Final Technical Support Document

Carbon Monoxide Maintenance Plan Revision For The Greeley Attainment Area

December 19, 2002

Final

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Air Pollution Control Division
Technical Services Program
4300 Cherry Creek Drive South
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1992-2015

Greeley Attainment Area Emission Inventories

The mobile source and area/non-road emission inventories to support the revision to the Greeley Carbon Monoxide Maintenance Plan are summarized in the following table.

	Attainment Area	Fleet Avg. CO rate	Mobile Inventory	Area/Non-road Inventory	Total Inventory	Strategies
Year	VMT	G/mi	Tons/day	Tons/day	Tons/day	
1992	1,071,930	50.20	59.3	16.4	75.7	Idle I/M 1992 oxy level
1998	1,369,412	31.6	47.7	17.7	65.4	Idle I/M 1998 oxy level
2004	1,778,877	30.07	59.0	12.0	71.0	No controls
2005	1,859,000	27.57	56.5	12.2	68.7	No controls
2010	2,147,150	19.99	47.3	13.2	60.5	No controls
2015	2,479,960	16.88	46.1	14.3	60.4	No controls
2020	2,836,535	15.04	47.0	Not Applicable	Not Applicable	No controls
2025	3,244,721	14.43	51.6	Not Applicable	Not Applicable	No controls
2030*	3,747,652	14.43	59.6	Not Applicable	Not Applicable	No controls

The technical support documentation to support these emission inventories is contained in the following sections of this document**.**

*The 2030 VMT estimate is based the travel demand modeled rate of VMT growth between 2025 and 2015 (2.72% per year) extrapolated to 2030. The 2030 mobile emission inventory estimate is based on the 2030 VMT estimate and the 2025 emission rate. The 2020, 2025 and 2030 emission inventory estimates are included for Transportation Improvement Plan Conformity considerations.

Greeley Attainment Area Vehicle Miles Traveled and Vehicle Speed Estimates

The Greeley component of the North Front Range 2025 Regional Transportation Plan demand modeling is the basis for the vehicle miles traveled (VMT) estimates used for the development of these emission inventories. USEPA's recently released MOBILE6 model (1/23/2002) was used as the basis for the emission factor estimates. The VMT and speeds resulting from the travel-demand modeling were the primary inputs for the estimation of the VMT-related carbon monoxide emissions in Greeley.

Travel demand-modeling for the North Front Range Transportation and Air Quality Planning Council (NFRTAQPC) was performed by Kimley-Horn and Associates, Inc. for a base year of 1998 and out-year estimates of 2005, 2015 and 2025. The 1998, 2005 and 2015 travel-demand modeling results for the Greeley Attainment area were used in this inventory analysis.

The Base Year inventory for the redesignation request analysis is 1992. A methodology based on HPMS traffic count data for 1992 and 1998 was developed to estimate the 1992 VMT based on the 1998 travel demand-model VMT estimates. This methodology is documented in Appendix A. The 1998 transportation model speeds were used to estimate the speeds in 1992. In order to determine the potential effects of this assumption, a simple MOBILE6 speed sensitivity analysis was performed. Between 1998 and 2005 the speeds resulting from the travel-demand modeling indicate the VMT-weighted fleet average speed in Greeley will decrease by 2.0 mph. This would be a good estimate of how much the speeds may have decreased between 1992 and 1998. Since the VMT in 1992 was substantially less than in 1998, it is possible that the fleet averaged speed would be about 2.0 mph higher in 1992. The MOBILE6 model speed sensitivity was tested using this 2.0 mph factor. All of the 1998 speeds were increased by a factor of 2.0 mph and the inventory analysis was re-run. The 1992 carbon monoxide emissions increased by .21 tons. Since a lower mobile source carbon monoxide emission estimate is considered more conservative in this case, the 1998 speeds were used to estimate the speeds in 1992.

The 2010 VMT was estimated by using the rate of VMT growth between the 2005 and 2015 travel demand modeled networks. This is calculated as follows:

2015 VMT = 2005 VMT * growthrate ^ (2015 – 2005)
2015 VMT = 2005 VMT * growthrate ^10
growthrate = [2015 VMT / 2005 VMT]^.1
growthrate = [2,479,960 / 1,856,000]^.1 = 1.0292
2010 VMT = 2015 VMT (1.0292)^ (-5) = .8658*2,479,960 = 2,147,150

The 2015 speeds from the travel demand modeling were used to characterize the 2010 speeds for the MOBILE6 inputs.

Tables 1 through Table 5 summarize the VMT estimates and vehicle speeds resultant from the travel demand modeling and the 1992 VMT estimate methodology.

Table 1
1992 Vehicle Miles Traveled in the Greeley Attainment Area

Area Type	Facility Class	VMT AM	VMT PM	VMT OFF	Speed AM	Speed PM	Speed OFF
CBD	Centroid Conn	2120.9	2775.9	10819.7	20.0	20.0	23.0
CBD	Collector	192.4	235.0	962.8	19.8	19.7	22.9
CBD	Expressway	2244.6	2884.6	10545.3	37.5	38.1	41.8
CBD	Major Arterial	3851.7	4831.9	18158.5	27.7	27.9	32.9
CBD	Minor Arterial	1415.3	1747.4	6994.7	25.0	25.0	28.0
Rural	Centroid Conn	22.4	28.2	107.0	22.0	22.0	27.0
Rural	Collector	143.0	108.8	383.9	42.0	42.0	47.0
Rural	Expressway	1562.6	1934.5	7028.1	40.8	46.0	50.3
Rural	Major Arterial	3593.0	4268.2	15259.6	36.6	45.0	48.3
Rural	Minor Arterial	228.5	216.5	808.6	50.3	51.9	56.9
Urban	Centroid Conn	14142.6	17596.3	69723.7	15.0	15.0	20.0
Urban	Collector	12682.5	13337.5	54056.0	29.7	29.8	34.7
Urban	Expressway	33980.7	41099.3	142867.7	38.6	39.7	43.9
Urban	Ramp	17.6	14.9	71.3	21.5	21.0	28.9
Urban	Major Arterial	48760.7	59558.8	219576.9	37.8	38.4	43.0
Urban	Minor Arterial	37272.9	41417.4	160279.6	33.5	33.6	38.2

Table 2
1998 Vehicle Miles Traveled and Speeds in the Greeley Attainment Area

Area Type	Facility Class	VMT AM	VMT PM	VMT OFF	Speed AM	Speed PM	Speed OFF
CBD	Centroid Conn	2715.0	3553.4	13850.2	20.0	20.0	23.0
CBD	Collector	246.3	300.8	1232.4	19.8	19.7	22.9
CBD	Expressway	3065.1	3939.1	14400.2	37.5	38.1	41.8
CBD	Major Arterial	4086.7	5126.7	19266.3	27.7	27.9	32.9
CBD	Minor Arterial	1811.7	2236.8	8953.8	25.0	25.0	28.0
Rural	Centroid Conn	76.8	96.9	367.0	22.0	22.0	27.0
Rural	Collector	490.6	373.2	1317.0	42.0	42.0	47.0
Rural	Expressway	2133.9	2641.6	9597.2	40.8	46.0	50.3
Rural	Major Arterial	12326.0	14642.0	52348.5	36.6	45.0	48.3
Rural	Minor Arterial	784.0	742.9	2773.9	50.3	51.9	56.9
Urban	Centroid Conn	18103.7	22524.7	89252.1	15.0	15.0	20.0
Urban	Collector	16234.6	17073.1	69196.0	29.7	29.8	34.7
Urban	Expressway	46402.6	56123.6	195094.5	38.6	39.7	43.9
Urban	Ramp	18.7	15.8	75.6	21.5	21.0	28.9
Urban	Major Arterial	51735.5	63192.4	232972.9	37.8	38.4	43.0
Urban	Minor Arterial	47712.4	53017.7	205171.0	33.5	33.6	38.2

Table 3
2005 Vehicle Miles Traveled and Speeds in the Greeley Attainment Area

Area Type	Facility Class	VMT AM	VMT PM	VMT OFF	Speed AM	Speed PM	Speed OFF
CBD	Centroid Conn	3126.9	4139.6	16207.5	20.0	20.0	23.0
CBD	Collector	335.9	414.5	1649.5	19.8	19.9	23.0
CBD	Expressway	3669.2	4437.4	16267.8	35.6	36.9	40.3
CBD	Major Arterial	4868.7	6162.7	23314.9	27.3	27.8	32.7
CBD	Minor Arterial	2555.4	3232.6	12529.0	24.9	25.0	28.0
Rural	Centroid Conn	153.4	203.9	772.5	22.0	22.0	27.0
Rural	Collector	1553.2	1083.5	4764.9	39.5	41.5	46.0
Rural	Expressway	2618.1	3402.9	12218.5	33.2	34.1	35.6
Rural	Major Arterial	12229.3	15546.8	56512.1	37.0	40.8	41.7
Rural	Minor Arterial	1364.9	1487.4	5620.4	44.6	49.5	52.1
Urban	Centroid Conn	23586.8	30142.7	119298.5	15.0	15.0	20.0
Urban	Collector	28106.6	27760.2	121596.0	28.6	29.1	34.4
Urban	Expressway	58634.0	70739.8	251504.1	35.8	37.0	40.6
Urban	Ramp	20.6	17.4	82.8	21.8	21.3	29.0
Urban	Major Arterial	64344.0	81706.6	298097.2	36.3	36.9	41.3
Urban	Minor Arterial	69196.9	81220.9	310501.0	31.6	32.5	37.0

Table 4
2010 Vehicle Miles Traveled and Speeds in the Greeley Attainment Area

Area Type	Facility Class	VMT AM	VMT PM	VMT OFF	Speed AM	Speed PM	Speed OFF
CBD	Centroid Conn	3171.	4173.	16455.	20.0	20.0	23.0
CBD	Collector	411.	487.	1888.	19.9	19.9	23.0
CBD	Expressway	3546.	4357.	17494.	34.1	35.4	36.9
CBD	Major Arterial	4880.	6272.	24375.	26.7	27.5	32.2
CBD	Minor Arterial	3055.	3734.	15168.	24.7	24.9	27.8
Rural	Centroid Conn	210.	281.	1055.	22.0	22.0	27.0
Rural	Collector	2293.	2175.	9728.	33.0	39.0	41.0
Rural	Expressway	2527.	3258.	11744.	27.3	28.1	28.5
Rural	Major Arterial	11294.	13999.	51675.	32.5	38.4	37.3
Rural	Minor Arterial	1403.	1644.	5858.	37.7	41.8	43.9
Urban	Centroid Conn	27548.	35296.	140293.	15.0	15.0	20.0
Urban	Collector	38602.	40636.	173884.	27.3	28.6	32.2
Urban	Expressway	64771.	77501.	287771.	32.3	33.9	36.3
Urban	Ramp	766.	897.	3479.	24.8	24.9	29.9
Urban	Major Arterial	71584.	90471.	337445.	33.8	34.9	38.5
Urban	Minor Arterial	78033.	92603.	356960.	29.7	31.3	34.3

Table 5
2015 Vehicle Miles Traveled and Speeds in the Greeley Attainment Area

Area Type	Facility Class	VMT AM	VMT PM	VMT OFF	Speed AM	Speed PM	Speed OFF
CBD	Centroid Conn	3662.5	4819.7	19005.1	20.0	20.0	23.0
CBD	Collector	474.7	562.9	2180.6	19.9	19.9	23.0
CBD	Expressway	4096.0	5032.5	20205.4	34.1	35.4	36.9
CBD	Major Arterial	5636.5	7244.5	28153.5	26.7	27.5	32.2
CBD	Minor Arterial	3528.6	4312.9	17518.6	24.7	24.9	27.8
Rural	Centroid Conn	243.0	324.6	1218.4	22.0	22.0	27.0
Rural	Collector	2648.0	2511.6	11235.3	33.0	39.0	41.0
Rural	Expressway	2919.1	3763.0	13564.6	27.3	28.1	28.5
Rural	Major Arterial	13044.8	16168.5	59684.4	32.5	38.4	37.3
Rural	Minor Arterial	1621.0	1898.6	6765.5	37.7	41.8	43.9
Urban	Centroid Conn	31817.7	40767.2	162038.0	15.0	15.0	20.0
Urban	Collector	44584.9	46934.4	200836.0	27.3	28.6	32.2
Urban	Expressway	74810.6	89513.7	332375.9	32.3	33.9	36.3
Urban	Ramp	884.2	1036.6	4018.6	24.8	24.9	29.9
Urban	Major Arterial	82679.4	104494.1	389749.6	33.8	34.9	38.5
Urban	Minor Arterial	90128.7	106956.8	412289.1	29.7	31.3	34.3

MOBILE6 SPEED VMT and VMT BY HOUR files

The AM, PM and Off peak speeds and VMT resulting from the travel-demand model were pre-processed into input files for MOBILE6. The code for the Fortran program designed to accomplish this formatting, M6input.f, is in Appendix B. M6input.f also writes the Scenario Record files: one record for each area type and facility class. Consequently, thirteen distinct scenarios result from the MOBILE6 input pre-processing. Thirteen distinct diurnal profiles of VMT BY HOUR also result from this processing. MOBILE6 accepts speed profiles for freeway and arterial facility classes. Consequently, SPEED VMT profiles are referenced in the Scenario Records in the MOBILE6 input files only for these two facility class type. MOBILE6 default speed profiles are used for ramp and local/centroid connector classes.

Automobile Emission Control Strategies:

As part of Colorado's Carbon Monoxide State Implementation Plan (SIP), automobile Inspection and Maintenance (I/M) programs have been operating in Colorado Automobile Inspection and Repair (AIR) Program areas since 1982. An oxygenated fuel program has been operating in the same areas since 1988. The 1992 I/M program operating in Greeley and the and AIR Program oxygenated fuel programs (in MOBILE6 input format) are characterized as follows:

1992 Emission Control Strategies:

```
I/M PROGRAM         : 1 1982 2025 1 TRC IDLE
I/M MODEL YEARS     : 1 1952 1987
I/M VEHICLES        : 1 22222 22222222 2
I/M STRINGENCY      : 1 25.0
I/M COMPLIANCE      : 1 64.0
I/M WAIVER RATES    : 1 1.71 1.71
I/M EFFECTIVENESS   : 1 0.50 0.50 0.50
I/M GRACE PERIOD    : 1 2

I/M PROGRAM         : 2 1982 2025 2 TRC IDLE
I/M MODEL YEARS     : 2 1988 1990
I/M VEHICLES        : 2 22222 22222222 2
I/M STRINGENCY      : 2 25.0
I/M COMPLIANCE      : 2 64.0
I/M WAIVER RATES    : 2 1.71 1.71
I/M GRACE PERIOD    : 2 2

I/M PROGRAM         : 3 1982 2025 1 TRC IDLE
I/M MODEL YEARS     : 3 1991 1992
I/M VEHICLES        : 3 22222 22222222 2
I/M STRINGENCY      : 3 25.0
I/M COMPLIANCE      : 3 64.0
I/M WAIVER RATES    : 3 1.71 1.71
I/M GRACE PERIOD    : 3 2

ANTI-TAMP PROG      :
82 75 91 22222 22222222 2 21 074 22211111

OXYGENATED FUELS    : .80 .20 .021 .035 2
```

1998 Emission Control Strategies:

The 1998 I/M program operating in Greeley and the AIR Program oxygenated fuel programs (in MOBILE6 input format) can be characterized as follows:

```
I/M PROGRAM         : 1 1982 2025 1 TRC IDLE
I/M MODEL YEARS     : 1 1952 1980
I/M VEHICLES        : 1 22222 22222222 2
I/M STRINGENCY      : 1 21.0
I/M COMPLIANCE      : 1 64.0
I/M WAIVER RATES    : 1 .025 .025
I/M EFFECTIVENESS   : 1 0.50 0.50 0.50
I/M GRACE PERIOD    : 1 5

I/M PROGRAM         : 2 1982 2025 1 TRC 2500/IDLE
I/M MODEL YEARS     : 2 1981 1981
I/M VEHICLES        : 2 22222 22222222 2
I/M STRINGENCY      : 2 21.0
I/M COMPLIANCE      : 2 64.0
I/M WAIVER RATES    : 2 .025 .025
I/M GRACE PERIOD    : 2 5

I/M PROGRAM         : 3 1982 2025 2 TRC 2500/IDLE
I/M MODEL YEARS     : 3 1982 2025
I/M VEHICLES        : 3 22222 22222222 2
I/M STRINGENCY      : 3 21.0
I/M COMPLIANCE      : 3 64.0
I/M WAIVER RATES    : 3 025 .025
I/M GRACE PERIOD    : 3 5

ANTI-TAMP PROG       :
82 75 94 22222 22222222 2 21 074 22111112

OXYGENATED FUELS    : .050 .950 .027 .035 2
```

No state mandated automobile emission control strategies were assumed in the MOBILE6 emission factor generated for 2005, 2010 and 2015.

Greeley Automobile Fleet Vehicle Miles Traveled Mix

Since 1988, Colorado SIP mobile source emission inventories were prepared using regional information on the mix of vehicles in the fleet. This fleet mix information was collected in a roadway count survey in the late 1980s. Today, this survey information is dated. Consequently, Colorado believes that default fleet mix values in the newly released MOBILE6 model more closely characterizes the fleet mix in Greeley than the dated Colorado information. Default MOBILE6 fleet mix vehicle miles traveled were utilized to generate 1998, 1992, 2005, 2010 and 2015 emission factors.

Greeley VMT BY FACILITY Definitions for MOBILE6

MOBILE6 calculates emission factors based on four facility class definitions. These are freeway, arterial, ramps and locals. These four facility class definitions were assigned to the facility classes defined by the travel-demand modeling as follows:

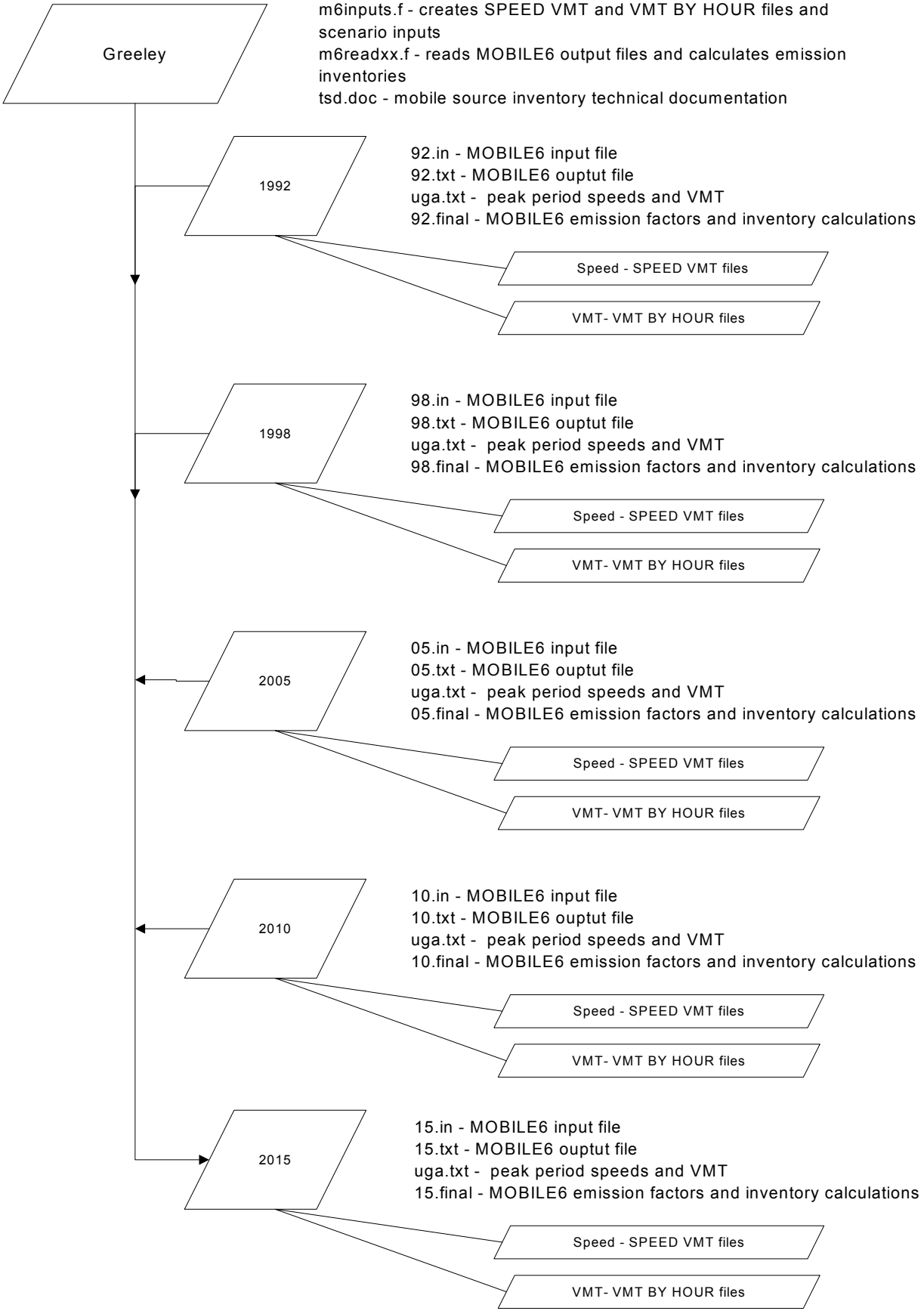
Greeley Facility Classes	**MOBILE6 Facility Assignments**
Expressway	Freeway
Major Arterial	Arterial
Minor Arterial	Arterial
Collector	Arterial
Ramps	Ramps
Frontage	Arterial
Centroid Connector	Local

These facility class assignments are referenced in the Scenario Record inputs. The references point to input files defining the various classes. These input files, art.txt, fwy.txt, rmp.txt and loc.txt are included on the diskette with the MOBILE6 input and output files

MOBILE6 Input and Output files

The MOBILE6 input and output files along with the Fortran programs used to read the output files and generate the emission inventories are included on the compact disk accompanying this document. The directory structure and file organization of these files is as follows:

Diagram 1: Directory structure of digital files for Greeley Mobile Source Inventory TSD



MOBILE6 Emission Factors and Emission Inventory Calculations

Table 6 through Table 10 show the emission factors and the results of the emission inventory calculations.

