

Alternate Design Value Calculation and Attainment Demonstration

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EPA's Draft Modeling Guidance for Demonstrating Attainment of Air Quality Goals for Ozone, PM₂s, and Regional Haze¹ provides for developing various alternatives in defining and calculating the base year and projection year design values associated with the determination of an area to be in attainment of a NAAQS. Specifically, in this document, EPA recommends that "[t]he base design value for each monitoring site is the anchor point for estimating future year projected concentrations. Because the modeling is being used in a relative sense to determine how the modeled emissions changes will affect air quality design values in an area, it is important to match the base design value as closely as possible to the base year for which future/base ratios will be assessed."

Additionally, EPA recommends that "[i]n addition to the model attainment test, air agencies should also consider performing a set of corroboratory analyses to further assess whether a proposed set of emission reductions will lead to attainment of the NAAQS (or uniform rate of progress for regional haze)." The document goes on to say "[i]n practice, the choice of the base design value can be critical to the determination of the estimated future year design values and careful consideration should be given to the calculation of base year values. There is no single methodology that can derive a "correct" base design value" and that a "5 year weighted average value establishes a relatively stable value that is weighted towards the emissions and meteorological modeling year."

The document also states that "[a]lternate, equally plausible, calculations of base design values may be considered as part of the corroborating analyses that comprise the aggregate weight of evidence determination."

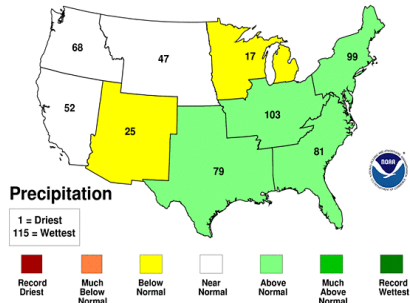
The purpose of this document is to provide an alternate, corroboratory analysis designed to investigate the changes in air quality associated with more current year (2011-2015) ozone concentration observations compared to the historical observations (2009-2013) used by EPA in CSAPR. This study will provide an up-to-date picture of projected air quality concentrations and design values inclusive of controls implemented between 2009 and 2011 and the impacts of these controls as observed in most recent ozone monitor observations.

As is noted in Figures 1 and 2 of this document generated from data published by the National Oceanic and Atmospheric Administration (NOAA)², meteorological years of 2011 through 2015 have shown relatively consistent precipitation amounts in the eastern states with a noted wet year in 2009 followed by an exceptionally dry season in 2010. Similarly, for this series of recent years, 2009 appeared relatively cold compared to the seven year series, as 2010 also demonstrated exceptionally warm temperatures.

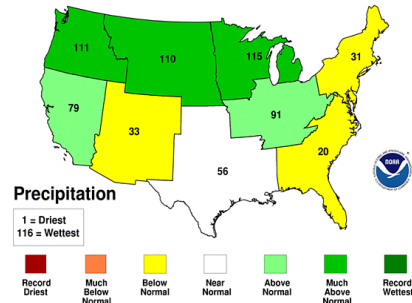
¹ http://www3.epa.gov/scram001/guidance/guide/Draft_O3-PM-RH_Modeling_Guidance-2014.pdf

² <http://www.ncdc.noaa.gov/temp-and-precip/us-maps/>

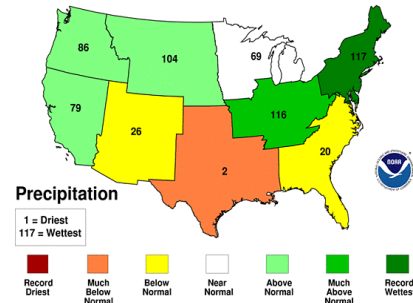
April-September 2009 Regional Ranks
National Climatic Data Center/NESDIS/NOAA



