

**Impacts of Updated Design Values on Determinations of
Contributions to Nonattainment and Maintenance in the
Cross State Air Pollution Rule**

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Background

On August 8, 2011, the U.S. Environmental Protection Agency (EPA) issued *Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals* (76 FR 48208; CSAPR) stating that:

EPA is limiting the interstate transport of emissions of nitrogen oxides (NOX) and sulfur dioxide (SO₂) that contribute to harmful levels of fine particle matter (PM_{2.5}) and ozone in downwind states. EPA is identifying emissions within 27 states in the eastern United States that significantly affect the ability of downwind states to attain and maintain compliance with the 1997 and 2006 fine particulate matter national ambient air quality standards (NAAQS) and the 1997 ozone NAAQS.

In support of this final rule, base year 2005 and future year emission inventories from multiple source categories were developed and processed by EPA with air quality models to determine relative contributions to downwind nonattainment and to simulate changes in air quality as the result of control strategy implementation.

CSAPR further identifies links between specific upwind states and downwind ozone or PM_{2.5} nonattainment areas based on photochemical modeling of the 2005 base year and two future years: 2012 and 2014.

Two categories of ozone and PM_{2.5} monitoring sites were then identified based on the predicted future year design values (DVs) determined from the Modeled Attainment Test Software (MATS) in the above manner:

1. “Nonattainment” sites are those monitoring sites for which the average of the three DVs is projected to exceed the NAAQS in 2012,
2. “Maintenance” sites are those monitoring sites that are not nonattainment sites as in (1) above but the maximum of the three DVs is projected to exceed the NAAQS in 2012.

Using source apportionment modeling, EPA determined which states are predicted to contribute an amount in excess of 1% of the level of the NAAQS to ozone or PM_{2.5} at each downwind nonattainment or maintenance monitoring site.

This document describes a process where we examined EPA’s list of nonattainment and maintenance monitoring sites for 2012 as defined in CSAPR to determine which of these sites were actually already in attainment of the NAAQS based on observations from 2007-2010¹.

A brief description of the technical work and results of this analysis is presented below.

¹ <http://www.epa.gov/airtrends/values.html>

Impacts of Updated Design Values on Determinations of Contributions to Nonattainment and Maintenance in the Cross State Air Pollution Rule (CSAPR)

The EPA's Cross State Air Pollution Rule (CSAPR) identifies links between specific upwind states and downwind ozone or PM_{2.5} nonattainment areas based on photochemical modeling of the 2005 base year and two future years: 2012 and 2014. Model results for the base and future years are used to compute relative reduction factors (RRFs) equal to the ratio of predicted future year to corresponding predicted base year design values (DVs). These RRFs are then multiplied by DVs calculated from monitoring data for a base period centered on the 2005 base model year to obtain the predicted future year DV.

Two different base period DVs are calculated by EPA from observations: the *average* of DVs computed from measurements for periods ending 2005, 2006, and 2007 (i.e., average of the three design values for the three attainment periods 2003-2005, 2004-2006, and 2005-2007) and the *maximum* of these three base period DVs. RRFs and resulting predicted future year DVs were computed by EPA using the Modeled Attainment Test Software (MATS).

EPA's CSAPR identifies two categories of ozone and PM_{2.5} monitoring sites based on the predicted future year DVs determined from MATS in the above manner:

1. "Nonattainment" sites are those monitoring sites for which the average of the three DVs is projected to exceed the NAAQS in 2012
2. "Maintenance" sites are those monitoring sites that are not nonattainment sites as in (1) above but the maximum of the three DVs is projected to exceed the NAAQS in 2012

The EPA then used source apportionment modeling to determine which states are predicted to contribute an amount in excess of 1% of the level of the National Ambient Air Quality Standard (NAAQS) to ozone or PM_{2.5} at each downwind nonattainment or maintenance monitoring site defined in the above manner. Emissions from any such states are deemed to produce a "significant" contribution to either nonattainment or maintenance, respectively, of the ozone or PM_{2.5} NAAQS for purposes of the CSAPR. Thus, significant transport couples are defined by EPA based on DVs calculated from observations made during 2003 – 2007. However, EPA has now released DV values based on observations from more recent periods: 2007-2009 and 2008-2010. These more recent DVs reflect reductions in ozone and PM_{2.5} precursor emissions which have occurred since 2003-2007 and thus a reduction in the number of potential nonattainment and maintenance sites as defined above.

