

Washoe County, Nevada
Residential Wood Use Survey
2003-2004

DISTRICT HEALTH



DEPARTMENT

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Washoe County District Health Department Air Quality Management Division Residential Wood Use Survey - conducted by MarkeTec

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EXECUTIVE SUMMARY

Residential wood combustion (RWC) is a significant source of air pollution in Washoe County. RWC emissions have been directly linked to monitored violations of particulate matters less than 10 microns in size (PM₁₀) and carbon monoxide (CO) of the national ambient air quality standards. It is therefore important that we quantify and characterize this emission source to the best of our abilities in order to develop appropriate preventative and mitigative measures.

The RWC report represents the sixth in a series of professionally administered surveys conducted once every two to three years. The establishment of a consistent survey instrument and the comparison of socioeconomic data with other agency surveys have allowed the Washoe County Air Quality Management Division (AQMD) staff to achieve a high degree of confidence in the results. The following are some highlights of the 2003-2004 survey:

- In Washoe County, there are approximately 36,000 fireplaces, 7,300 certified woodstoves/inserts, 900 non-certified woodstoves/inserts, and 3,100 pellet stoves.
- The survey indicates that only about one-half (47%) of the fireplaces, and three-quarters (75%) of the woodstoves/inserts, are actually used. Virtually all of the pellet devices are used on a regular basis.
- Approximately 63% of the certified woodstoves/inserts were described as nine (9) or more years old. It is uncertain if these devices are certified as EPA's Phase I or II stoves/inserts, since EPA's Phase II woodstoves can be as old as 14 years old and the Phase I stoves can be between 14 and 16 years old. Updating the next survey questionnaire to include more appropriate breakdown years of devices to reflect EPA Phase I & II cut-off dates can resolve this uncertainty.
- The number of wood burning devices has remained relatively flat over the fourteen-year survey period, despite an over 25% increase in population. The exception has been pellet stoves -- their number has doubled over the same period. Natural gas-fired appliances are not accounted for in this survey because they do not contribute significantly to CO or PM₁₀ air pollution.
- The Green/Yellow/Red curtailment program maintains a high level of public awareness (81%) and compliance (66%); however, these numbers are down slightly from previous surveys probably because the AQMD has not done a media campaign addressing this program recently up until the latest survey. A public awareness campaign has since been performed in late October 2004 and will most likely be performed again before the next survey is conducted. This will help to ensure a continuously high awareness and compliance rate.

The 2003-2004 survey indicated a slight increase in firewood consumption as compared to the 2001-2002 survey. This increase is caused primarily by the higher cost of heating fuel other than firewood as well as a colder winter in 2003-2004. However, the overall surveys from 1992 through 2003 indicate a declining trend in residential wood stove emissions in Washoe County. This reduction has been reflected in the improved ambient air quality monitored in Washoe County over the last decade. Staff will contract another survey in 2005-2006 to continue determining the trends in solid fuel burning.

I. INTRODUCTION

The Truckee Meadows Air Basin is designated non-attainment for PM₁₀ and CO. This means that the Truckee Meadows violates, or has violated, the federal health standards for PM₁₀ and CO. Residential wood combustion (RWC) is a significant contributor to air pollution in the Truckee Meadows. In order to estimate RWC's contribution to PM₁₀ and CO concentrations, several surveys of the region's wood use patterns have been conducted. The Desert Research Institute (DRI) conducted the first major study in 1983-1984. Since then, the Washoe County Air Quality Management Division (AQMD) has conducted surveys every two to three years. The most recent survey took place between April 26 and May 26 of 2004, when calls were made to 1,473 respondents. The next RWC survey will be conducted for the winter of 2005-2006. The continuation of future surveys will provide a trend of wood and pellet use in Washoe County and to alert AQMD staff of potential concerns regarding air quality in the Truckee Meadows.

This report analyzes the RWC activity for the winter of 2003-2004. The data for the report were gathered from a telephone survey of area residents. MarkeTec, Inc., a locally owned and operated marketing and surveying firm conducted the survey. MarkeTec, Inc. has been contracted to perform this survey since the 1992-1993 survey. The survey instrument used to gather data for this report has remained unchanged except for minor procedural changes over the survey years. AQMD plans to conduct this same survey again in future years to validate data and perhaps indicate trends.

II. RESIDENTIAL WOOD COMBUSTION SURVEY

SURVEY PART A – SCREENING QUESTIONS

Question A. Type of Fuel Used to Heat Residence

The first question was a screening question that concerned general energy use. The results from this question were compared with the Home Energy Survey (HES) conducted by Sierra Pacific Power Company (SPPCo) in 1991, the last survey performed by SPPCo, and the results from all past RWC surveys conducted by AQMD. The comparisons are shown in Table I. Please note that the categories may add up to more than 100% because more than one answer was given to the survey question asked.