Table 6
1992 VMT, MOBILE6 Emission Factors and Inventory in the Greeley Attainment Area

Area Type	Facility Class	VMT	MOBILE6 CO factor	grams/ day	tons/ day
CBD	Centroid Conn	15717.	57.18	898732.	0.991
CBD	Collector	1390.	53.18	73934.	0.081
CBD	Expressway	15675.	49.26	772142.	0.851
CBD	Major Arterial	26842.	49.28	1322725.	1.458
CBD	Minor Arterial	10157.	50.42	512187.	0.565
Rural	Centroid Conn	158.	57.20	9015.	0.010
Rural	Collector	636.	50.24	31941.	0.035
Rural	Expressway	10525.	50.59	532480.	0.587
Rural	Major Arterial	23121.	50.19	1160456.	1.279
Rural	Minor Arterial	1254.	52.36	65637.	0.072
Urban	Centroid Conn	101463.	57.20	5803864.	6.398
Urban	Collector	80076.	48.94	3918839.	4.320
Urban	Expressway	217948.	49.55	10799309.	11.904
Urban	Ramp	104.	61.48	6382.	0.007
Urban	Major Arterial	327896.	49.42	16203984.	17.862
Urban	Minor Arterial	238970.	48.95	11697099.	12.894
Totals:		**1071930.**	**50.20**	**53808724.**	**59.313**

Table 7
1998 VMT, MOBILE6 Emission Factors and Inventory in the Greeley Attainment Area

Area Type	Facility Class	VMT	MOBILE6 CO factor	grams/ day	tons/ day
CBD	Centroid Conn	20119.	33.97	683409.	0.753
CBD	Collector	1780.	33.02	58757.	0.065
CBD	Expressway	21404.	31.29	669829.	0.738
CBD	Major Arterial	28480.	30.88	879311.	0.969
CBD	Minor Arterial	13002.	31.45	408870.	0.451
Rural	Centroid Conn	541.	33.98	18373.	0.020
Rural	Collector	2181.	32.19	70204.	0.077
Rural	Expressway	14373.	32.51	467199.	0.515
Rural	Major Arterial	79317.	32.14	2549312.	2.810
Rural	Minor Arterial	4301.	33.96	146047.	0.161
Urban	Centroid Conn	129881.	33.98	4413599.	4.865
Urban	Collector	102504.	30.74	3150656.	3.473
Urban	Expressway	297621.	31.57	9397075.	10.358
Urban	Ramp	110.	42.92	4726.	0.005
Urban	Major Arterial	347901.	31.44	10939046.	12.058
Urban	Minor Arterial	305901.	30.91	9455708.	10.423
Totals		**1369413.**	**31.63**	**43312120.**	**47.743**

Table 8
2005 VMT, MOBILE6 Emission Factors and Inventory in the Greeley Attainment Area

Area Type	Facility Class	VMT	MOBILE6 CO factor	grams/ day	tons/ day
CBD	Centroid Conn	23474.	29.15	684197.	0.754
CBD	Collector	2400.	28.78	69079.	0.076
CBD	Expressway	24374.	27.46	669419.	0.738
CBD	Major Arterial	34346.	27.10	930716.	1.026
CBD	Minor Arterial	18317.	27.51	503974.	0.556
Rural	Centroid Conn	1130.	29.15	32930.	0.036
Rural	Collector	7402.	28.42	210331.	0.232
Rural	Expressway	18240.	26.95	491573.	0.542
Rural	Major Arterial	84288.	27.71	2335458.	2.574
Rural	Minor Arterial	8473.	29.38	248962.	0.274
Urban	Centroid Conn	173028.	29.16	5044805.	5.561
Urban	Collector	177463.	27.07	4803386.	5.295
Urban	Expressway	380878.	27.50	10475284.	11.547
Urban	Ramp	121.	36.40	4397.	0.005
Urban	Major Arterial	444148.	27.58	12249596.	13.503
Urban	Minor Arterial	460919.	27.13	12504266.	13.783
Totals		**1859000.**	**27.57**	**51258368.**	**56.502**

Table 9
2010 VMT, MOBILE6 Emission Factors and Inventory in the Greeley Attainment Area

Area Type	Facility Class	VMT	MOBILE6 CO factor	grams/ day	tons/ day
CBD	Centroid Conn	23799.	21.82	519260.	0.572
CBD	Collector	2786.	20.94	58351.	0.064
CBD	Expressway	25397.	19.74	501368.	0.553
CBD	Major Arterial	35528.	19.76	702169.	0.774
CBD	Minor Arterial	21957.	20.07	440694.	0.486
Rural	Centroid Conn	1546.	21.82	33738.	0.037
Rural	Collector	14195.	20.12	285583.	0.315
Rural	Expressway	17530.	19.86	348068.	0.384
Rural	Major Arterial	76968.	19.81	1524652.	1.681
Rural	Minor Arterial	8905.	20.38	181498.	0.200
Urban	Centroid Conn	203137.	21.83	4433455.	4.887
Urban	Collector	253121.	19.78	5006485.	5.519
Urban	Expressway	430043.	19.71	8476148.	9.343
Urban	Ramp	5142.	24.14	124136.	0.137
Urban	Major Arterial	499500.	19.84	9911579.	10.925
Urban	Minor Arterial	527597.	19.66	10370438.	11.431
Totals		**2147150.**	**19.99**	**42917624.**	**47.308**

Table 10
2015 VMT, MOBILE6 Emission Factors and Inventory in the Greeley Attainment Area

Area Type	Facility Class	VMT	MOBILE6 CO factor	grams/ day	tons/ day
CBD	Centroid Conn	27487.	18.59	510934.	0.563
CBD	Collector	3218.	17.62	56714.	0.063
CBD	Expressway	29334.	16.65	488527.	0.538
CBD	Major Arterial	41035.	16.66	683676.	0.754
CBD	Minor Arterial	25360.	16.91	428789.	0.473
Rural	Centroid Conn	1786.	18.59	33196.	0.037
Rural	Collector	16395.	16.98	278385.	0.307
Rural	Expressway	20247.	16.73	338748.	0.373
Rural	Major Arterial	88898.	16.71	1485658.	1.638
Rural	Minor Arterial	10285.	17.21	176996.	0.195
Urban	Centroid Conn	234623.	18.59	4362344.	4.809
Urban	Collector	292355.	16.67	4874440.	5.373
Urban	Expressway	496700.	16.63	8257641.	9.102
Urban	Ramp	5939.	19.80	117618.	0.130
Urban	Major Arterial	576923.	16.74	9659424.	10.648
Urban	Minor Arterial	609375.	16.58	10100385.	11.134
Totals		**2479960.**	**16.88**	**41853476.**	**46.135**

Greeley Carbon Monoxide Maintenance Plan Area/Non-road Emission Inventories

Source Category	1992	1998	2005	2010	2015
Commercial Heating	0.025	0.039	0.054	0.065	0.076
Residential Heating	0.167	0.182	0.219	0.246	0.272
Agricultural Non-road	0.008	0.009	0.009	0.009	0.010
Commercial Non-road	2.536	3.166	3.920	4.607	5.259
Construction Non-road	0.828	0.816	0.693	0.711	0.759
Industrial Non-road	1.559	1.574	1.667	1.708	1.754
Commercial Lawn and Garden	0.280	0.304	0.346	0.377	0.412
Residential Lawn and Garden	0.100	0.115	0.129	0.140	0.153
Recreational Non-road	0.003	0.003	0.003	0.004	0.004
Railroad Non-road	0.004	0.005	0.005	0.005	0.005
Railroad Locomotives	0.119	0.135	0.128	0.135	0.145
Wood burning	8.967	9.558	2.908	2.933	2.958
Point Sources	1.850	1.838	2.101	2.287	2.474
Total(ton/day)	**16.447**	**17.744**	**12.182**	**13.228**	**14.282**

Residential and Commercial Heating Emissions for 1998 were based on Version 1.5 of the 1999 EPA National Eimissions Inventory (NEI) for Weld County and were apportioned to the nonattainmet area by households using the 1990 Census. Daily emissions were obtained from annual emissions by multiplying by the ration of heating degree days in the high CO season (November, December and January) to the entire year (0.5112), based on National Weather Service data for Greeley UNC for 1967 to 2000 with a base of 65 degrees F, and dividing by 92 (the number of days in the season). Projections to other years were based on population and employment projections from the land use and transportation plan.

Non-road Emissions with the exception of railroad, recreational and agricultural were based on the EPA Non-road model, and apportioned to the nonattainmet area by households using the 1990 Census. Railroad Non-road Emissions from the Non-road model were apportioned to the nonattainmet area by the miles of track. Recreational and Agricultural Non-road Emissions were apportioned to the nonattainmet area by land area. The following equipment categories were excluded from the Lawn and Garden categories in computing the winter emissions: Commercial Turf Equipment, Front Mowers, Lawn & Garden Tractors, Lawn mowers, Other Lawn & Garden Equipment, Rear Engine Riding Mowers, Rotary Tillers < 6 HP, Trimmers/Edgers/Brush Cutter. The following lawn and garden equipment winter emissions were included: Chippers/Stump Grinders, Chain Saws < 6 HP, Leaf blowers/Vacuums, Shredders < 6 HP, Snow blowers.

Railroad Locomotive Emissions for 1998 were based on Version 1.5 of the 1999 EPA National Emissions Inventory (NEI) for Weld County and were apportioned to the nonattainmet area by miles of track. Projections to other years were based on the change in Railroad Non-road emissions.

Wood burning Emissions were developed by calculating per-household wood burning rates from the wood burning surveys used for the Fort Collins CO Redesignation Plan (July 2002) and multiplying by the appropriate AP-42 emission factors. The Fort Collins wood burning survey, Outdoor Air Quality Survey, Spring, 2002 Report: Fort Collins is included as Attachment 1. The number of households for each year was taken from the land use and transportation plan. Daily emissions were obtained from annual emissions by multiplying by the ratio of heating degree days in the high CO season (November, December and January) to the entire year (0.5112), based on National Weather Service data for Greeley

UNC for 1967 to 2000 with a base of 65 degrees F, and dividing by 92 (the number of days in the season).

1992 Point Source Emissions were taken from the 1990 Greeley CO SIP. 1998 Point Source Emissions were taken from the Colorado Air Inventory System which is based on the stationary source permit data. Point Source Emissions after 1998 are grown by the growth in non-retail employment.
.

Calculation of the 1992 Demographic Information:
1992 calculated by interpolation.

	1990*	1992	1995*	1998**	2005**	2010**	2015**	1992/1998 Factor
Employment	30,330	30,876	31,694	48,040	57,119	63,573	70,026	0.642706
Households	27,722	28,396	29,407	30,910	37,229	46,258	46,258	0.918679

* From Greeley 1996 Redesignation TSD **From 11/29/01 Land Use and Transportation Plan

GREELEY Wood burning (from Fort Collins)**:**
New stoves after 1992 assumed to equal population growth times existing stoves. Fireplaces and existing stove emissions held constant from 1990.

From 1990 SIP Inventory							
1990	NUMBER	CORDS	kg/cord	ef (g/kg)		kg burned	kg/hh
Fireplaces	17102	0.58	1,100	126		10911076	260.862
Conv.	3561	1.02	1,100	115.4		3995442	
Phase I	826	1.02	1,100	58.9		926772	
Phase II	1081	1.02	1,100	48.7		1212882	
Total Stoves	22570					6135096	146.6779
No. Households	41,827						
Total Stoves	22,570						

	HDD ratio	Days per season	kg burned/HH	*1992* Fraction phase II	1992 kg burned	*1992 CO (t/d)*	*1998* Fraction phase II	1998 kg burned	*1998 CO (t/d)*
Fireplace	0.511206	92	260.862		7,407,437	5.730		8,063,137	6.238
conventional	0.511206	92	146.6779		4,165,066	2.944		4,165,066	2.944
Phase II	0.511206	92	146.6779	0.2144	892,841	0.293	0.2532	1,147,742	0.376
TOTAL						8.967			9.558

Average EF (g/kg)	CO
Fireplace	126.3
conventional	115.4
Phase II	53.5

2005 and Later Wood Burning:

According to calculations based on the 2002 Fort Collins Wood Burning Survey, the average Wood Burning rate for fireplaces and stoves combined is 116.69 kg per household. Since there is no data on the break out between stoves and fireplaces, the ratio found in 1990 is used. This gives a Wood Burning rate per household of 74.69 kg per household for fireplaces and 42.00 kg per household for stoves.

According to calculations based on the 2002 Fort Collins Wood Burning Survey, 5.4% of the households have Wood Burning stoves, and 32.9% of the households have Wood Burning fireplaces. Of the 5.4% of the households with stoves, 30.71% have certified stoves.

Based on the changes in fireplace and stove ownership from 1990 to 2002, as reflected in the Fort Collins surveys, the number of wood burning stoves and fireplaces per household in 2005 would be less than in 2002. To be conservative, the total number of stoves per household is held constant after 2002, and the total amount of wood burned in fireplaces is held constant at 2002 levels.

		Number	fraction	kg burned	emissions (t/d)
2005	**Rate**				
Fireplaces(constant at 2002 levels)				2,645,965	2.047
Annual growth Conv.	919,615	0.650	0.5881	919,615	0.650
Phase II		643,999	0.211	643,999	0.211
wb soves/hh	0.097	5,740		**TOTAL**	**2.908**
2010					
Fireplaces(constant at 2002 levels)				2,645,965	2.047
Annual growth Conv.	822,434	2.412	0.4691	822,434	0.581
Phase II		930,773	0.305007295	930,773	0.305
wb soves/hh	0.097	6,427	3.0376	**TOTAL**	**2.933**
2015					
Fireplaces(constant at 2002 levels)				2,645,965	2.047
Annual growth Conv.	-0.021	0.512	0.3730	1,153,414	0.512
Phase II		4,460	0.399	1,938,488	0.399
wb soves/hh	0.097	7,113	3.584	**TOTAL**	**2.958**

Non-road Model Emissions tons per day

Area	Agricultural Equipment	Commercial Equipment	Construction and Mining Equipment	Industrial Equipment	Lawn and Garden Equipment (Com)	Lawn and Garden Equipment (Res)
1992						
Weld County	0.60	4.71	1.54	2.89	0.520	0.186
Nonatttainment Grid	0.01	2.54	0.83	1.56	0.280	0.100
1998						
Weld County	0.63	5.88	1.51	2.92	0.564	0.213
Nonatttainment Grid	0.01	3.17	0.82	1.57	0.304	0.115
2005						
Weld County	0.63	7.27	1.29	3.09	0.642	0.239
Nonatttainment Grid	0.01	3.92	0.69	1.67	0.346	0.129
2010						
Weld County	0.66	8.55	1.32	3.17	0.701	0.260
Nonatttainment Grid	0.01	4.61	0.71	1.71	0.377	0.140
2015						
Weld County	0.71	9.76	1.41	3.26	0.765	0.285
Nonatttainment Grid	0.01	5.26	0.76	1.75	0.412	0.153

Non-road Model Input File For 1998

The "Non-road Model Input File for 1998" was produced automatically by the NonRoad Model. The inputs to the model that are reflected in this file are those within the /***NAME***/…/**END**/ delimiters such as:

/PERIOD/
Period type : Seasonal
Summation type : Typical day
Year of episode : 1998
Season of year : Winter
Month of year :
Weekday or weekend : Weekday
/END/

Written by Nonroad interface at 1/8/2002 12:42:46 PM
This is the options file for the NONROAD program.
The data is sperated into "packets" bases on common
information. Each packet is specified by an
identifier and a terminator. Any notes or descriptions
can be placed between the data packets.

10/8/1999 changed default RVP from 9.0 to 8.0

PERIOD PACKET

This is the packet that defines the period for
which emissions are to be estimated. The order of the
records matter. The selection of certain parameters
will cause some of the record that follow to be ignored.
The order of the records is as follows:

1 - Char 10 - Period type for this simulation.
Valid responses are: ANNUAL, SEASONAL, and MONTHLY
2 - Char 10 - Type of inventory produced.
Valid responses are: TYPICAL DAY and PERIOD TOTAL
3 - Integer - year of episode (4 digit year)
4 - Char 10 - Month of episode (use complete name of month)
5 - Char 10 - Type of day
Valid responses are: WEEKDAY and WEEKEND

/PERIOD/
Period type : Seasonal
Summation type : Typical day
Year of episode : 1998
Season of year : Winter
Month of year :
Weekday or weekend : Weekday
/END/

OPTIONS PACKET

This is the packet that defines some of the user
options that drive the model. Most parameters are
used to make episode specific emission factor
adjustments. The order of the records is fixed.
The order is as follows.

1 - Char 80 - First title on reports
2 - Char 80 - Second title on reports
3 - Real 10 - Fuel RVP of gasoline for this simulation
4 - Real 10 - Oxygen weight percent of gasoline for simulation

5 - Real 10 - Percent sulfur for gasoline
6 - Real 10 - Percent sulfur for diesel
7 - Real 10 - Percent sulfur for LPG/CNG
8 - Real 10 - Minimum daily temperature (deg. F)
9 - Real 10 - maximum daily temperature (deg. F)
10 - Real 10 - Representative average daily temperature (deg. F)
11 - Char 10 - Flag to determine if region is high altitude
Valid responses are: HIGH and LOW
12 - Char 10 - Flag to determine if RFG adjustments are made
Valid responses are: YES and NO

/OPTIONS/
Title 1 : Greeley 98
Title 2 :
Fuel RVP for gas : 12.4
Oxygen Weight % : 3.0
Gas sulfur % : 0.034
Diesel sulfur % : 0.3300
CNG/LPG sulfur % : 0.003
Minimum temper. (F): 21
Maximum temper. (F): 53
Average temper. (F): 36
Altitude of region : LOW
/END/

REGION PACKET

This is the packet that defines the region for which emissions are to be estimated.

The first record tells the type of region and allocation to perform.

Valid responses are:
US TOTAL - emissions are for entire USA without state breakout.

50STATE - emissions are for all 50 states and Washington D.C., by state.

STATE - emissions are for a select group of states and are state-level estimates

COUNTY - emissions are for a select group of counties and are county level estimates. If necessary, allocation from state to county will be performed.

SUBCOUNTY - emissions are for the specified sub counties and are subcounty level estimates. If necessary, county to subcounty allocation will be performed.

The remaining records define the regions to be included. The type of data which must be specified depends on the region level.

US TOTAL - Nothing needs to be specified. The FIPS code 00000 is used automatically.

50STATE - Nothing needs to be specified. The FIPS code 00000 is used automatically.

STATE - state FIPS codes

COUNTY - state or county FIPS codes. State FIPS code means include all counties in the state.

SUBCOUNTY - county FIPS code and subregion code.

/REGION/
Region Level : COUNTY
Weld County CO : 08123
/END/

or use -
Region Level : STATE
Michigan : 26000

SOURCE CATEGORY PACKET

This packet is used to tell the model which source
categories are to be processed. It is optional.
If used, only those source categories list will
appear in the output data file. If the packet is
not found, the model will process all source
categories in the population files.

All Equipment - just put semicolon at start of packet name line
or use the following SCC list -
:2260000000
:2265000000
:2267000000
:2268000000
:2270000000
:2282000000
:2285000000
Diesel Only -
:2270000000
:2282020000
:2285002015
Spark Ignition Only -
:2260000000
:2265000000
:2267000000
:2268000000
:2282005010
:2282005015
:2282010005
:2285004015
:2285006015

This is the packet that lists the names of output files
and some of the input data files read by the model. If
a drive:\path\ is not given, the location of the
NONROAD.EXE file itself is assumed. You will probably
want to change the names of the Output and Message files
to match that of the OPTion file, e.g., MICH-97.OPT,
MICH-97.OUT, MICH-97.MSG, and if used MICH-97.AMS.

/RUNFILES/
ALLOC XREF : c:\nonroad\data\allocate\allocate.xrf
ACTIVITY : c:\nonroad\data\activity\activity.dat
TECHNOLOGY : c:\nonroad\data\tech\tech.dat
SEASONALITY : c:\nonroad\data\season\season.dat
REGIONS : c:\nonroad\data\season\season.dat
MESSAGE : c:\nonroad\grco98.msg
OUTPUT DATA : c:\nonroad\grco98.out
EPS2 AMS :
/END/

This is the packet that defines the equipment population
files read by the model.

```
-------------------------------------------------------
/POP FILES/
Population File    : c:\nonroad\data\pop\co.pop
/END/

POPULATION FILE    : c:\nonroad\data\POP\MI.POP


-------------------------------------------------------
This is the packet that defines the growth files
files read by the model.
-------------------------------------------------------
/GROWTH FILES/
National defaults  :C:\nonroad\data\growth\nation.grw
/END/

-------------------------------------------------------
This is the packet that defines the spatial
allocation files read by the model.
-------------------------------------------------------
/ALLOC FILES/
Air Transportation :c:\nonroad\data\allocate\co_airtr.alo
Contruction empl.  :c:\nonroad\data\allocate\co_const.alo
Havested Cropland  :c:\nonroad\data\allocate\co_farms.alo
Golf Course estab. :c:\nonroad\data\allocate\co_golf.alo
Wholesale establis.:c:\nonroad\data\allocate\co_holsl.alo
Family housing     :c:\nonroad\data\allocate\co_house.alo
Logging empl.      :c:\nonroad\data\allocate\co_loggn.alo
Landscape empl.    :c:\nonroad\data\allocate\co_lscap.alo
Metal mining empl. :c:\nonroad\data\allocate\co_metal.alo
Manufacturing empl.:c:\nonroad\data\allocate\co_mnfg.alo
Oil & Gas employees:c:\nonroad\data\allocate\co_oil.alo
Census population  :c:\nonroad\data\allocate\co_pop.alo
RV Park employees  :c:\nonroad\data\allocate\co_rvprk.alo
Surface water area :c:\nonroad\data\allocate\co_water.alo
/END/

-------------------------------------------------------
This is the packet that defines the emssions factors
files read by the model.
-------------------------------------------------------
/EMFAC FILES/
THC exhaust        : c:\nonroad\data\emsfac\exhthc.emf
CO exhaust         : c:\nonroad\data\emsfac\exhco.emf
NOX exhaust        : c:\nonroad\data\emsfac\exhnox.emf
PM exhaust         : c:\nonroad\data\emsfac\exhpm.emf
BSFC               : c:\nonroad\data\emsfac\bsfc.emf
Crankcase          : c:\nonroad\data\emsfac\crank.emf
Spillage           : c:\nonroad\data\emsfac\spillage.emf
Diurnal            : c:\nonroad\data\emsfac\diurnal.emf
/END/

-------------------------------------------------------
This is the packet that defines the deterioration factors
files read by the model.
-------------------------------------------------------
/DETERIORATE FILES/
THC exhaust        : c:\nonroad\data\detfac\exhthc.det
CO exhaust         : c:\nonroad\data\detfac\exhco.det
NOX exhaust        : c:\nonroad\data\detfac\exhnox.det
PM exhaust         : c:\nonroad\data\detfac\exhpm.det
/END/

Optional Packets - Add initial slash "/" to activate

/STAGE II/
Control Factor     : 0
/END/
Enter percent control: 95 = 95% control = 0.05 x uncontrolled
```

Default should be zero control.

MODELYEAR OUT/
by-model-year out : C:\nonroad\outputs\template.bmy
/END/

SI REPORT/
SI report file-CSV :C:\NONROAD\OUTPUTS\NRPOLLUT.CSV
/END/

1998 Point Sources	
facility_name	1998 tpd
WESTERN SUGAR_COMPANY	0.59
CAMAS COLORADO INC/BES	0.01
CONAGRA BEEF COMPANY	0.05
NORTHERN CO MEDICAL CT	0.01
DUKE ENERGY FIELD SERV	0.63
THERMO POWER & ELEC IN	0.24
MEADOW GOLD DAIRY	0.01
THERMO GREELEY INC	0.27
LAFARGE - 35TH AVE PLA	0.02
UNIV OF NORTHERN COLOR	0.00
TOTAL	1.84

Railroad and Rail Service Equipment Emissions t/d

Weld County Rail	92	98	5	10	15
1998 Total Locomotive	total rse	total rse	total rse	total rse	total rse
0.4635	0.0146	0.0166	0.0158	0.0166	0.0178
Total Rail Length	NAA RSE	NAA RSE	NAA RSE	NAA RSE	NAA RSE
111,580	0.0043	0.0048	0.0046	0.0048	0.0052
NAA Rail LENGTH	NAA Locomotive	NAA Locomotive	NAA Locomotive	NAA Locomotive	NAA Locomotive
32,535	0.1186	0.1352	0.1283	0.135	0.1447

Weld (sq meters)	NAA (sq meters)	Weld Households 98	NAA Households 98
10,679,806,897	150,088,633	57,366.46	30,909.59

Appendix A - Greeley Attainment Area VMT Estimate for 1992

Greeley Attainment Area VMT Estimate for 1992

Background

Ambient carbon monoxide monitoring in Greeley since 1981 indicates that the CO NAAQS was last violated in 1988. This implies that the 1989 emission inventory which resulted in this ambient concentration for Greeley would be reasonable estimate of the maximum allowable level of carbon monoxide emissions to maintain the carbon monoxide NAAQS. In conjunction with this proposed revision of the Carbon Monoxide Maintenance Plan for Greeley, a similar mobile source inventory analysis has been performed for the Fort Collins Urban Growth Area to support a Redesignation Request and Maintenance Plan for the area. The base year for the Fort Collins inventory was set at 1992.

The North Front Range Transportation and Air Quality Council (NFRTAQPC) completed *a Mobility Report Card and Household Travel Survey* in 1998. During 1999, planning for the Fort Collins Redesignation Request and Maintenance Plan analysis commenced. At that time, NFRTAQPC felt that limited MPO funds would be spent more wisely on a travel demand model development for 1998 using the *Mobility Report Card* survey data. A later, more current year based on the 1998 survey would also be more useful to the MPO from a planning perspective and in the development of Transportation Improvement Plans and Regional Transportation Plans. Consequently, a travel demand model based on 1998 was developed for the NFRTAQPC over the 10/2000 to 10/2001 timeframe. This travel demand model served as the basis for the 2025 Regional Transportation Plan for NFRTAQPC and was also the basis of the NFRTAQPC 2003-2008 Transportation Improvement Plan.

Greeley Redesignation Base Year Implications

By 1998, the second-high eight-hour average ambient carbon monoxide concentrations in Greeley had dropped to 4.4 parts per million. Consequently, a 1998 inventory represents a level of carbon monoxide emission resulting in ambient concentration of 4.4 parts per million. Since the carbon monoxide NAAQS is 9.0 parts per million for an eight-hour average, the 1998 carbon monoxide emission level represent a level significantly below that needed to attain the ambient standard. Using 1998 as the base year without a complex modeling demonstration to allow higher emission levels eliminates the possibility of relaxing the oxygenated fuels or the automobile inspection and maintenance program in the short term as well as longer term (Calcagni, 1982).

Despite a potentially high rate of VMT growth in the Greeley area between 1989 and 1998, the level of emissions in 1989 would be expected to be significantly higher than 1998 as reflected in the ambient concentration which was closer to the carbon monoxide NAAQS in 1989 (8.0 maximum, 7.3 second-maximum). The general decline of ambient concentrations since 1988 indicates that inventory levels have declined despite the increase in VMT. APCD has chosen to use1992 as the base year for Greeley SIP Revision since a methodology has been developed to estimate VMT levels for this year for the Fort Collins Urban Growth Area. Using 1992 will eliminate the necessity for over-control while still assuring emission levels that maintain the carbon monoxide NAAQS. In fact, the use of 1992 as the base year inventory for a Greeley SIP Revision will assure a high level of conservatism since the 1992 inventories will representative of a 7.2 ppm ambient concentration.