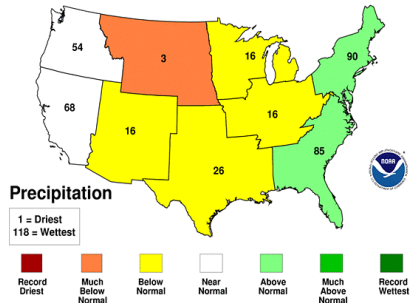
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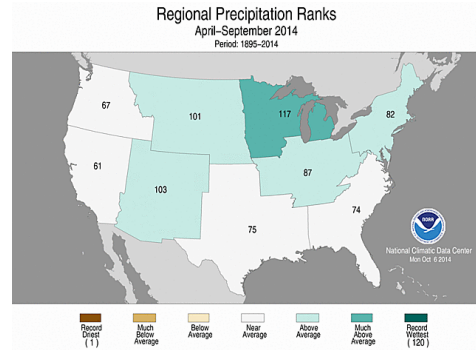
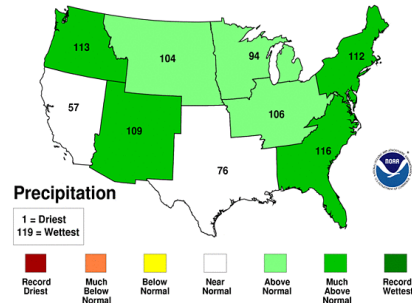
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National Climatic Data Center/NESDIS/NOAA



April-September 2012 Regional Ranks
National Climatic Data Center/NESDIS/NOAA



April-September 2013 Regional Ranks
National Climatic Data Center/NESDIS/NOAA



Regional Precipitation Ranks
April-September 2015
Period: 1895-2015

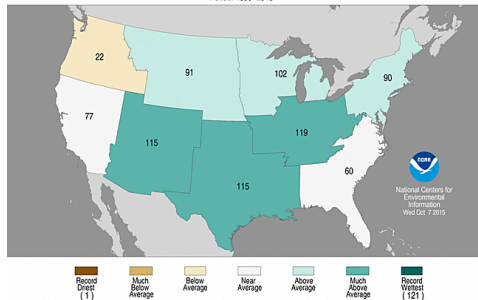
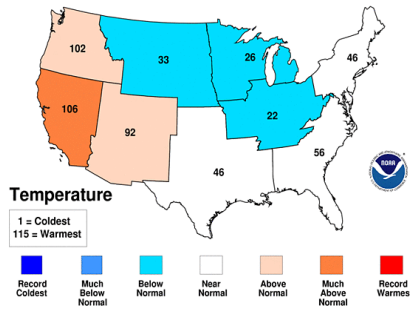
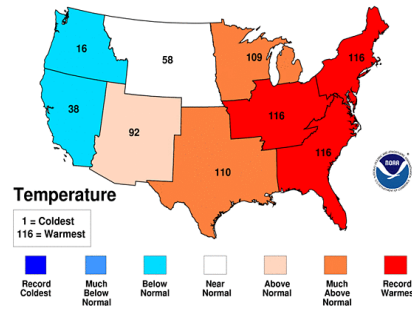


Figure 1. April-September regional precipitation ranks; 2009 – 2015.

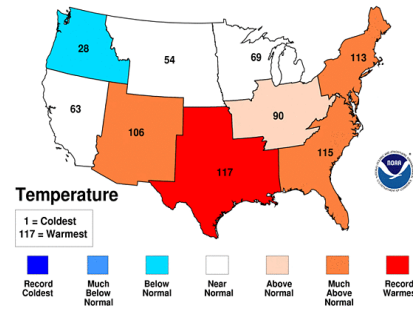
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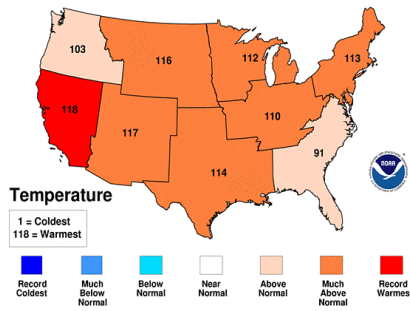
April-September 2010 Regional Ranks
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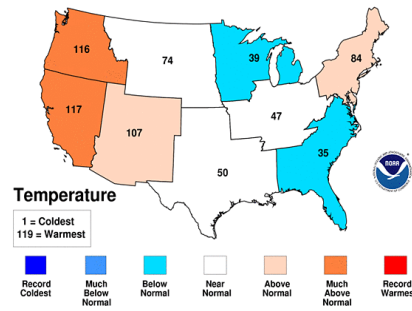
April-September 2011 Regional Ranks
National Climatic Data Center/NESDIS/NOAA



