Appendix G-15: WOE Probable Range With Voluntary Measures

This Appendix supplies results and methodology for the Baltimore 8-Hour Ozone NAA WOE Attainment Demonstration Without Voluntary Measures & With Voluntary Measures

Baltimore 8-Hour Ozone NAA WOE Attainment Demonstration Without Voluntary Measures & With Voluntary Measures

Site Name – County, State	Site ID Number	Observed	Modeled		WOE Without Voluntary Measures				Modeled	WOE With Voluntary Measures	
		2002 Base Year	2009 BOTW-B4	2012 BOTW-B4	2009 Probable	2009 Probable Range	2012 Probable	2012 Probable Range	2009 Telecommute	2009 Probable	2009 Probable Range
Davidsonville – ANNE ARUNDEL CO, MD	240030014	98.0	84	78	77.0	80.1 - 73.9	68.0	71.1 - 64.9	80.5	74.8	77.9 - 71.7
Ft. Meade – ANNE ARUNDEL CO, MD	240030019	97.0	84	78	77.5	80.6 - 74.4	68.5	71.6 - 65.4	80.1	75.1	78.2 - 72.0
Padonia – BALTIMORE CO, MD	240051007	88.7	77	72	71.2	74.3 - 68.1	63.7	66.8 - 60.6	74.6	69.5	72.6 - 66.4
Essex – BALTIMORE CO, MD	240053001	91.3	80	76	74.4	77.5 - 71.3	68.4	71.5 - 65.3	78.6	73.2	76.3 - 70.1
South Carroll – CARROLL CO, MD	240130001	88.7	75	69	68.2	71.3 - 65.1	59.2	62.3 - 56.1	71.8	66.1	69.2 - 63.0
Edgewood – HARFORD CO, MD	240251001	100.3	85	80	77.4	80.5 - 74.3	69.9	73.0 - 66.8	83.3	76.0	79.1 - 72.9
Aldino – HARFORD CO, MD	240259001	97.0	82	76	74.5	77.6 - 71.4	65.5	68.6 - 62.4	80.0	73.0	76.1 - 69.9

WOE Without Voluntary Measures 2009 & 2012 Probable Ranges

The monitoring station at Edgewood was used for the following sample calculations.

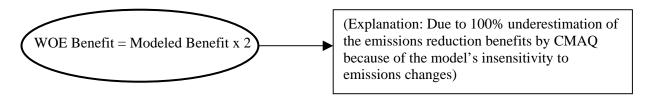
Given:

All values are 8-hour ozone design values (ppb)

Observed 2002 = 100.3 ppb

Modeled 2009 BOTW-B4 = 85 ppb

Modeled Benefit = Observed 2002 – Modeled 2009 BOTW-B4 = 100.3 ppb - 85 ppb = 15.3 ppb



Allowing for considerable margin, the underestimation of the WOE Benefit is conservatively cut in half (50%). The conservative WOE Benefit is calculated as follows:

WOE Benefit_{Conservative} = Modeled Benefit x 1.5 = 15.3 ppb x 1.5 = 22.95 ppb

WOE Without Voluntary Measures 2009 Probable = Observed
$$2002 - \text{WOE Benefit}_{\text{Conservative}}$$

= $100.3 \text{ ppb} - 22.95 \text{ ppb} = 77.4 \text{ ppb}$

WOE Without Voluntary Measures 2009 Probable Range Calculations:

Upper Bound = Probable 2009 + 3.1 ppb = 77.4 ppb + 3.1 ppb = 80.5 ppbLower Bound = Probable 2009 - 3.1 ppb = 77.4 ppb - 3.1 ppb = 74.3 ppb

WOE Without Voluntary Measures 2012 Probable Range Calculations:

Process is identical to the steps described above, except for the substitution of Modeled 2012 BOTW-B4 instead of Modeled 2009 BOTW-B4.

Note:

The 3.1 ppb adjustment to calculate the lower bound and upper bound represents the uncertainty in future design values and was calculated by Jeff Stehr (UMD). More detailed information can be found in Appendix G-9.

WOE With Voluntary Measures 2009 Probable Range

The monitoring station at Edgewood was used for the following sample calculations.

Given:

Modeled 2009 BOTW-B4 = 85 ppb Modeled 2009 Telecommute = 83.3 ppb

Benefit of Telecommuting = Modeled 2009 BOTW-B4 - Modeled 2009 Telecommute = 85 ppb - 83.3 ppb = **1.7 ppb**

Assume an additional benefit of 1 ppb for the High Energy Demand Day (HEDD) program (1):

Total

Voluntary = Benefit of Telecommuting + Assumed Benefit of HEDD Program = 1.7 ppb +1 ppb=2.7 ppb

Measures
Benefit

Divide the Total Voluntary Measures Benefit by 2 to be conservative:

Total Voluntary Measures Benefit_{Conservative} = 2.7 ppb / 2 = 1.35 ppb

WOE With Voluntary Measures 2009 Probable

= WOE Without Voluntary Measures 2009 Probable - Total Voluntary Measures Benefit_{Conservative} = $77.4 \text{ ppb} - 1.35 \text{ ppb} = \underline{\textbf{76.0 ppb}}$

WOE With Voluntary Measures 2009 Probable Range Calculations:

Upper Bound: Probable $2009 + 3.1 \text{ ppb} = 76.0 \text{ ppb} + 3.1 \text{ ppb} = \frac{79.1 \text{ ppb}}{10.0 \text{ ppb}}$ Lower Bound: Probable $2009 - 3.1 \text{ ppb} = 76.0 \text{ ppb} - 3.1 \text{ ppb} = \frac{72.9 \text{ ppb}}{10.0 \text{ ppb}}$

Note:

(1) Additional modeling is planned to calculate the modeled benefit of the HEDD program.

The 3.1 ppb adjustment to calculate the lower bound and upper bound represents the uncertainty in future design values and was calculated by Jeff Stehr (UMD). More detailed information can be found in the Appendix G-9, "Uncertainty in CMAQ and Over-predictions of Future Year Ozone Design Values".