Methodology for Estimating 1992 VMT in Greeley

The USEPA and USDOT recommend two methods for estimating VMT (*Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*, section 3.4). The direct use of Highway

Performance Management System (HPMS) generated VMT is one of the recommendations. The second method, travel demand modeling, also relies on HPMS data. The VMT estimates resultant from transportation planning and travel demand modeling are required to be consistent with HPMS. HPMS data is used directly in the calibration of travel demand modeling, assuring that the travel demand model results are consistent with HPMS.

HPMS data or any standardized, quality assured 'traffic count' data for that matter are an excellent source and information available to infer estimates of VMT levels. Traffic counts are a measure of actual activities on roadways.

The APCD has developed a methodology to use the HPMS traffic count data with the results of the 1998 NFRTAQPC travel demand model to estimate 1992 VMT in Greeley. The goal of this methodology is to determine the growth rates between 1992 and 1998 based on the HPMS traffic data as a function of area type and facility class. These growth rates can then be applied to the 1998 transportation model results to estimate the 1992 VMT in the Greeley Attainment area. The APCD will use the 1992 VMT estimated from this methodology to estimate a 1992 base case mobile source emission inventory for Greeley.

HPMS Traffic Count Data in the Greeley Attainment Area

Table 1 describes the route location, 1992 and 1998 HPMS ADT counts in the Greeley Attainment Area. In order to match the area type and facility class designation with the Greeley Transportation modeling, the area type and facility class of these locations was determined directly from the 1998 transportation modeling.

Summary of HPMS Traffic Count Data by Area Type and Facility Class

The HPMS traffic count data in Table 1 can be summarized by facility type. Table 2 is this base set of HPMS traffic count data in Table 1 volume weighted and summarized by the route and area type and facility class.

Table 1

ROUTE	LOC	92 ADT	98 ADT
263A	ON SH 263, 8TH ST E/O SH 85(Urban/Min. Art.)	4050	6404
034A	ON SH 34 W/O E JCT SH 85(Urban/Exwy)	16400	22715
034A	ON SH 34 E/O E JCT SH 85 BYPASS(Urban/Exwy)	5000	7789
034A	ON SH 34 E/O 8TH AVE(Urban/Exwy)	10400	14711
034A	ON SH 34 E/O 17TH AVE(Urban/Exwy)	24600	34613
034A	ON SH 34 E/O 23RD AVE(Urban/Exwy)	18400	27150
034A	ON SH 34 W/O 23RD AVE(Urban/Exwy)	17700	23040
034A	ON SH 34 E/O 47TH AVE(Urban/Exwy)	17500	20011
034A	ON SH 34 E/O CO RD 29, 71ST AVE(Urban/Exwy)	9150	15251
085C	ON SH 85 NE/O SUNSET DR, LA SALLE(Urban/Exwy)	14400	15901
085C	ON SH 85 N/O 31ST AVE, EVANS(Urban/Exwy)	13400	19470
085C	ON SH 85 S/O 13TH ST(Urban/Exwy)	15800	18713
085C	ON SH 85 S/O 16TH ST(Urban/Exwy)	17100	20444
085C	ON SH 85 S/O SH 34 BUS RT, 18TH ST(Urban/Exwy)	14100	18821
085C	ON SH 85 N/O E JCT SH 34(Urban/Exwy)	13800	19470
085C	ON SH 85 S/O W JCT SH 34(Urban/Exwy)	7000	8004
085C	ON SH 85 N/O 37TH ST, EVANS(Urban/Exwy)	14700	18821
085C	ON SH 85 S/O 37TH ST, EVANS(Urban/Exwy)	18800	21092

ROUTE	LOC	92 ADT	98 ADT
085C	ON SH 85 S/O 42ND ST, EVANS(Urban/Exwy)	17600	20768
085C	ON SH 85 S/O SH 263, 8TH ST(Urban/Exwy)	14100	17739
085C	ON SH 85 S/O FIRST ST, LA SALLE(Urban/Exwy)	16700	21742
085C	ON SH 85 N/O 1ST AVE, LA SALLE(Urban/Exwy)	16300	19254
085C	ON SH 85 N/O FIRST ST, LA SALLE(Urban/Exwy)	17000	20768
085C	ON SH 85 SE/O N JCT SH 85 BUS RT(Urban/Exwy)	7800	7031
085C	ON SH 85 N/O "O" ST, CO RD 64(Urban/Exwy)	10700	11465
085C	ON SH 85 S/O SH 392, LUCERNE(Urban/Exwy)	11200	12007
085C	ON SH 85 SW/O SUNSET DR(Urban/Exwy)	13200	15053
085C	ON SH 85 N/O SH 263, 8TH ST(Urban/Exwy)	11800	15793
085C	ON SH 85 N/O SH 392, LUCERNE(Urban/Exwy)	8200	10844
392B	ON SH 392 W/O CO RD 35(Rural/Maj. Art.)	2850	4377
392B	ON SH 392 E/O SH 85, LUCERNE(Rural/Maj. Art.)	610	3324
392B	ON SH 392 E/O CO RD 31(Rural/Maj. Art.)	2850	4432
392B	ON SH 392 E/O CO RD 35(Rural/Maj. Art.)	2850	4266
392B	ON SH 392 E/O CO RD 37(Rural/Maj. Art.)	2550	4045
392B	ON SH 392 E/O CO RD 29(Rural/Maj. Art.)	2850	4432
034D	ON SH 34 BUS RT, 18TH ST, W/O CHERRY ST(Urban/Min. Art.)	2850	3069
034D	ON SH 34 BUS RT, 18TH ST, E/O 1ST AVE(Urban/Min. Art.)	4850	4385
034D	ON SH 34 BUS RT NW/O E JCT SH 34(Urban/Min. Art.)	1600	1754
034D	ON SH 34 BUS RT, 18TH ST, W/O 1ST AVE(Urban/Min. Art.)	6500	5919
263A	ON SH 263, 8TH ST W/O SH 85(Urban/Min. Art.)	4200	6358
263A	ON SH 263, 8TH ST E/O SH 85 BUS RT(Urban/Min. Art.)	1800	3618
034D	ON SH 34 BUS RT, 10TH ST E/O 14TH AVE(Urban/Maj. Art.)	8800	8875
034D	ON SH 34 BUS RT, 10TH ST E/O 11TH AVE(Urban/Maj. Art.)	7700	7772
034D	ON SH 34 BUS RT W/O 47TH AVE(Urban/Maj. Art.)	15600	18171
034D	ON SH 34 BUS RT, 10TH ST E/O 10TH AVE(Urban/Maj. Art.)	9600	10240
034D	ON SH 34 BUS RT, 10TH ST E/O 23RD AVE(Urban/Maj. Art.)	10200	9821
034D	ON SH 34 BUS RT, 10TH ST W/O 23RD AVE(Urban/Maj. Art.)	10400	10923
034D	ON SH 34 BUS RT W/O ONEWAY PAIR, W/O 23RD AVE(Urban/Maj. Art.)	22200	21847
034D	ON SH 34 BUS RT E/O 35TH AVE(Urban/Maj. Art.)	21100	20796
034D	ON SH 34 BUS RT, 10TH ST W/O N JCT SH 85 BUS RT(Urban/Maj. Art.)	9900	10293
034D	ON SH 34 BUS RT E/O 47TH AVE(Urban/Maj. Art.)	18800	20587
034D	ON SH 34 BUS RT, 18TH ST, W/O SH 85 BYPASS(Urban/Maj. Art.)	3400	3414
034D	ON SH 34 BUS RT E/O CO RD 29, 71ST AVE(Urban/Maj. Art.)	12000	13759
034D	ON SH 34 BUS RT W/O 35TH AVE(Urban/Maj. Art.)	19500	23317
034D	ON SH 34BUS RT, 8TH AVE S/O N JCT SH 85 BUS RT(Urban/Maj. Art.)	11300	13970
034D	ON SH 34 BUS RT, 8TH AVE S/O 13TH ST(Urban/Maj. Art.)	12200	15230
034D	ON SH 34 BUS RT, 8TH AVE S/O 16TH ST(Urban/Maj. Art.)	15100	16385
034D	ON SH 34 BUS RT, 8TH AVE N/O S JCT SH 85 BUS RT(Urban/Maj. Art.)	15500	14284
034D	ON SH 34 BUS RT, 18TH ST W/O 6TH AVE(Urban/Maj. Art.)	3000	2311
034D	ON SH 34 BUS RT, 18TH ST E/O S JCT SH 85 BUS RT(Urban/Maj. Art.)	6300	2731
034Z	ON SH 34 BUS RT, 9TH ST E/O 14TH AVE(Urban/Maj. Art.)	8000	8140
034Z	ON SH 34 BUS RT, 9TH ST SW/O 23RD AVE(Urban/Maj. Art.)	11800	11763
034Z	ON SH 34 BUS RT, 9TH ST E/O 11TH AVE(Urban/Maj. Art.)	5000	5094
034Z	ON SH 34 BUS RT, 10TH AV N/O SH 34 BUS RT,10 ST(Urban/Maj. Art.)	6100	7982
034Z	ON SH 34 BUS RT, 9TH ST W/O 22ND AVE(Urban/Maj. Art.)	10100	9978
085G	ON SH 85 BUS RT S/O 22ND ST(Urban/Maj. Art.)	12900	13865
085G	ON SH 85BUS RT S/O SH 34(Urban/Maj. Art.)	5500	7247
085G	ON SH 85 BUS RT N/O SH 34(Urban/Maj. Art.)	8100	8403
085G	ON SH 85 BUS RT N/O 25TH ST(Urban/Maj. Art.)	5500	5567

ROUTE	LOC	92 ADT	98 ADT
085G	ON SH 85 BUS RT S/O S JCT SH 34 BUS RT(Urban/Maj. Art.)	14200	14494
085G	ON SH 85 BUS RT N/O 22ND ST(Urban/Maj. Art.)	13200	13865
085H	ON SH 85 BUS RT S/O SH 263, 8TH ST(Urban/Maj. Art.)	10400	11449
085H	ON SH 85 BUS RT N/O SH 263, 8TH ST(Urban/Maj. Art.)	10000	11449
085H	ON SH 85 BUS RT S/O N JCT SH 85(Urban/Maj. Art.)	6300	5672
085H	ON SH 85 BUS RT N/O 5TH ST(Urban/Maj. Art.)	8800	9978

Table 2

ROUTE	Facility	Area Type	Sum of 92 ADT	Sum of 98 ADT	Growth Factor
263A	Minor Arterial	Urban	4050	6404	0.5812
034A	Expressway	Urban	119150	165280	0.3872
085C	Expressway	Urban	265500	322356	0.2141
392B	Major Arterial	Rural	14560	24876	0.7085
034D	Minor Arterial	Urban	15800	15127	-0.0426
263A	Minor Arterial	Urban	6000	9976	0.6627
034D	Major Arterial	Urban	232600	244726	0.0521
034Z	Major Arterial	Urban	41000	42957	0.0477
085G	Major Arterial	Urban	59400	63441	0.0680
085H	Major Arterial	Urban	35500	38548	0.0859

Similar road class and area types from the Table 2 (Urban/Expressway, Urban Major Arterial and Urban/Minor Arterial) can be further aggregated and volume weighted. Table 3 lists the aggregation (volume weighted) of the duplicated area type and facility class HPMS traffic count data.

Table 3

Urban/Expressway

Route	Sum of 92 ADT	Sum of 98 ADT	Growth Factor
034A	119150	165280	
085C	265500	322356	
	384650	487636	0.2677

Urban/Major Arterial

Route	Sum of 92 ADT	Sum of 98 ADT	Growth Factor
034D	232600	244726	
034Z	41000	42957	
085G	59400	63441	
085H	35500	38548	
	368500	389672	0.0575

Urban/Minor Arterial

Route	Sum of 92 ADT	Sum of 98 ADT	Growth Factor
263A	4050	6404	
034D	15800	15127	
263A	6000	9976	
	25850	31507	0.2188

HPMS Traffic Count Based Growth Rates

Table 4 describes the final set of HPMS ADT derived growth factors that will be used to estimate the 1992 VMT in the Greeley Attainment Area.

Table 4

Category Assignment	Area Type	Facility Class	1998 - 1992 Growth Factor (1- Growth Factor from Tables 2 and 3)
1	Urban	Expressway	.7323
2	Urban	Major Arterial	.9425
3	Urban	Minor Arterial	.7812
4	Rural	Major Arterial	.2915

1992 Greeley VMT Estimate Based on HPMS Traffic Counts

Area types and facility classes in the 1998 Greeley transportation data set that are not represented in the HPMS traffic count data (Table 4) are assigned growth rates of the closest area type and facility class possible. The assignments are made as follows:

1. Urban/Centroid connectors and Urban/Collector facility classes for all area types were assigned the Urban/Minor arterial growth rate.
2. CBD/Major Arterial and Urban/Ramps were assigned the Urban/Major Arterial growth rate.
3. CBD/Minor Arterial was assigned the Urban/Minor Arterial growth rate.
4. CBD and Rural Expressways were assigned the Urban/Expressway growth rate.
5. All Rural road classes (except Expressway) were assigned the Rural/Major Arterial growth rate.

Table 5 summarizes the application of the growth rates to the 1998 travel demand model to estimate 1992 VMT in the Greeley Attainment area:

Table 5

Area Type	Facility Type	1998 VMT	Growth Factor	1992 VMT
CBD	Centroid Conn	20,119	0.7812	15,717
CBD	Collector	1,780	0.7812	1,390
CBD	Expressway	21,404	0.7323	15,675
CBD	Major Arterial	28,480	0.9425	26,842
CBD	Minor Arterial	13,002	0.7812	10,157
Rural	Centroid Conn	541	0.2915	158
Rural	Collector	2,181	0.2915	636
Rural	Expressway	14,373	0.7323	10,525
Rural	Major Arterial	79,317	0. 2915	23,121
Rural	Minor Arterial	4,301	0.2915	1,254
Urban	Centroid Conn	129,881	0.7812	101,463
Urban	Collector	102,504	0.7812	80,076
Urban	Expressway	297,621	0.7323	217,948
Urban	Ramp	110	0.9425	104
Urban	Major Arterial	347,901	0.9425	327,896
Urban	Minor Arterial	305,901	0.7812	238,970
		1,369,413		1,071,930

Summary and Conclusions

The 1992 VMT in the Greeley Attainment area using the methodology described in the above section is 1,071,930 miles traveled per day. This equates to a growth rate of 4.2%, compounded annually between 1992 and 1998.

On the basis of the information provided in this paper, the APCD believes that the 1992 VMT in Table 5 represents a reasonable and credible estimate of 1992 VMT in the Greeley Attainment Area. The matrix of VMT in Table 5 will be used to estimate the 1992 emissions related to mobile sources in the Greeley Attainment area.

Appendix B - FORTRAN program for the SPEED VMT and VMT BY HOUR MOBILE6 inputs

```
C     program vmt
C     3x period vmt and speeds read from file; bins are calculated for each period
C****
C     and then written to M6 speed definition files
      Dimension am(2),pm(2),op(20),vmt(24),vmtfrac(24),speed(3)
      dimension spdbin(14),binfrac(3,14)
      Character*40 fnam,ayr(5)
      character*3 facdef(4),area(3),rdcls(9)
      data area/'cbd','urb','rur'/
C     this is the order of the fun classes in the text files
      data facdef/'fwy','art','rmp','loc'/
        data rdcls/'fwy','exy','pra','maa','mia','col','rmp','frn',
     x            'loc'/
      data spdbin/2.5,5.,10.,15.,20.,25.,30.,35.,40.,45.,50.,55.,60.,65/
      data am/.5301,.4699/
      data pm/.5156,.4844/
      data op/.0802,.0782,.0761,.082,.0857,.0804,.0842,.0896,
     x      .0706,.0548,.0434,.0372,.0273,.0203,.0152,.0121,.0114,.0113,
     x  .0138,.0262/
C analysis years as follows based on NFRTAQPC 2025 Plan
        data ayr/'1998','2005','2015','1992','2025'/
        do iyr = 1,5
      write(fnam,1)ayr(iyr)
      print *,fnam
1     format(a4,'\uga.txt')
      open(3,file=fnam)
      write(fnam,8)ayr(iyr)
      open(8,file=fnam)
      gtot = 0.0
      do iline = 1,22         ! do loop for max number of lines in ASCII file
          read(3,*,end=10)iarea,ifac,ifc,amvmt,pmvmt,
     x            offvmt,(speed(ip),ip=1,3)
C**********
C processing for hour vmt files
C**********
            vmt(1) = offvmt * op(1)             !op hr 1 (hr 06)
            do ip = 1,2
                 vmt(ip+1)= amvmt * am(ip)            !am in 2-3 (hrs 07-08)
                 vmt(ip+10) = pmvmt * pm(ip)    !pm in 11-12 (hrs17-18)
            end do
            do ip = 4,10                        !op 4-10 (hrs 09-16)
                vmt(ip) = offvmt * op(ip-2)
            end do
            do ip = 13,24                       !op 13-24 (hrs 19-05)
                vmt(ip) = offvmt * op(ip-4)
            end do
            vmtot = amvmt + pmvmt + offvmt
            do ip = 1,24
                 vmtfrac(ip) = vmt(ip)/vmtot
            end do
            write(fnam,5)ayr(iyr),area(iarea),rdcls(ifc)
            close(2)
            open(2,file=fnam)
C write file header
            write(2,6)
C write freeway speeds
            write(2,4)(vmtfrac(ip),ip=1,24)
            gtot = gtot + vmtot
C*************************************************************
C speed bin calculations follow
C*************************************************************
      do ip=1,3
C zero out the bin fractions
```

```
      do i = 1,14
          binfrac(ip,i) = 0
      end do
C find the bin levels for given speed
      if(speed(ip).gt. 65.) speed(ip) = 65.
      do i = 1,14
          if (spdbin(i).ge.speed(ip)) go to 11
      end do
 11   xll = spdbin(i-1)
      xul = spdbin(i)
      binfrac(ip,i-1) = (speed(ip) - xul) / (xll - xul)
      binfrac(ip,i) = 1 - binfrac(ip,i-1)
      end do      !end for period loop
      write(fnam,3)ayr(iyr),area(iarea),rdcls(ifc)
      close(1)
      open(1,file=fnam)
C write file header
      write(1,2)
C write freeway speeds
      do iclass = 1,2         !write Freeway and Arterial Speed vectors
C 6 am - off peak speed
      i = 1
      write(1,9)iclass,i,(binfrac(3,k),k=1,14)
C 7-8 am am peak speeds
      do i = 2,3
           write(1,9)iclass,i,(binfrac(1,k),k=1,14)
      end do
C 9 am - 3 pm off peak speeds
      do i = 4,11
           write(1,9)iclass,i,(binfrac(3,k),k=1,14)
      end do
C 5-6 pm pm peak speeds
      do i = 12,13
            write(1,9)iclass,i,(binfrac(2,k),k=1,14)
      end do
C 7 pm - 5 am off peak speeds
      do i = 14,24
             write(1,9)iclass,i,(binfrac(3,k),k=1,14)
      end do
      end do            !end for freeway/arterial file write loop
C*********************
C write a scenario for this vmt/speed file record
C
C write scenario header record
      write(8,21)area(iarea),rdcls(ifc),ayr(iyr)
 21   FORMAT('SCENARIO REC       : Fort Collins',2X,A3,2X,A3,2X,A4,A2)
C write calendar year record
      WRITE(8,22)ayr(iyr)
 22   format('CALENDAR YEAR      : ',a4)
C write altitude record
      write(8,23)
 23   format('ALTITUDE           : 2')
C write speed vmt record (if road class is Freeway or ARterial)
      if ((facdef(ifac).eq.'fwy').or.(facdef(ifac).eq.'art'))
     x           write(8,24)area(iarea),rdcls(ifc)
C
 24   format('SPEED VMT          : speed\',2a3,'.def')
C write vmt by hour file
      write(8,25)area(iarea),rdcls(ifc)
 25   format('VMT BY HOUR        : vmt\',2a3,'.def')
C write vmt by facility record
      write(8,26)facdef(ifac)
 26   format('VMT BY FACILITY    : ..\..\..\fac\',a3,'.def')
```

```
      write(8,27)
 27   format(a)
      end do      !end for vmt/speed file read
C
 10   continue
      print *,' vmt totals: ',gtot
      end do      !end for the analysis years
 9    format(i1,x,i2,14f7.4)
 4    format(4x,6f8.4)
 7    format(9f5.1)
 5    format(a4,'\vmt\',2a3,'.def')
 3    format(a4,'\speed\',2a3,'.def')
 8    format(a4,'\m6scen.txt')
 6    format('VMT BY HOUR')
 2    format('SPEED VMT')
      end
```

Attachment 1 - Outdoor Air Quality Survey, Spring, 2002 Report: Fort Collins

Outdoor Air Quality Survey

Spring, 2002 Report:

City of Fort Collins

The purpose of this survey and report was to provide the City of Fort Collins with their bi-yearly assessment of the knowledge, attitudes, perceptions and behavior of a representative sample of residents concerning outdoor air quality. For the 2002 survey, special emphasis was placed on wood burning and wood smoke.

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6/3/02

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BACKGROUND

The City of Fort Collins' Air Quality Policy Plan AQPP identifies air quality in Fort Collins to be an issue of significant importance to the City. The City of Fort Collins performs a survey of the general population to assess (1) the appropriateness of the priorities listed in the City's current Air Quality Action Plan (AQAP) and the AQPP; (2) to help define the questions that will give direction to policy, planning, outreach and marketing; (3) to help staff assess current programs and to plan future actions; and (4) to address any other temporary and current air quality issues.

In February of 2000, the four Fort Collins' air quality surveys underwent a rigorous reliability and validity evaluation. The result was an Indoor Air Quality Survey (IAQ) and an Outdoor Air Quality Survey (OAQ) performed on alternating years. The first revised OAQ survey was performed in the fall of 2001. To get both surveys on the schedule of being administered in the Spring on alternating years, the OAQ survey was again administered in the spring of 2002 and the report is on the following pages. In addition, a wood smoke management effort that had been ongoing in the City needed data immediately.

One can always make changes in the home that will not have major effects on lifestyle, and WILL be effective, but outside of the home, or outdoor air quality, the major pollutant is an item that can not easily be forfeited without sometimes some very major changes by the respondent: the automobile. In addition, the air quality is in the control of many, not just the respondent. A community survey could ask what actions the respondent takes, but these are better addressed using objective monitoring techniques. However, a perception and attitude survey can tell the policy makers and planners where their actions and programs might be most effective by measuring the respondent's individual (beliefs, knowledge), social (attitudes), cultural (community norms) and situational (amount of perceived control) variables that go into predicting the intent to act in either pro-environmental or non- pro-environmental ways in their community.

The Outdoor Air Quality survey is designed to address the following objectives:

- Provide knowledge of which programs or events have reached the public;
- Be a measure of which marketing techniques were most effective;
- Measure the resident's perception of the major source of pollution in Fort Collins;
- Determine the resident's belief in "who" is responsible for maintaining and improving air quality in FC;
- Tell planners where to focus programmatic efforts that will be most readily accepted;
- Use attitudes to predict the residents' intent to "reduce the daily miles traveled with his of her vehicle" and some factors that are more likely than others to predict this;
- Measure of apathy due to loss of perceived control over the situation;
- Measure of the current pleasantness rating of the air in FC to compare over time;
- Determine the major source of heat used in FC homes; and
- Determine the number and kind of "other" types of heat, especially wood stoves or wood-burning fireplaces along with are they certified, how often these are used, what percentage of heating they are used for, and (in the case of wood) how much wood is burned.
- Preferences for wood smoke management options currently under consideration.

EXECUTIVE SUMMARY

The 2002 Outdoor Air Quality Survey Objectives and Results:

Objective 1: Knowledge of which programs or events have reached the public and how many have participated in them;

- Emissions Stickers: 77% Participated
- Earth-day: 94% either Participated/Heard of it
- CO2 in the Home 75% either Participated/Heard of it
- Clean Air Logo: 30% Heard of it
- Wood-Smoke Response Line: 22% Heard of it
- Lawn-Mower Rebate: 21% Heard of it

Objective 2: A measure of which marketing techniques were most effective;

Most Effective

- Local Newspaper 63%
- Utility Bill Insert 63%
- Radio 24%
- TV 20%
- Fliers/Brochures 15%
- Friends 12%
- Job 12%

Least Effective

- City Line 0.7%
- Presentations 2%
- Children 4%
- Internet 4%

Objective 3: Residents' perceptions of the major source of air pollution in Fort Collins;

Major

- Gasoline Vehicles: 62%
- Diesel Vehicles: 56%

Minor

- Wood-Burning(Fort Collins): 47%
- Wood-Burning("Your neighborhood"): 47%
- Industry: 42%
- Transfort Buses 30%

Objective 4: The residents' belief in "who" is most responsible for maintaining and improving air quality in Fort Collins;

This question was dropped this year to provide room for the extra wood smoke questions.

