

## **Summary of Member Comments on the Residential Wood Draft Final Document**

Prepared October 6, 2006

The Residential Wood Draft Final Report was emailed to the MANE-VU Technical Support Committee, Technical Support Committed EI Work Group, and the Technical Support Committee Modeling Work Group, and the MANE-VU Monitoring and Data Analysis Committee on October 6<sup>th</sup> and the replies were due by November 3<sup>rd</sup>. Seven members commented on the document and their comments are summarized here. Comments were received from the following groups: the Delaware Department of Natural Resources and Environmental Control via Jack Sipple, the Connecticut Department of Environmental Protection via Dave Wackter, the MANE-VU Technical Support Committee, the New York State Department of Environmental Conservation (NYSDEC) via John Barnes, the Massachusetts Department of Environmental Protection (DEP) via Kenneth Santlal, the New Jersey Department of Environmental Protection via Judy Rand, and the Mid-Atlantic Regional Air Management Association, Inc., via Susan S.G. Wierman and Angela Crenshaw.

### **General Comments**

MARAMA has recently been incorporated. Wherever Mid-Atlantic Regional Air Management Association is written out “Inc.” needs to follow, i.e. “Mid-Atlantic Regional Air Management Association, Inc.” This affects the cover page and page 1 of the document. However, MARAMA the acronym can stay the same.

When referring to Tasks and Technical Memoranda, it is requested that the names of the Tasks and Technical Memoranda be used, not the numbers. For example, Task 4 or Technical Memorandum 2 should be referred to as the Emissions Inventory.

At the end of the report, before the reference section, it is requested that a section summarizing what was done in this project be added. This section should state what was learned and gained as a result of this Residential Wood Combustion project.

Throughout the document, please replace cost-benefit with cost-effectiveness. This document does not constitute a cost-benefit analysis.

### **Section 1**

Add a discussion to the introduction that recognizes other studies that were done and state that there is uncertainty involved with each method. It is requested that the previous Residential Wood Combustion reports by Pechan, NYSERDA and others be referred in Section 1 of the report. Use New York as an example and add the following sentences from New York’s comments, “To date, there have been three estimates published regarding how much wood was used in residential wood combustion (RWC) sources in New York during calendar year 2002. The estimate by the New York State Energy Research and Development Authority was at least four times greater than OMNI’s

estimate. Pechan & Associates prepared an estimate for MARAMA that was approximately three times higher than OMNI's estimate." Also include a statement saying that the decision on which calculation method to use for State Implementation Plan development is up to the individual states.

## **Section 2**

In section 2.1.1, it is stated that eight different methods were used. Explain that not all eight methods were used for each county.

On page 2, section 2.1.1., the third line needs "of" inserted into the sentence after the word number. The sentence should read, "The calculation of the number of fireplaces without inserts used for heat..."

The second sentence in section 2.1.1, uses the phrase "has been estimated." Provide a reference for this sentence.

On page 3, provide the mean and standard deviation for each county as a footnote.

On page 4, under calculation method 7, in the third sentence is unclear "proportioning" does not seem clear. Explain how the proportioning was done and were the ratios different in urban and rural areas?

*The fraction of households by county that use wood as the main heating fuel was obtained from the 2000 Census (long form results based on one-in-six houses). The ratios of the total number of households that use wood as a heating source (sum of main and other heating source) to those that use it as a main source only were determined by proportioning the relative wood-burning activity between the rural and urban portions of each county. This was done because the urban and rural ratios differ from one another. (The AHS has developed these data for a number of categories. Ratios for urban and rural areas both inside and outside MSAs were calculated).*

On page 5, section 2.1.2, the 2.1.2 needs a "." inserted after the last two, so the numbering reads "2.1.2."

On page 5, section 2.1.2., in the fifth sentence the word form should be from, the sentence should read, "...that used wood as their main heating fuel as determined from the U.S. Census Bureau."

On page 5 the final sentence uses the term "heating category" is this supposed to be heating degree day?

*Heating degree day category*

On page 6 on section 2.1.3., why was the manufacturer's shipment records used to determine the total number of pellet heaters in the U.S.? As opposed to the sales record?

*As there were no sales records, the shipment records were used. Out of business necessity, stove retailers do not maintain a large inventory of pellet heaters, hence stoves shipped to retailers is representative of stoves purchased by consumers.*

In section 2.1.4, in the middle of the paragraph the term "apportioning" is used, is this the correct term to use? Towards the bottom of the paragraph the discussion of wax/fiber firelogs (after the reference to Table 10) is unclear, please clarify what you mean in these sentences. Also, Table 10 is referenced and there is no Table 10 in the draft final report please fix this error and review the entire document for similar Table and Figure numbering errors.