TABLE I
GENERAL ENERGY USAGE

	SPPCo 1991 HES	AQMD 1992-93	AQMD 1994-95	AQMD 1995-96	AQMD 1999-00	AQMD 2001-02	AQMD 2003-04
Natural Gas	58%	64%	65%	67%	75%	75%	67%
Propane	10.7%	3%	3%	5%	5%	6%	6%
Electric	10.8%	9%	11%	15%	18%	18%	24%
Wood	7.4%	7%	2%	8%	6%	4%	6%
Oil	8.2%	16%	7%	7%	2%	4%	3%
Heating Degree Days*	3,533	3,869	3,142	2,958	2,962	3,094	3,210

* Based on data for November, December, following year January and February.

As indicated in Table I, good agreement was shown between the AQMD's earlier RWC surveys and the SPPCo 1991 HES. However, natural gas usage had fluctuated over the AQMD survey

years as compared with the SPPCo 1991 HES, whereas electric usage has steadily increased and now doubled by the last survey as compared with the SPPCo 1991 HES. It is questionable if the 2003-04 figure for electric usage is accurate since it is much higher than the 2001-02 survey. However, there is no way to determine the validity of this data since there are no other surveys available at this time. This usage will have to be validated/verified by the data collected during the 2005-2006 season RWC survey. Propane and wood usage had remained more or less constant during the survey period between the AQMD RWC surveys and the SPPCo 1991 HES. Oil usage for home heating has seen a decrease over the years.

If the respondents did not mention wood, they were questioned directly about the presence of a wood-burning device in their homes. If they did not have a solid fuel-burning device, the respondents were not asked the Wood-Use Survey questions (16 questions), but were asked only questions B and C of the remaining screening survey. If they did have a wood-burning device, the actual Wood-Use Survey questions, beginning with question one, were asked.

Question B. Type of Dwelling

To validate if our sample population was a true representation of Washoe County households, the second screening question asked in what type of dwelling the respondents resided. There was concern that perhaps a survey of this type would over estimate the amount of wood used when the ratios from this sample group were applied to the whole household population. It was hypothesized that because calls were made randomly, primarily in the evenings and on the weekends, until the surveyor got enough respondents that happened to be home, the surveyor would probably get more people who lived in single-family residences. Since more single-family residences have wood-burning devices than multi-family units, we would get an inflated wood use figure.

According to this survey, that hypothesis might be correct. In Table II, the ratio of percent type of dwelling units as determined by the AQMD survey compared to the Washoe County Department of Community Development’s (WCDCD) figures for the entire county are shown (see App. B for actual household estimates from WCDCD). The percentages are slightly higher for single family and slightly lower for multi-family. This result may be biased due to survey sampling method. Revised procedures will be employed for future survey to eliminate or reduce sampling bias.

**TABLE II
PERCENTAGE OF DWELLING TYPE FOR WASHOE COUNTY**

	Single Family	Multi-Family	Mobile Home
WCDCP Statistics*	55%	37%	8%
AQMD Survey**	68%	26%	7%

* July 1, 2003 data

** All respondents

In addition, when only the respondents who utilized wood combustion devices were used to get the device percentage and subsequent wood use estimate, the bias towards single-family residents became more pronounced. Out of just the wood use respondents, 89% lived in single-family homes, 8% lived in multi-family homes, and 3% lived in mobile homes. The study conducted last year and this report both use the device percentage obtained from the total number of respondents.

Question C. Home Zip Code

The last screening question obtained residential zip code from the respondents. This information was collected to ensure that the respondents lived in Washoe County.

SURVEY PART B – WOOD USE SURVEY

The following questions were only asked of the 400 respondents, out of a total of 1,473, who indicated they had a wood-burning device:

Question 1. Type of Wood-Burning Device

The answers were categorized into four basic device types: fireplaces, uncertified woodstoves or inserts, certified woodstoves or inserts, and pellet devices. Of the 400 respondents having a device, 84% reported they had a fireplace, 17% had a certified woodstove/insert, 2% had a non-certified woodstove/insert, and 7% had a pellet device.

Question 2. Name of Device

For each device used in question 1, the respondents were asked to indicate the total number of devices in their household. They were also asked to identify the specific type of device (fireplace, woodstove, pellet stove) if more than one device was present at the dwelling as well as the primary device used in the household.

Question 3. Age of Device

This question was asked to verify the respondent's classification of the woodstove/insert as certified or uncertified. An EPA Phase II certified stove should be less than 14 years old (July 1, 1990 or newer) as of the 2004 survey. An EPA Phase I certified stove should be between 14 and 16 years old (July 1, 1988 – July 1, 1990). An uncertified woodstove/insert should be 16 years of age or older.

Seventy-six (76) woodstoves/ inserts were reported, with 68 certified and 8 uncertified. This equates to an 89% certified stoves versus an 11% uncertified stoves. Of the 68 stoves that were deemed certified, at least 32% were Phase II and 68% were Phase I. The slight uncertainty comes from the fact that the respondents were asked if their device was under 6 years, 6-8 years, or more than 9 years old, while the EPA Phase I device is between 14 and 16 years of age and Phase II device 14 years or less. This is an oversight on AQMD's part forgetting to inform MarkeTec of the year changes as the surveys progressed from year to year. Therefore, this question will be revised to obtain more accurate breakdown data for EPA Phase I & II certified woodstoves for the next survey.