Objective 5: Where to focus efforts that will be most readily accepted;

1. Improve Traffic Light Timing to Reduce Vehicle Idling at Lights.
2. Increase Enforcement of Exhaust Regulations for Gas/Diesel Vehicles
3. Prohibit wood-burning on high pollution days
4. Increase Enforcement of Emissions Law
5. Do more to reduce the "Brown Cloud" and improve visibility.
7. Promote the Use of Alternative Fuel Vehicles.
8. Improve safety and access for bikes, skates, pedestrians

Objective 6: An attitude scale that will (1) predict the resident's intent to behave in a pro-environmental way and which factors are more important in their decision; and (2) predict the residents' intent to "reduce the daily miles traveled with his/her vehicle" and some factors that are more likely than others to predict this.

Using "I feel a personal obligation to help improve the AQ in FC" as the intent to behave pro-environmentally and which factors weigh heavier in that decision are listed in the next table. The higher the R^2, the more important this factor is to whether or not they will make personal pro-environmental decisions. In other words, this table shows that when the respondent understands that "small changes" THEY make will improve the air quality, they are more likely to feel a personal obligation to make changes. This tells you where and how to address education programs. Other important factors to the resident to behave in a way that would improve air quality is how they feel about emissions inspections, visibility, the environment, global warming, people with respiratory problems, and odor.

Statement	R^2
I feel that small changes I make can affect the AQ in FC.	.51
Even if no longer required, FC should retain the MV emissions inspection program.	.22
FC has a problem with visibility due to air pollution.	.15
AP in FC is significant enough to hurt the environment.	.15
FC Residents will be negatively affected by global warming.	.15
The City and residents (including myself) of FC are contributing to global warming.	.15
People with respiratory problems have a right to breathe clean air.	.14
AP in FC makes the air smell bad	.12
AP in FC hurts the local economy.	.09
AP in FC is significant enough to cause human health problems, at least for some of the residents. Many of the people I know in FC will NOT be willing to change their day-to-day transportation habits to improve AQ.	.09 .02

The next table shows which factors impact the respondent more in making their decision to reduce the daily miles driven in their vehicle. Results shows that tax break incentives, being able to ride a bike for work or errands, and taking the bus for errands and/or work and if it was more convenient are good predictors of whether or not a respondent would reduce the number of miles that they drive their vehicle each day. Keeping their vehicle tuned up or contributing $10 to subsidize the repair of high polluting vehicles do not predict individual behavior change in reducing miles driven.

Statement	R^2
Reduce the daily miles traveled in my car if there were tax break incentives.	.28
Ride a bike for errands and/or work.	.25
Take the bus for errands and/or work.	.18
Use public transportation if it were more convenient for me.	.16
Keep my vehicle tuned up.	.11
Contribute $10 when registering my vehicle to subsidize repair of high polluting vehicles.	.06

Objective 7: Measure the apathy of residents due to loss of perceived control over the quality of the air in Fort Collins:

Comparing the means of *"Will anything be done"* to *"Can anything be done"* show that they are significantly different ($p < .000$). This tells us that people believe that something can be done but won't be done. Efforts to reverse this belief, which will lead to apathy (they will stop doing anything individually too) should be undertaken.

Objective 8: Current pleasantness rating of the air in Fort Collins for comparison over time.

Very Good	18.7
Good	49.6
Fair	20.2
Poor	0

Objective 9: Major sources of heat used in Fort Collins homes.

1.Natural Gas		80%
2.Hot Water Heater/Furnace		37%
3.Electric		15%
4.Solar Passive	4%	
5.Propane		3%
6. Wood	3%	
7. Solar Active	1.3%	
8. Other	0.7%	
9. Coal		0%

Objective 10: Number and other types of heat sources, especially wood stoves or wood-burning fireplaces.

There were 271 homes with wood-burning appliances (fireplace, insert or stove). Of these, most burnt no wood to less than ¼ of a cord last winter and used it either not at all, or 1-2 times per month. The wood smoke management option most preferred was the least intrusive, of course, and was a voluntary "no burn" on high pollution days.

Summary

The Outdoor Air Quality Survey was conducted in May of 2002. Of the 1500 surveys sent out to a random sample of residents of Fort Collins by mail, we got a very good response for a total of 818 completed surveys were returned, or 55%. The summary of the survey objectives are listed in the previous section of the Executive Summary.

As a way to determine the effectiveness of the City's Air Quality information programs and events, respondents were asked if they recalled hearing about or participating in some of the current and recent programs. In response, residents said they were most familiar with the *Emission Sticker Law*, *Earthday*, and *Carbon Monoxide in the Home* through participation in the programs. *Earthday*, *Carbon Monoxide in the Home*, and the *Clean Air Logo* were substantial in the "heard of it" category.

Next we asked where the resident recalls seeing or hearing information about air quality issues in Fort Collins. Residents responded the most to the *Local Newspaper* (63%),and the *City Utility Bill Insert* (63%). The least effective measures of getting information was *City Line*(.7%), *Presentations* (2%), *Children* (2%), and *Internet* (2%).

Residents perceive *Gasoline Vehicles* (62%) and *Diesel Vehicles* (56%) as the major source of air pollution in Fort Collins.

Sixty two per cent (62%) of the residents state that the air pollution in Fort Collins affects them in some negative way (allergies, respiratory, visually, indoor air. The biggest concern is visibility or that it C*auses a "Brown Cloud*" (76%) and it *Obscured Mountain Views* (70%).

One question focused on *where* the resident believed the City should focus their efforts to best address air quality issues in Fort Collins. The overwhelming response was to *Improve Traffic Light Timing to Reduce Vehicle Idling at Lights* (76% "Strongly Agree). Another response that was chosen often as a "Strongly Agree" was to *Increase Enforcement of Exhaust Regulations for Both Gas and Diesel Vehicles* (55%). Overall, residents agreed more (97%-60%) with the current or planned programs or plans. Even though these were the most frequently picked options, the best predictors of *what* the respondent thinks the City should be doing was to reduce the "brown cloud" and local greenhouse gas emissions; increase enforcement of exhaust regulations and the emissions law; and decrease wood burning.

When asked the question of what the resident would be willing to do to help reduce air pollution in Fort Collins, overall, most residents agreed they would be willing to do something (average of 55.3%) compared to those residents who disagreed that they would be willing to do something (average of 36.4%). The top action residents would be willing to take is to keep their *vehicles tuned up*. An action the residents would very much oppose (69%) is to *contribute $10 when registering vehicle to subsidize repair of high-polluting vehicles.*

The next scale, or set of questions, can tell planners an overall "intent to act/behave" on the resident's part to help reduce air pollution in Fort Collins. Overall, most residents agreed, (70%) that they would be more likely to act (or at least be open to accepting pro-environmental programs or plans), pro-environmentally. See Objective 6.

Even though residents believe that something can be done to improve or maintain the air quality in Fort Collins (70%), only 21% believe something *will* be done.

The main source of heat used in the homes of the respondents was natural gas (79%). Hot water (37%), and electric (15%) were the next most checked sources.

The most common additional source of heat used in homes was electric (16%), followed closely by wood (14%) and passive solar (9%).

Gas fireplaces are the top *other source* of heat for residents (38%) followed very closely by wood burning fireplaces (33%) and electric fireplaces (15%). Gas heat sources show that about half are

certified, but all other sources only show ¼ to 1/3 certified. Gas fireplaces (19.4%) followed by wood heat sources (14.5%) are used to provide the highest percentage of heat for the homes in the survey.

There were 271 homes with wood-burning appliances (fireplace, insert or stove). Of these, most burnt no wood to less than ¼ of a cord last winter and used it either not at all, or 1-2 times per month. The wood smoke management option most preferred was the least intrusive, of course, and was a voluntary "no burn" on high pollution days.

The number of respondents that stated they have experienced unacceptable air quality dropped sharply from 2001 (46%) to 2002 (38%).

Most respondents believe that Fort Collins' air quality will be worse (62%) in five years, while 31% believe it will not change, and only 6% believe it will be better than it is now.

Very few people warm their cars up on cold mornings (16%) longer than 2 minutes, and half (50%) do not warm it up at all.

The numbers of people who will allow guests to smoke in their homes (6.6%) has increased, while the number of people actually smoking in their own homes (7.1%) has dramatically decreased (2000 survey, 17.1%).

The respondents of this survey were equally represented by males and females. The majority fell between 40 and 60 years of age, were two-member households, not pregnant, and 31.8% stated that there was a member suffering from asthma, emphysema, heart disease, or other respiratory ailments. Of these 31.8%, 58.8% believed that the outdoor air negatively impacted their respiratory problems. Most lived here more than 10 years (62%), 60% had a Bachelor's degree or higher and a median family income in the $40,000-$59,000 range. Most respondents were employed outside the home (47%), with an increasing number of self-employed (12%) and retired (28%). Home-owners were the majority of (81.2%), 48.3% live in a home that is more than one-story, a single story (44.1%), with the number of respondents living in apartments or condominiums decreasing steadily.

Recommendations would be to closely examine the marketing efforts that people consistently recognize. Through the additional analyses (regression) it is also apparent that the citizens want the City to improve the visibility and health impacts of the outdoor air in Fort Collins. They also need to understand very clearly the individual impacts they can make. The growing discrepancy between what the residents believe can be done and what will be done also needs to be addressed.

Survey Sample

Response Rate

The Outdoor Air Quality Survey was conducted in May of 2002. The survey used a non-experimental design (survey) with a stratified (by zip code) random sampling of 1,500 residents of the City of Fort Collins. The survey was a mail survey using the Total Design Method (Dillman, 1978) of surveying in order to achieve a higher response rate. Data was scanned into a Scantron scanner for accuracy, and results were analyzed using SPSS for Windows. A total of 818 completed surveys were returned, for a response rate of 55%.

Selecting the Sample

The method used to select a sample for the surveys was stratified random sampling. In random stratified sampling there is some sub-group in a population that is of interest and can be identified. The sub-groups in a community survey are frequently identified by zip codes. The zip codes in Fort Collins represent the various regions of the City. If we had selected a simple random sample of 1,500 residents, we might not have obtained a representative sample from one or more of the zip codes, or regions of the City. The City of Fort Collins has five zip codes and two post office box zip codes. Four of the zip codes (80521, 80524, 80525, 80526) are approximately equally represented in number. Another is a relatively new zip code (80528) and has significantly fewer addresses than the first four. The two post office box zip codes are 80522 in the old post office building downtown, and 80527 in the newer post office building in the south end of town. There is another zip code in Fort Collins (80523) that is exclusive to the University, Colorado State University. No surveys were mailed to 80523. This does not mean the survey excluded students. The only students excluded were ones living on campus in resident halls, dormitories or campus housing. Any students living off campus had an equal chance to be included in the survey. As such, the surveys were mailed proportionately to each zip code (excluding 80523) and the numbers mailed to each can be seen in Table 1.

Table 1. Stratified Random Sampling of 1,500 Surveys by City of Fort Collins' Zip Codes

Zip Codes	Number of Surveys Mailed
80521	350
80524	350
80525	350
80526	350
80528	100

An up-to-date, accurate "resident" mailing list was obtained through a reputable local mailing list company. The mailing list company was directed to randomly sample from the above zip codes. A computer-based record system was used to generate the random list.

Determining Sample Size

The formula used to determine the size of sample necessary to meet the above criteria is:

$$n = (t)^2 (p)(q)/d^2$$

$$(1.96)^2 (.5)(1-.5)/.04^2 = \mathbf{600}$$

Where:

n = sample size needed

t = 1.960 for a 95% confidence limit

p = the proportion estimate (e.g., .50)

q = (1 - p)

d = margin of error (degree of precision or 4%)

In other words, a sample of 600 returned surveys would be an adequate sample at a confidence level of 95%, a margin of error of 4%, and a probability of 0.5. This survey's response rate was 48%.

The response rate for this survey, 818 responses, fell well over the 600 recommended.

METHOD

Survey Procedure

The framework for implementing the 2002 Outdoor Air Quality survey followed the Total Design Method (TDM) developed by Don Dillman (1978). Among other techniques, this method makes use of mailings which both inform potential respondents of forth-coming surveys and remind them to answer and return the survey materials. Typical response rates using this method range from 60% to 99% depending on the perceived importance to the respondent, and the length of the questionnaire. These rates meet established standards of "very good" (Babbie, 1973; as cited in Edwards, Thomas, Rosenfeld & Booth-Kewley, 1997).

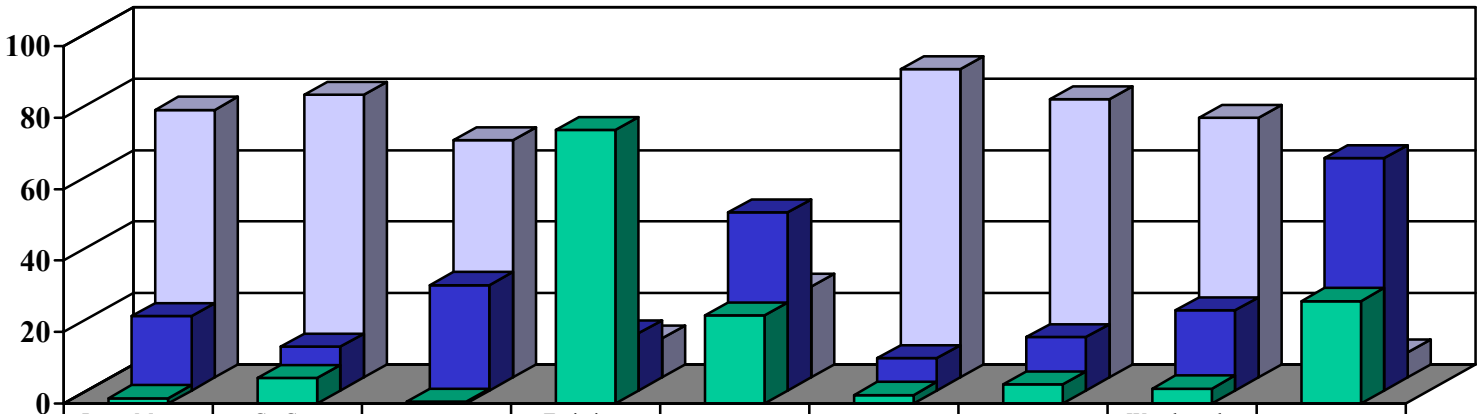
Outline of Survey Procedure Below is an outline of the survey procedure used.

A. Tasks completed before sending out the survey:
    1. Obtained approval from Natural Resources Board
    2. Chose random sample and determined sample size
    3. Developed surveys, scanning software and database to score surveys
    4. Ordered surveys and address labels
    5. Ordered envelopes, postcards, letters (cover, introductory, second and third letters)
    6. Generated address label database to keep track of respondents
    7. Developed database for survey responses
    8. Sent introductory letter April15, 2002 (See Appendix A)
B. Sending out the survey (See Appendix B & C):
    1. Prepared return envelopes
    2. Prepared survey packet
    3. Sent survey packet April 22, 2002
C. Sending out reminder letters:
    1. Sent first reminder postcard April 29, 2002 (See Appendix D)
    2. Sent second copy of the survey with a follow-up cover letter May 6, 2002 to non-respondents (See Appendix E)
    3. Sent a third final reminder letter May 13, 2002 to non-respondents (See Appendix F)
D. Established a final date to accept completed surveys: May 25, 2002.

Q1. In Order to Address Air Quality Issues, the City Focuses on a Variety of Specific Programs and Events. Do you Recall Hearing About, or Participating in, Any of the Following?

The first set of questions focused on specific air quality programs or campaigns currently in place at the City. As a check on marketing success, the responses can tell *where* money and time was well spent and where it was not well spent. This list is updated as needed for each survey year. The *Emission Sticker Law*, *Earthday*, and *Carbon Monoxide in the Home* were the programs/events most people had participated in. *Earthday*, *Carbon Monoxide in the Home*, and the *Clean Air Logo* were substantial in the "heard of it" category. On the other hand, with the exception of *Earthday*, *Emissions Sticker*, and *Carbon Monoxide in the Home*, most events and programs listed fell in the "Never Heard of It" response category.

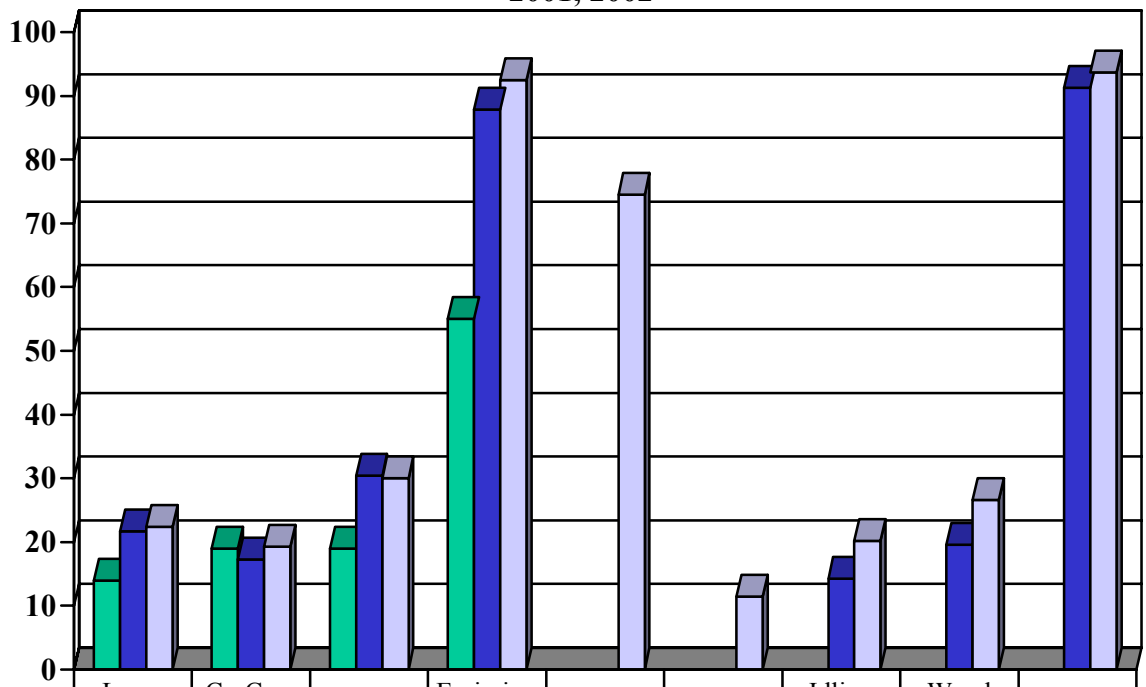
Figure 1. Percentage of Respondents Reached Through Programs and Events: 2002



	Lawn Mower Rebate	CarCare Maintenance	Clean Air Logo	Emissions Sticker	CO2 in Home	ClimateWise	Idling Campaign	Wood-smoke Complaint Line	Earthday
Participated	1.5	7.1	0.5	76.5	24.7	2.4	5.3	4.2	28.7
Heard of it	20.9	12.2	29.5	16	49.8	9	14.9	22.4	65
Never Heard of it	74.9	79.1	66.4	10.9	25.4	86.3	77.8	72.7	7

The survey in 1999 was the first year this question was asked (see Figure 2). New to this survey were the programs/events, *Carbon Monoxide in the Home*, and *ClimateWise*. Though not many changes can be seen, it is still evident that in the past few years, an increasing percentage of residents are being reached by these programs and events.

Figure 2: Either "Heard Of" or "Participated In" Programs and Events Comparison 1999, 2001, 2002

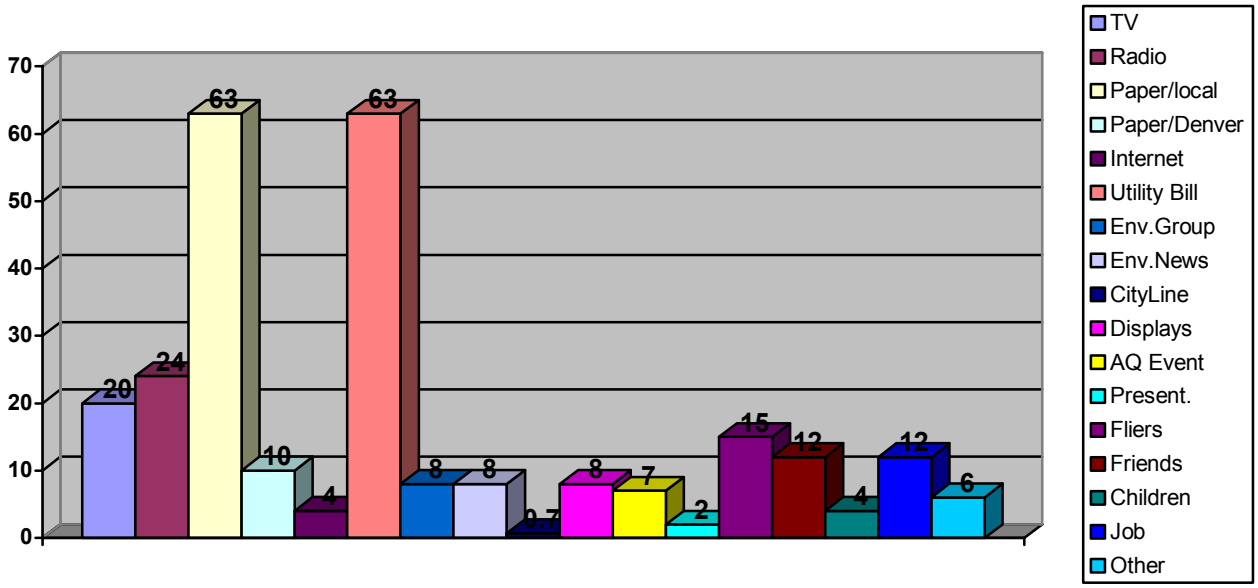


	Lawn Mower Rebate	CarCare Maintenance	Clean Air Logo	Emissions Complian	CO2 in Home	Climate Wise	Idling Campaign	Wood Complaint Line	Earthday
1999	14	19	19	55					
2001	21.7	17.3	30.4	87.9			14.3	19.6	91.3
2002	22.4	19.3	30	92.5	74.5	11.4	20.2	26.6	93.7

Q2. Where do you Recall Seeing or Hearing Information About Air Quality Issues in Fort Collins?

Education of citizens of Fort Collins is a significant part of the City's air quality program. This question gives planners and staff an indication of ***the success of some recent programs and events the City uses to address air quality issues***. This question is also updated each survey year as appropriate. Question Two asked the residents how they recalled receiving information about air quality issues in Fort Collins. The *local newspaper* (63%) and the *utility bill inserts* (63%) were the main sources of information about air quality information (see Figure 3). The least effective sources were found to be: *City Line, Presentations, Children,* and *Internet*.

Figure 3. Sources of Air Quality Information



Comparing years 1997, 1999, 2001, and 2002 (Table 1) we find that very few reall changes are occurring in the sources of air quality information overall. City Line, however, appears to be on a steady decline along with Environmental Groups or News. The utility bill insert and local newspaper remain strong sources of information for residents.

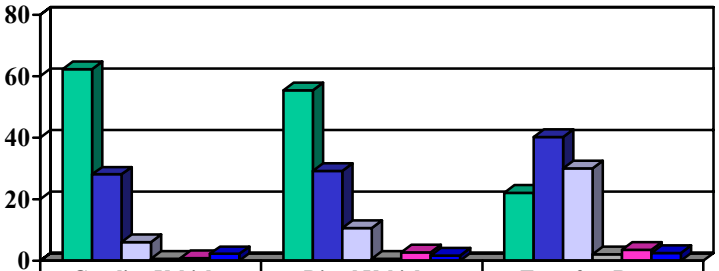
Table 2. Sources of Air Quality Information Comparisons: 1997, 1999, 2001, 2002

Source of Information	Recalled or Heard Information			
	1997 (%)	**1999 (%)**	**2001 (%)**	**2002 (%)**
TV	22	20	22	20
Radio	27	15	27	24
Local Newspaper	64	49	67	63
Denver Newspaper	16	11	8	10
Internet	5	2	4	4
Utility Bill Insert	58	57	61	63
Environmental Group	19	10	8	8
Environmental News	16	10	10	8
City Line	6	3	2	1
Displays	*	7	13	8
Air Quality Program/Event	*	*	*	7
Presentations	*	2	3	2
Flyers/Brochures	*	12	14	15
Friends	30	8	10	12
Children	13	4	3	4
Jobs/School	15	7	11	12
Other	7	3	6	6

Q3. For Each of the Following, Please Indicate if you believe it is a Major, Moderate, or Minor Source of Air Pollution in Fort Collins.