In section 2.1.5, the second sentence states, "These data were calculated from the 2002 MARAMA survey." This statement is unclear. Were the same cords of wood per state and per county as MARAMA used? Were the same cords of wood per state, but allocated differently to the counties used? Were MARAMA's cords of wood adjusted with other data? It is requested that this statement be clarified and that it be clarified that the tons of wood per cord will be different than in the Pechan study because a different conversion factor was used.

*The number of cords burned by each of the main appliance types used for heat, by state, were calculated from the 2002 MARAMA survey. Because it was the best available data, the number of cords burned per appliance in each heating category from the MARAMA survey was used to determine the average number of cords burned per appliance by county, depending on the heating degree day category in which the county is located.*

### **Section 3**

There is concern about the disparity between the Pechan derived wood-burning emissions and the OMNI emissions. To address this concern add a statement to the emissions inventory section that discusses the variability and uncertainty of emissions inventory data. Also include a statement saying that the decision on which calculation method to use for State Implementation Plan development is up the individual states and that the emission estimates in this report were used for the purpose of calculating the cost-effectiveness analysis.

There is also a concern regarding the New Jersey emissions, which seem to be very low compared to other states. See the MS Excel document entitled "omni-mvu-woodb-em\_NJ" which shows that New Jersey emissions per capita are much lower than the other states (including Maryland and Delaware). It is requested that the table in "omni-mvu-woodb-em\_NJ" be included in the final report with a brief explanation of the differences (e.g. why certain states are above average).

*See the attached document "Task 6 comment response for NJ question".*

There is concern that the OMNI County distribution looks off with some of the urban counties like Bergen and Union ranked high, and some rural counties like Cumberland and Gloucester ranked low. Rand stated that the calculations she did based on NJ/EPA calculations, based on census data for people who use woodstoves for primary heating purposes, showed different results, with zero emissions in 5 urban counties. This source was one of many sources OMNI may have used, but it is not clear what OMNI actually used to distribute emissions by county. Has this been looked into? Were any of the county allocations revised? Rand thinks other states had the same comment.

*OMNI results include primary and secondary heating. Even though many urban counties have zero households using RWC as main heat, many more use RWC as secondary heat. This is shown in the attached document "Task 6 comment response for NJ question".*

On page 21, section 3.1., add an introduction statement that discusses uncertainty with respect to estimating RWC emission

On page 21, section 3.1., line 8, the word "the" and the letter "m" need to be joined into "them."

*This was due to an error during the Word to .pdf conversion, Word document is unchanged.*

On page 25, section 3.2., line 1, the "E" in emissions needs to be lower case, so the sentence reads, "The emissions inventories are provided in Tables...."

Why weren't aesthetic wood-burning emissions included in the totals? It is clear that the emissions are small and therefore not included, but the emissions were calculated, they are in the graph, and they are higher than those from firelogs. If the data has been calculated and shown on the graph, it is requested that they should be included in the total.

*The aesthetic wood-burning emissions have been added to the total figure.*

The labeling of the tables and figures throughout the report does not specify that the data is "per year for 2002" or just "2002." Specifically, pages 26-41 and also on page 25, this should be specified in the last paragraph.

On page 42, section 3.3., line 5, the letters "apportio" needs to be joined with letters "ning" to form the word "apportioning."

*This was due to an error during the Word to .pdf conversion, Word document is unchanged.*

#### **Section 4**

At the beginning of this section on page 44, the purpose and context of the section should be explained. Text similar to that on page 1, paragraph 3 may provide a starting point. Is

this analysis limited to the cost-effectiveness of replacing existing equipment? What about new construction?

*The cost effectiveness scenarios deal with the replacement of an existing uncertified device with, or the installation into an existing fireplace with a newer technology/alternative fuel device. Many of the RWC control measures addressed in section 4 do consider new construction*

At the beginning of Section 4 it is requested that a few sentences about Washington State having tighter standards for residential wood devices be added, as well as referencing the OMNI analysis of whether most us-certified stoves meet Washington's PM limits.

*Notable among state and local regulations is the Washington State standard. Washington State has implemented more stringent standards for residential wood burning devices, so devices installed in Washington State must be certified to the more stringent standard. This has affected the stove market because many U.S. certified stove manufacturers choose to have their appliances certified to the more stringent Washington State standard, unless the manufacturer can or does not choose to test to the tighter standard. To provide a sense of the stringency of the Washington State standard as compared to the NSPS (generally referred to as the EPA standard), as of January 2006 approximately 40% of non-catalytic wood heaters certified for the U.S. EPA for sale did not meet the Washington State standard.*

Add the following sentences from New York's comments to the introduction to Section 4 on page 44, "Due to the high costs of natural gas and fuel oil, many residential consumers are turning to wood combustion in order to reduce their energy costs. Several states, including New York, are encouraging the use of renewable energy sources. Wood is a renewable energy source."