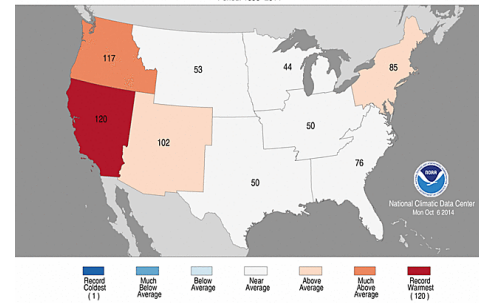
April-September 2012 Regional Ranks
National Climatic Data Center/NESDIS/NOAA



April-September 2013 Regional Ranks
National Climatic Data Center/NESDIS/NOAA



Regional Average Temperature Ranks
April-September 2014
Period: 1895-2014



Regional Average Temperature Ranks
April-September 2015
Period: 1895-2015

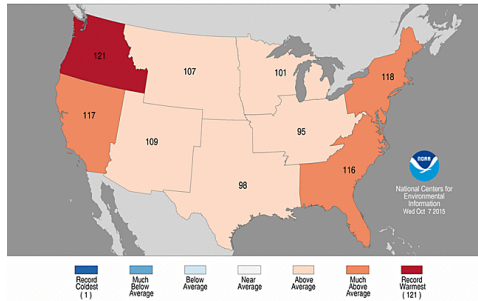


Figure 2. April-September regional temperature ranks; 2009 – 2015.

In this analysis, we ran EPA's CSAPR 2011/2017 base case modeling platform using the MATS tool and CSAPR configuration with the exception of using a shifted base year design value to account for more recent observations commensurate with the state of emissions and meteorology of more current years. Using this shift, the weighting of design values moved from a higher weighted 2011 base year (that includes the below/above average temperature years of 2009 and 2010) to a higher weighted 2013 base year. Using this option, the three, three year design values selected for the base year dv were 2011-2013, 2012-2014, and 2013-2015.

But temperature and precipitation are not the only conditions that led us to developing this alternate approach. It is well established that inter-annual variability in meteorological conditions often leads to year-to-year differences in design values, even with static emissions levels. However, in this case, there is also year to year variability in emissions due to economic factors and compliance with regulations.