We examined EPA's list of nonattainment and maintenance monitoring sites for 2012 as defined in the CSAPR to determine which of these sites were actually already in attainment of the NAAQS based on observations from 2007-2010. Sites already in attainment based on these most recent data represent locations where transport from

upwind sources is not contributing to nonattainment or maintenance problems. In performing this comparison, we used three-year average DVs as published by EPA and calculated from annual summary statistics (e.g., annual fourth highest daily maximum 8-hour average ozone concentration) for 2007-2009 and 2008-2010.

Results

Summary statistics from actual monitored air quality data that arose after the CSAPR public comment period further confirms that virtually all counties identified in the final rule as nonattainment or maintenance sites are in fact currently in compliance with the ozone and/or PM_{2.5} standards. The final rule air quality modeling technical support document lists the nonattainment/maintenance monitors identified in CSAPR in Tables IV-1 through IV-6 and is available on the CSAPR technical data website². The recent statistics developed from actual monitored air quality data and published by EPA for these monitors are presented in Tables 1 through 6 below.

Tables 1 and 2 present 8-hour ozone nonattainment and maintenance areas in the eastern U.S. as identified in U.S. EPA's CSAPR air quality modeling technical support document and the associated observed and modeled design value data for monitors meeting these designation criteria. Table 1 and Figure 1 present data for those monitors U.S. EPA has designated as nonattainment (modeled 2012 base case average design value exceeds NAAQS), i.e., projected nonattainment sites, and Table 2 presents data for those monitors where the maximum value of the 2012 modeled base case exceeds the NAAQS, i.e., projected maintenance-only sites. Both tables provide the following data for the monitors U.S. EPA identified in CSAPR: average and maximum 2003-2007 ambient values, average 2007-2009 and 2008-2010 ambient values, and average and maximum 2012 base case 8-hour ozone design values in parts per billion. In addition, Table 2 (maintenance-only sites) provides 2007-2009 and 2008-2010 maximum ambient values for the monitors. U.S. EPA identifies seven (7) monitors that meet nonattainment thresholds and an additional nine (9) monitors that meet maintenance thresholds. Of these sixteen monitors, none demonstrates any residual nonattainment although six monitors are shown to be maintenance areas based on maximum ambient ozone values for 2007-2009 (Table 2).

Tables 3 and 4 present annual PM_{2.5} nonattainment and maintenance areas in the eastern U.S. as identified in U.S. EPA's CSAPR air quality modeling technical support document and the associated observed and modeled design value data for monitors meeting these designation criteria. Table 3 and Figure 2 present data for those monitors U.S. EPA has designated as nonattainment (modeled 2012 base case average design value exceeds NAAQS), i.e., projected nonattainment sites, and Table 4 presents data for those monitors where the maximum value of the 2012 modeled base case exceeds the NAAQS, i.e., projected maintenance-only sites. Both tables provide the following data for the monitors U.S. EPA identified in CSAPR: average and maximum 2003-2007 ambient values, average 2007-2009 and 2008-2010 ambient values, and average and maximum 2012 base case annual PM_{2.5} design values in micrograms per cubic meter.

² <http://www.epa.gov/airtransport/pdfs/AQModeling.pdf>

In addition, Table 4 (maintenance-only sites) provides 2007-2009 and 2008-2010 maximum ambient values for the monitors. U.S. EPA identifies twelve (12) monitors that meet nonattainment thresholds and an additional four (4) monitors that meet maintenance thresholds. Of these sixteen monitors, only two monitors (one in Jefferson County, AL and one in Allegheny County, PA) are shown to exceed the annual $PM_{2.5}$ NAAQS using observational design value calculations from 2007-2009 (Table 3). Three other monitors also have design values calculated below the NAAQS, but are noted as having incomplete data to confirm either attainment or nonattainment status (Table 3). Using 2008-2010 design value calculations, we see that only the Allegheny County, PA monitor is exceeding the annual $PM_{2.5}$ NAAQS. There are no maintenance areas for annual $PM_{2.5}$ using either 2007-2009 or 2008-2010 data. Again, three monitors are noted to have incomplete data to confirm either attainment or nonattainment status.