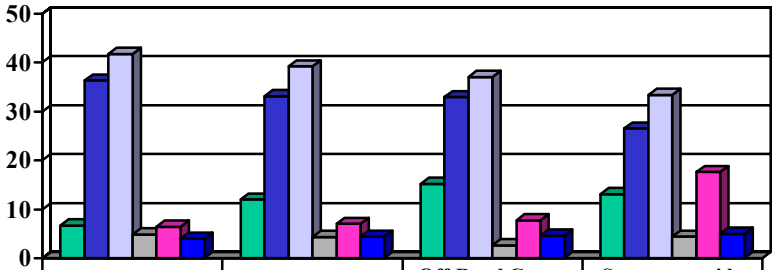
Question Three will directly tell planners and staff where the respondent believes the source of air pollution is coming from and how major, moderate, minor, or non-contributing that source is perceived to be by the respondent. Figures 4a, 4b, and 4c show that gasoline vehicles, followed closely by diesel vehicles are the perceived major source of air pollution in the opinion of the resident. Of the three motor vehicle categories (gasoline, diesel, bus), buses were considered as "minor" sources of air pollution compared to either diesel or gasoline vehicles; with gasoline and diesel three times more than the bus. All others were perceived to be "minor" sources of air pollution in Fort Collins.

Figure 4a: Sources of Air Pollution in Fort Collins



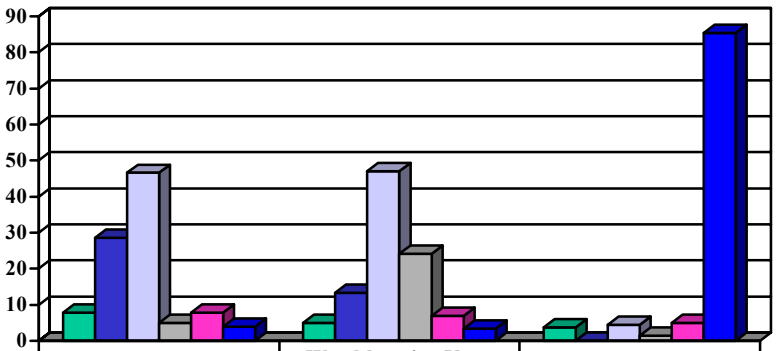
	Gasoline Vehicles	Diesel Vehicles	Transfort Buses
Major	62.3	55.5	22
Moderate	28	29.1	40.2
Minor	6	10.6	30
Does Not Contribute	0.5	0.6	2
Don't Know	0.7	2.7	3.4
Missing Values	2.1	1.5	2.4

Figure 4b: Sources of Air Pollution in Fort Collins



	Industry	Street Dust	Off-Road Const. Equip.	Sources outside FC
Major	6.7	12	15.2	13.1
Moderate	36.3	33.1	32.9	26.5
Minor	41.7	39.2	37	33.4
Does Not Contribute	4.9	4.3	2.6	4.4
Don't Know	6.4	7	7.7	17.6
Missing Values	4	4.4	4.6	5

Figure 4c: Sources of Air Pollution in Fort Collins



	Wood-burning in FC	Wood-burning Your Neighborhood	Other
Major	7.9	4.9	3.8
Moderate	28.6	13.4	0
Minor	46.6	47.1	4.4
Does Not Contribute	5	24.2	1.5
Don't Know	7.9	7	5
Missing Values	3.9	3.4	85.3

Comparing the 2002 survey to previous surveys, Table 3 shows that diesel and gasoline vehicles are still considered to be the biggest contributors to air pollution in Fort Collins. Transfort buses showed a slight increase as a major or moderate source, along with a decrease as a minor source. All other sources, showed a decrease as a major and moderate source, and an increase as a minor source. All together, it appears the respondents perceive motor vehicle emissions to be the major contributing source of air pollution in Fort Collins.

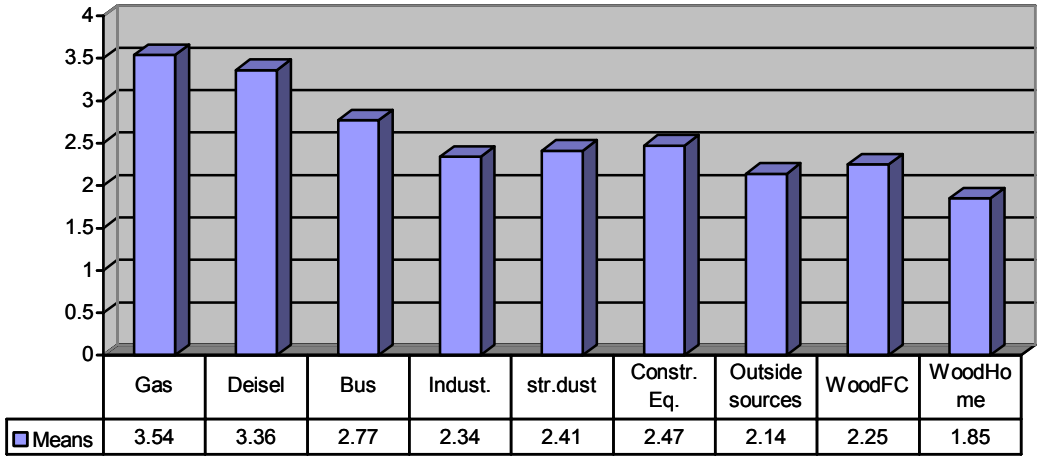
Table 3. Sources of Air Pollution in Fort Collins Comparison: 1997, 1999, 2001, 2002

Sources of AP in FC	Major				Moderate				Minor				Doesn't Contrib.			
	'97	'99	'01	'02	'97	'99	'01	'02	'97	'99	'01	'02	'97	'99	'01	'02
Gasoline Vehicles	57	65	70	62	32	26	22	28	9	9	7	6	<1	<1	0.3	.5
Diesel Vehicles	56	50	56	56	33	35	30	29	9	12	9	11	<1	<1	0.7	.6
Transfort Buses	20	25	21	22	37	36	39	40	37	36	35	30	2	1	1.7	2
Industry in Fort Collins	8	11	13	7	39	37	40	36	43	39	35	42	4	5	4	5
Street Dust	16	17	20	12	32	38	36	33	44	37	31	39	5	5	5	4
Off-Road Construction	*	15	22	15	*	45	37	33	*	32	31	37	*	3	3	3
Sources Outside FC	11	14	18	13	33	30	32	27	27	30	29	33	6	4	3	4
Wood burning Stoves in FC	17	12	15	8	32	32	39	29	40	45	39	47	6	6	2	5
WB in Your Neighborhood	*	*	*	5	*	*	*	13	*	*	*	47	*	*	*	24

A graphic view of the means of the major sources of air pollution in Fort Collins validate that gas and diesel vehicles are considered to be the major sources of air pollution. Wood smoke in their home/neighborhoods had the lowest mean. As to be expected, a test of significance between the means of "wood smoke in Fort Collins" and "wood smoke in your neighborhood" revealed highly significant differences between the two choices ($p < .001$). It is common for an individual to perceive a negative situation to be affecting "everyone else" and not them, even when it is. The psychological explanation for this perception is called cognitive dissonance. It is cognitively dissonant for an individual to believe that they are *knowingly* doing something "wrong." In this example, it is

cognitively dissonant to believe that they are knowingly choosing to live someplace that has negative ambient air. Especially when they may be one of the contributors of that negative air. As such, the respondents in this survey believe that wood smoke is negatively affecting the air quality in Fort Collins, but not in their neighborhood, even though "their neighborhood" is in Fort Collins.

Figure 5. Mean Comparisons of Sources of Air Pollution



	Gas	Deisel	Bus	Indust.	str.dust	Constr. Eq.	Outside sources	WoodFC	WoodHome
Means	3.54	3.36	2.77	2.34	2.41	2.47	2.14	2.25	1.85

Q4, Q5, Q6, Q7. Reliability of Scales

Four of the questions in this survey, Questions Four, Five, Six and Seven, though made up of several questions each, described a "general" scale that represented a concept, or construct. To verify that each question does actually make up a "scale" that reliably measures one factor, an analysis of reliability was performed on each, or a Cronbach's Alpha (α). The closer Cronbach's Alpha comes to 1.0, the more reliable the scale. Table Four shows the reliability scores for Questions Four, Five, Six and Seven. All four scales have good to excellent reliability.

Table 4. Reliability Scores of Questions Four, Five, Six and Seven.

Questions	α
Q4. Adverse Affects of Air Pollution	.87
Q5. Where City Should Focus Programs and Plans	.89
Q6. Something Should be Done about Air Quality in Fort Collins	.88
Q7. Actions Resident Would Take to Help Reduce Air Pollution	.80

Q4. Air Pollution in Fort Collins Affects Me Because it…

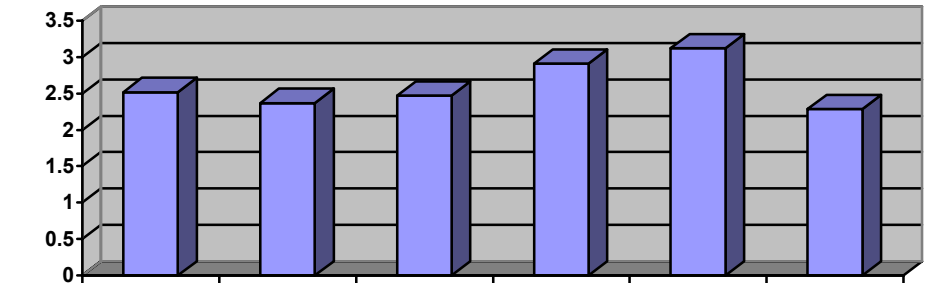
Question Four measured the resident's opinion or belief of how the outdoor air quality of Fort Collins affects their lives. Table Five shows the overall responses (the sum of all the statements or questions for each "agree" category) to Question Four. Sixty two per cent (62%) of the residents state that the air pollution in Fort Collins affects them in some negative way (allergies, respiratory, visually, indoor air). Four percent (4%) were missing values.

Table 5. Overall Responses of Adverse Affects of Air Pollution.

Strongly Agree	Agree	Somewhat Disagree	Disagree	Don't Know
25	37	12	13	9

Means of the adverse affects of air pollution show that more people believe they are affected negatively by the *visual impacts* such as "obscuring mountain views" and "creating a brown cloud" than the physical impacts. Significant differences ($p < .05$) were found between all the means except "Triggers allergies/respiratory problems" and "Causes burning/itchy eyes, nose" ($p > .05$) and "Causes long-term respiratory problems" and "Affects my indoor residential air quality."

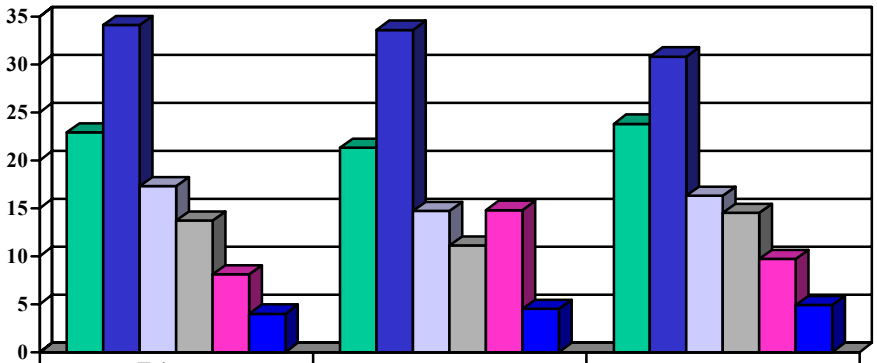
Figure 6. Mean Comparisons for Adverse Affects of Air Pollution



	Allergies	Lg-tm Resp	Burning/Itchy Eyes	Obscures Views	Brown Cloud	Affects IAQ
Means	2.52	2.37	2.47	2.91	3.12	2.29

The results of how residents perceive the adverse affects of air pollution are broken down in Figures 7a and 7b. Visual affects, such *as creating a brown cloud* and *obscuring mountain views*, are rated the highest by the respondents as an adverse affect.

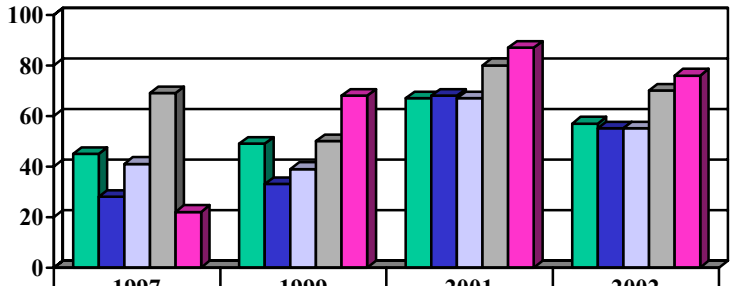
Figure 7a. Adverse Affects of Air Pollution



	Triggers Allergies/Respiratory Problems	Causes Long-Term Respiratory Problems	Causes Burning/Itchy Eyes, Nose
Strongly Agree	22.9	21.3	23.8
Somewhat Agree	34.1	33.6	30.8
Somewhat Disagree	17.3	14.7	16.3
Strongly Disagree	13.7	11.1	14.5
Don't Know	8.1	14.8	9.7
Missing Values	4	4.5	4.9

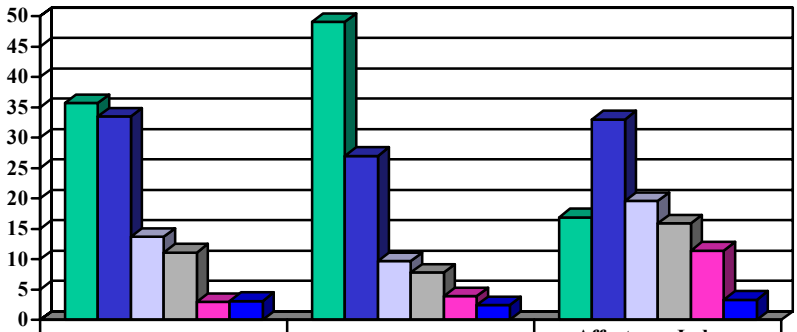
The 2001 and 2002 survey asks the respondent on a scale of "agreement" instead of the 1997 and 1999 "Yes/No" responses. The result is a more accurate and complete measure of the respondent's perceptions of the adverse affects of air pollution in Fort Collins. Even though the comparisons to previous years can not be as clear cut, comparisons between which category is perceived to be the most adverse can still be made. "Strongly Agree" and "Somewhat Agree" from the 2001 survey were added

Figure 8. Adverse Affects of Air Pollution: Changes From 1997, 1999, 2001, 2002



	1997	1999	2001	2002
Triggers Allergies/Respiratory Problems	45	49	67	57
Causes Long-Term Respiratory Problems	28	33	68	55
Causes Burning/Itchy Eyes, Nose	41	39	67	55
Obscures Mountain Views	69	50	80	70
Causes a "Brown Cloud"	72	68	87	76

Figure 7b. Adverse Affects of Air Pollution



	Obscures Mountain Views	Causes a "Brown Cloud"	Affects my Indoor Residential Air Quality
Strongly Agree	35.7	49.1	16.9
Somewhat Agree	33.5	27	33
Somewhat Disagree	13.7	9.7	19.6
Strongly Disagree	11.1	7.8	15.9
Don't Know	2.9	3.9	11.4
Missing Values	3.1	2.4	3.3

together to compare to "Yes" from the previous surveys. In looking closely at the comparisons from 2001 to 2002, "obscuring mountain views" and "creating a brown cloud" were still considered by the respondents to have the worst adverse affects (see Figure 8). With the increased choices on the questions from "Yes" to "Strongly Agree" and "Somewhat Agree" more respondents rank "allergies", "respiratory problems" and "burning, itchy eyes/nose" as important negative affects than did so in both 1997 and 1999.

Q5. To Help Improve Air Quality, City Air Quality Programs and Plans Should…

The main focus of Question Five is to determine ***where the City should focus air quality programs and plans***. Responses should help planners and staff focus efforts where they will be easily and readily accepted. In response to the statements and questions regarding where the City should focus programs and plans, overall, the resident responses ranged from 75 percent *agreeing* to 17 percent *disagreeing* more should be done by the City to better the air quality (see Table 6). Only 3 percent felt that City programs or plans "would not help."

Table 6. Overall: *"City Air Quality Programs and Plans Should…".*

Strongly Agree	Agree	Somewhat Disagree	Disagree	Would Not Help
45	30	10	7	3

The comparison of the means (Table 7) and the frequencies (Figures 8a-8d) for *"City Air Quality Programs and Plans Should…"* show that improving traffic light timing is a very high priority of what the residents believe the City should be doing to improve air quality. Increasing enforcement of exhaust regulations, prohibiting wood burning on high pollution days, increasing enforcement of emissions compliance, and doing more to improve visibility are also important to the residents.

Table 7: Mean Comparisons Of *"City Air Quality Programs And Plans Should…"* With "4" = "Strongly Agree" And "1" = "Strongly Disagree" From Highest To Lowest

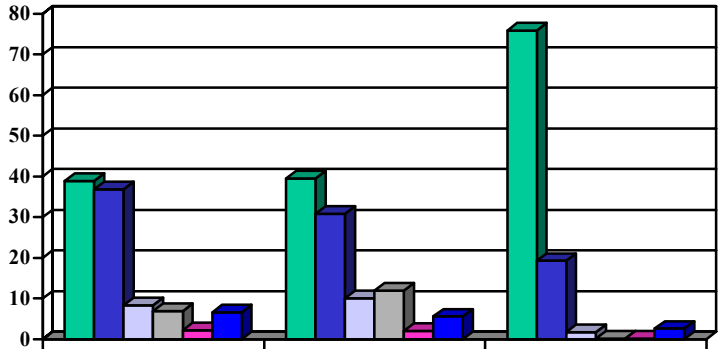
Statement	Means
Improve Traffic Light Timing to Reduce Vehicle Idling at Lights.	3.75
Increase Enforcement of Exhaust Regulations for Both Gas and Diesel Vehicles.	3.30
Prohibit wood-burning on high pollution days.	3.30
Increase Enforcement of Emissions Law.	3.26
Do more to reduce the "Brown Cloud" and improve visibility.	3.23
Promote the Use of Alternative Fuel Vehicles.	3.20
Improve safety and access for bikes, skates, pedestrians.	3.11
Develop Economic Incentives for Repair of High Polluting Vehicles.	3.00
Improve Convenience of Bus Service.	2.94
Encourage Drivers to Turn off Vehicles at any Wait Longer than 3 Minutes.	2.91
Do more to reduce local greenhouse gas emissions.	2.85
Require non-certified wood stoves to be removed at time of home sales.	2.70

Interestingly, the programs/plans that **best predict whether a person believes the City should do "more"** to control air pollution are not in the same order as the means. Table Eight shows a large effect of *doing more to reduce the brown cloud, doing more to reduce local greenhouse emissions, increasing enforcement of exhaust regulations for motor vehicles* and *increasing enforcement of emissions laws* on how strongly the resident believes the City should do more. A moderate effect is seen with *prohibiting wood-burning on high pollution days, requiring non-certified wood stoves to be removed at time of home sales*, and *promoting the use of alternative fuel vehicles* on the belief that the City should do more to control air pollution. A small effect was found for *improving convenience of bus service, developing economic incentives for repair of high polluting vehicles, improving safety and access for bikes, skates, pedestrians, encouraging drivers to turn off vehicles at any wait longer than 3 minutes*, and *improving traffic light timing to reduce vehicle idling at lights.* It is not surprising that improving traffic light timing did not predict as strongly as some of the others since almost all the respondents strongly agreed to this statement. Though the table of means (Table 7) and the frequency responses are important statistics to examine, it is also useful to look at Table 8. Means and frequencies are only revealing preferences for a program or plan to improve air quality in Fort Collins. What Table 8 tells you is how important each program or plan is to the residents in predicting whether the City should be doing more to control air pollution. In other words, programs and plans that focus on visibility, greenhouse gas emissions, exhaust from motor vehicles, and wood smoke are the programs or plans that most residents believe the City should do *more of* to control air pollution. Conversely, the programs that had a small effect on predicting strong responses to the City needing to do *more*, may have been chosen often (frequencies and means), but the same people did not think the City should actually do more of anything to control air pollution. This information should help guide your marketing efforts.

Table 8. Effect Size Of Each Program And Plan On The Resident's Belief That The City Should Do More To Control Air Pollution In Fort Collins

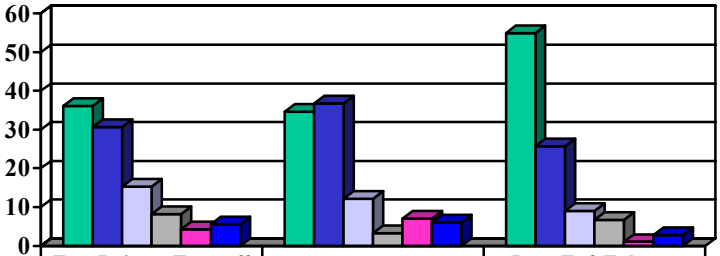
Statement	R^2
Do more to reduce the "Brown Cloud" and improve visibility.	.47
Do more to reduce local greenhouse gas emissions.	.40
Increase Enforcement of Exhaust Regulations for Both Gas and Diesel Vehicles.	.37
Increase Enforcement of Emissions Law.	.36
Prohibit wood-burning on high pollution days.	.28
Require non-certified wood stoves to be removed at time of home sales.	.26
Promoting the use of Alternative Fuel Vehicles	.26
Improve Convenience of Bus Service.	.18
Develop Economic Incentives for Repair of High Polluting Vehicles.	.17
Improve safety and access for bikes, skates, pedestrians.	.14
Encourage Drivers to Turn off Vehicles at any Wait Longer than 3 Minutes.	.07
Improve Traffic Light Timing to Reduce Vehicle Idling at Lights.	.04

Figure9a. City Air Quality Programs and Plans Should...



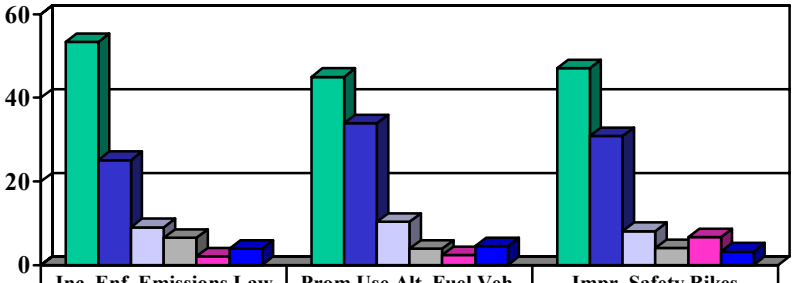
	Do More to control Air Pollution in Fort Collins	Develop Economic Incentives for Repair of High Polluting	Improve Traffic Light Timing to Reduce Vehicle Idling at Lights
Strongly Agree	38.9	39.5	75.9
Somewhat Agree	36.9	30.9	19.3
Somewhat Disagree	8.4	10.1	1.7
Strongly Disagree	7	11.9	0.2
Would Not Help	2.2	2	0.2
Missing Values	6.6	5.6	2.6

Figure 9b. City Air Quality Programs and Plans Should...



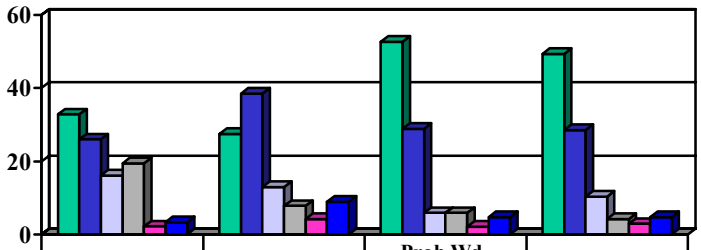
	Enc. Drivers Turn off Veh.	Improve Conven. Bus	Incr. Enf. Exhaust Regs.
Strongly Agree	36.1	34.6	54.9
Somewhat Agree	30.7	36.7	25.7
Somewhat Disagree	15.3	12.2	9
Strongly Disagree	8.2	3.3	6.7
Would Not Help	4.2	7.1	1
Missing Values	5.6	6.1	2.7

Figure 9c. City Air Quality Programs and Plans Should...



	Inc. Enf. Emissions Law	Prom.Use Alt. Fuel Veh.	Impr. Safety Bikes
Strongly Agree	53.4	45	47.1
Somewhat Agree	25.1	33.9	30.9
Somewhat Disagree	9	10.3	8.1
Strongly Disagree	6.5	3.9	4
Would Not Help	2.1	2.4	6.7
Missing Values	3.9	4.5	3.2

Figure 9d. City Air Quality Programs and Plans Should...



	Req.Non-Cert. Wood. Stoves	Reduce Local Greenhouse	Proh.Wd-Burning HghPollution	Reduce Brown Cloud
Strongly Agree	32.8	27.5	52.6	49.3
Somewhat Agree	26	38.5	28.9	28.5
Somewhat Disagree	16.1	13	5.9	10.4
Strongly Disagree	19.4	7.8	5.9	4.2
Would Not Help	2.2	4.2	2.1	2.9
Missing Values	3.4	9	4.8	4.8

As in previous years, in general, the residents support the City's efforts to improve air quality, with those agreeing with the current programs or plans. As in both 1997,1999, and 2001, residents agreed that *improved traffic light timing* should remain at the top of the list for what actions the City should take to improve air quality. Traffic signal timing was followed closely by *Increase enforcement of exhaust regulations for both gas and diesel vehicles, Improve safety and access for bikes, skates, and pedestrians,* and *Increase enforcement of emissions laws.* No major changes were observed from previous years with the exceptions of residents appear to be slightly less concerned about *bike safety and access* and more concerned about *drivers leaving vehicles running at a wait longer than 3 minutes* (Table 9).

