

## **SECTION 7.1 APPENDIX B**

### **RESIDENTIAL WOOD COMBUSTION**

*SAN JOAQUIN VALLEY  
2009 Methodology for Fireplaces*

#### **Summary**

This Appendix presents the emission factors and activity data used to estimate the criteria pollutant emissions from fireplaces in the San Joaquin Valley (SJV) for the year 2009 and thereafter. As discussed in the main methodology document, Air Resources Board and District staff determined that the historical fireplace wood consumption rate in SJV was probably best represented by the results of a district survey conducted in 1997. However, after full implementation of District Rule 4901, *Wood Burning Fireplaces and Wood Burning Heaters*, in 2009 (which calls for curtailment of residential wood burning when ambient PM<sub>2.5</sub> levels reach a predetermined concentration), and an extensive public education campaign, staff determined that the lower wood consumption rates used as the statewide default values would be more representative of fireplace wood consumption rates in SJV.

This adjustment applies only to fireplaces. The tables below present the summary of fireplace fuel use and associated emissions in 2009 for all counties in SJV.

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**Table B-1: FIREPLACES - Number of Devices in 2009 (SJV)**

AB	Dis	County (AB)	H <sub>total</sub> (# of homes in 2005)	P <sub>fp</sub> (% of homes with wood burning fireplaces)	P <sub>fp,u</sub> (% of homes that use their wood burning fireplace)	[P <sub>fp</sub> ]x[P <sub>fp,u</sub> ] (% of homes with wood burning fireplaces that are in use)	H <sub>fp,u</sub> (# of homes with fireplaces in use)	M <sub>fp</sub> (# of fireplaces per home)	FP (# of fireplaces in use)	Ref.
SJV	SJU	Fresno	261,554	41	34	13.9	36,461	1.1	40,107	1,2,3
SJV	SJU	Kern (SJV)	181,734	32	37	11.8	21,517	1.1	23,669	1,2,3
SJV	SJU	Kings	35,812	32	37	11.8	4,240	1.1	4,664	1,2,3
SJV	SJU	Madera	38,051	33	43	14.2	5,399	1.1	5,939	1,2,3
SJV	SJU	Merced	67,116	33	43	14.2	9,524	1.1	10,476	1,2,3
SJV	SJU	San Joaquin	193,423	54	49	26.5	51,180	1.1	56,298	1,2,3
SJV	SJU	Stanislaus	153,742	46	43	19.8	30,410	1.1	33,451	1,2,3
SJV	SJU	Tulare	114,640	33	57	18.8	21,564	1.1	23,720	1,2,3
			<b>1,046,072</b>						<b>198,324</b>	

H<sub>total</sub>: Number of occupied housing units/homes in 2003.

P<sub>fp</sub>: Percent of homes with wood burning fireplaces.

P<sub>fp,u</sub>: Percent of homes with a fireplace, where the fireplace was actually used during the burn season.

H<sub>fp,u</sub>: Number of homes with fireplaces that are actually being used. H<sub>fp,u</sub> = [H<sub>total</sub>]\*[P<sub>fp</sub>]\*[P<sub>fp,u</sub>]

M<sub>fp</sub> = 1.1 fireplaces per home (OMNI, 2003)

FP<sub>all</sub> = Total number of fireplaces that are actually being used. FP<sub>all</sub> = [H<sub>total</sub>]\*[P<sub>fp</sub>]\*[P<sub>fp,u</sub>]\*[M<sub>fp</sub>]

