

Spreadsheet Changes for WBT 4.2.3

March 19, 2014

1. Average Duct Temperature

Sheets: Test-1, Test-2, Test-3

Location: Bottom of the Measurements section for Cold, Hot, and Simmer

Cells: AA21, AI21, AP21

The average duct temperature for each portion of the WBT was added in as an input to replace the previous duct temperature input, which assumed that duct temperature was constant throughout the test. The cells are colored blue, like the other emission inputs.

The variable name for the cold section is: T_{cd} , for hot it is: T_{hd} , for simmer it is: T_{sd}

2. Duct Temperature Removed

Sheets: General Information

The previous Duct Temperature cell was removed.

3. Emission Report placed below the IWA Metrics, IWA Metrics moved below Calculations/Results

Sheets: Test-1, Test-2, Test-3

Cells: Top-left cell moved to U43

The IWA metrics were moved left, above the Emission Report, in order to highlight their importance. They are now located with a one space gap below the Cold/Hot Start Calculations/Results section. The Emission Report is located directly below the IWA Metrics Section.

4. Total Emission of CO2 via total capture method added

Sheets: Test-1, Test-2, Test-3

Location: Directly below the Total Emissions (carbon balance)

Cells: U73, AA73, AE73

Cold Start Formula: $[V_c * (CO_{2c} - CO_{2,b}) * (44 * P_{atm})] / (0.008314 * (T_{cd} + 273.15) * 1000000)$

For the hot and simmer version, the hot and simmer versions of the input variables are used.

The result is in grams.

5. Total Emission of CO via total capture method added

Sheets: Test-1, Test-2, Test-3

Location: Directly below the Total Emissions (carbon balance)

Cells: U74, AA74, AE74

Cold Start Formula: $[V_c * (CO_c - CO_b) * (28 * P_{atm})] / (0.008314 * (T_{cd} + 273.15) * 1000000)$

For the hot and simmer version, the hot and simmer versions of the input variables are used.

The result is in grams.

6. Total Emission of PM via total capture method added

Sheets: Test-1, Test-2, Test-3

Location: Directly below the Total Emissions (carbon balance)

Cells: U75, AA75, AE75

Cold Start Formula: $V_c * (PM_c - PM_b) / 1000000$

For the hot and simmer version, the hot and simmer versions of the input variables are used.

The result is in grams.

7. Total CO2, Total CO, Total PM inputs added to Measurements section

Sheets: Test-1, Test-2, Test-3

Location: Directly below the Average Emission inputs in the Measurements section

Cells: AA22-24, AI22-24, AP22-24

These inputs were added in order to allow for a custom input of the total emissions, instead of requiring the calculation to occur or be overwritten.

8. Calculation method dropdown menu added

Sheets: Test-1, Test-2, Test-3

Location: Directly above the IWA performance metrics

Cells: U42, V42, W42(cell where value from menu is stored)

The dropdown menu was added to allow the user to choose which of the three total emission options (total capture, carbon balance, user inputted) they'd prefer to be used for calculations for that particular test. The inputs are listed as: "Carbon Balance", "Total Capture", and "Custom: Entered Above". These are pulled from cells in the List Sheet. Each particular input chosen equates to a specific number in the cell behind the list, One for "Carbon Balance", Two for "Total Capture", and Three for "Custom: Entered Above".

9. Emission per water boiled cells changed to reflect Calculation Method

Sheets: Test-1, Test-2, Test-3

Cells: W61-63, AA61-63, AE61-63

The 'emission per water boiled' cells were changed to depend on the dropdown Calculation method menu. If statements within the cells reflect the value from the dropdown menu, and so when "Carbon Balance" is selected, the emission per water boiled cells read the "1" from the cell and utilize the Total emissions from the Carbon Balance cells in their calculations. When "Total Capture" is selected, the cells read the "2" from the cell and utilize the Total Emissions from the Total Capture cells in their calculations. When "Custom: Entered Above" is selected, the cells read the "3" from the cell and utilize the Inputted Total Emissions in their calculations.