*The fact that wood is a domestic renewable energy source and the fact that the cost of the widely used home fuels of natural gas, propane, and fuel oil have a history of rising together have been responsible for the increase of RWC. For example, several states, notably New York, are encouraging the use of renewable energy sources such as wood.*

On page 44, the last sentence states that because the majority of particles emitted by RWC are submicron, the PM<sub>10</sub> control measures that have been developed for RWC are directly applicable for the control of PM<sub>2.5</sub> and are generally applicable for other RWC air pollutants as well." Is this statement true? Explain.

*Yes. Because most of the products of incomplete combustion (PIC) emitted by RWC are submicron (less than one micron in size), the PM<sub>10</sub> control measures that have been developed for RWC are directly applicable for the control of PM<sub>2.5</sub>. Stated another way, submicron particles from RWC are both PM<sub>2.5</sub> and PM<sub>10</sub> because they have aerodynamic diameters less than 2.5 microns and less than 10 microns, respectively, i.e., the same particles will be controlled by both PM<sub>2.5</sub> and PM<sub>10</sub> control measures. Similarly, since*

*most key air pollutants that are emitted from RWC are PIC, control measures for particles (which are PIC) will also reduce the emission of other key RWC air emissions.*

Provide the discount rate that was used in the cost-effectiveness analyses.

*All costs are based on cash purchases or expenditures and as such neither discount or interest rates were taken into consideration. Also, all costs were based on nominal 2006 dollars and no attempt was made to make adjustments to another year dollar basis.*

On page 45, in Table 4.01, in line 5 “=5” is a typo and should be corrected.

On page 46, in Table 4.01, in line 1, the word “form” should be changed to “from” and a period needs to be inserted at the end of the sentence.

On page 46, in Table 4.01, in line 8, the word “or” should be changed to “of.” And clarify whether the effectiveness is stated as annual or daily percentages?

*It is the overall effectiveness of the control measures, and on the average is independent of time.*

On page 48, at the end of Section 4, include the following sentences from New York’s comments, “The northeast states, through NESCAUM, are developing a model rule for regulating outdoor hydronic heaters. As part of this rule, strict particulate emission standards have been developed which will take effect in 2008. In order to meet these limits, these sources will likely need to be significantly redesigned.”

## **Section 5**

The general idea of Section 5 is unclear, it is requested that introductory comments be included at the beginning of the section, that explain what is in the following tables, especially Tables 5.11 through 5.31.

*The analysis focuses on the cost per unit mass of pollutant reduced when converting to improved technology and alternative fuels from traditional uncertified cordwood-burning units (summarized in Table 5.11 – Table 5.23). In addition to the total cost effectiveness of the conversions, the costs associated with each component of such conversions are provided (Table 5.06 – Table 5.10).*

On page 62, the heading of section 5.2 should read, “Pollution Reduction Cost Analysis by State and Average MANE-VU Region.” It is also requested that a statement saying that the Cost Analysis tables are in reference to the replacement of existing devices and not new construction and that this not a cost-effectiveness project for other measures be added.

*The cost effectiveness tables are in reference to the replacement of an existing RWC device, and do not include new construction. This is not a cost-effectiveness project for other RWC control measures such as described in the U.S. EPA's PM<sub>10</sub> RACM/BACM guideline documents. Costs associated with these measures are predominantly organizational and administrative associated with the implementation of regulations and are outside the scope of this project.*

On page 62, in the second to last line, should the “ ` ” be replaced with “ \*\* ”?

*Yes.*

Also on page 62, please explain why the cost per ton differs between states (in the text before the tables). It is requested that a few clarifying examples be included before the tables.

*The magnitude of pollutant reduction combined with the cost of the various mitigation scenarios are what primarily drive the cost effectiveness analyses. Replacement units, new installations, or alternative fuels that allow for greater emission reductions would have a lower cost per unit mass of pollutant reduction if all costs were equal. Similarly, replacement units, installations or alternative fuels with lower costs would have a lower cost per unit mass of pollutant reduction if the magnitude of pollutant reductions were equal. However, due to climate and sociodemographic differences, the cost per unit mass of pollutant reduction for the same mitigation scenarios vary from state to state as different amounts of fuel are characteristically burned per appliance in the different states with commensurately different amounts of total emissions. While the emission factors and the corresponding pollutant reductions for the same amount of fuel used, for a given scenario, are the same from state to state, the total amount of emission varies along with the total amount of fuel consumed. (More total emissions in cold climates and in rural settings.) This, combined with fixed costs that are part of the cost component and do not differ with location, produces higher costs per unit mass primarily in states with warmer climates. For example, Delaware and Washington D.C. generally have lower costs per unit mass of pollutant reductions as compared to New Hampshire, New York, and Vermont.*

It was requested that tables of cost per ton of SO<sub>2</sub> and NO<sub>x</sub> be omitted, leaving PM, CO, and VOCs. Controls of residential wood burning are designed to reduce PM, CO, and/or VOC emissions.