Table 9. City "Should Focus Programs and Plans on" Comparison: 1997, 1999, 2001, 2002

Programs and Plans	Strongly Agree				Somewhat Agree				Somewhat Disagree				Strongly Disagree			
	'97	'99	'01	'02	'97	'99	'01	'02	'97	'99	'01	'02	'97	'99	'01	'02
Develop economic incentives for repair of high polluting vehicles.	32	36	44	40	37	40	36	31	16	10	10	10	9	11	9	12
Improve traffic light timing to reduce vehicle idling at lights.	76	73	76	76	20	21	21	19	2	2	2	2	<1	2	0	.2
Encourage drivers to turn off vehicles at any wait longer than 3 min.	36	30	39	36	28	32	34	31	23	19	17	15	8	13	6	8
Improve convenience of bus service.	*	48	47	35	*	7	7	37	*	8	2	12	*	6	5	3
Increase enforcement of exhaust regulations for both gas and diesel vehicle.	59	65	60	55	30	25	26	26	6	5	7	9	4	4	4	7
Increase enforcement of emissions laws.	58	58	58	53	28	27	29	25	7	6	8	9	5	6	4	7
Promote the use of alternative fuel vehicles.	39	40	50	45	39	36	38	34	10	11	7	10	4	5	2	4
Improve safety and access for bikes, skates, and pedestrians.	*	67	59	47	*	24	27	31	*	4	7	8	*	2	2	4
Require non-certified wood-stoves to be removed/replaced at time of home sale.	33	35	30	33	26	27	30	26	19	16	22	16	15	18	14	19

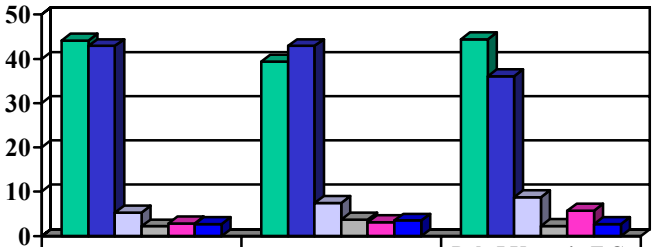
Q6. How strongly do you agree/disagree with the following?

The next scale, or set of questions, gets at the resident's belief of how big the issue of air quality in Fort Collins is to him or her. The questions are based on three factors: (1) statements of their beliefs or perceptions of the air quality in Fort Collins is (attitudes, beliefs), (2) their perception of what type of actions other residents may make (social norms), and (3) how much difference actions they may take would make (perceived control). According to the Theory of Planned

Behavior, the sum of responses to these questions should give a general idea of whether or not the resident may actually act in a pro-environmental fashion. In other words, if the residents generally agreed that there was a problem, their neighbors and friends believed there was a problem, and they could actually do some things to alleviate the problem—they would be more likely to do so. This scale can tell planners an overall "intent to act/behave.". In looking at all the responses, most residents agreed, (70%) indicating that they would be more likely to act (or at least be open to accepting pro-environmental programs or plans), pro-environmentally. See Figures 10a-10d.

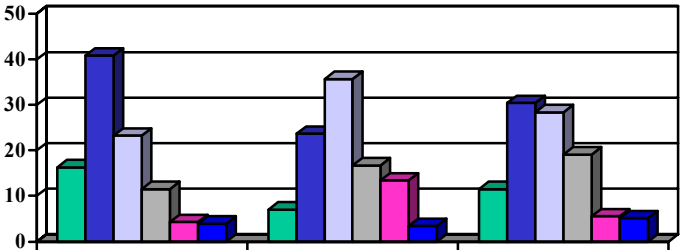
Even though people responded that they would be willing to make changes, they perceive that others will not. We see this in the first graph where they state they will make changes, but everyone they know will not. One must keep in mind the fact that to someone else, the respondent (who claims they will make changes), is "people I know in Fort Collins" and is perceived by others as not willing to make changes. The second graph shows that people are, again, disturbed by the visibility due to air pollution in Fort Collins. They agree, but not strongly, that the air pollution may be negatively impacting the economy and that the air smells bad. More people believe that Fort Collins is impacting and being impacted by global warming than do not believe this. Also, it is very clear from several places in this survey (reliability) that the emissions program is a program that should be kept.

Figure 10a: Attitudes, Norms, and Perceived Control of Air Quality in Fort Collins



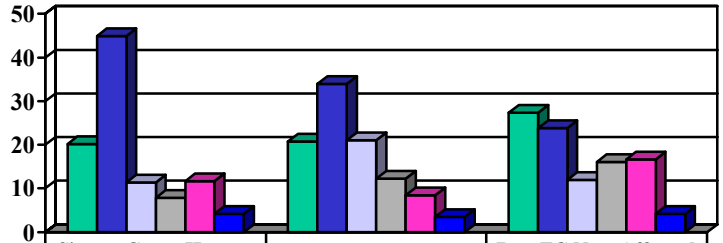
	Personal Obl. Help Improve AQ in FC	Small Changes I Make Affect AQ FC	Pple I Know in F.C. Will NOT Chge Transportation
Strongly Agree	44.1	39.4	44.4
Somewhat Agree	42.9	42.9	36.1
Somewhat Disagree	5.3	7.5	8.8
Strongly Disagree	2.2	3.7	2.3
Don't Know	2.8	3.1	5.7
Missing Values	2.7	3.5	2.7

Figure 10b: Attitudes, Norms, and Perceived Control of Air Quality in Fort Collins



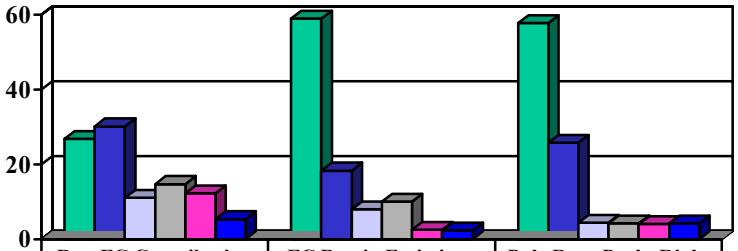
	F.C. Has a Problem with Visibility Due to Air Pollution.	AP Hurts Local Economy.	AP in F.C. Makes Air Smell Bad.
Strongly Agree	16.3	7	11.5
Somewhat Agree	40.8	23.7	30.4
Somewhat Disagree	23.2	35.7	28.4
Strongly Disagree	11.5	16.7	19.1
Don't Know	4.3	13.4	5.5
Missing Values	3.9	3.4	5.1

Figure 10c: Attitudes, Norms, and Perceived Control of Air Quality in Fort Collins



	Sign.to Cause Human Hlth Probl	Hurt Environment	Res. FC Neg. Affected by global warming
Strongly Agree	20.2	20.7	27.3
Somewhat Agree	44.9	34	23.8
Somewhat Disagree	11.4	21.1	11.9
Strongly Disagree	7.8	12.3	16.1
Don't Know	11.6	8.4	16.7
Missing Values	4.2	3.4	4.2

Figure 10d: Attitudes, Norms, and Perceived Control of Air Quality in Fort Collins



	Res. FC Contributing To Global Warming	FC Retain Emissions Program	Pple Resp Prob: Right to Clean Air
Strongly Agree	26.8	58.9	57.7
Somewhat Agree	30.1	18.3	25.7
Somewhat Disagree	11	7.9	4.3
Strongly Disagree	14.7	10	4.2
Don't Know	12.2	2.4	4
Missing Values	5.3	2.3	4.2

For 2001 and 2002, all statements were compared. Small, non-significant changes were seen.

Table 10: Comparison Between Belief Statements 2001, 2002

Statements	Strongly Agree		Somewhat Agree		Somewhat Disagree		Strongly Disagree	
	2001	2002	2001	2002	2001	2002	2001	2002
I feel a personal obligation to help improve the air quality in FC.	41	44	48	43	7	5	2	2
I feel that small changes I make *can* affect the air quality in FC	38	39	46	43	10	8	5	4
Many of the people I know in FC will NOT change their transportation habits to improve air quality in FC	41	44	39	36	12	9	1	2
FC has a problem with visibility due to air pollution	21	16	40	41	27	23	7	12
Air pollution in FC hurts the local economy	9	7	29	24	37	36	14	17
Air pollution in FC makes the air smell bad.	16	12	32	30	33	28	15	19
Air pollution in FC is bad enough to cause human health problems.	29	20	40	45	16	11	7	8
Air pollution in FC is significant enough to hurt the environment	28	21	33	34	22	21	11	12
The City of FC's residents will be negatively affected by global warming	32	27	32	24	11	12	11	16
The City and residents (including myself) of FC are contributing to global warming	34	27	37	30	10	11	10	15
Even if not required, FC should retain motor vehicle emissions inspect.	64	59	23	18	7	8	7	10
People with respiratory problems have a right to breathe clean air	68	58	23	26	4	4	3	4

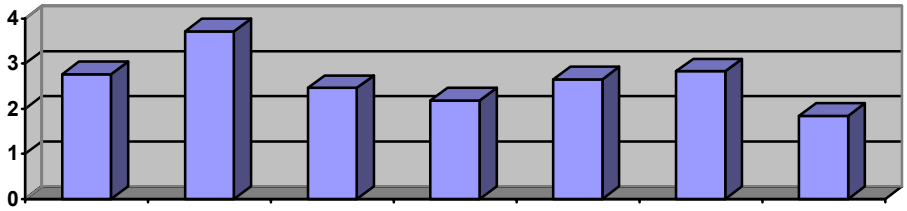
Q7. To Help Reduce Air Pollution in the City of Fort Collins, "I" Would be Willing To…

When asked the question of what the resident would be willing to do to help reduce air pollution in Fort Collins, overall, most residents agreed they would be willing to do something (average of 55.3%) compared to those residents who disagreed that they would be willing to do something (average of 36.4%). An average of 3% felt that the actions would not help anyway. The top action residents would be willing to take is to keep their *vehicles tuned up*. The next set of actions many residents state they would be willing to do is *reduce the number of miles they drive their vehicle, ride a bike for work or errands, reduce number of miles driven in car if there was a tax break incentive,* and *use public transportation if it were more convenient* (Figure 12a and 12b). An action the residents would very much oppose (69%) is to *contribute $10 when registering vehicle to subsidize repair of high-polluting vehicles.* Residents also appear to disagree/somewhat disagree that taking the bus is a possible action they might take to reduce air pollution (53 %).

Compared to 2001, 1999 and 1997, residents again picked *keep my vehicle tuned up* as a top action they would take to help reduce air pollution. This year, less residents would be willing to *ride their bike* or *take the bus* (see Table 11). Overall, residents stated they were less likely to take actions that would contribute to reducing air pollution. Even though the 2001 survey changed the dollar amount of the *contribution when registering their vehicle*, the number of residents that disagreed that this is an action they would be willing to take remained larger than those who agreed they would take.

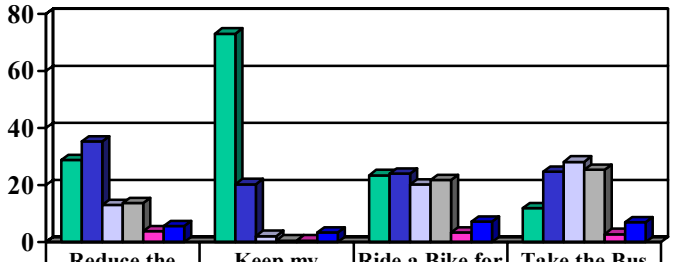
Mean comparisons of the measures of the intent to behave pro-environmentally (Figure 11) show that people are most willing to keep their car tuned up, but least willing to contribute$10.00 to subsidize the repair of high polluting vehicles. This is interesting and could be explained as, residents are willing to spend much more money on their own property to reduce air pollution, but not at all willing to spend a very small (in comparison to a tune-up) amount on someone else's property. Some thought could go into how a marketing or education program could address this issue.

Figure 11: Individual Actions Respondents Would be Willing to Do



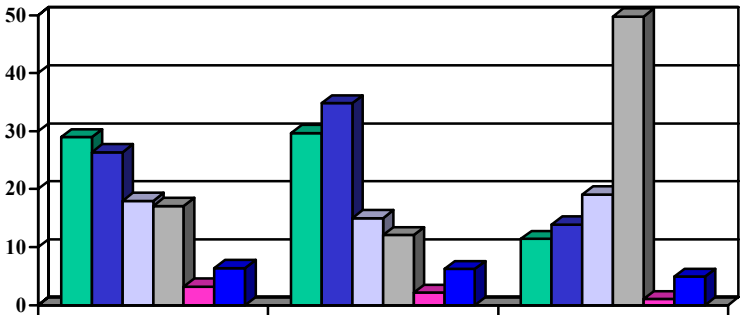
Means	2.76	3.71	2.46	2.19	2.65	2.83	1.84

Figure 12a: Individual Actions to Reduce Air Pollution



	Reduce the Number of Miles I Drive	Keep my Vehicle Tuned Up	Ride a Bike for Errands and/or Work	Take the Bus for Errands and/or Work
Strongly Agree	28.7	73.2	23.5	11.9
Somewhat Agree	35.2	20.3	24.1	24.7
Somewhat Disagree	13	2.1	20.2	28.2
Strongly Disagree	13.7	0.5	21.8	25.4
Would Not Help	3.8	0.5	3.3	2.8
Missing Values	5.6	3.4	7.2	7

Figure 12b: Individual Actions to Reduce Air Pollution



	Reduce Daily Miles Traveled in My Car if Tax Break Incentives	Use Public Transportation if more Convenient	Contri $10 Reg.Veh. to Subsidize Repair of High Polluting Vehicles
Strongly Agree	29	29.7	11.4
Somewhat Agree	26.4	34.8	13.9
Somewhat Disagree	18	15	19.1
Strongly Disagree	17.1	12.1	49.8
Would Not Help	3.2	2.1	1
Missing Values	6.4	6.2	4.9

Table 11: Comparison of Individual Actions to Reduce Air Pollution: 1997, 1999, 2001, 2002

Statements	Strongly Agree				Somewhat Agree				Somewhat Disagr.				Strongly Disag.			
	'97	'99	'01	'02	'97	'99	'01	'02	'97	'99	'01	'02	'97	'99	'01	'02
Reduce the number of miles I drive my vehicle each day.	27	30	34	29	41	43	35	35	15	12	14	13	13	14	12	14
Keep my vehicle tuned up.	76	77	71	73	22	20	25	20	1	1	2	2	<1	1	<1	<1
Ride a bike for errands and/or work.	21	26	30	24	22	27	30	24	16	16	19	20	34	27	18	22
Take the bus for errands and/or work.	10	12	15	12	19	23	30	25	34	28	29	28	28	31	22	25
Reduce the daily miles traveled in my car if there were tax break incentives	*	*	34	29	*	*	34	26	*	*	16	18	*	*	11	17
Use public transportation if it was more convenient for me	*	*	40	30	*	*	36	32	*	*	13	15	*	*	9	12
Contribute ($1*) $10 when registering my vehicle to subsidize repair of high-polluting vehicles.	* 24	* 25	10	11	* 22	* 20	17	14	* 14	* 13	19	19	* 38	* 38	49	50

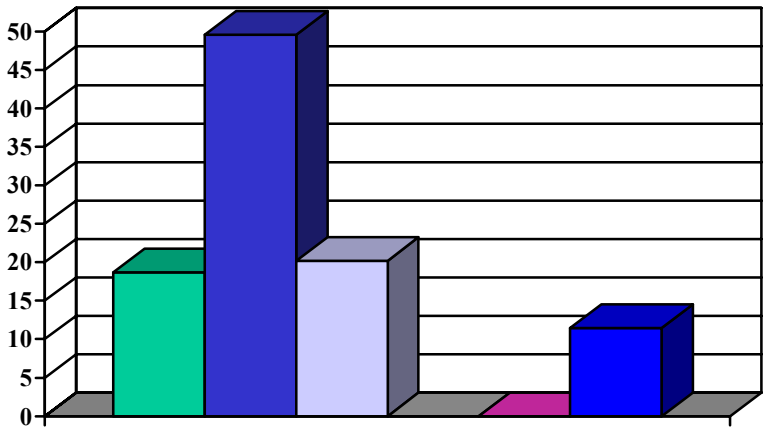
Q8. Have You Ever Experienced Unacceptable Outdoor Air Quality in Fort Collins?

This question was new to the 2001 survey so only comparisons with 2001 can be made. Figure 13 shows that more residents did not experience unacceptable outdoor air quality in Fort Collins. Between this question and the next question, the degree of awareness and concern in regard to air quality in Fort Collins can be found. Somewhat less than half of the respondents have at some time or another experienced unacceptable air quality in Fort Collins, but more have not. The responses to this question changed somewhat since last year and will be interesting to watch over time.

Q9. Overall, How Would You Rate the Quality of Outdoor Air in Fort Collins?

Figure 14 shows that half of the respondents rate the overall air quality in Fort Collins as "good" (50%).

Figure 14: Rating of Overall Air Quality in Fort Collins



Very Good	18.7
Good	49.6
Fair	20.2
Poor	0
Not Sure	0
Missing Values	11.5

Table 12 shows the results of the previous surveys. Most respondents rated the air quality as "good", 46% in 1997 and 43% in 1999, with very few rating it as "excellent" or "poor." Compared to the first two surveys, both the 2001 and the 2002 surveys found less people rating the air quality as "very good." However, this year, no one rated it as "poor."

Table 12: Rating of Overall Air Quality in Fort Collins Comparison: 1997, 1999, 2001

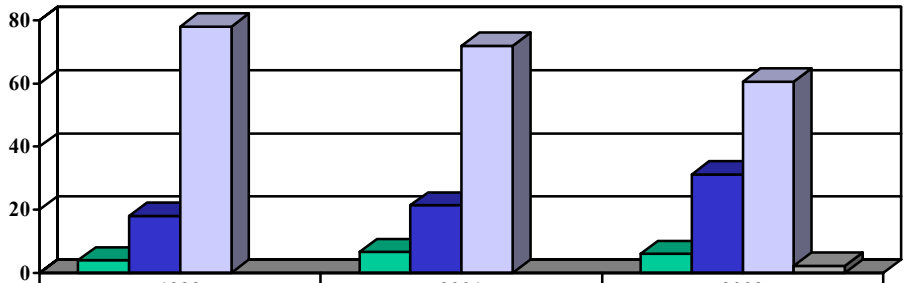
Rating	1997	1999	2001	2002
Excellent	4	6	*	*
Very Good	23	24	16	19
Good	46	43	53	50
Fair	23	23	28	20
Poor	2	2	2	0
Not Sure	*	*	0.8	0

Q10. What Do You Think Fort Collins' Air Quality Will be Like in Five Years?

Figure 15 shows that most respondents believe that Fort Collins' air quality will be worse (61%) in five years, while 31% believe it will not change, and only 6% believe it will be better than it is now. Considering that 50% consider the air quality "good" and almost half have at some time or another experienced unacceptable air quality, these results indicate that the respondents believe the air quality is going to not remain at "good", especially in light of the fact that they have already experienced unacceptable air quality. More respondents in this survey, 2002, believe that the air quality will remain the same and less believe it will get worse, however, about the same percent of respondents believe it will get better.

What about the public's feelings about the actualities? The issue the previous question and the next two questions get at concerns the respondent's view of the chances that anything effective will or can be done to maintain and/or better

Figure 15: What Will Fort Collins'Air Quality Be Like In Five Years From Now?

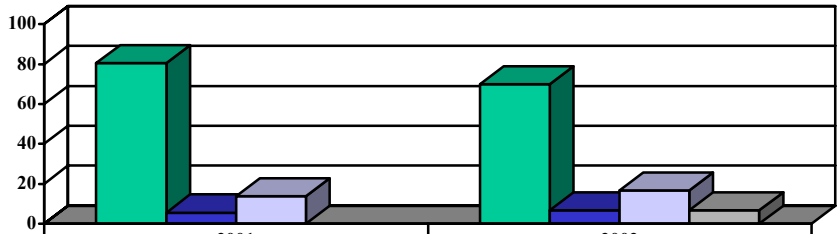


	1999	2001	2002
Better Than Now	4	6.6	6
No Change From Now	18	21.4	31.2
Worse Than Now	78	71.9	60.6
Missing Values			2.2

the air quality in Fort Collins. The next two questions directly assess whether something can be done. Results show in Figure 13 that residents do, in general, believe that something can be done to improve or maintain the air quality in Fort Collins (70%). Still, less residents in 2002 compared to 2001 think that something can be done. More people just don't know. Comparing can something be done to will something be done shows that four times as many people believe nothing will be done as can be done. This is important to note.

Q11. Do You Think Anything *Can* Be Done to Improve the Air Quality in Fort Collins?

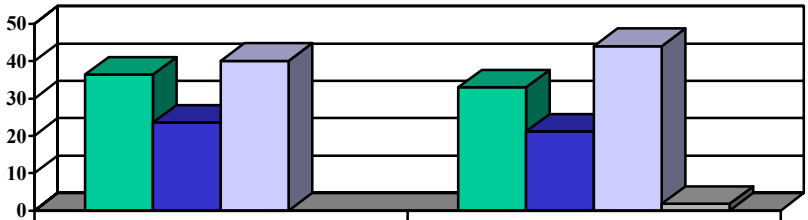
Figure 16: Can Something Be Done To Maintain or Improve the Air Quality in Fort Collins?



	2001	2002
Yes	80.5	69.9
No	5.6	6.7
Don't Know	13.8	16.7
Missing Values		6.6

Q12. Do You Think Anything *Will* Be Done to Improve the Air Quality in Fort Collins?

Figure 17: Will Something Be Done To Improve or Maintain the Quality of Air in Fort Collins?

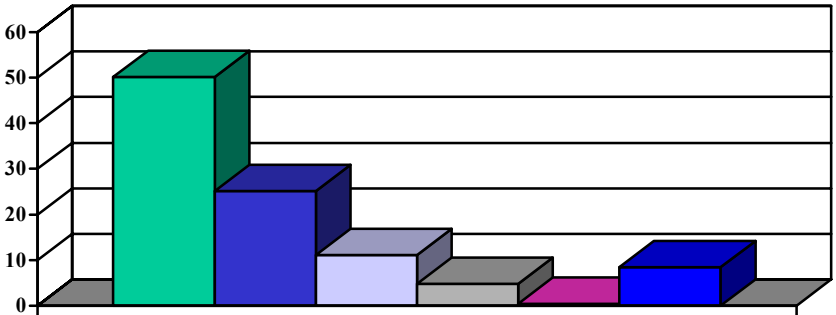


	2001	2002
Yes	36.4	33
No	23.5	21.1
Don't Know	40.1	44
Missing Values		1.8

Q13. How Long Do You *Typically* Warm Up Your Car on Winter Mornings Before Driving Away?

Figure 18 shows that almost half of the respondents do not warm up their car at all, a quarter of the respondents warm it up for 1-2 minutes, and very few warm it up more than 5 minutes.

Figure 18: Time Respondent Warms up Car on Cold Days



	2002
Do NOT warm up car	50.1
1-2 Minutes	25.2
3-5 Minutes	11.1
5-10 Minutes	4.8
> 10 Minutes	0.4
Missing Values	8.4

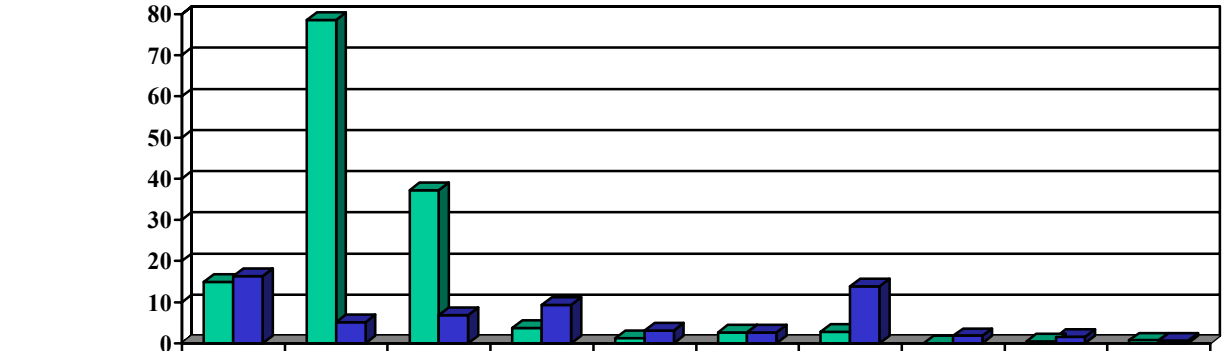
Q14. How Many People in Your Household Smoke Cigarettes, Cigars, or Pipes?

This is an interesting change from the Indoor Air Quality survey of 2000. The numbers of people who will allow guests to smoke has increased, while the number of people actually smoking in their own homes has dramatically decreased.