**References:**

- 1 Total Homes Data Obtained From:  
State of California, Department of Finance; E-5 Population and Housing Estimates for Cities, Counties and the State, 2001-2010, with 2000 Benchmark; May 2010; For the San Joaquin Valley, the data represent the number of Occupied Housing Units during 2003, because of a district moratorium on new wood-burning fireplaces after 2003.
- 2 SJVUAPCD, 2010. San Joaquin Valley Air Pollution Control District; "District's Comprehensive Public Outreach and Education Program"; summary of survey conducted by CC&G (Feb.-May 2010); presented at the September 29-30, 2010 board hearing. County-level data provided by SJV/Jessica Fierro on 06/07/2011.
- 3 OMNI, 2003. D. Broderick and J. Houck; OMNI Consulting Services, Inc.; "Results of Wood Burning Survey - Sacramento, San Joaquin, and San Francisco Areas, University of California Berkeley/California Air Resources Board - GIS Study", Table 2.3a; Jan. 15, 2003; <http://www.omni-test.com/publications/final.pdf>

**Table B-2: Fireplaces – Amount of Cord Wood Burned in 2009 (SJV)**

AB	Dis	County (AB)	P <sub>fp,cord</sub> % of people who used their fireplaces and primarily burned cord wood	P <sub>fp,aes</sub> % of fireplace use that is for aesthetic purposes	P <sub>fp,heat</sub> % of fireplace use that is for heating purposes	FP <sub>aes</sub> # of Fireplaces Being Used for Aesthetic Purposes	N <sub>cord,aes</sub> # of cords burned in fireplaces – aesthetics (cord/fireplace/yr)	F <sub>aes</sub> Cord Wood Burned in Fireplaces for Aesthetics, tons/yr	FP <sub>heat</sub> # of Fireplaces Being Used for Heating Purposes	N <sub>cord,heat</sub> # of cords burned in fireplaces – heating (cord/fireplace/yr)	F <sub>heat</sub> Cord Wood Burned in Fireplaces for Heating, tons/yr	F <sub>aes</sub> +F <sub>heat</sub> Total Cord Wood Burned in Fireplaces, tons/yr	Ref.
SJV	SJU	Fresno	88.0	59.7	40.3	21,070	0.069	2,239	14,223	0.656	14,369	16,608	1,2
SJV	SJU	Kern (SJV)	88.0	50.8	49.2	10,581	0.069	1,124	10,248	0.656	10,353	11,477	1,2
SJV	SJU	Kings	88.0	52.6	47.4	2,159	0.069	229	1,946	0.656	1,965	2,195	1,2
SJV	SJU	Madera	88.0	21.6	78.4	1,129	0.069	120	4,098	0.656	4,140	4,260	1,2
SJV	SJU	Merced	88.0	50.0	50.0	4,610	0.069	490	4,610	0.656	4,657	5,147	1,2
SJV	SJU	San Joaquin	88.0	52.6	47.4	26,059	0.069	2,769	23,483	0.656	23,723	26,492	1,2
SJV	SJU	Stanislaus	88.0	61.5	38.5	18,104	0.069	1,924	11,333	0.656	11,449	13,373	1,2
SJV	SJU	Tulare	88.0	52.6	47.4	10,980	0.069	1,167	9,894	0.656	9,995	11,162	1,2

**90,714**

P<sub>fp,cord</sub>: Percent of people who used their fireplaces who primarily used cord wood.

P<sub>fp,aes</sub>: Percent of fireplace use that is for aesthetic purposes.

P<sub>fp,heat</sub>: Percent of fireplace use that is for heating purposes.

FP<sub>aes</sub>: Number of fireplaces used for aesthetic purposes

F<sub>aes</sub>: Amount of cord wood burned in fireplaces for aesthetics, tons/yr ( $F_{aes} = [FP_{all}] * [P_{fp,cord}] * [P_{fp,aes}] * [N_{cord,aes}] * [W_{cord}]$ ), where N<sub>cord,aes</sub> = 0.069 cords/fireplace/year (Houck, 2001); W<sub>cord</sub> = 1.54 tons/cord (OMNI, 2006)

FP<sub>heat</sub>: Number of fireplaces used for heating

F<sub>heat</sub>: Amount of cord wood burned in fireplaces for heating, tons/yr ( $F_{heat} = [FP_{all}] * [P_{fp,cord}] * [P_{fp,heat}] * [N_{cord,heat}] * [W_{cord}]$ ), where; N<sub>cord,heat</sub> = 0.656 cords/fireplace/year (Houck, 2001); W<sub>cord</sub> = 1.54 tons/cord (OMNI, 2006)

[F<sub>aes</sub>]+[F<sub>heat</sub>]: Total amount of cord wood burned in fireplaces, tons/yr.