Tables 5 and 6 present 24-hour $PM_{2.5}$ nonattainment and maintenance areas in the eastern United States as identified in U.S. EPA's CSAPR air quality modeling technical support document and the associated observed and modeled design value data for monitors meeting these designation criteria. Table 5 and Figure 3 present data for those monitors U.S. EPA has designated as nonattainment (modeled 2012 base case average design value exceeds NAAQS), i.e., projected nonattainment sites, and Table 6 presents data for those monitors where the maximum value of the 2012 modeled base case exceeds the NAAQS, i.e., projected maintenance-only sites. Both tables provide the following data for the monitors U.S. EPA identified in CSAPR: average and maximum 2003-2007 ambient values, average 2007-2009 and 2008-2010 ambient values, and average and maximum 2012 base case 24-hour $PM_{2.5}$ design values in micrograms per cubic meter. In addition, Table 6 (maintenance-only sites) provides 2007-2009 and 2008-2010 maximum ambient values for the monitors. U.S. EPA has identifies twenty (20) monitors that meet nonattainment thresholds and an additional twenty-one (21) monitors that meet maintenance thresholds. Of these forty-one monitors, only three nonattainment monitors and two maintenance monitors are shown to exceed the 24-hour $PM_{2.5}$ NAAQS using observational design value calculations from 2007-2009 (Tables 5 and 6) and an additional nine (9) monitors with design values calculated below the NAAQS, but noted as having incomplete data to confirm either attainment or nonattainment status (Tables 5 and 6). Using 2008-2010 design value calculations, we see that one nonattainment monitor (Allegheny County, PA) and three of the maintenance monitors in 2 counties are exceeding the 24-hour $PM_{2.5}$ NAAQS with nine (9) monitors noted as having incomplete data to confirm either attainment or nonattainment status.

Table 1. Average and maximum 2003-2007, average 2007-2009 and 2008-2010 and 2012 base case 8-hour ozone design values (ppb) at projected nonattainment sites.

			8-Hour Ozone (ppb)					
Monitor ID	State	County	2003-2007 Average Ambient Values	2003-2007 Maximum Ambient Values	2012 Base Case Average Values	2012 Base Case Maximum Values	2007-2009 Average Ambient Values*	2008-2010 Average Ambient Values*
220330003	Louisiana	East Baton Rouge	92.0	96.0	85.6	89.3	80	78
480391004	Texas	Brazoria	94.7	97.0	86.7	88.8	84	84
482010051	Texas	Harris	93.0	98.0	86.1	90.8	76	77
482010055	Texas	Harris	100.7	103.0	93.3	95.4	84	82
482010062	Texas	Harris	95.7	99.0	88.8	91.8	71	72
482010066	Texas	Harris	92.3	96.0	87.1	90.6	79	75
482011039	Texas	Harris	96.3	100.0	88.8	92.2	81	80

* Data source: <http://www.epa.gov/airtrends/values.html>

Table 2. Average and maximum 2003-2007, 2007-2009 and 2008-2010 and 2012 base case 8-hour ozone design values (ppb) at projected maintenance-only sites.

			8-Hour Ozone (ppb)							
Monitor ID	State	County	2003-2007 Average Ambient Values	2003-2007 Maximum Ambient Values	2012 Base Case Average Values	2012 Base Case Maximum Values	2007-2009 Average Ambient Values*	2007-2009 Maximum Ambient Values*	2008-2010 Average Ambient Values*	2008-2010 Maximum Ambient Values*
090011123	Connecticut	Fairfield	92.3	94.0	83.9	85.5	84	92	81	86
090093002	Connecticut	New Haven	90.3	93.0	82.7	85.1	81	93	76	79
240251001	Maryland	Harford	92.7	94.0	84.4	85.6	87	90	89	96
260050003	Michigan	Allegan	90.0	93.0	82.4	85.1	81	94	74	76
482010024	Texas	Harris	88.0	92.0	83.4	87.2	83	86	83	87
482010029	Texas	Harris	91.7	93.0	84.2	85.4	84	90	81	86
482011015	Texas	Harris	89.0	96.0	82.4	88.9	**	73	**	83
482011035	Texas	Harris	86.3	95.0	79.9	88.0	74	78	76	79
482011050	Texas	Harris	89.3	92.0	82.8	85.4	78	85	75	79