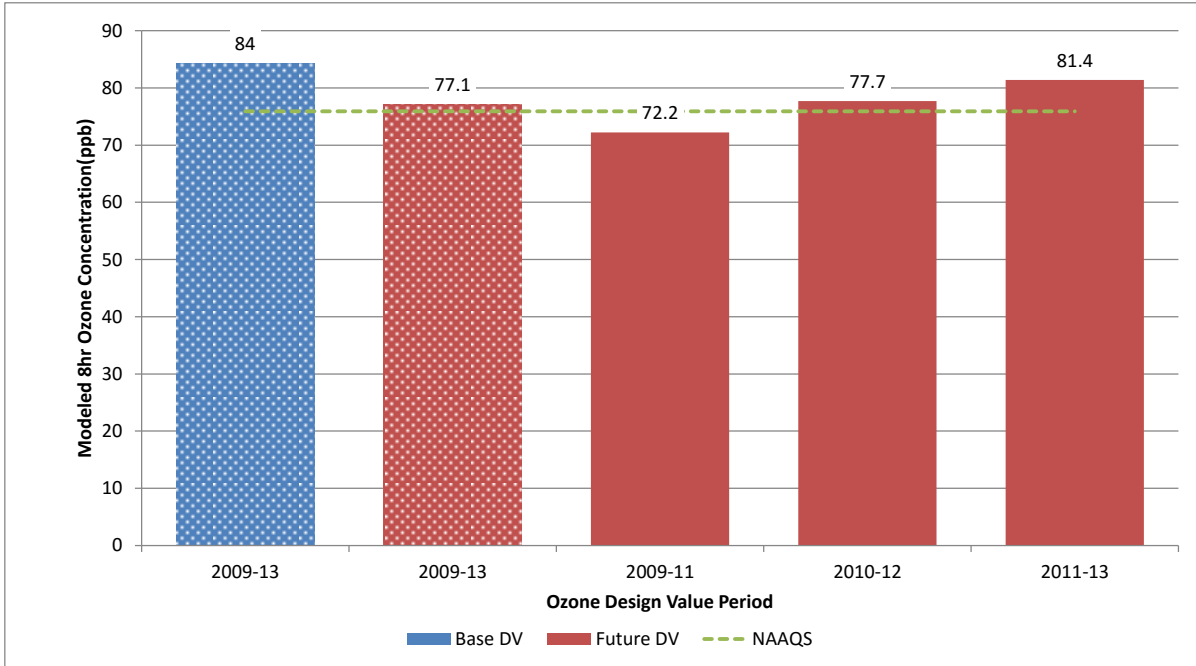
Significant emission reductions and associated air quality improvements have been demonstrated in the eastern states during the period of time between 2011 and 2015. To account for this reduction in ozone in accord with the most current emissions and meteorological conditions, we find that calculating future year design values using the basis of current conditions is an appropriate alternative for consideration.

Recalculating the modeled baseline design values demonstrates an alternative approach to calculating the modeled design values that shows less bias to past conditions. This average is expected to best represent the air quality resulting from current year emissions with attention to meteorological and emissions variability while placing less weight on conditions in past years that are no longer representative of present conditions.

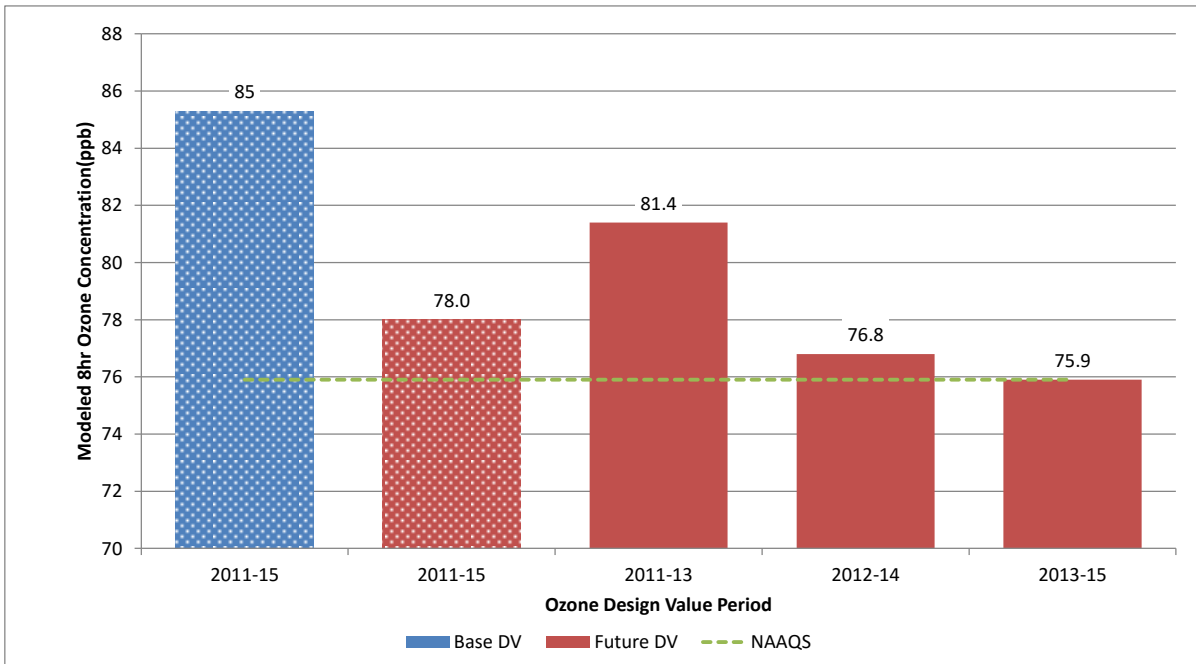
Until future year attainment tests include comparable base year inventory averages (over multiple years) consistent with the same years selected in the development of base year design values, this alternate approach should be considered as adequate a representation of base year conditions as the guidance recommended default.