Question 4. Quantity of Wood/Pellets used in 2003-2004

MarkeTec was provided with a copy of an EPA guidance document that described a cord of wood in recognizable units, such as, 4'x4'x8', or a full size pickup truck bed holds 0.5 cord of wood, etc. This was provided to assist respondents who did not know their wood consumption in exact cords. There were respondents who reported having a wood-burning device but did not use it. To determine the average amount of wood used, staff looked only at the respondents who reported burning wood countywide. For respondents who reported using their fireplaces, the average amount of wood used was 0.94 cords per season. Respondents who reported using their certified woodstoves/inserts had an average wood consumption rate of 1.90 cords of wood per season. Those who had uncertified woodstove/insert reported an average wood consumption rate of 2.05 cords per season. Respondents who reported using a pellet device consumed on the average 0.72 tons of pellets each for the 2003-2004 winter season.

Question 5. Species of Wood

Total emissions from RWC are calculated using the EPA AP-42 emission factors and the total weight, by species, of all wood consumed. Different species of wood have different weights, so the survey was used to estimate the species of wood consumed by the respondents. The weight of the different wood species was derived from the "Fuel Wood Facts" handbook published by Oregon State University. Table III lists the most common types of wood used. The table also lists the percentage of wood used, and the corresponding weight per cord.

**TABLE III
WOOD SPECIES BURNED**

Type of Wood	Percentage Used	Weight per cord (lbs)
Mixed (Pine/Cedar/Tamarack)	41.1	2543
Pine	21.3	2240
Others	20.2	2500
Manufactured Logs	7.5	3456
Oak	6.7	3680
Tamarack	2.0	3330
Fir	1.2	2970
Average Weight of Wood		2,635

Question 6. Other Fuels

To determine the extent that non-traditional fuels are used in wood-burning devices, question 6 asked the respondent if they burned "scrap" wood, pallets, or coal. Of the respondents who reported using their devices, 6% consumed some type of "scrap" wood, 1.2% reported burning pallets, while 0.3% reported burning coal. Considering these numbers, staff assumes the total amount of wood consumed is adequately accounted for in the previous question under the "others" category.

Question 7. Number of Days Burned

Table IV compares average days used in the 2003-2004 season with that of the 2001-2002 season. The average heating degree days for residential wood combustion, calculated from the months of November, December, January, and February, is 3,459 per year. This is based on a 30-year average from 1971 to 2000. The 2003-2004 winter season had 3,210 heating degree days, which is less than the 30-year average. This indicates that 2003-2004 had a milder winter as compared to the 30-year average.

**TABLE IV
AVERAGE DAYS OF SOLID FUEL USED**

	2001-2002 Season (3,094 Heating Degree Days*)	2003-2004 Season (3,210 Heating Degree Days*)
Fireplaces	13	17
Woodstoves/Inserts	57	45
Pellet Stoves	59	54

* Based on data for November, December, following year January and February.

Question 8. Time of Day Start Fire?

The respondents were asked what time of day they usually start their fire. Forty-seven point eight percent (47.8%) started their fire between 5pm and midnight, 4.5% between midnight and 8am, 3.6% between noon and 5pm, and 2.9% between 8am and noon. The remaining 41% of the respondents did not start a fire.

Question 9. Cut or Buy Wood?

Of the respondents who burned wood (54.3%), they were asked if they bought their wood or if they cut it themselves. Most of the respondents, 29%, reported buying their wood. 16.8% reported cutting the wood themselves, 3% both buying and cutting, and 5.5% getting it by some other means (such as scrap).

Question 10. If cut Wood, Where?

Of the 16.8% of respondents who reported cutting their own wood, 10.5% cut on private land, 6.8% on public land, 1.3% on both types of land, and 1% on "other" types of land.

Question 11. For Pellet Stove Users -- Where Purchased Pellets?

Pellet stove users were asked where they bought their pellets. 51% reported buying their pellets from lumber store, 17% from supermarket, 13% bought it elsewhere, and 6% from pellet stove dealers. The remaining 13% did not use their pellet stoves for the 2003-2004 season.

Question 12. Have you heard of the Green/Yellow/Red Burn Days?

To determine the effectiveness of the AQMD's Green/Yellow/Red burn curtailment program, three questions were asked. Question 12 asked if the respondents had ever heard of the program: 81% replied they had heard of the program and 19% had not.

Question 13. If yes to Question 12, do you follow it?

Of the respondents who were aware of the program, 66% said they followed the program, 34% said they did not follow the program or did not use the device. Of the 34% who did not follow the program, most do know about the program.

Question 14. Would you support additional restrictions on wood burning as a means to reduce air pollution?

Fifty-seven percent (57%) of the respondents said they would support the restrictions. This percentage continues to increase from 47% in 1999-2000 and 55% in 2001-2002 surveys.