* Data source: <http://www.epa.gov/airtrends/values.html>
 ** denotes incomplete information available to make attainment determination

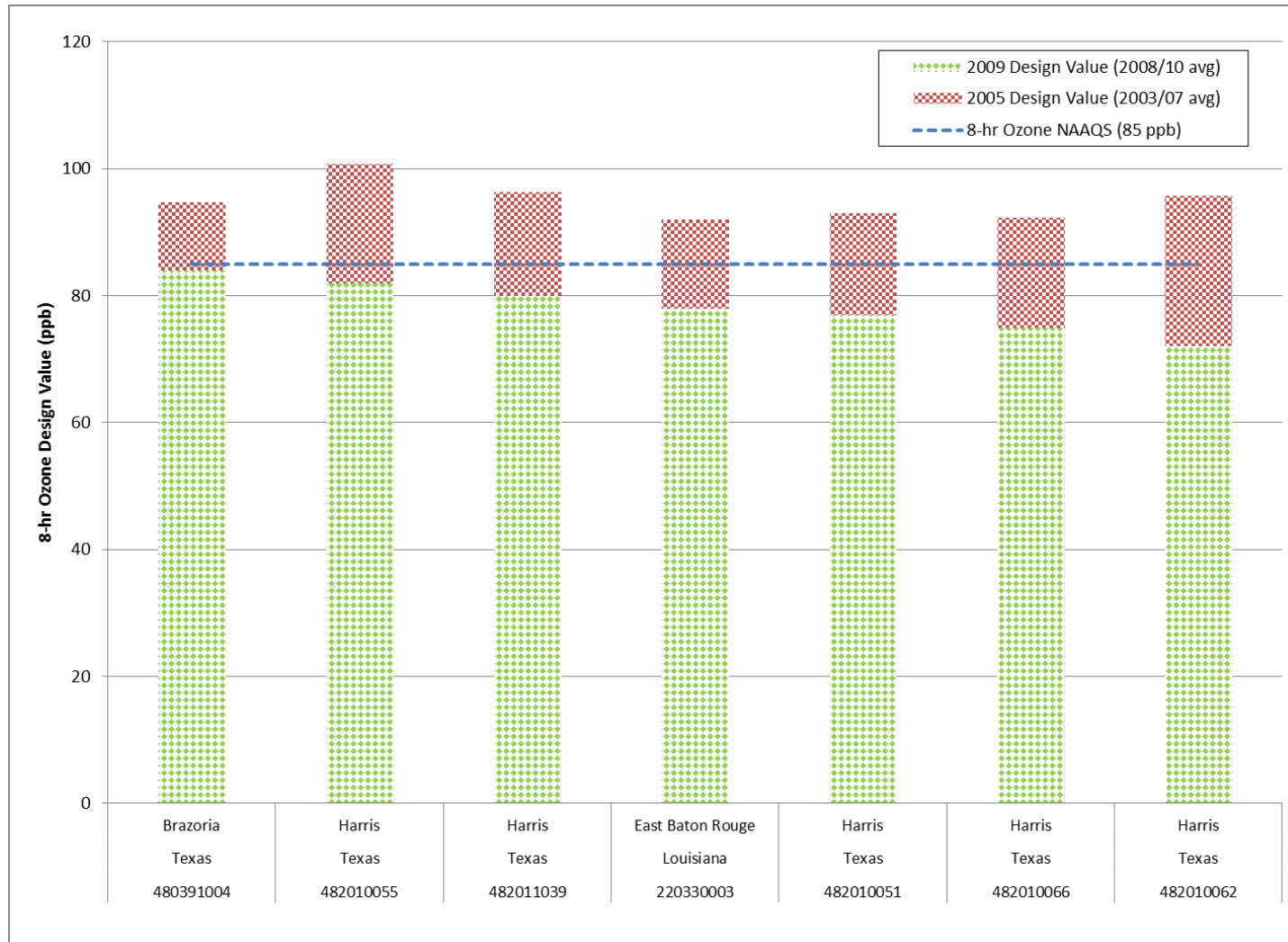


Figure 1. Comparison of average 8-hour ozone air quality at projected CASPR nonattainment sites; 2005 vs. 2009.