As is shown in Figures following in this document, using this alternate method, with the exception of three monitors in Fairfield, Connecticut, all remaining monitors in the eastern U.S. show attainment in 2017.

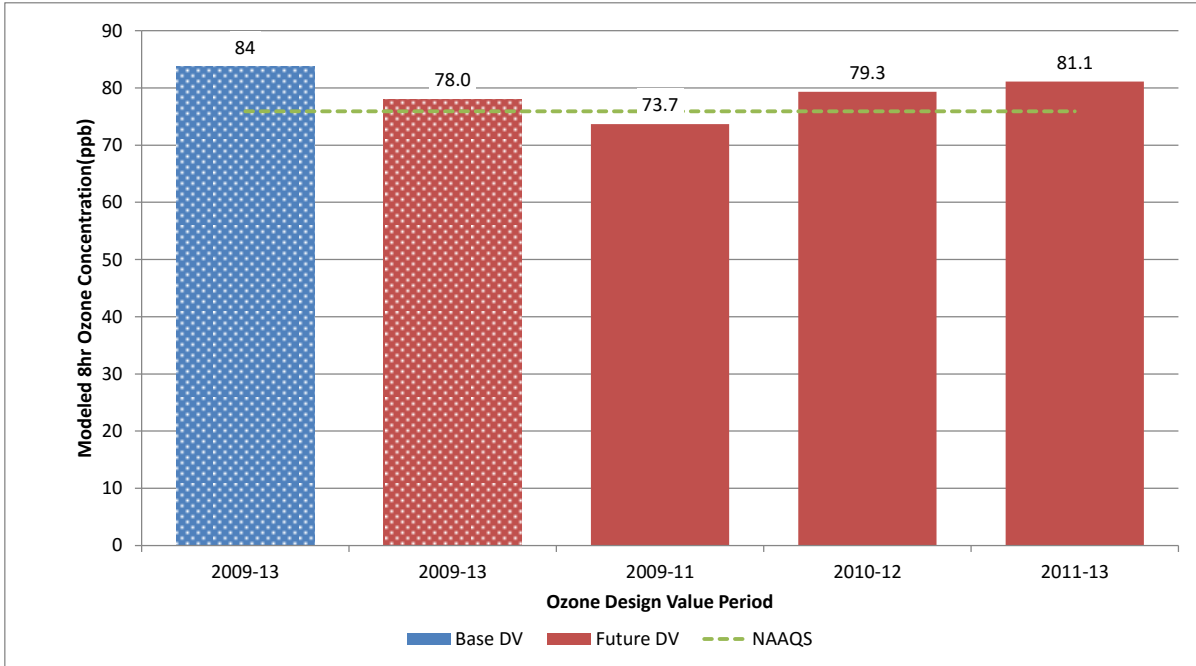
DV Period	Design Value (ppb)	Description
2009-13	84	<- CSAPR Base Year (2011) Design Value Average
2009-13	77.1	<- CSAPR Future Year (2017) Design Value Average
2009-11	72.2	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	77.7	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	81.4	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