The percentages on questions 12 through 14 indicate that most of the community is aware of and follows the Green/Yellow/Red program. They would also support additional restrictions as a means to reduce air pollution. Although awareness of the Green/Yellow/Red program remains at a high level, the percentage of people who had heard of the program has declined over the years. Compliance of the program has fluctuated over the survey years, with the last survey year showing a 66% compliance rate, as shown in Table V. Staff assumes that the growth of the area and the reduction of recent public outreach is the cause of the slight decline in the compliance rate for the Green/Yellow/Red program in the last few years at the time of this survey. Public awareness campaign for the Green/Yellow/Red burn curtailment program has since been conducted in late October 2004 to ensure continuously high awareness and a consistent compliance rate.

**TABLE V
GREEN/YELLOW/RED BURN CURTAILMENT PROGRAM**

Survey Year	1992-93	1994-95	1995-96	1999-00	2001-02	2003-04
Awareness of Program						
Yes, aware	97%	94%	93%	89%	87%	81%
No, unaware	3%	5%	7%	11%	13%	19%
Follow Program (of those aware)						
Yes, curtail burning	88%	61%	81%	91%	83%	66%
No, do not/do not use wood	12%	9%	11%	8%	13%	34%
Don't know	-	30%	8%	1%	8%	-

Question 15. Types of Dwelling

Respondents who indicated using a wood-burning device were asked in what type of dwelling they resided. Although question 15 is similar to screening question “B,” the function used is different. Question 15 is asked of the respondents who actually use a wood-burning device, whereas screening question “B” was asked to validate sampling ratio/field. As stated in a previous paragraph of this report, the screening population indicates more single-family residences have wood-burning devices than those found in multi-family dwellings.

Question 16. Zip Code

Zip code information was obtained from the wood-burning respondents to help estimate what percentage of wood used is within the PM₁₀ and CO non-attainment area (NAA). It could also help ascertain locations in the county where wood use may be more prevalent. The results of this survey indicate that 27% of the total households in Washoe County use some type of solid fuel-burning device. Thirty-nine percent (39%) of the households that burn some form of solid fuel (which were 27% of the total respondents) are located in zip codes that are primarily within the NAA. Based on this statistic alone, it is not apparent if there is more burning inside or outside the NAA because this percentage is consistent with the population concentration that estimates that about 70% of the population of Washoe County live in the NAA.

A review based on zip code indicates the figures for average cords burned and days used are higher in outlying areas. Table VI below gives the average cords and average days used for sample zip codes inside and outside the NAA.

**TABLE VI
COMPARISON OF WOOD USED BY ZIP CODE**

NAA	Zip Code	Average Cords Burned	Average Days Used	Avg Cords Burned/Avg Days Used
Yes	89431 (W. Sparks)	1.1	34	0.03
No	89433 (Sun Valley)	1.8	79	0.02
Yes	89434 (Central Sparks)	0.9	33	0.03
No	89436 (Spanish Springs)	1.5	59	0.03
No	89451 (Incline Village)	1.2	55	0.02
Yes	89501/2 (Central/E. Reno)	0.6	27	0.02
Yes	89503 (N. Reno)	0.9	26	0.03
No	89506 (NW Reno)	1.7	60	0.03
Yes	89509 (SW Reno)	1.2	31	0.04
Yes	89511 (S. Reno)	0.9	63	0.01
Yes	89512 (NE Reno)	0.9	28	0.03
Yes	89523 (W. Reno)	1.0	31	0.03
No	89704 (Washoe Valley)	1.3	92	0.01