Table 3. Average and maximum 2003-2007, average 2007-2009 and 2008-2010 and 2012 base case annual PM_{2.5} design values (µg/m³) at projected nonattainment sites.

Site ID	State	County	Annual PM _{2.5} Design Values (µg/m ³)					
			2003-2007 Average Ambient Values	2003-2007 Maximum Ambient Values	2012 Base Case Average Values	2012 Base Case Maximum Values	2007-2009 Average Ambient Values*	2008-2010 Average Ambient Values*
010730023	Alabama	Jefferson	18.57	18.94	16.15	16.46	15.1	13.7
010732003	Alabama	Jefferson	17.15	17.69	15.16	15.64	14.0	12.7
131210039	Georgia	Fulton	17.43	17.47	15.07	15.10	9.8**	11.4**
171191007	Illinois	Madison	16.72	17.01	15.46	15.73	14.1	13.8
261630033	Michigan	Wayne	17.50	18.16	15.73	16.32	14.1	12.3
390350038	Ohio	Cuyahoga	17.37	18.10	15.99	16.66	14.4	13.6
390350045	Ohio	Cuyahoga	16.47	16.98	15.14	15.61	13.6	12.9
390350060	Ohio	Cuyahoga	17.11	17.66	15.67	16.18	14.1**	13.4**
390610014	Ohio	Hamilton	17.29	17.53	15.76	15.98	15.0	14.4
390610042	Ohio	Hamilton	16.85	17.25	15.40	15.77	14.7	14.2
390618001	Ohio	Hamilton	17.54	17.90	16.01	16.33	14.6**	15.1**
420030064	Pennsylvania	Allegheny	20.31	20.75	17.94	18.33	17.0	16.0

* Data source: <http://www.epa.gov/airtrends/values.html>
 ** denotes incomplete information available to make attainment determination

Table 4. Average and maximum 2003-2007, 2007-2009 and 2008-2010 and 2012 base case annual PM_{2.5} design values (µg/m³) at projected maintenance-only sites.

Site ID	State	County	Annual PM _{2.5} Design Values (µg/m ³)							
			2003-2007 Average Ambient Values	2003-2007 Maximum Ambient Values	2012 Base Case Average Values	2012 Base Case Maximum Values	2007-2009 Average Ambient Values*	2007-2009 Maximum Ambient Values*	2008-2010 Average Ambient Values*	2008-2010 Maximum Ambient Values*
180970081	Indiana	Marion	16.05	16.36	14.86	15.16	14.3	16.1	13.6	14.0
180970083	Indiana	Marion	15.90	16.27	14.71	15.06	13.8	15.9	13.2	13.9
390350065	Ohio	Cuyahoga	15.97	16.44	14.67	15.10	14.3	15.8	13.4	14.6
390617001	Ohio	Hamilton	16.17	16.56	14.74	15.10	13.9	15.1	13.6	14.1