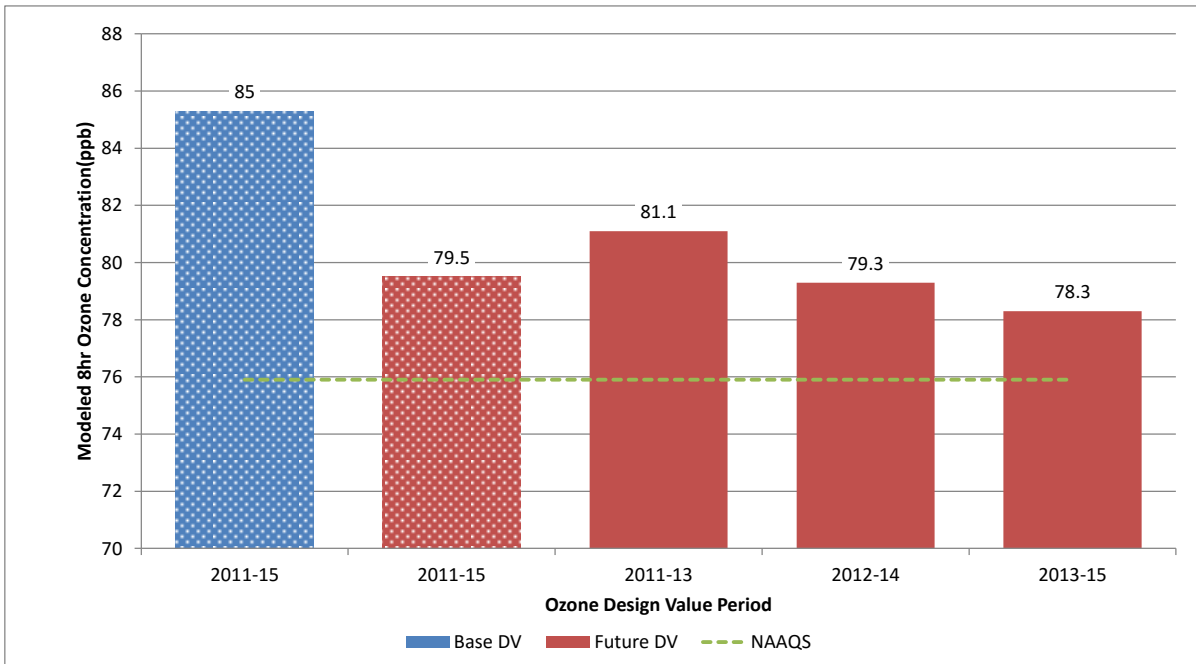
DV Period	Design Value (ppb)	Description
2011-15	85	<- Alternate Base Year (2011) Design Value Average
2011-15	78.0	<- Alternate Future Year (2017) Design Value Average
2011-13	81.4	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	76.8	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	75.9	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



