

Appendix G-15: WOE Probable Range With Voluntary Measures

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

Philadelphia 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
Fairhill - CECIL CO, MD	240150003	97.7	81	75	72.7	75.8 - 69.6	63.7	66.8 - 60.6	78.1	70.7	73.8 - 67.6
Brandywine Creek - NEW CASTLE CO, DE	100031010	92.7	81	76	75.2	78.3 - 72.1	67.7	70.8 - 64.6	79.2	73.8	76.9 - 70.7
Bellefonte - NEW CASTLE CO, DE	100031013	90.3	78	74	71.9	75.0 - 68.8	65.9	69.0 - 62.8	76.0	70.4	73.5 - 67.3
Killens Pond - KENT CO, DE	100010002	88.3	78	74	72.9	76.0 - 69.8	66.9	70.0 - 63.8	76.4	71.6	74.7 - 68.5
Lewes - SUSSEX CO, DE	100051003	87.0	77	74	72.0	75.1 - 68.9	67.5	70.6 - 64.4	76.4	71.2	74.3 - 68.1
Lums Pond - NEW CASTLE CO, DE	100031007	94.5	79	74	71.3	74.4 - 68.2	63.8	66.9 - 60.7	76.9	69.7	72.8 - 66.6
Seaford - SUSSEX CO, DE	100051002	90.0	75	70	67.5	70.6 - 64.4	60.0	63.1 - 56.9	73.7	66.4	69.5 - 63.3
Colliers Mills - OCEAN CO, NJ	340290006	105.7	91	86	83.7	86.8 - 80.6	76.2	79.3 - 73.1	89.9	82.6	85.7 - 79.5
Rider - MERCER CO, NJ	340210005	97.0	86	81	80.5	83.6 - 77.4	73.0	76.1 - 69.9	84.5	79.3	82.4 - 76.2
Ancora State Hospital - CAMDEN CO, NJ	340071001	100.7	87	82	80.2	83.3 - 77.1	72.7	75.8 - 69.6	86.5	79.4	82.5 - 76.3
Camden - CAMDEN CO, NJ	340070003	98.3	88	83	82.9	86.0 - 79.8	75.4	78.5 - 72.3	87.0	81.9	85.0 - 78.8
Clarksboro - GLOUCESTER CO, NJ	340155001	98.3	88	83	82.9	86.0 - 79.8	75.4	78.5 - 72.3	86.2	81.5	84.6 - 78.4
Millville - CUMBERLAND CO, NJ	340110007	95.7	81	75	73.7	76.8 - 70.6	64.7	67.8 - 61.6	79.3	72.3	75.4 - 69.2
Nacote Creek - ATLANTIC CO, NJ	340010005	89.0	77	73	71.0	74.1 - 67.9	65.0	68.1 - 61.9	76.4	70.2	73.3 - 67.1
Bristol - BUCKS CO, PA	420170012	99.0	88	84	82.5	85.6 - 79.4	76.5	79.6 - 73.4	87.0	81.5	84.6 - 78.4
West Chester - CHESTER CO, PA	420290050	95.0	82	77	75.5	78.6 - 72.4	68.0	71.1 - 64.9	79.2	73.6	76.7 - 70.5
New Garden - CHESTER CO, PA	420290100	94.7	79	73	71.2	74.3 - 68.1	62.2	65.3 - 59.1	76.1	69.2	72.3 - 66.1

Chester - DELAWARE CO, PA	420450002	91.7	81	77	75.7	78.8 - 72.6	69.7	72.8 - 66.6	79.6	74.5	77.6 - 71.4
Norristown - MONTGOMERY CO, PA	420910013	92.3	81	77	75.4	78.5 - 72.3	69.4	72.5 - 66.3	80.1	74.4	77.5 - 71.3
Elmwood - PHILADELPHIA CO, PA	421010136	83.0	75	71	71.0	74.1 - 67.9	65.0	68.1 - 61.9	73.2	69.6	72.7 - 66.5
Lab - PHILADELPHIA CO, PA	421010004	71.3	64	61	60.4	63.5 - 57.3	55.9	59.0 - 52.8	63.4	59.6	62.7 - 56.5
Roxborough - PHILADELPHIA CO, PA	421010014	90.7	82	78	77.7	80.8 - 74.6	71.7	74.8 - 68.6	80.5	76.4	79.5 - 73.3
Northeast Airport - PHILADELPHIA CO, PA	421010024	96.7	87	82	82.2	85.3 - 79.1	74.7	77.8 - 71.6	85.7	81.0	84.1 - 77.9

**WOE Without Voluntary Measures
2009 & 2012
Probable Ranges**

The monitoring station at Fairhill, MD was used for the following sample calculations.

Given:

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

Observed 2002 = 97.7 ppb

Modeled 2009 BOTW-B4 = 81 ppb

Modeled Benefit = Observed 2002 – Modeled 2009 BOTW-B4 = 97.7 ppb – 81 ppb = **16.7 ppb**

WOE Benefit = Modeled Benefit x 2

(Explanation: Due to 100% underestimation of the emissions reduction benefits by CMAQ because of the model's insensitivity to emissions changes)

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 = 16.7 ppb x 1.5 = **25.05 ppb**

WOE Without Voluntary Measures 2009 Probable = Observed 2002 – WOE Benefit_{Conservative}
= 97.7 ppb – 25.05 ppb = **72.7 ppb**

WOE Without Voluntary Measures 2009 Probable Range Calculations:

Upper Bound = Probable 2009 + 3.1 ppb = 72.7 ppb + 3.1 ppb = **75.8 ppb**

Lower Bound = Probable 2009 – 3.1 ppb = 72.7 ppb – 3.1 ppb = **69.6 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 Fairhill, MD was used for the following sample calculations.

Given:

Modeled 2009 BOTW-B4 = 81 ppb
Modeled 2009 Telecommute = 78.1 ppb

Benefit of Telecommuting = Modeled 2009 BOTW-B4 – Modeled 2009 Telecommute
= 81 ppb – 78.1 ppb = **2.9 ppb**

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

Total
Voluntary Measures Benefit = Benefit of Telecommuting + Assumed Benefit of HEDD Program = 2.9 ppb+1 ppb= **3.9 ppb**

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

Total Voluntary Measures Benefit_{Conservative} = 3.9 ppb / 2 = **1.95 ppb**

WOE With Voluntary Measures 2009 Probable

= WOE Without Voluntary Measures 2009 Probable - Total Voluntary Measures Benefit_{Conservative}
= 72.7 ppb – 1.95 ppb = **70.7 ppb**

WOE With Voluntary Measures 2009 Probable Range Calculations:

Upper Bound: Probable 2009 + 3.1 ppb = 70.7 ppb + 3.1 ppb = **73.8 ppb**

Lower Bound: Probable 2009 - 3.1 ppb = 70.7 ppb - 3.1 ppb = **67.6 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".