* Data source: <http://www.epa.gov/airtrends/values.html>

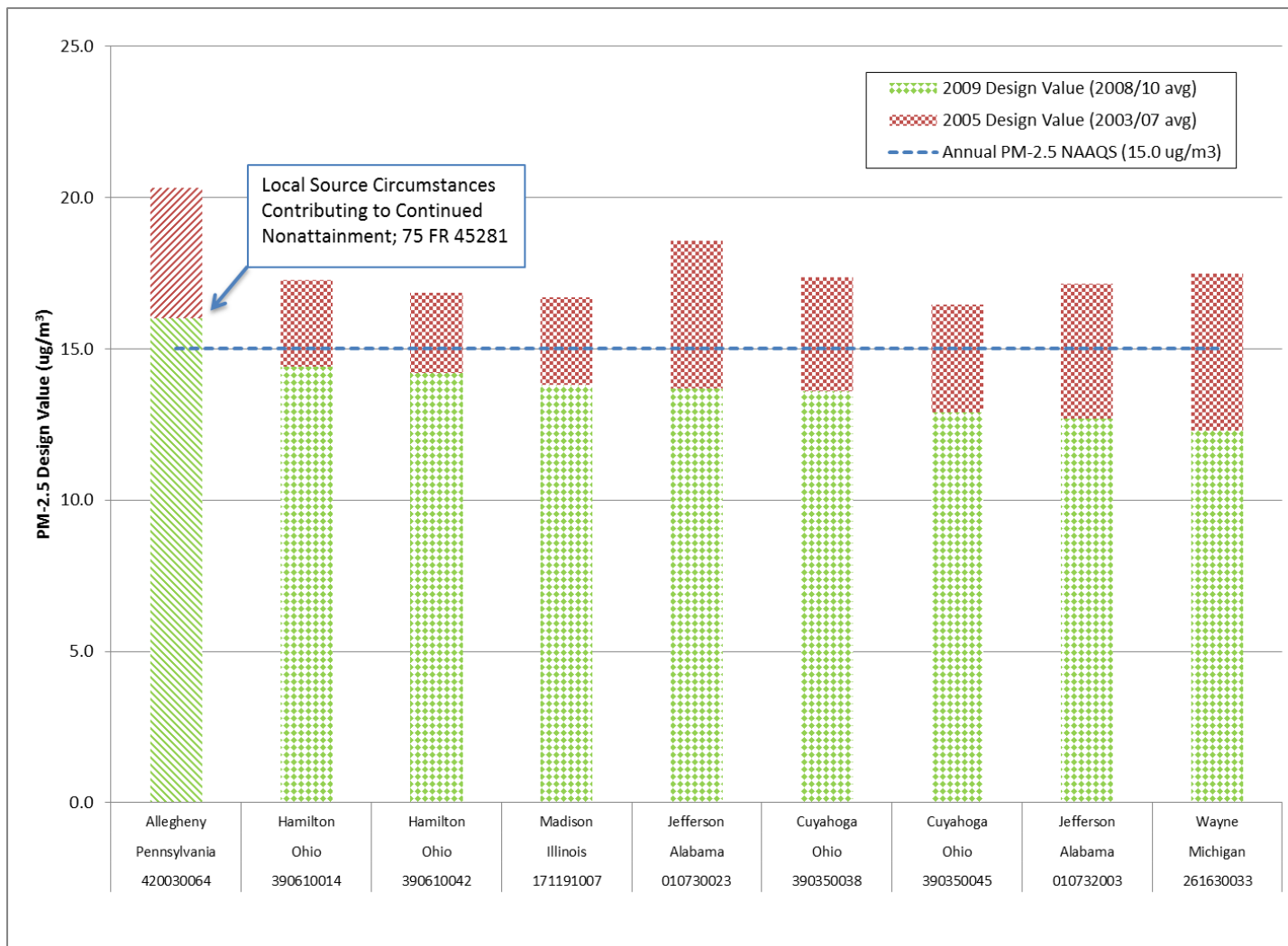


Figure 2. Comparison of average annual PM_{2.5} air quality at projected CSAPR nonattainment sites; 2005 vs. 2009.

Table 5. Average and maximum 2003-2007, average 2007-2009 and 2008-2010 and 2012 base case 24-hour PM_{2.5} design values ($\mu\text{g}/\text{m}^3$) at projected nonattainment sites.