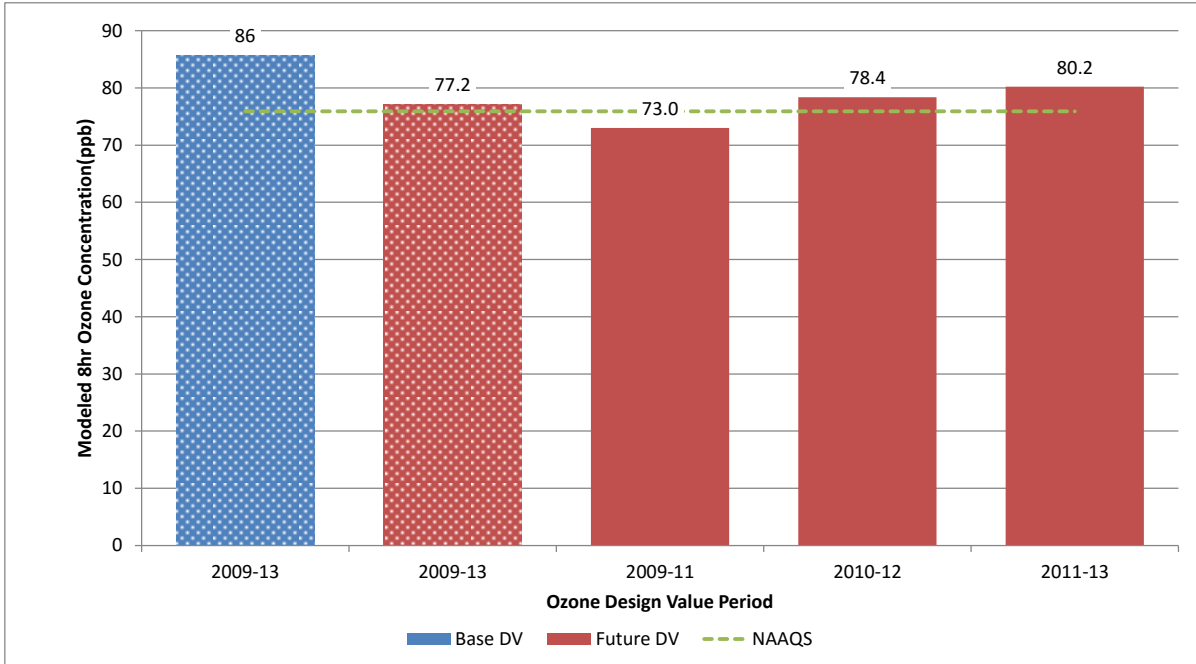
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2009-13	84	<- CSAPR Base Year (2011) Design Value Average
2009-13	78.0	<- CSAPR Future Year (2017) Design Value Average
2009-11	73.7	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	79.3	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	81.1	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



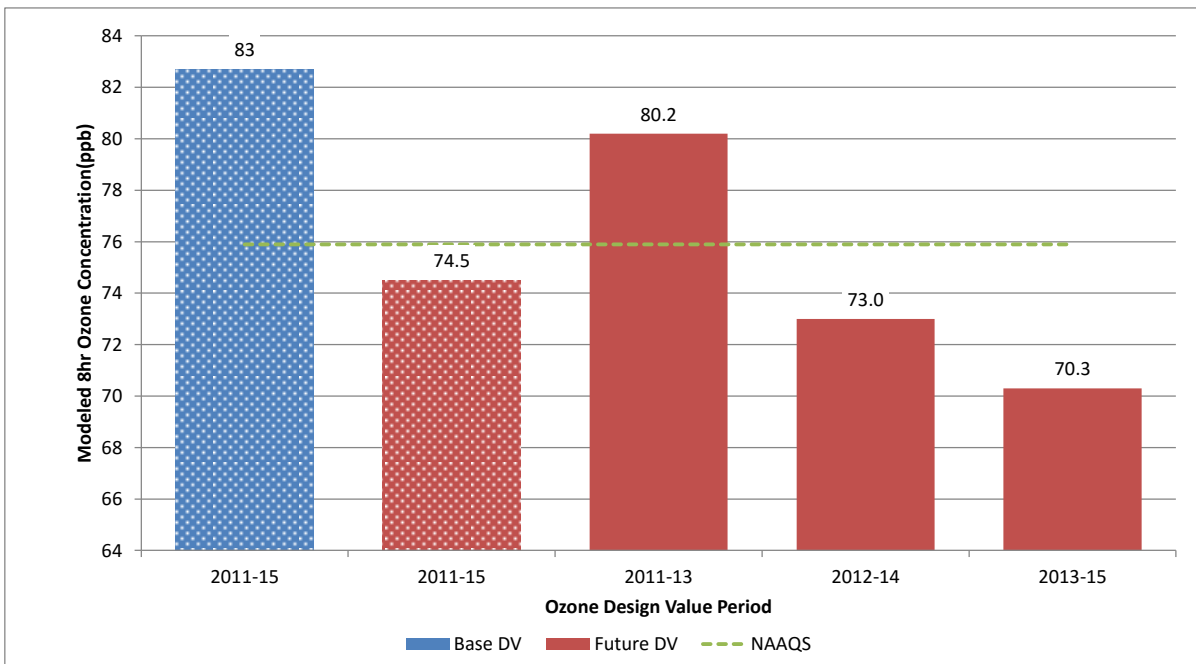
DV Period	Design Value (ppb)	Description
2011-15	85	<- Alternate Base Year (2011) Design Value Average
2011-15	79.5	<- Alternate Future Year (2017) Design Value Average
2011-13	81.1	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	79.3	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	78.3	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