2003-2004 Season Comparison of Wood-Use by Zip Code

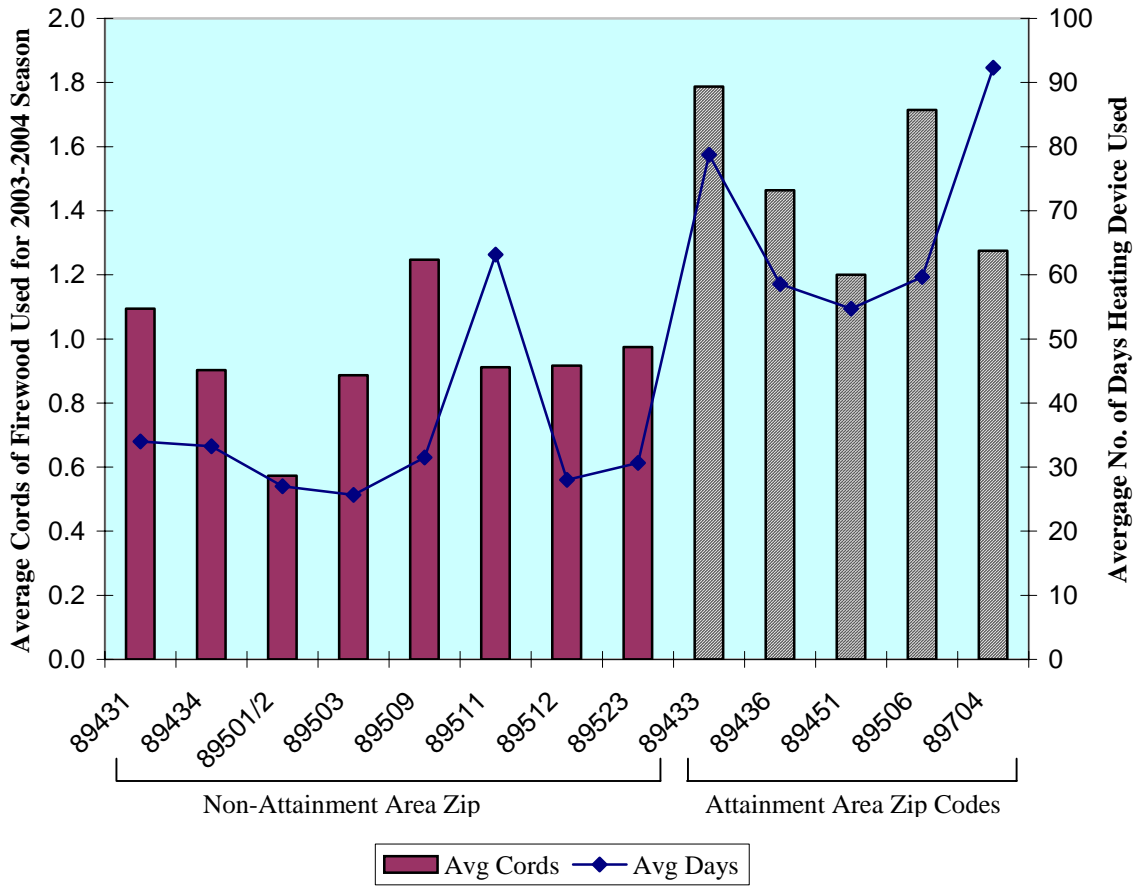


Figure 1

III. DATA ANALYSIS AND METHODOLOGY

The objectives of the survey were to determine the quantity of wood consumed and the activity levels of the Residential Wood Combustion (RWC) devices owned by the residents of Washoe County during the 2003-2004 winter season. There were 1,473 Washoe County residents questioned during the survey. Of the 1,473 people surveyed, 400 reported burning some type of solid fuel. For each category of RWC device, the corresponding percentage of the whole sample population was calculated. This percentage was then multiplied by the estimated total number of dwellings in Washoe County, which for July 1, 2003 was 157,548 dwellings, as provided by the Washoe County Department of Community Development, Advanced Planning Program. The number derived from this calculation was then considered the 2003 estimate of total number of a specific type of device in the area.

Estimates of the wood-burning devices and wood used in the PM₁₀/CO NAA were also calculated. Based on zip code, approximately 1,017 of the total 1,473 respondents were determined to be within the NAA. Based on that it was determined that approximately 69% of the households would be within the NAA. Therefore, 69% of 157,548 are 108,776 households in the NAA.

A. FIREPLACES

1. *Percentage of Fireplaces*

Countywide respondents reported having 336 fireplaces either as their first, second, or third device. Of these respondents, 47.3% (159 units) reported actually using them. Within the NAA, respondents reported 270 fireplaces with 50.4% (136 units) of those actually used.

County Wide:

$$336 \text{ fireplaces} \div 1,473 \text{ respondents} \times 100\% = 22.8\% \text{ fireplaces}$$

$$22.8\% \times 157,548 \text{ households} = 35,938 \text{ fireplaces}$$

$$47.3\% \text{ used} \times 35,938 \text{ fireplaces} = 17,006 \text{ fireplaces used}$$

NAA:

$$270 \text{ fireplaces} \div 1,017 \text{ respondents} \times 100\% = 26.6\% \text{ fireplaces}$$

$$26.6\% \times 108,776 \text{ households} = 28,878 \text{ fireplaces}$$

$$50.4\% \text{ used} \times 28,878 \text{ fireplaces} = 14,546 \text{ fireplaces used}$$

2. *Average Wood Consumption for Fireplaces*

Based on the raw data for fireplaces, the number of cords burned for each device on average was 0.94 cord/device countywide and 0.90 cord/device within the NAA.

B. CERTIFIED WOODSTOVES/INSERTS

1. Percentage of Certified Woodstoves/Inserts

Respondents reported having 68 certified woodstoves or inserts as either their first, second, or third device. Of these respondents, 80.9% (55 units) were reported as actually being used. Within the NAA, respondents reported 36 woodstoves or inserts with 80.6% (29 units) of those actually used.

County Wide:

$$\begin{aligned} 68 \text{ woodstove/inserts} \div 1,473 \times \text{respondents} \times 100\% &= 4.6\% \text{ woodstoves/inserts} \\ 4.6\% \times 157,548 \text{ households} &= 7,273 \text{ woodstoves/inserts} \\ 80.9\% \text{ used} \times 7,273 \text{ woodstove/inserts} &= 5,883 \text{ used} \end{aligned}$$

NAA:

$$\begin{aligned} 42 \text{ woodstove/inserts} \div 1,017 \text{ respondents} \times 100\% &= 4.1\% \text{ woodstoves/inserts} \\ 4.1\% \times 108,776 \text{ households} &= 4,492 \text{ woodstoves/inserts} \\ 80.6\% \text{ used} \times 4,492 \text{ woodstove/inserts} &= 3,619 \text{ used} \end{aligned}$$

2. Average Wood Consumption for Certified Woodstoves/Inserts

Based on the raw data for woodstove/inserts, the number of cords burned for each device on average was 1.90 cords/device countywide and 1.64 cords/device within the NAA.