On page 72, why do Delaware and DC have higher cost/ton? Why are New Hampshire, New York, and Vermont lowest?

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*cost per unit mass of pollutant reduction if the magnitude of pollutant reductions were equal. However, due to climate and sociodemographic differences, the cost per unit mass of pollutant reduction for the same mitigation scenarios vary from state to state as different amounts of fuel are characteristically burned per appliance in the different states with commensurately different amounts of total emissions. While the emission factors and the corresponding pollutant reductions for the same amount of fuel used, for a given scenario, are the same from state to state, the total amount of emission varies along with the total amount of fuel consumed. (More total emissions in cold climates and in rural settings.) This, combined with fixed costs that are part of the cost component and do not differ with location, produces higher costs per unit mass primarily in states with warmer climates. For example, Delaware and Washington D.C. generally have lower costs per unit mass of pollutant reductions as compared to New Hampshire, New York, and Vermont.*

Please explain the length of time considered in this analysis. Is it from the beginning of the change? Does it include capital costs averages over a certain amount of years?

*Costs considered in the cost effectiveness analyses are based on the lifetime of the replacement device or installation. Costs are amortized over the lifetime of the unit.*

Please include an explanation of the numbers in Tables 5.11 through 5.25. Are they completely cost driven or are there other benefits included?

*They are based on the pollutant reduction and cost from installing/replacing with a newer technology or alternative fuel heating device. Cost per unit mass of pollutant reduced.*

MANE-VU cannot support replacing a device used for heat with one used for aesthetics. Table 5.10 provides information about aesthetic uses. Page 52 notes the concerns regarding vent-free gas stoves and fireplaces inserts. Cost effectiveness analysis for fireplaces used for aesthetic purposes was calculated using different assumptions (see page 61). However, Tables 5.06, 5.07, and 5.08 show relative costs to replace various equipment with vent-free devices. Also Tables 5.11-5.20 and 5.21-5.25 in particular show the cost-effectiveness of replacing equipment with vent-free devices. Please remove the columns concerning vent-free devices from these tables. It is requested that a statement similar to this be added at the beginning of Section 5, "Vent free devices are not included in the tables as requested by MARAMA's Technical Oversight Committee because they are not primarily used for heating."

*As requested by MARAMA's Technical Oversight Committee, vent-free devices are not included in the tables for heating appliances as there is considerable concern regarding indoor air quality and damage to homes by moisture created from their use, as combustion gases are not vented. For completeness, the cost effectiveness analyses for vent-free appliances can be found in the cost benefit analysis task. The vent-free appliance data are also included for the fireplace aesthetic use scenario as aesthetic use is the primary application of vent-free devices.*

Is it correct to say that gas fired boilers are the best alternative to centralized cordwood heating systems in the MANE-VU region? Please provide text summarizing the implications of the cost-effectiveness analysis.

*The cost effectiveness of the various mitigation options listed in Tables 5.11-5.23 are the central part of any realistic emission reductions program for RWC in the MANE-VU states. Wood resources are abundant and widely utilized as fuel. Space heating is essential given the climate of the region. Some areas are economically depressed. The cost to households of any regulatory program mandating acceptable heating practices is a pivotal consideration. Likewise, the cost to households of any voluntary program is paramount for its success. The cost effectiveness of all reasonable scenarios for the replacement, modification or alternative fuel use for existing, older high emission wood-burning appliances is provided in this report for regulators and policy makers charged with the task of specifically lowering particulate, volatile organic compound and carbon monoxide emissions from residential wood combustion. The tables provided here allow for a direct comparison of the cost burden for each realistic mitigation option that would be shouldered by residential users. For example, for an average resident in the MANE-VU region with an existing older technology centralized cordwood heating system, the best current option in terms of cost, among the pellet, natural gas, and LPG options, is natural gas (assuming natural gas is available)(Table 5.22). Similarly, for wood-burning fireplaces used for aesthetics, manufactured wax/fiber firelogs offer the lowest cost per unit mass of air pollutant reduction (Table 5.23).*