**References:**

- 1 Houck, 2001. Houck, James E. (OMNI Consulting, Inc.), "Recommended Procedure for Compiling Emission Inventory Data for Manufactured Wax/Sawdust Fireplace Logs", prepared for Roy Huntley (U.S. EPA, OAQPS); October 10, 2001; <http://www.omni-test.com/publications/actfire.pdf>
- 2 Sierra, 1989. Sierra Research, Inc.; "Draft Report, Residential Wood Use in California", prepared for the U.S. Environmental Protection Agency, Table D-3; October 20, 1989.
- 3 OMNI, 2006. J.E. Houck and B.N. Eagle; OMNI Environmental Services, Inc.; "Residential Wood Combustion Emission Inventory South Coast Air Basin and Coachella Valley Portion of Salton Sea Air Basin, 2002 Base Year", Table 4.6; October 24, 2006; <http://www.omni-test.com/publications/SCAQMD-RWC4.pdf>

**Table B-3: Fireplaces – 2009 Fuel Use and Emissions Estimates (SJV)**

AB	Dis	County (Air Basin)	FUEL USE (Tons/Yr)			2009 EMISSIONS (Tons/Year)						
			Cord Wood	Mfrd. Logs	Total All Fuels	CO	NO <sub>x</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	SO <sub>2</sub>	ROG	NH <sub>3</sub>
SJV	SJU	Fresno	16,608	715	17,323	1,286	24	205	213	5	169	15
SJV	SJU	Kern (SJV)	11,477	422	11,899	884	16	140	146	3	116	10
SJV	SJU	Kings	2,195	83	2,278	169	3	27	28	1	22	2
SJV	SJU	Madera	4,260	106	4,365	325	6	51	53	1	42	4
SJV	SJU	Merced	5,147	187	5,333	396	7	63	65	1	52	5
SJV	SJU	San Joaquin	26,492	1,003	27,496	2,042	38	324	337	7	267	24
SJV	SJU	Stanislaus	13,373	596	13,969	1,037	19	166	172	4	136	12
SJV	SJU	Tulare	11,162	423	11,585	861	16	137	142	3	113	10

<b>Totals (tons/year) =</b>	<b>90,714</b>	<b>3,534</b>	<b>94,248</b>	<b>7,000</b>	<b>129</b>	<b>1,112</b>	<b>1,156</b>	<b>26</b>	<b>917</b>	<b>82</b>
<b>Totals (Annual Avg. tons/day) =</b>	<b>249</b>	<b>10</b>	<b>258</b>	<b>19</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>0</b>	<b>3</b>	<b>0</b>

Fireplace Emission Factors (lb/ton fuel burned)							
	CO	NO <sub>x</sub>	PM <sub>2.5</sub>	PM <sub>10</sub>	SO <sub>2</sub>	ROG	NH <sub>3</sub>
Cord Wood / Bundles	149	2.6	22.7	23.6	0.4	18.9	1.8
Mfrd. Log	137	6.5	46.4	48.2	4.2	33.8	0.004

[Emissions, tons/yr] = [Emission Factor, lb/ton]\*[Fuel Use, tons/yr]/[2000 lbs/ton]

[Total PM] = [PM<sub>10</sub>]/[0.935], per ARB particulate matter profile code #424

[PM<sub>2.5</sub>] = [Total PM]\*[0.9001] = [PM<sub>10</sub>]\*[0.9001/0.935] = [PM<sub>10</sub>]\*[0.963], per ARB particulate matter profile code #424

[Total Organic Gases, TOG] = [ROG]/0.4385, per ARB organic profile code #549