C. NON-CERTIFIED WOODSTOVES/INSERTS

1. Percentage of Non-Certified Woodstoves/Inserts

Respondents reported having 8 non-certified woodstoves or inserts as either their first, second, or third device. Of these respondents, 25% (2 units) were reported as actually being used. Within the NAA, respondents reported 6 woodstoves or inserts with 0% of those actually used.

County Wide:

$$\begin{aligned} 8 \text{ woodstoves/inserts} \div 1,473 \times \text{respondents} \times 100\% &= 0.5\% \text{ woodstoves/inserts} \\ 0.5\% \times 157,548 \text{ households} &= 856 \text{ woodstoves/inserts} \\ 25\% \text{ used} \times 856 \text{ woodstoves/inserts} &= 214 \text{ used} \end{aligned}$$

NAA:

$$\begin{aligned} 6 \text{ woodstoves/inserts} \div 1,017 \text{ respondents} \times 100\% &= 0.6\% \text{ woodstoves/inserts} \\ 0.6\% \times 108,776 \text{ households} &= 642 \text{ woodstoves/inserts} \\ 0\% \text{ used} \times 642 \text{ woodstove/inserts} &= 0 \text{ used} \end{aligned}$$

2. Average Wood Consumption for Certified Woodstoves/Inserts

Based on the raw data for woodstove/inserts, the number of cords burned for each device on average was 2.05 cords/device countywide and 0 cord/device within the NAA.

D. PELLET STOVES

1. *Percentage of Pellet Stoves*

Respondents reported having 29 pellet stoves as either their first, second, or third device. Of these respondents, 82.8% (24 units) reported actually using them. Within the NAA, respondents reported 17 pellet stoves with 76.5% (13 units) of those actually used.

County Wide:

$29 \text{ pellet stoves} \div 1,473 \text{ respondents} \times 100\% = 2.0\% \text{ pellet stoves}$

$2.0\% \times 157,548 \text{ households} = 3,102 \text{ used}$

$82.8\% \text{ used} \times 3,102 \text{ pellet stoves} = 2,567 \text{ used}$

NAA:

$17 \text{ pellet stoves} \div 1,017 \text{ respondents} \times 100\% = 1.7\% \text{ pellet stoves}$

$1.7\% \times 108,776 \text{ households} = 1,818 \text{ pellet stoves}$

$76.5\% \text{ used} \times 1,818 \text{ pellet stoves} = 1,390 \text{ used}$

The number of pellet stoves sold since 1988 as estimated from WCDHD-AQMD Dealer Affidavits of Sale (DAS) is 2,079. The 2003-2004 survey calculated number of 2,567 pellet stoves was more than the DAS count.

2. *Average Pellet Consumption for Pellet Stoves*

Based on the raw data for pellet stoves, the tons of pellets burned for each device on average was 0.72 ton/device countywide and 0.75 ton/device within the NAA.

E. ESTIMATED EMISSIONS BASED ON THE 2003-2004 SURVEY

Tables VII and VIII list the activity data based on the 2003-2004 Survey for the NAA and the entire County, respectively.

**TABLE VII
2003-2004 NAA ACTIVITY DATA**

Type of Device	Average cords or tons used per Device	Total # of Units	# of Units Actually Used	Total # of Cords or Tons Used	Average Weight of Wood (lbs./cord)	Total Lbs. of Wood/Yr.
Fireplaces	0.90	28,878	14,546	13,091	2,635	34,494,785
Woodstoves/Inserts						
Certified	1.64	4,492	3,619	5,935	2,635	15,638,725
Uncertified	0	642	0	0	2,635	0
Wood Totals				19,026		50,133,510
Pellet Stoves	0.75	1,818	1,390	1,043	-	-

TABLE VIII
2003-2004 COUNTYWIDE ACTIVITY DATA

Type of Device	Average cords or tons used per Device	Total # of Units	# of Units Actually Used	Total # of Cords or Tons Used	Average Weight of Wood (lbs./cord)	Total Lbs. of Wood/Yr.
Fireplaces	0.94	35,938	17,006	15,986	2,635	42,123,110
Woodstoves/Inserts						
Certified	1.90	7,273	5,883	11,178	2,635	29,454,030
Uncertified	2.05	856	214	439	2,635	1,156,765
Wood Totals				27,603		72,733,905
Pellet Stoves	0.72	3,102	2,567	1,848		

The estimated emissions based on the 2003-2004 Survey data are calculated using emission factors from AP-42, Fifth Edition, Sections 1.9 and 1.10 for fireplaces and woodstoves/pellet stoves, respectively. Table IX gives the estimate for the NAA and Table X gives the estimate on the County Wide basis.

