

## **Response to comments in the July 28, 2006 and August 1, 2006 Orlando Cabrera-Rivera e-mails.**

The selection of data (references) for compiling average emission factors had a number of criteria. These were:

1. The wood-burning device tested was a commercially available unit not a novel research unit, or an atypical unit not generally used by the public.
2. Reasonable burn rates and representative fuel were used in the testing.
3. A narrative was provided documenting established and/or technically sound testing and analytical methodologies.
4. If there was a large enough literature database available for a given pollutant, the reported emission factor or the emission factor calculated from data provided in the document was evaluated to determine if it were an outlier as compared to data from other sources (i.e., outside of two standard deviation of the mean of the other data). An outlier status could be indicative of a non-representative use of the wood-burning devices, or measurement or calculation errors.
5. Adequate supporting ancillary data was supplied along with the key emission factor data to establish the veracity of the results. These included fuel moisture, temperatures and pressures associated with gas volumes, operational temperatures, stack gas velocities, etc.
6. The emission factor units or the units of data used to calculate the emission factors, as well as, units for supporting ancillary data were provided.
7. Some of the references were review documents with the emission factors being the compilation of primary measurements from more than one source. Care was taken to insure that data from no reference was included in the calculation of the final recommended emission factors more than once.
8. Calculation methods were either provided or transparent.
9. Institutional and/or authorship information was provided with unpublished reports.

*The above criteria were included in Section 2 of Technical Memorandum 2*

Response to specific comment, "I noticed that Reference 1.05 for example, was used in deriving the PM emission factor, but not for HAP. This particular research paper addresses both. Any reason for not looking at the HAP emission factors of this and other references."

Reference 1.05 was not used for HAP because it only listed HAP for the particulate phase not the vapor phase. Many HAP's are either primarily in the vapor phase or are partitioned between the vapor phase and the particulate phase (solid or liquid). Further, there was only one HAP listed in the reference that was on the list of HAP's for which OMNI compiled emission factors. This was benzo(a)pyrene. Even though benzo(a)pyrene is primarily in the particulate phase at ambient temperatures, at woodstove chimney temperatures it is not. It is impossible to determine the fraction that

is in the particulate and in the fraction that is in the vapor phase at the point of sample collection. A resin trap such as XAD would have been needed to be part of the sampling train to make the data usable. for benzo(a)pyrene total emissions.

**Response to comment in Judy Rand's August 1, 2006 e-mail.**

Two of the total of nine measurements that made up the AP-42 database were clearly outliers and were deleted when calculating the mean emission factors. *The following discussion was included in Section 2.3.1 of Technical Memorandum 2.*

It is important to note that the VOC emission factor used in this report is much lower than the VOC emission factor in AP-42. This is due to the fact that the AP-42 used an average of nine emission factors from three documents created between 1977 and 1983<sup>2,9,06,9,11</sup>. Of those nine emission factors, two were clearly outliers (from reference 9.11) since they are 37 and 13 standard deviations larger than the mean of 12.9 (which excluded the two outliers). Since the report containing the two outliers only contained three emission factors, the entire report was omitted. After the report's three emission factors were removed, 11 emission factors from two more recent studies<sup>8,10</sup> were averaged with the remaining six factors from AP-42 to determine the more reasonable updated VOC emission factor for fireplaces without inserts burning cordwood from Table 2.3.1 of 9.43 g/kg.

**Response to comment in David Fees' August 1, 2006 e-mail**

Response to part 1 – The fifth county is Frederick, MD

Response to part 2 – The treatment of zeros was not done correctly. We have revised portions of Technical Memorandums 1 and 2 to reflect the change in average burn rates that this has caused. The Pechan database was not interpreted correctly and the burn rate averaged across all households reporting having a wood-burning device rather than across only households that report using their wood-burning device was erroneously used. This has a small but real effect on the emission inventory (20% to 30%). Mr. Fees should be complimented for going into enough detail to find this mistake. The Pechan survey questionnaire and associated database were not transparent.

Mr. Fees' concern over too "little data" is absolutely correct for centralized heating systems, with the low HDD category the poorest. The uncertainty for that category is high. We provided the data that were available.

Hopefully this helps to clear up any remaining questions. Updated Technical Memorandums 1 and 2 and their corresponding Excel databases will be sent to MARAMA.