

Final Work Plan - California Regional PM10/PM2.5 Air Quality Study Ammonia Emissions Improvement Projects in Support of CRPAQS Aerosol Modeling and Data Analyses: Draft Ammonia Inventory Development (pages 2-9 to 2-11)

Recommendations for Residential Wood Combustion

The Team recommends generating year 2000 estimates based on the EPA's Emission Inventory Improvement Program (EIIP) alternative method for this category (EPA, 1997). This method specifies the use of State-level estimates of the amount of wood consumed for California according to the Energy Information Administration's (EIA's) State Energy Data Report. This State estimate is then allocated to the county level using the number of wood-burning households in each county, as reported by the 1990 United States Census. Since these data represent 1990, the Team will determine whether newer information will be available for this study from the 2000 census. As mentioned above, U.C. Berkeley is conducting research in estimating emissions from this category, however the results are not expected to be available for inclusion in this study.

For the NEI, residential wood combustion activity was estimated for the year 1990 by running the County Wood Consumption Estimation Model. For each year since 1990 up to 1999, county-level activity estimates (i.e., cords of wood) were updated using the national total for residential wood consumption and heating degree days. For most States, monthly heating degree days are obtained from one representative meteorological station in the State. For California, 2 stations, one in Northern California and one in Southern California, are used for Northern and Southern California counties, respectively. Heating degree data for 2000 from the National Climatic Data Center (NCDC) are likely to be available by June 2001.

ARB estimates emissions for all air districts within the State. For fireplaces, ARB multiplies an average wood consumption per fireplace estimate (0.28 cords per year) by the estimated number of houses with active fireplaces. The estimated number of houses with active fireplaces is derived by subtracting the estimated number of wood heating houses (available from the 1990 Census of Population and Housing-Summary Tape File 3A) from the total number of wood burning houses. The total number of wood burning houses is estimated by multiplying the fraction of houses burning wood by the total number of houses. The 1988 report, *The California Residential Wood Consumption Survey, Draft*, lists the percentage of wood burning households by Air Basin. ARB estimates emissions for wood stoves differently than emissions for fireplaces, since wood stove activity is believed to correlate more closely with temperature (i.e., heating degree days). For wood stoves, a model equation was developed that estimates energy consumption using inputs such as number of households burning wood, housing design characteristics, heating degree days, and fuel heating values.

In discussions with ARB, year 2000 estimates for residential wood combustion are likely to be grown from 1999 estimates, using the annual change in population as a growth factor. ARB last used the method described above for the inventory year 1997, and has grown the estimates using county-level population for each year since then.

Because the same NH₃ emission factors would likely be applied to all activity data, regardless of whether the activity corresponds to fireplaces or wood stoves, a method that distinguishes between the activity from these two types of devices may not add value. If, in the process of researching this issue, it is found that emission factors or seasonal profiles are available by device type, the Team will make an effort to distinguish the activity among the various devices separate EIC/CES codes will be used for each). This distinction could be made using data from EIA's *Housing Characteristics 19xx*, which is part of its Residential Energy Consumption Survey. This publication has information to estimate the percent of households in the Western region that use fireplaces versus wood stoves.

Most residential wood burning occurs during the cold season (typically in the fall, winter and early spring). Temporal allocation profiles have been developed by ARB to apply to annual estimates of wood burned by households. Both Statewide profiles and profiles specific for the SJV APCD have been developed (ARB, 1997). Heating degree-day data for 2000 can also be obtained from National Climatic Data Center and used to update these profiles specifically for the inventory year in question, if warranted. Other factors, such as the price of electricity, may also affect the wood-burning activity for a specific time period during the inventory year being modeled. The Team will examine potential factors and will determine if information is available (e.g., from the literature or from State agency contacts) to improve the activity data or temporal allocation factors.

As with prescribed burning and wildfires, contacts with EPA staff and searches of the literature to date have not yielded NH₃ emission factors specific for residential wood combustion. Consistent with ARB's current approach, NH₃ emissions may be estimated based on ratios of NH₃ to CO emission rates from other biomass combustion sources (e.g., wildfires). Care must be taken in the use of these ratios, however since NH₃ emissions from sources such as wildfires can come from the underlying soil as well as the burned biomass.

Based on other ongoing work for this source category, it is clearly important to be able to distinguish between urban and rural residential wood burning activity. Per unit household, activity in urban areas is lower than in rural areas (where wood can be an important primary or supplemental fuel source; Houck, 1997). The team will develop weighting factors to account for this issue from the U.S. Department of Energy household energy consumption surveys (e.g., DOE, 1993) and the U.S. Bureau of Census American Housing Survey.

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Emissions for fireplaces and woodstoves were also estimated using the NH₃ to CO ratio approach described above for the previous two categories. County-level CO emissions were taken from the 2000 CEIDARS database. A NH₃:CO ratio of 0.0073 was derived from information on “average forest products” combustion in wildfires (EPA, 2002). The monthly TAFs were assigned as supplied by the Districts, except where a uniform distribution was assumed. In these cases, a distribution was assigned that showed no activity from May through September (commonly employed by Districts for most counties). Weekly and daily temporal allocation was assigned based on typical temporal allocation for this source category (CARB, 1991).

As with the other biomass burning categories, ammonia emissions should be considered highly uncertain. This is based not only on the emission ratio approach itself, but also the extrapolation of emission ratios for other sources that were used to construct estimates for agricultural burning and residential wood combustion.