TABLE IX
2003-2004 NAA ESTIMATED EMISSIONS

Type of Device	Total tons of wood or pellets/yr.	Emission Factors (lbs./ton)					Emissions (tons/yr.)				
		PM ₁₀	PM _{2.5}	CO	NO _x	VOC	PM ₁₀	PM _{2.5}	CO	NO _x	VOC
Fireplaces	17,247	34.6	34.6	252.6	2.6	229	298	298	2,178	22	1,975
Woodstoves/Inserts											
Certified	7,819	19.6	19.6	104.4	2.0	15	77	77	408	8	59
Uncertified	0	30.6	30.6	230.8	2.8	53	0	0	0	0	0
Total Woodstoves/Inserts							77	77	408	8	59
Pellet Stoves	1,043	4.2	4.2	39.4	13.8	0*	2	2	21	7	0
**Total Fireplaces + Woodstoves + Pellets (tons/yr.)							377	377	2,607	37	2,034

* No data

** Rounded to fewer significant digits

TABLE X
2003-2004 COUNTYWIDE ESTIMATED EMISSIONS

Type of Device	Total tons of wood or pellets/yr.	Emission Factors (lbs./ton)					Emissions (tons/yr.)				
		PM ₁₀	PM _{2.5}	CO	NO _x	VOC	PM ₁₀	PM _{2.5}	CO	NO _x	VOC
Fireplaces	21,062	34.6	34.6	252.6	2.6	229	364	364	2,660	27	2,412
Woodstoves/Inserts											
Certified	14,727	19.6	19.6	104.4	2.0	15	144	144	769	15	110
Uncertified	578	30.6	30.6	230.8	2.8	53	9	9	67	1	15
Total Woodstoves/Inserts							153	153	836	16	125
Pellet Stoves	1,848	4.2	4.2	39.4	7	0*	4	4	36	36	0
**Total Fireplaces + Woodstoves + Pellets (tons/yr.)							521	521	3,532	79	2,537

* No data

** Rounded to fewer significant digits

IV. SURVEY COMPARISONS

Tables XI and XII compares the six recent surveys conducted by the WCDHD-AQMD and MarkeTec.

**TABLE XI
NAA AVERAGE RWC ACTIVITY**

Device Type	Estimate of Total # of Devices		# of Devices Actually Used		Total # of Cords/Pellets used	
	Estimates	Average*	Estimates	Average*	Estimates	Average*
Fireplaces:		31,848		15,963		0.66
92-93 Survey	33,054		17,684		Unknown	
94-95 Survey	33,336		18,142		0.61	
95-96 Survey	30,179		16,003		0.56	
99-00 Survey	35,205		16,968		0.58	
01-02 Survey	30,437		12,435		0.63	
03-04 Survey	28,878		14,546		0.90	
Woodstoves/Inserts**		8,308		5,728		1.47
92-93 Survey	9,692		6,784		Unknown	
94-95 Survey	7,564		5,128		1.64	
95-96 Survey	10,015		7,283		1.43	
99-00 Survey	9,056		6,249		1.24	
01-02 Survey	5,211		3,198		1.55	
Certified Woodstoves/Inserts		4,492		3,619		1.64
03-04 Survey	4,492		3,619		1.64	
Non-Certified Woodstoves/Inserts		642		0		0
03-04 Survey	642		0		0	
Pellet Stoves		1,729		1,449		0.82
92-93 Survey	822		712		Unknown	
94-95 Survey	2,179		1,773		0.67	
95-96 Survey	1,560		1,431		1.2	
99-00 Survey	1,981		1,611		0.89	
01-02 Survey	2,013		1,776		0.61	
03-04 Survey	1,818		1,390		0.75	

*Rounded to fewer significant digits

**Past reports combined certified and non-certified woodstoves/inserts

**TABLE XII
COUNTY WIDE RWC ACTIVITY**

Device Type	Estimate of Total # of Devices		# of Devices Actually Used		# of Cords/Pellets used per Device	
	Estimates	Average*	Estimates	Average*	Estimates	Average*
Fireplaces:		35,148		17,647		0.76
92-93 Survey	34,431		17,695		0.84	
94-95 Survey	34,047		18,777		0.73	
95-96 Survey	31,701		18,008		0.73	
99-00 Survey	39,479		19,976		0.57	
01-02 Survey	35,292		14,419		0.73	
03-04 Survey	35,938		17,006		0.94	
Woodstoves/Inserts**		12,043		8,746		1.66
92-93 Survey	13,845		9,573		1.90	
94-95 Survey	10,972		8,031		1.72	
95-96 Survey	13,803		10,640		1.57	
99-00 Survey	11,886		8,380		1.33	
01-02 Survey	9,711		7,106		1.79	
Certified Woodstoves/Inserts		7,273		5,883		1.90
03-04 Survey	7,273		5,883		1.90	
Non-Certified Woodstoves/Inserts		856		214		2.05
03-04 Survey	856		214		2.05	
Pellet Stoves		2,647		2,359		1.00
92-93 Survey	1,264		1,264		1.08	
94-95 Survey	3,053		2,939		1.29	
95-96 Survey	2,808		2,574		1.25	
99-00 Survey	1,981		1,611		0.85	
01-02 Survey	3,671		3,198		0.83	
03-04 Survey	3,102		2,567		0.72	

*Rounded to fewer significant digits

**Past reports combined certified and non-certified woodstoves/inserts

Some results of the six surveys compare well and some do not. Since there are minor variations because of the methodology used has changed slightly over the year, staff elected to use the average activity data from six years' surveys to estimate emissions for emission inventory purposes.