10. Mass emission factors cells changed to include Total Capture method calculation

Sheets: Test-1, Test-2, Test-3

Cells: W65-67, AA65-67, AE65-67

The mass emission factor cells were changed to depend on the dropdown Calculation method menu. If statements within the cells reflect the value from the dropdown menu, and so when "Total Capture" is selected, the mass emission factor cells are calculated by taking the total grams of emission measured via the total capture method, divided by the kg of dry fuel weighed by the scale.

Cold Start CO2 Formula: $EF_{CO_2,c} = m_{CO_2,c} / (f_{cm} * (1-MC) - \Delta c_c * \text{'Char Carbon Fraction' / 'Fuel Carbon Fraction'})$

11. IWA Emissions Metrics (High/Low/Indoor CO/PM emissions) changed to reflect Calculation Method

Sheets: Test-1, Test-2, Test-3

Cells: AE46-51

The IWA Emission Metrics were changed to depend on the dropdown Calculation method menu. All six of the CO and PM metrics depended on the Total Emissions, and so they now reflect the different calculation methods. If statements within the cells reflect the value from the dropdown menu, and so when “Carbon Balance” is selected, the emission per water boiled cells read the “1” from the cell and utilize the Total emissions from the Carbon Balance cells in their calculations. When “Total Capture” is selected, the cells read the “2” from the cell and utilize the Total Emissions from the Total Capture cells in their calculations. When “Custom: Entered Above” is selected, the cells read the “3” from the cell and utilize the Inputted Total Emissions in their calculations.

12. If statements removed from Temp-Corr time, Burning Rate, Firepower, Turn Down Ratio, Specific Fuel Consumption, Specific Energy Consumption, and Hood Carbon Balance for cold, hot, and simmer tests

Sheets: Test-1, Test-2, Test-3

Cells: W34, W36, W37, W38, W40, W59, AA34, AA36, AA37, AA38, AA40, AA59, AP34-39, AE59

The if-statements were used to eliminate the div/0 errors. These were replaced by the following change.

13. Conditional Formatting added to eliminate div/0 errors

Sheets: Test-1, Test-2, Test-3, Results

Cells: All cells in Calculations/Results, IWA Metrics, and the Emission Report

Conditional formatting was added to all cells that weren't inputs to replace the div/0 error with a conditional format of a salmon-colored fill and text color if any error is occurring.

14. Formatting explanation added

Sheets: Test-1, Test-2, Test-3

Cells: M8-P8

Added a cell explaining that pink formatting indicates that an input is missing that is required for the cell to calculate.

15. Row Heights and Widths standardized between all three sheets

Sheets: Test-1, Test-2, Test-3

The row heights and widths were made the same for all three test sheets, following any adjustments required to properly display the added changes.

16. Air Temperature removed from General Information

Sheets: General Information

The Air temperature cell in the General Information sheet was removed, as it had previously been replaced with a cell in each test sheet.

17. Duct Temperature added to Test Entry sheet

Sheets: Test Entry

Cells: E56, J56, O56

The Duct Temperature was added to the Test Entry sheet.

18. Old Duct Temperature cells removed from Test Entry sheet

Sheets: Test Entry

Rows: 28 and 29

The Old Duct Temperature cells were removed from the Test Entry sheet.

19. Error in calculation of IWA Tiers for Average values of the IWA Performance Metrics fixed

Sheets: Results

Cells: I56-62

The Average tiers for the IWA Performance Tiers were being calculated opposite of the direction in which they should have been, except for the High Power Thermal Efficiency. Instead of marking the average as tier 0 if the stove was above 16 g/MJd, it would instead mark it as tier 0 if it was below 16 g/MJd. The

calculation has been fixed to correctly account for the fact that the IWA Performance metrics other than the High Power Thermal Efficiency decrease for higher tiers, rather than increase.

20. Units and Tests 1-3 removed from IWA Performance Tiers section of Results sheet

Sheets: Results

Cells: E56-62

The tiers for the IWA Performance metrics had erroneously included units alongside the tiers. These have been removed. Additionally, the tiers section has been changed to only list the tier of the average of the three tests, rather than listing all three test tiers and the tier of the average of the three tests.