Site ID	State	County	24-Hour PM _{2.5} Design Values ($\mu\text{g}/\text{m}^3$)					
			2003-2007 Average Ambient Values	2003-2007 Maximum Ambient Values	2012 Base Case Average Values	2012 Base Case Maximum Values	2007-2009 Average Ambient Values*	2008-2010 Average Ambient Values*
010730023	Alabama	Jefferson	44.0	44.2	36.9	37.3	34	29
170311016	Illinois	Cook	43.0	46.3	37.5	40.4	34	33
171191007	Illinois	Madison	39.1	40.1	36.5	36.8	31	29
180970043	Indiana	Marion	38.4	39.9	35.7	37.1	32	30
180970066	Indiana	Marion	38.3	39.6	35.7	36.9	33**	30**
180970081	Indiana	Marion	38.2	39.2	35.8	36.9	32	30
261470005	Michigan	St Clair	39.6	40.6	36.2	37.1	32	28
261630015	Michigan	Wayne	40.1	40.6	35.5	36.0	33	31
261630016	Michigan	Wayne	42.9	45.4	38.9	41.2	32	30
261630019	Michigan	Wayne	40.9	41.4	37.3	37.8	31	30
261630033	Michigan	Wayne	43.8	44.2	39.4	39.8	35	32
390350038	Ohio	Cuyahoga	44.2	47.0	39.4	41.8	36	33
390350060	Ohio	Cuyahoga	42.1	45.7	37.7	40.8	35**	32**
420030064	Pennsylvania	Allegheny	64.2	68.2	56.7	59.9	50	48
420030093	Pennsylvania	Allegheny	45.6	51.5	39.1	44.3	28**	25**
420030116	Pennsylvania	Allegheny	42.5	42.5	35.5	35.5	**	**
420070014	Pennsylvania	Beaver	43.4	44.6	36.2	37.4	33	30
420710007	Pennsylvania	Lancaster	40.8	44.0	35.9	38.3	35	33
540090011	West Virginia	Brooke	43.9	44.9	37.5	38.3	37	31
550790043	Wisconsin	Milwaukee	39.9	40.8	36.2	37.1	36**	35**

* Data source: <http://www.epa.gov/airtrends/values.html>
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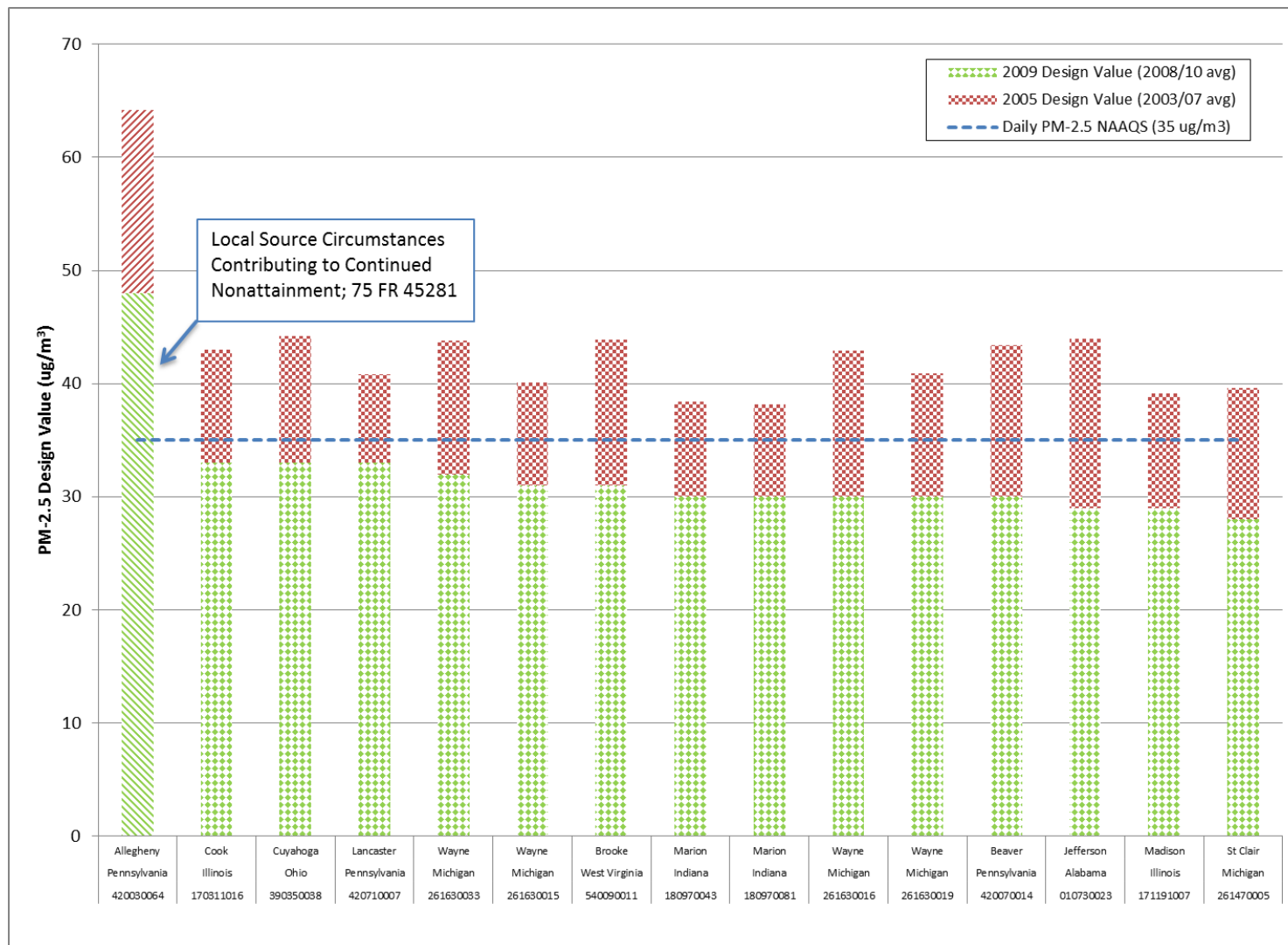