Q15. Main Sources of Heat Currently Used in Home.

The main source of heat used in the homes of the respondents of the 2002 survey was natural gas (79%). Hot water (37%), and electric (15%) were the next most checked sources. (see Figure 20).
* Numbers do not add to 100% because each source was checked "yes" "no."

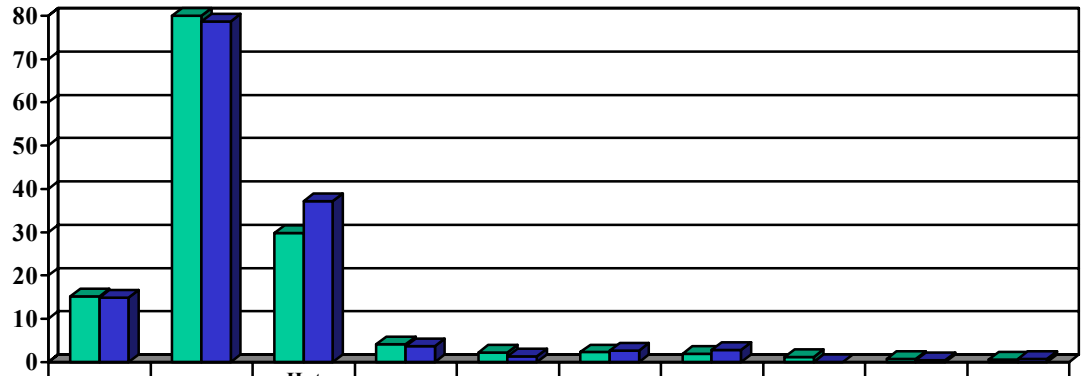
Figure 20: Main and Additional Sources of Heat



	Electric	Natural Gas	Hot Water Heater/Fu	Solar Passive	Solar Active	Propane	Wood	Coal	Other	Don't Know
Main Heat	14.9	78.6	37.2	3.7	1.3	2.7	2.8	0	0.5	0.7
Additional Heat	16.3	5.1	6.8	9.4	3.1	2.6	13.8	1.8	1.6	0.6

For previous years, 1995 and 1997, natural gas was the most common source of heat at 81% and 79% respectively. Hot water heat was not listed in 1995 as a choice and was only 4% in 1997. Electric heat was 15% in 1995 and 12% in 1997. Figure 21 shows very little change from 2001 to 2002 in the main household heating sources. Hot water decreased somewhat and wood and propane increased.

Figure 21: Comparison of Main Heating Sources: 2001, 2002

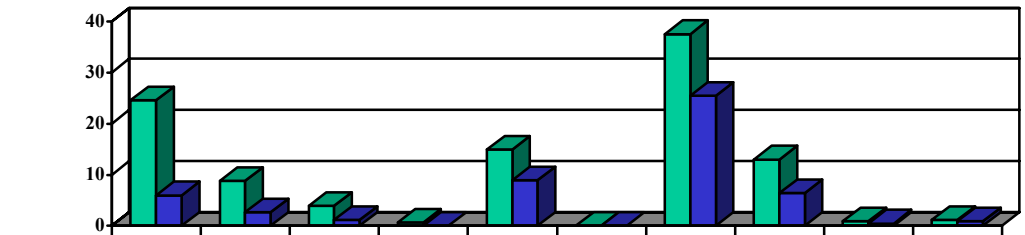


	Electric	Natural Gas	Hot Water Heater/Fu	Solar Passive	Solar Active	Propane	Wood	Coal	Other	Don't Know
2001	15.2	80	29.8	4.1	2.2	2.3	1.9	1.2	0.7	0.6
2002	14.9	78.6	37.2	3.7	1.3	2.7	2.8	0	0.5	0.7

Q16. Please Indicate if your Home has Each of the Following and if it is Certified?

Gas fireplaces are the top other source of "other sources of heat" for residents (38%) followed by wood burning fireplaces (25%) and electric fireplaces (15%). The percent of those who checked they are certified are calculated on the group of those who responded "Yes" to each. Gas fireplaces appear to be the most likely to be "certified." Any of the wood-burning sources were the least likely to be certified. (see Figure 22).

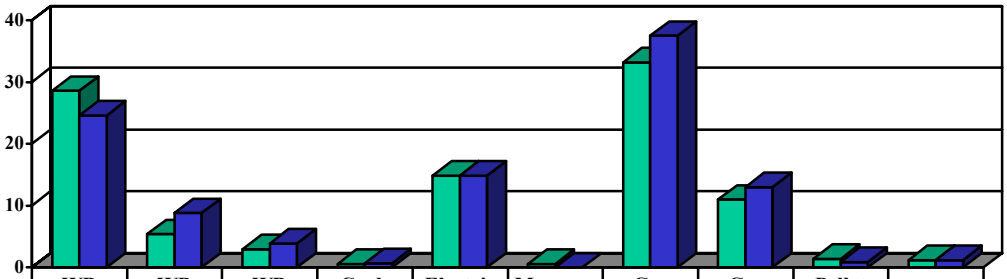
Figure 22. Percent of Homes With Other Sources of Heat and the Percent Certified



	WB Fireplace	WB Stove	WB Insert	Coal-Burning	Electric Fireplace/	Masonry Heater	Gas Fireplace	Gas Stove	Pellet Stove	Other
Percent	24.6	8.8	3.9	0.7	14.9	0	37.5	13	0.9	1.2
Certified	6	2.7	1.2	0	8.9	0	25.4	6.4	0.5	0.9

Comparing results to the 2001 survey, the percent of Other Heat Sources were virtually unchanged. Small increases are seen in wood-burning stoves and inserts and a decrease in wood-burning fireplaces. Gas fireplaces and stoves are increasing.

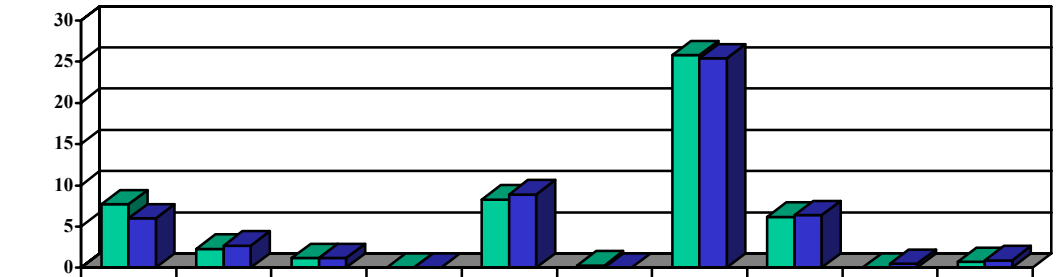
Figure 23. Comparison 2001, 2002, Percent of Homes with Other Sources of Heat



	WB Fireplace	WB Stove	WB Insert	Coal-Burning	Electric Fireplace	Masonry Heater	Gas Fireplace	Gas Stove	Pellet Stove	Other
2001	28.6	5.4	3	0.6	14.9	0.6	33.2	11	1.4	1.2
2002	24.6	8.8	3.9	0.7	14.9	0	37.5	13	0.9	1.2

Comparing the percent of those other sources of heat that were certified to the 2001 survey, again, no changes were found.

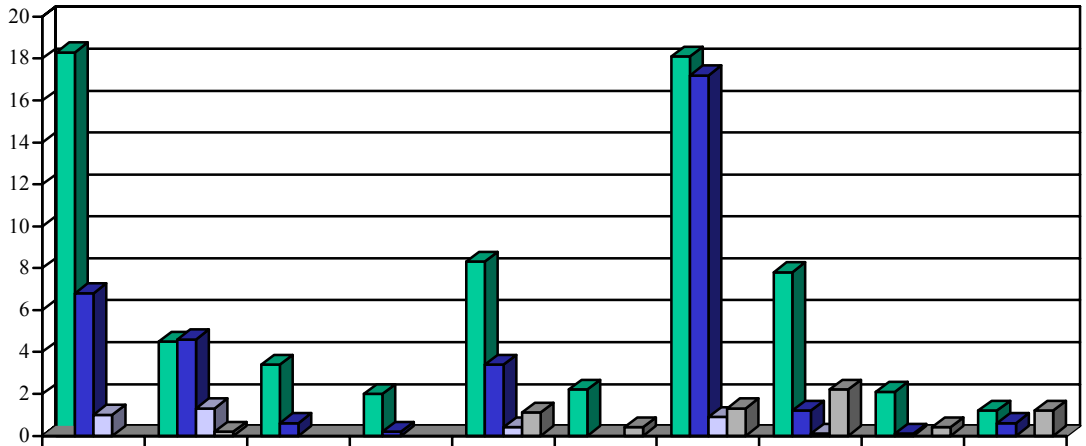
Figure 24. Comparison 2001, 2002, Percent of Other Sources of Heat That are Certified



	WB Fireplace	WB Stove	WB Insert	Coal-Burning	Electric Fireplace	Masonry Heater	Gas Fireplace	Gas Stove	Pellet Stove	Other
2001	7.7	2.3	1.2	0	8.3	0.3	25.8	6.2	0	0.7
2002	6	2.7	1.2	0	8.9	0	25.4	6.4	0.5	0.9

A new question for 2002, respondents were asked what percentage of heating each "other source of heat" provided and how often it was checked or cleaned.

Figure 25. Percentage of Heating for Other Heat Sources

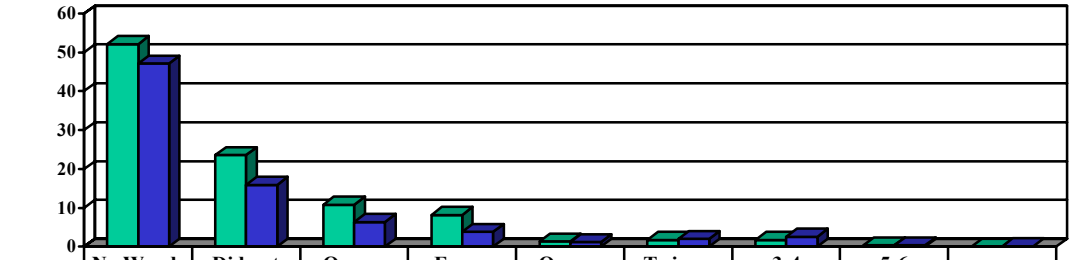


	WB Fireplace	WB Stove	WB Insert	Coal-Burning	Elect.	Masonry	Gas Frpl.	Gas Stove	Pellet	Other
none	18.3	4.5	3.4	2	8.3	2.2	18.1	7.8	2.1	1.2
<25%	6.8	4.6	0.6	0.2	3.4		17.2	1.2	0.1	0.6
25-50%	1	1.3			0.4		0.9	0.1		
>50%		0.2			1.1	0.4	1.3	2.2	0.4	1.2

Q17. If Resident Has a Wood-Burning Fireplace or Stove, How Often Was it Used Last Winter? (Figure 26)

Most respondents did not use their wood stove or fireplace at all last winter (23.6%). Only one respondent used one every day.

Figure 26: Days Per Month Wood Stove/Fireplace Used

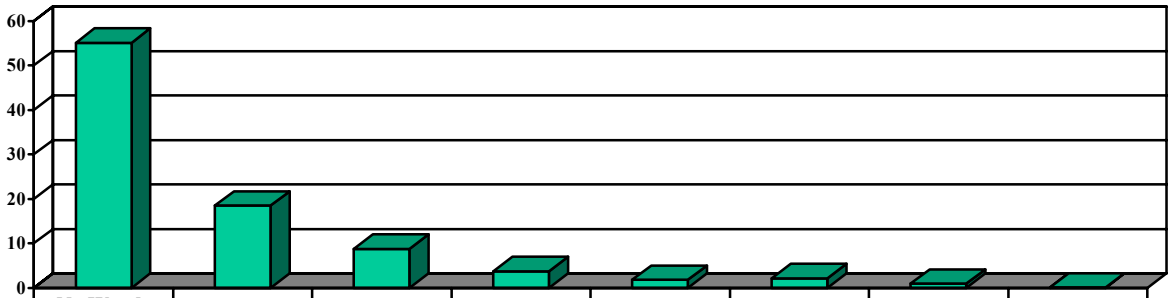


	No Wood-burning	Did not use	Once a Month	Every Couple	Once a Week	Twice a Week	3-4 X/Week	5-6 X/Week	Every Day
2001	52.1	23.6	10.8	8.2	1.4	1.8	1.8	0.4	0
2002	47.1	15.9	6.4	3.8	1.2	2	2.6	0.4	0.1

Q18. About How Much Wood Did You Burn This Past Winter in Your Fireplace of Heating Stove?

Most respondents (18.5%) did not use their wood stove or fireplace last winter. Only one used more than 3 cords and of those who did burn wood, the majority (8.8%) used under ¼ of a cord.

Figure 27: Amount Of Wood Burned in Fireplaces/Stoves Last Winter

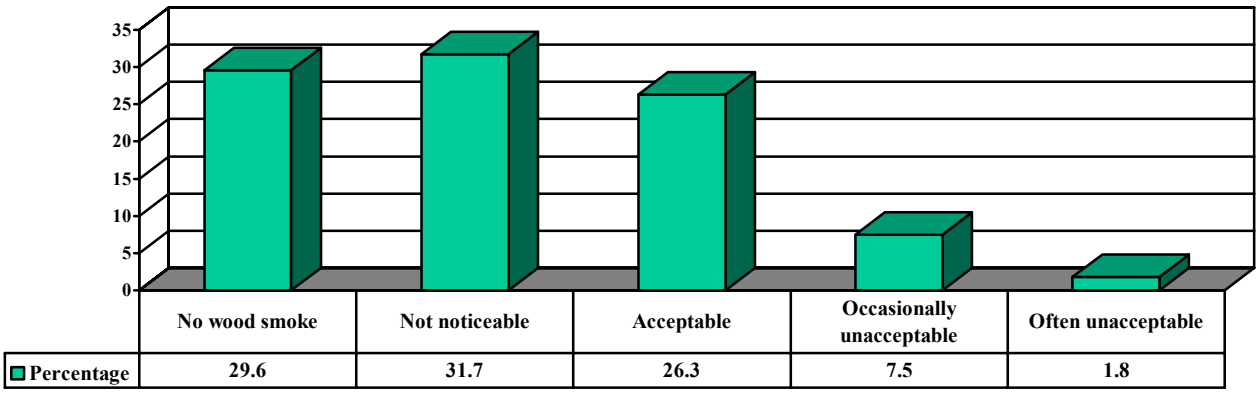


	No Wood-burning	Did not use	<1/4 Cord	1/4-1/2 Cord	1/2-1 Cord	1-2 Cords	2-3 Cords	>3 Cords
Percentage	55.1	18.5	8.8	3.8	1.8	2.2	1	0.1

Q19. To What Extent Are You Affected by Wood Smoke in Your Neighborhood?

Most respondents are not bothered by wood smoke in their neighborhood, either because there is no wood smoke (29.6%), or there is wood smoke but it is acceptable (55.9%). Only 9.3% of the respondents ever found the wood smoke in their neighborhood to be unacceptable.

Figure 28: Percentage of Respondents Affected by Wood Smoke in Their Neighborhood

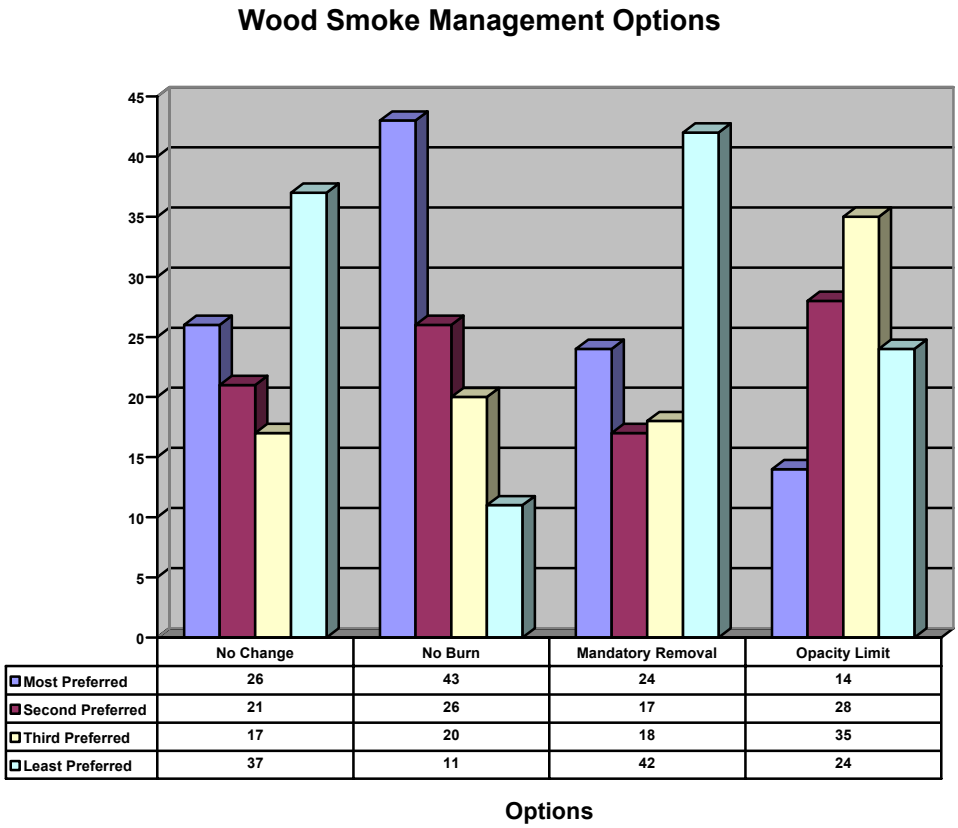


Cross-tabs were performed on the type of wood burning appliance used and the amount of wood burned last winter. In other words, is most of the wood burning occurring with fireplaces, stoves or inserts? From the crosstabulation we learn that the majority of the homes that have wood burning sources did not burn any wood last year, while the group of respondents with either an insert or a stove burnt more wood than did those with just a fireplace. The 9% in the Stove or Insert category had just an insert, and not a stove.

		Fireplace		Stove or Insert		Fireplace and Stove or Insert	
		# Responses to Q16					
# Responses to Q18		201		102		32	
		%	Number	%	Number	%	Number
451	**No fireplace or stove**		0	9%	9	0	0
151	**None-did not use**	49%	99	35%	35	42%	13
72	**Less than ¼ cord**	30%	60	22%	22	35%	11
31	**¼ to ½ cord**	9%	17	15%	15	3%	1
15	**½ to 1 cord**	4%	8	6%	6	3%	1
18	**1 to 2 cords**	7%	13	7%	7	13%	4
8	**2 to 3 cords**	2%	4	5%	5	3%	1
1	**More than 3 cords**	0	0	1%	1	0	0

Wood Smoke Management Options Insert

An insert was included in the first survey mailing only that asked respondents to rank order a set of preferences for wood smoke management possibilities in the City of Fort Collins. Clearly, the wood smoke management option "most preferred" was the "Voluntary *No Burn* on high pollution days." The option chosen as "least preferred" was the "Mandatory removal or upgrade of Non-EPA-certified wood stoves or inserts (older than 1990)."



Means for each Option

No Change	No Burn	Mandatory Removal	Opacity Limit
2.65	1.99	2.77	2.69

Means validate that the option preferred most often was the "Voluntary *No Burn* on high pollution days" and the least preferred option, the "Mandatory removal or upgrade of Non-EPA-certified wood stoves or inserts (older than 1990)." All means were compared using a paired-samples T-test to examine for significant differences. No significant differences were found (>.01) comparing means of: No Change and Opacity Limit; No Change and Mandatory Removal; or, Mandatory Removal and Opacity Limit. Significant difference were found (<.01) when comparing means of: No Change and No Burn; No Burn and Mandatory Removal; or, No Burn and Limit Opacity.

Table 2. Paired Samples Test

Pairs	t	df	Sig. (2-tailed)
No Change From Present - Voluntary "No Burn"	9.438	476	.000
No Change From Present - Mandatory removal or upgrade of Non-certified woodstoves	-.926	476	.23
No Change From Present - Tighten residential chimney opacity limit from 40% to 20%	-.359	476	.63
Voluntary "No Burn" - Mandatory removal or upgrade of Non-certified woodstoves	-8.671	476	.000
Voluntary "No Burn" - Tighten residential chimney opacity limit from 40% to 20%	-9.614	476	.000
Mandatory removal or upgrade of Non-certified woodstoves - Tighten residential chimney opacity limit from 40% to 20%	.945	476	.29

• Objective 11: Evaluation of the survey by the residents.

Responses: 143

•How long did the survey take you?–Minimum time: 15 minutes
–Maximum time: 50 minutes
–Mode: 30 minutes
–Mean: 31 minutes

It is important to survey citizens' opinions of the air quality to help the city make planning decisions.
–Strongly Agree 26
–Agree 38
–Neutral 10
–Disagree 18
–Strongly Disagree 8

•It is important to survey citizens' opinions to let the City know whether their education efforts to improve air quality are effective.
–Strongly Agree 18
–Agree 41
–Neutral 26
–Disagree 10
–Strongly Disagree 5

Demographics

The following questions will address the demographics of the survey, or *who* responded to the survey.

Gender

The sex of the respondents (Figure 1D, Table 1D) remains essentially equal, with slightly more males responding to the surveys as females.

Figure 1D: Gender of Respondent

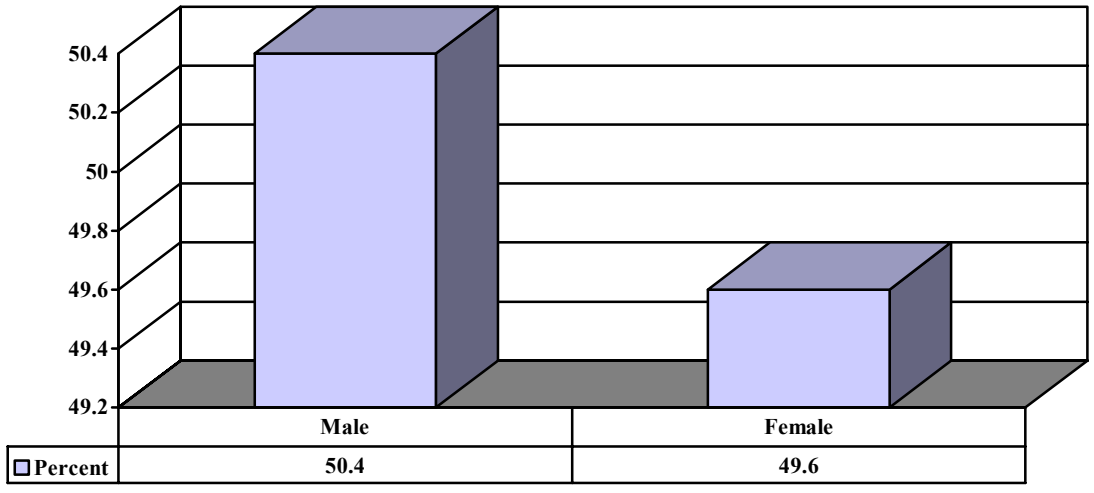


Table 1D: Gender Comparison Surveys 1994, 1995, 1997, 1999, 2001, 2002

Gender	1994	1995	1997	1999	2001	2002
Male	52.9	49	53	46	45.5	50.4
Female	47.1	51	47	54	54.5	49.6

Age of Respondent

As in previous years (Figure 2D, Table 2D), the majority of the respondents fell between 40 and 60 years of age.

