to compute the growth in residential housing in Grid 25 from the 2000 base year to the year 2001.

In 2000, Grid 25 had 250 occupied residences.

$$(\textit{250 Occupied Housing Units})(\textit{0.40 in Tract 2.02 with 0.2039 Growth}) +$$

$$(\textit{250 Occupied Housing Units})\ (\textit{0.60 in Tract 14 with 0.0379 Growth}) +$$

$$(\textit{250 Occupied Housing Units}) =$$

$$\textit{276.08} = \textit{276 Occupied Housing Units in 2001}$$

3. CO EMISSIONS ADJUSTMENTS

The population of wood burning devices changed due to the sales of residential housing with devices that had to be removed and the installation of three pellet stoves annually. Both activities were tracked concurrently.

4. CO CONTROLS

The MCCHD was contacted to determine whether future amendments to the Missoula City-County Air Pollution Control Program regulations involving wood burning devices were being considered. Based on professional judgement, no further revisions were anticipated so no controls were imposed on the projected CO emissions from these sources.

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