Figure 3. Comparison of Average 24-hour $\text{PM}_{2.5}$ Air Quality at Projected CSAPR Nonattainment Sites; 2005 vs. 2009.

Table 6. Average and maximum 2003-2007, 2007-2009 and 2008-2010 and 2012 base case 24-hour PM_{2.5} design values (µg/m³) at projected maintenance-only sites.

			24-Hour PM_{2.5} Design Values (µg/m³)							
Site ID	State	County	2003-2007 Average Ambient Values	2003-2007 Maximum Ambient Values	2012 Base Case Average Values	2012 Base Case Maximum Values	2007-2009 Average Ambient Values*	2007-2009 Maximum Ambient Values*	2008-2010 Average Ambient Values*	2008-2010 Maximum Ambient Values*
010732003	Alabama	Jefferson	40.3	40.8	35.3	35.9	32	37.7	28	33.5
170310052	Illinois	Cook	40.2	41.4	34.9	36.0	33	39.4	31	33.8
170312001	Illinois	Cook	37.7	40.6	33.6	36.1	31	35.1	28	29.5
170313301	Illinois	Cook	40.2	43.3	34.9	37.6	32	36.7	32	35.0
170316005	Illinois	Cook	39.1	41.8	34.1	36.4	33**	36.9	30**	34.1
171190023	Illinois	Madison	37.3	38.1	35.1	35.8	**	-	**	-
180890022	Indiana	Lake	38.9	44.0	34.9	39.5	31	35.2	31	33.6
180890026	Indiana	Lake	38.4	41.3	34.0	37.0	34	35.0	33	33.8
261610008	Michigan	Washtenaw	39.4	40.8	35.0	36.3	30	34.5	27	28.2
390170003	Ohio	Butler	39.2	41.1	34.4	36.5	30	36.8	29	31.7
390350045	Ohio	Cuyahoga	38.5	41.5	34.7	38.1	31	35.3	31	35.3
390350065	Ohio	Cuyahoga	38.6	41.0	34.9	37.6	33	37.5	30	33.8
390618001	Ohio	Hamilton	40.6	40.9	35.2	35.8	32**	35.4	31**	33.3
390811001	Ohio	Jefferson	41.9	45.5	34.5	37.8	31	35.4	28	35.0
391130032	Ohio	Montgomery	37.8	40.0	33.6	35.6	31	36.9	29	30.4
420031008	Pennsylvania	Allegheny	41.3	42.8	35.0	36.3	33**	39.8	31**	30.3
420031301	Pennsylvania	Allegheny	40.3	42.4	33.9	35.6	37	43.7	35	37.2
420033007	Pennsylvania	Allegheny	37.5	43.1	32.3	37.3	32	35.0	30	34.6
421330008	Pennsylvania	York	38.2	40.7	33.3	36.0	32	37.0	30	32.3
550790010	Wisconsin	Milwaukee	38.6	40.0	35.4	36.7	36	40.6	32	39.1
550790026	Wisconsin	Milwaukee	37.3	41.3	33.6	37.2	35	39.8	33	39.0

* Data source: <http://www.epa.gov/airtrends/values.html>
 ** denotes incomplete information available to make attainment determination