Figure 2D: Age of Respondent

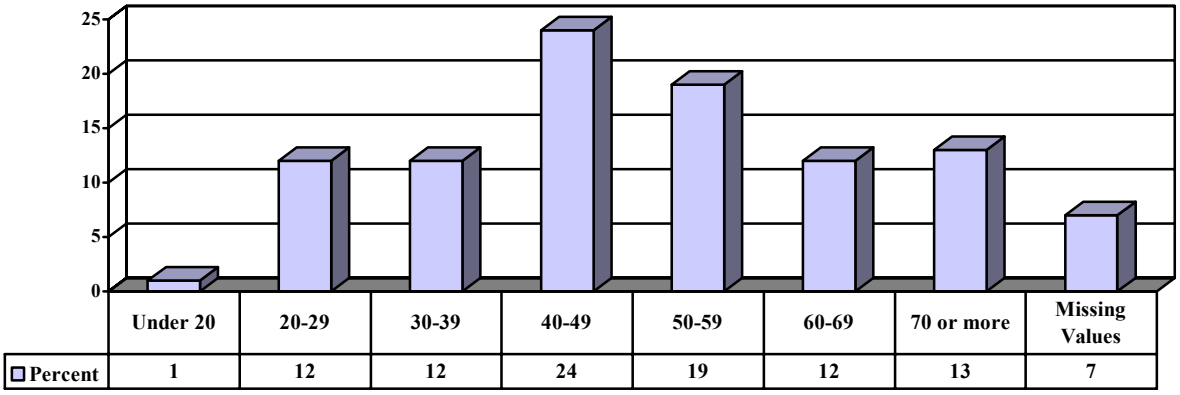


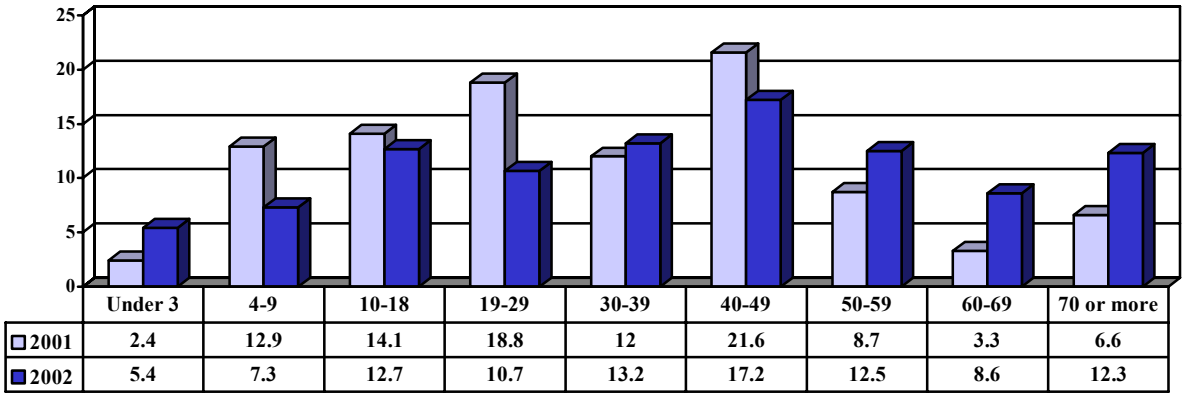
Table 2D: Age of Respondent Comparison, 1994, 1995, 1997, 1999, 2001, 2002

Age	1994	1995	1997	1999	2001	2002
Under 20	0	0	0	0	1	1
20-29	9.22	7	5	6	12.4	12
30-39	20.6	19	10	14	14.7	12
40-49	23.6	26	21	24	21.6	24
50-59	15.5	18	29	24	24.9	19
60-69	11.2	10	12	16	13.4	12
> 70	19.8	20	14	16	12.5	13

Ages of People in Household

The ages of people in the household show the largest group to be between 40 and 49 (see Figure 3D). The range of ages went from 4 months to 98 years. The mean age was between 30-39; the mode (most often occurring) is 40-49; and the average age is also 40-49.

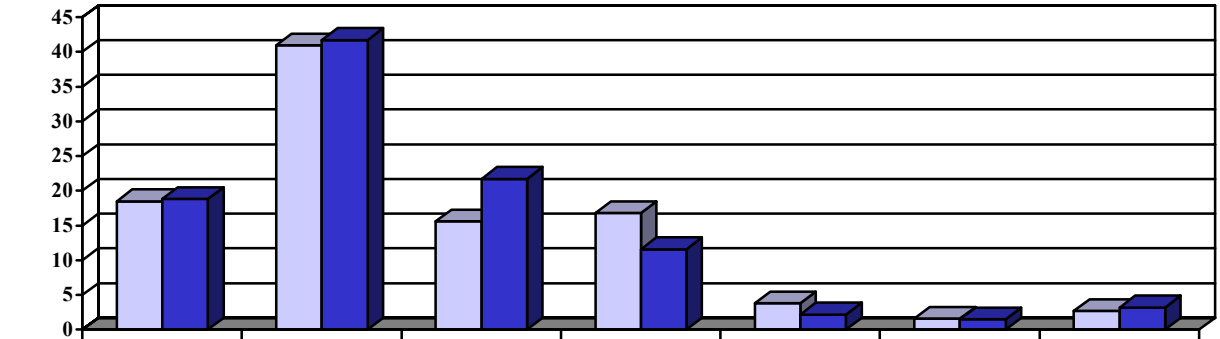
Figure 3D: Ages of People in the Household



Number of People in Household

The majority of the households responding to the survey were two-member households. Three and four-member households totaled 33.4%, 6.9% were five or more member households, and a fairly large 18.8% were one-member households.

Figure 4D: Number of People in the Household

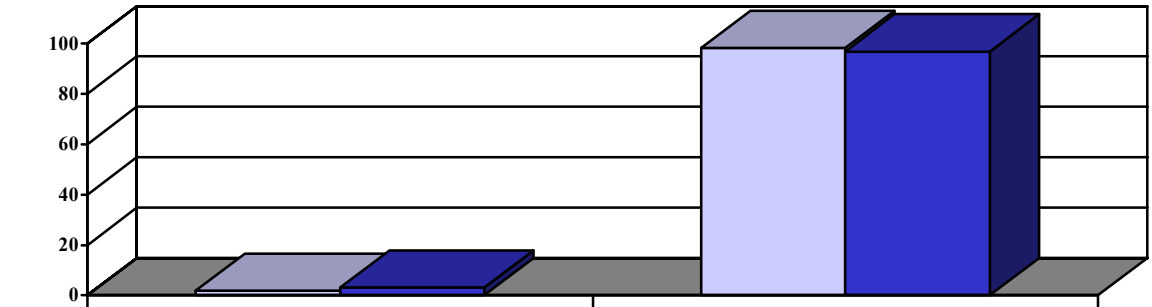


	1	2	3	4	5	6	7 or more
2001	18.5	40.9	15.6	16.8	3.8	1.6	2.7
2002	18.8	41.7	21.7	11.6	2.2	1.5	3.2

Anyone in Household Pregnant?

Almost two times as many responding households reported that there was a pregnant person in their household as 2001. This number is very similar to the 1994 and 1995 surveys.

Figure 5D: Percent of Households with a Pregnant Member



	Yes	No
2001	1.8	98.2
2002	3.2	96.8

Table 3D: Anyone in Household Pregnant? Comparison: 1994, 1995, 1997, 2001, 2002

Is anyone in household currently pregnant?

Response	1994	1995	1997	2001	2002
Yes	2.4	3	2	1.8	3.2
No	97.6	97	98	98.2	96.8

Anyone in Household Suffer from Asthma, Emphysema, Heart Disease, or other Respiratory Ailments?

Of the households reporting, 31.8% stated that there was a member suffering from asthma, emphysema, heart disease, or other respiratory ailments (see Figure 6D). This number has been rising steadily since the first record in 1994 (see Table 3D).

Figure 7D shows the percent of respondents that answered "yes" to the above question, that believe the outdoor air quality negatively affects their symptoms or their health. More people (58.8%) believed that the outdoor air negatively impacted their respiratory problems than did not believe it was affecting their symptoms (41.5%).

Figure 6D: Percent of Households With Member With Asthma, Respiratory Problems

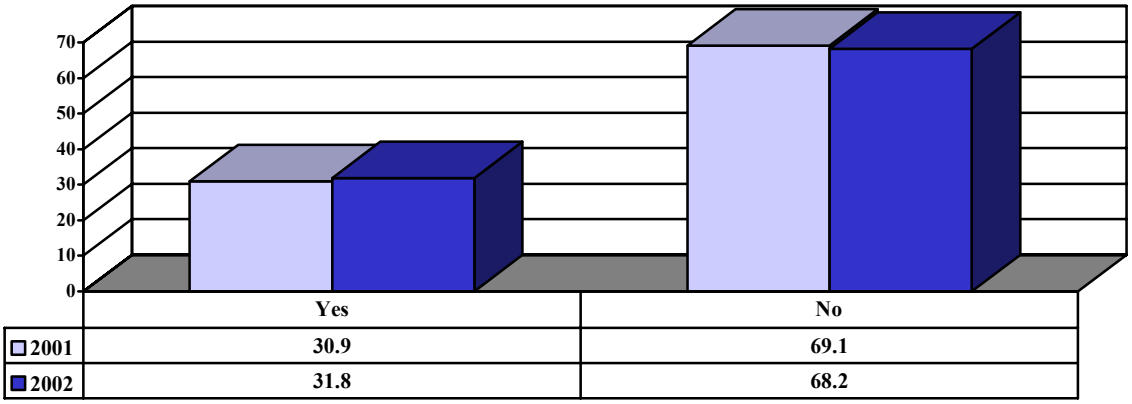
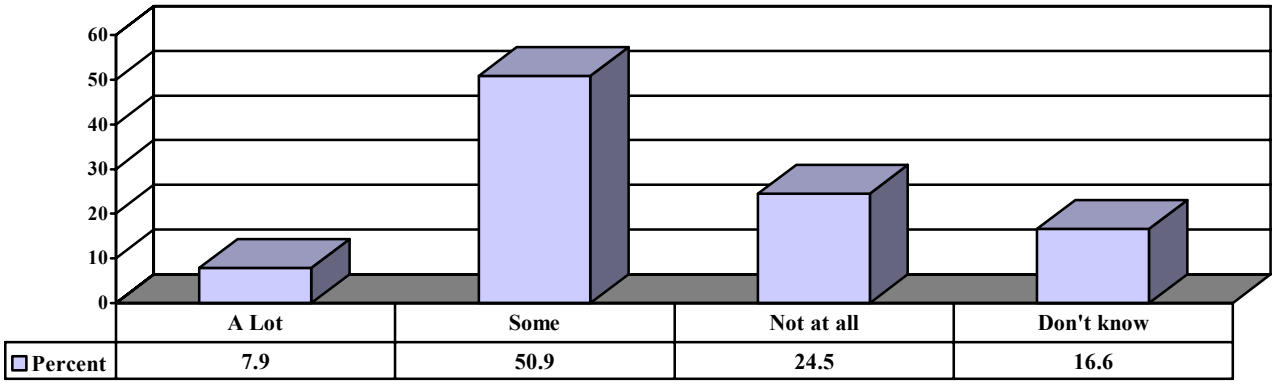


Table 4D: Percent of Households With Asthma, Emphysema, Heart Disease, or Other Respiratory Disease, Comparison: 1994, 1995, 1997, 2001, 2002

Response	1994	1995	1997	2001	2002
Yes	20.5	23	26	30.9	31.8
No	79.5	77	74	69.1	68.2

Figure 7D: Percent of Respondents that Answered "Yes" to Asthma, Emphysema, Heart Disease or Other Respiratory Ailments That Believe Outdoor Air Quality Negatively Affects Their Health



How Many Years in Fort Collins?

The 2002 survey showed a decrease in the number of respondents having lived in Fort Collins for less than five years (Figure 8D and Table 5D). The category of respondents that have lived here more than 20 years is increasing and the other categories are decreasing.

Figure 8D: Years Lived in Fort Collins

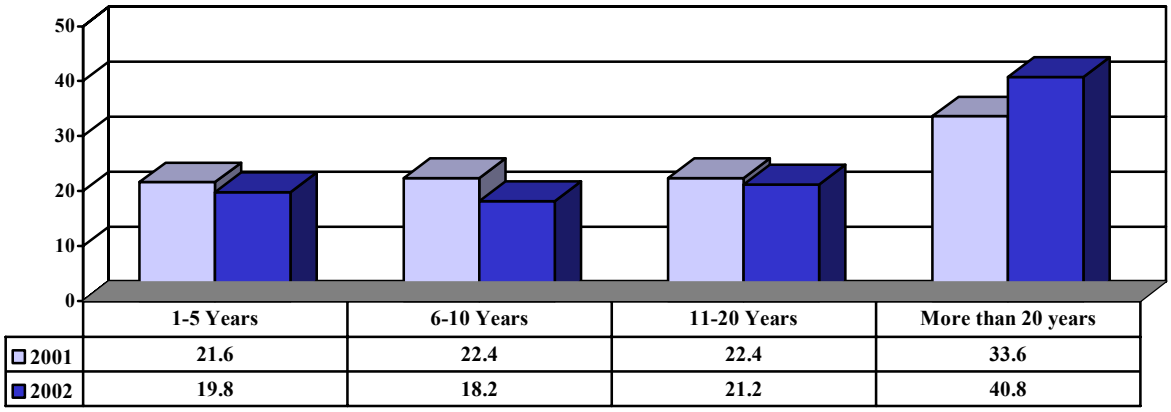


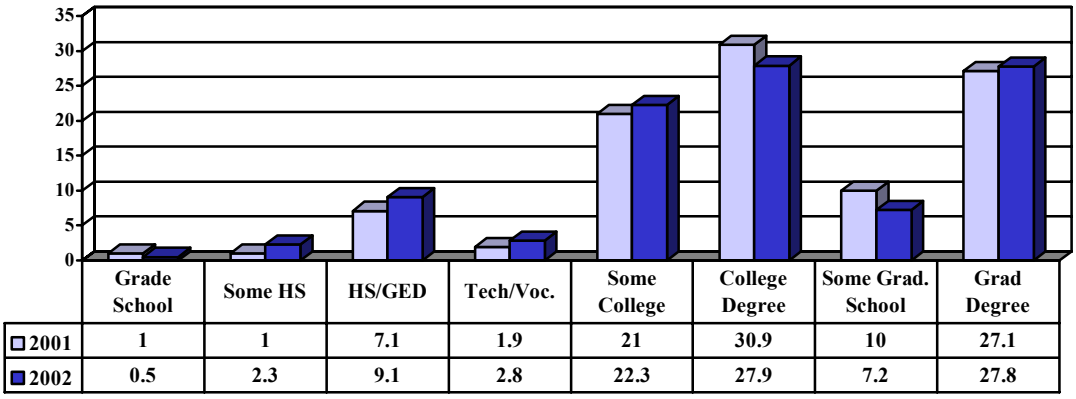
Table 5D: Years Lived in Fort Collins, Comparison: 1997, 1999, 2001, 2002

Years	1997 (%)	1999 (%)	2001 (%)	2002 (%)
0-5	17	33	22	19.8
6-10	16	17	22	18.2
11-20	27	20	22	21.2
More Than 20	39	29	34	40.8

Education Level

Figure 8D shows that most of the respondents in the survey have at least some college and a very large percentage have a graduate degree (27.1%). A closer look at Table 6D shows that very few changes from the 1997 survey to the 2002 survey can be seen in the education level of the respondents. According to the 1990 *Trends*, a report available for the City of Fort Collins, 43% of the residents have a Bachelor's degree or higher. This survey found 60% to have a Bachelor's degree or higher in the sample of respondents. Even though this number is much higher in this survey, the *Trends* data is over 10 years old.

Figure 8D: Education Level of Respondent



	Grade School	Some HS	HS/GED	Tech/Voc.	Some College	College Degree	Some Grad. School	Grad Degree
2001	1	1	7.1	1.9	21	30.9	10	27.1
2002	0.5	2.3	9.1	2.8	22.3	27.9	7.2	27.8

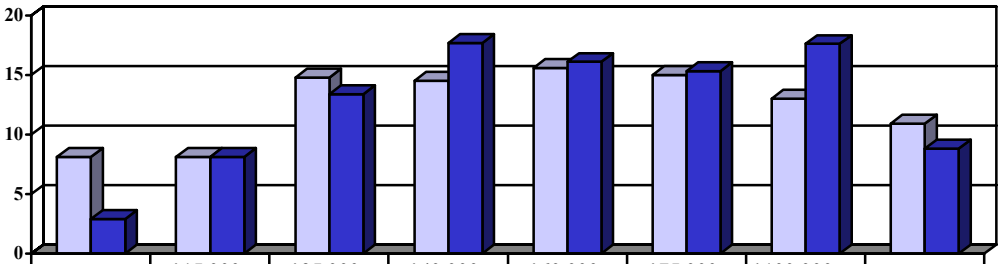
Table 6D. Respondent's Education Level, Comparison: 1994, 1995, 1997, 2001, 2002

Education Level	1994	1995	1997	2001	2002
Grade school		*	0	1	.5
Some high school	1.9	5	1	1	2.3
High school diploma/GED	34.34	5	10	7.1	9.1
Technical/vocational school	*	*	3	1.9	2.8
Some college	*	23	23	21	22.3
College degree	37.58	27	30	30.9	27.9
Some graduate degree	*	*	9	10	7.2
Graduate degree	26.16	32	23	27.1	27.8

Yearly Family Income

Figure 9D shows that a very even number of respondents reported earnings at several of the categories: $25,000-$39,999 (13.4%), $40,000-$59,999 (17.7%), $60,000-$74,999 (16.1%), and $75,000-$99,999 (15.3%). Comparing to *Trends* data from 1990, whereas the median family income was reported at $27,000, this survey's median family income was in the $40,000-$59,000 range (17.7%). Again, the *Trends* data is over 10 years old and caution must be made in comparing the two.

Figure 9D: Yearly Family Income



	< $15,000	$15,000-$24,999	$25,000-$39,999	$40,000-$59,999	$60,000-$74,999	$75,000-$99,999	$100,000 or More	Unanswered
2001	8.1	8.1	14.8	14.5	15.6	15	13	10.9
2002	2.9	8.1	13.4	17.7	16.1	15.3	17.6	8.8

Employment Situation

As in 1997, 1999, and 2001, most respondents were employed outside the home (47%), with an increasing number of self-employed (12%) and a growing group of retired respondents (28%). See Figure 10D and Table 7D.

Figure 10D: Employment Status

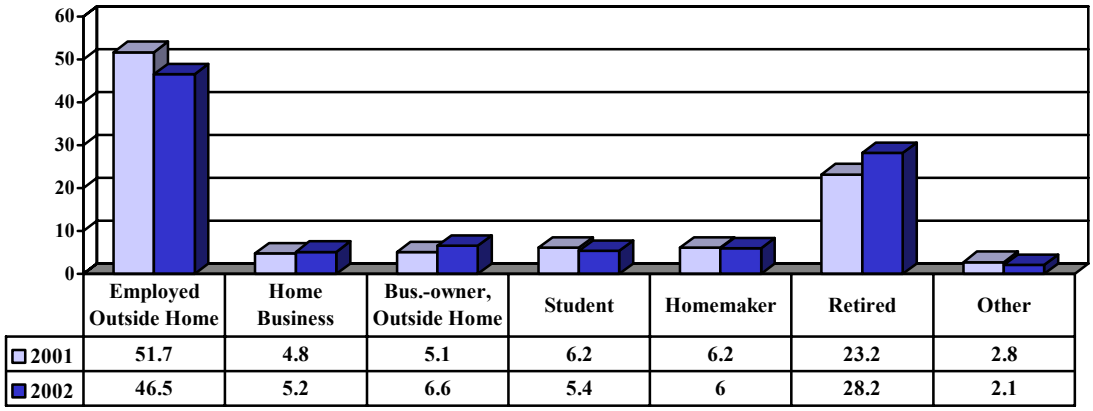


Table 7D: Employment Situation Comparison: 1997, 1999, 2001, 2002

Employment Situation	1997 (%)	1999 (%)	2001 (%)	2002 (%)
Employed Outside Home	57	53	52	47
Home Business	10	10	5	5
Business Owner-Outside Home	*	*	5	7
Student	4	9	6	5
Homemaker	5	4	6	6
Retired	24	21	23	28
Other	1	3	3	2

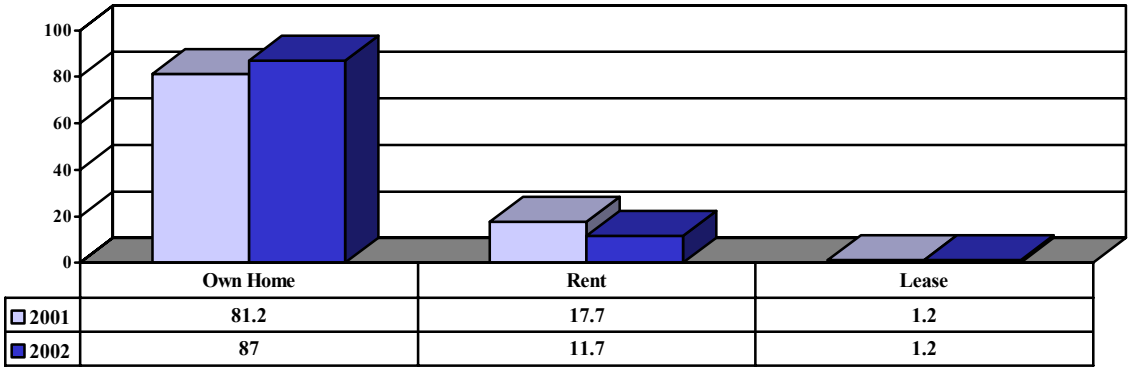
Home Ownership

Figure 15D shows that home-owners are the majority of the respondents of the 2002 survey (81.2%). The number of respondents that rented is considerably less in this survey. The trend of more home owners, more college graduates, and higher incomes are an indication of the reliability of the measures in that if one does go up, so too would the others be expected to increase. Home ownership appears to be slowly on the rise for respondents from 1994 through 2002 (see Table 11D and Table 8D).

Table 8D. Home Ownership Comparison: 1994, 1995, 1997, 2001

Response	1994	1995	1997	2001	2002
Own	75.9	79	80	81.2	87
Rent	24.1	20	19	17.7	11.7
Lease	0	0	1	1.2	1.2

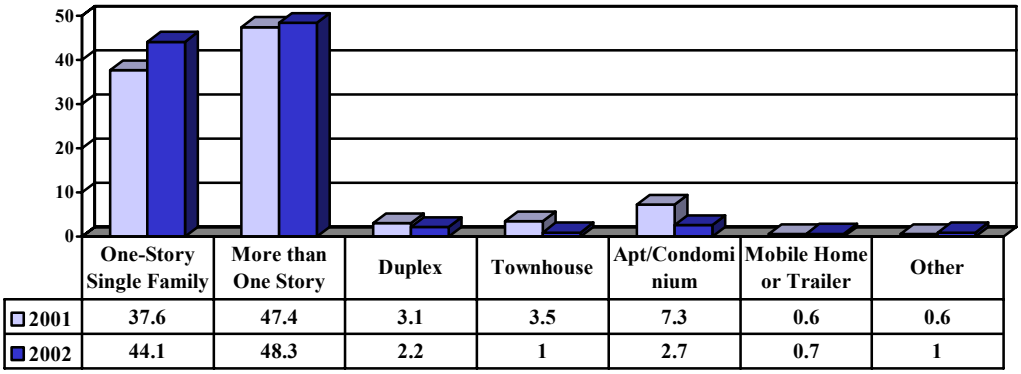
Figure 11D: Home Ownership



Home Type

Most of the respondents (48.3%) live in a home that is more than one-story, followed closely by single story (44.1%) homes which appears to be on the increase (See Figure 12D). Respondents living in apartments or condominiums is decreasing steadily (See Table 9D).

Figure 12D: Home Type



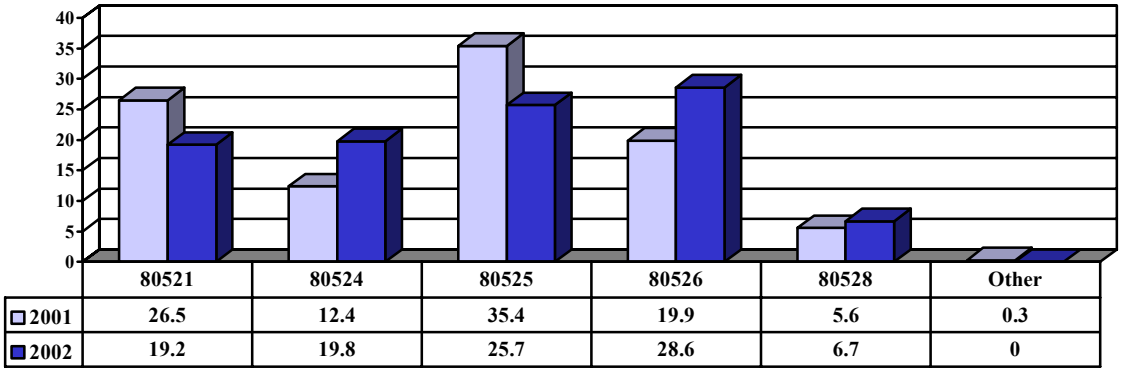
	One-Story Single Family	More than One Story	Duplex	Townhouse	Apt/Condominium	Mobile Home or Trailer	Other
2001	37.6	47.4	3.1	3.5	7.3	0.6	0.6
2002	44.1	48.3	2.2	1	2.7	0.7	1

Table 9D. Home Type Comparison: 1994, 1995, 1997, 2001, 2002

Which of the following best describes your home?

Home Type	1994	1995	1997	2001	2002
One-story single-family	34	34	33	37.6	44.1
More than one story single-family	36.9	39	44	47.4	48.3
Duplex	3.9	4	4	3.1	2.2
Townhouse	4.0	3	3	3.5	1
Apartment or condominium	16.6	12	10	7.3	2.7
Mobile home or trailer	4.5	6	4	0.6	0.7
1					

Figure 13D: Zip Code of Respondents



What is the zip code of your current residence?

Zip Code	1994	1995	1997	2001	2002
80521	21	25	20	26.5	19.2
80524	13	25	18	12.4	19.8
80525	38	25	31	35.4	25.7
80526	28	25	28	19.9	28.6
80528	0	0	0	5.6	6.7
Other	0	0	3	0.3	0