Table XIII summarizes the estimates of average firewood consumption for Washoe County for the last eight woodstove surveys/reports. Table XIV summarizes the heating degree days versus the total firewood consumed for the last 6 surveys, and Figure 2 depicts the data graphically.

**TABLE XIII
AVERAGE FIREWOOD CONSUMPTION (CORDS)* FOR WASHOE COUNTY**

	1984	1991	1992	1994	1995	1999	2001	2003
Fireplaces	0.91	0.39	0.84	0.73	0.73	0.57	0.73	0.94
Woodstoves/Inserts**	2.25	1.24	1.90	1.72	1.57	1.33	1.79	-
Certified Woodstoves/Inserts	-	-	-	-	-	-	-	1.90
Non-Certified Woodstoves/Inserts	-	-	-	-	-	-	-	2.05
Total cords	38,593	20,305	34,673	27,521	29,851	22,530	23,246	27,603

*Based on devices reported used

**Certified and non-certified combined

**TABLE XIV
HEATING DEGREE DAYS VS. TOTAL CORDS OF FIREWOOD CONSUMED**

	1992-93	1994-95	1995-96	1999-00	2001-02	2003-04
Heating Degree Days*	3,869	3,142	2,958	2,962	3,094	3,210
Total Cords of Firewood Consumed	34,673	27,521	29,851	22,530	23,246	27,603

* Based on data for November, December, following year January and February.

Heating Degree Days vs. Total Cords of Wood Consumed

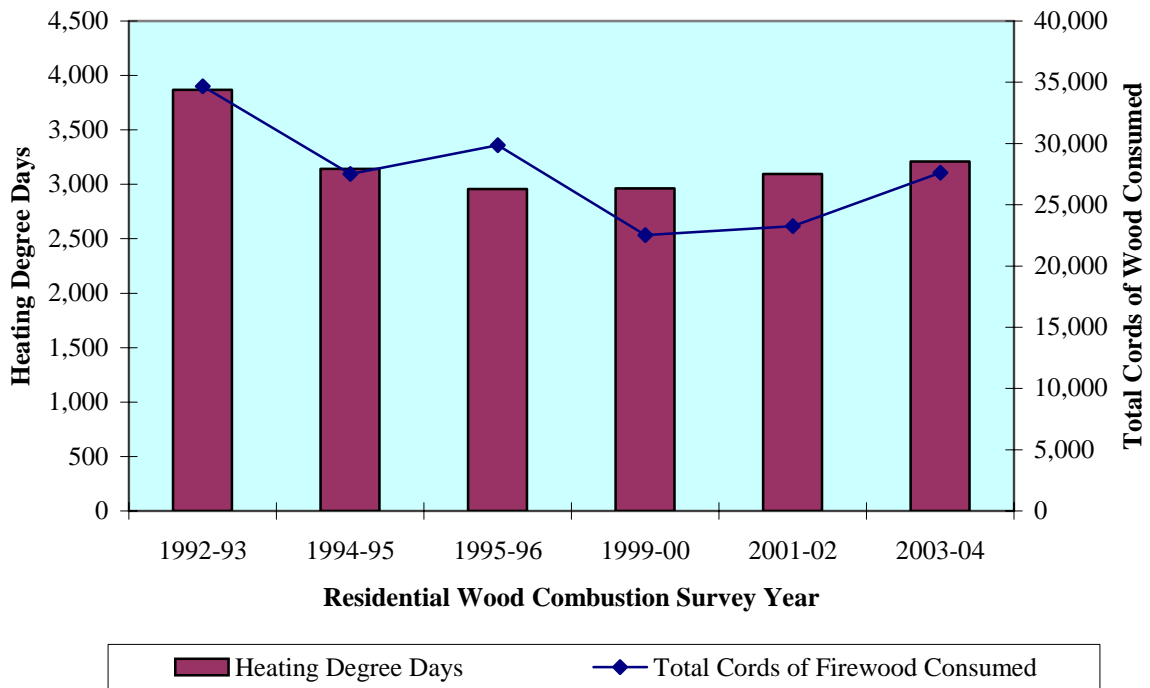


Figure 2

Appendix A

**Washoe County District Health Department
Air Quality Management Division
2003- 2004 Residential Wood Use Survey**

Conducted by MarkeTec

Appendix B

2003 Washoe County Dwelling Units

**Provided by Washoe County
Department of Community Development**

Appendix C

Local Climatological Data 30-Year Average Heating Degree Days

**Published by NCDC Asheville, NC
for the National Oceanic and Atmospheric
Administration**