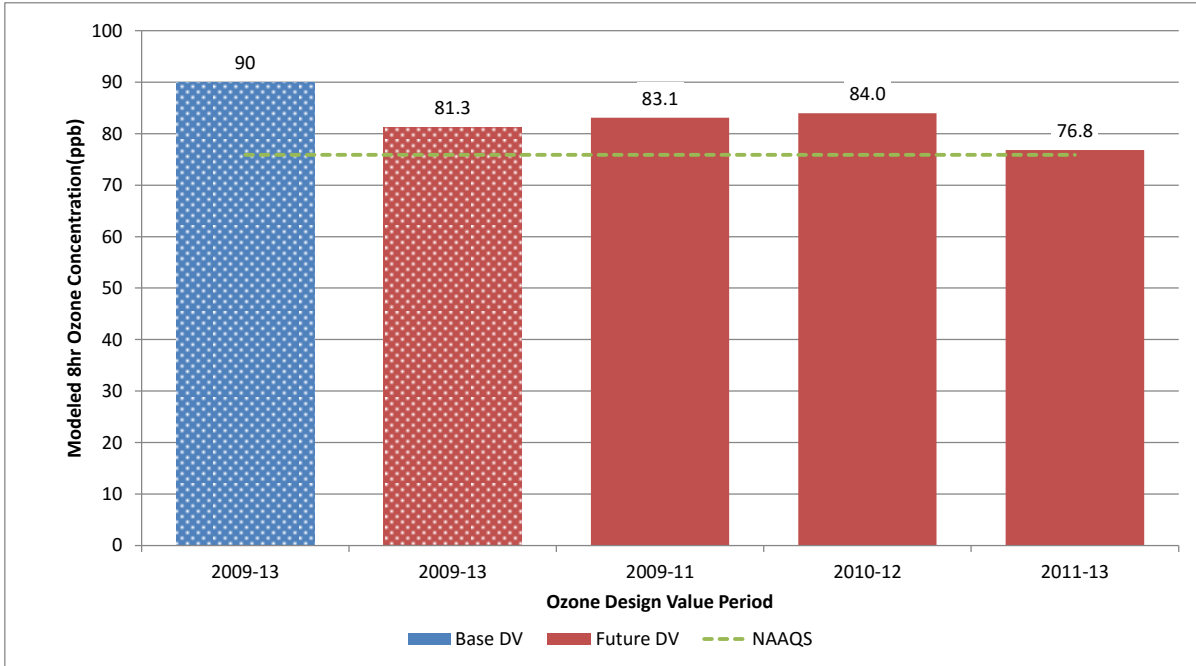
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2009-13	77.2	<- CSAPR Future Year (2017) Design Value Average
2009-11	73.0	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	78.4	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	80.2	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



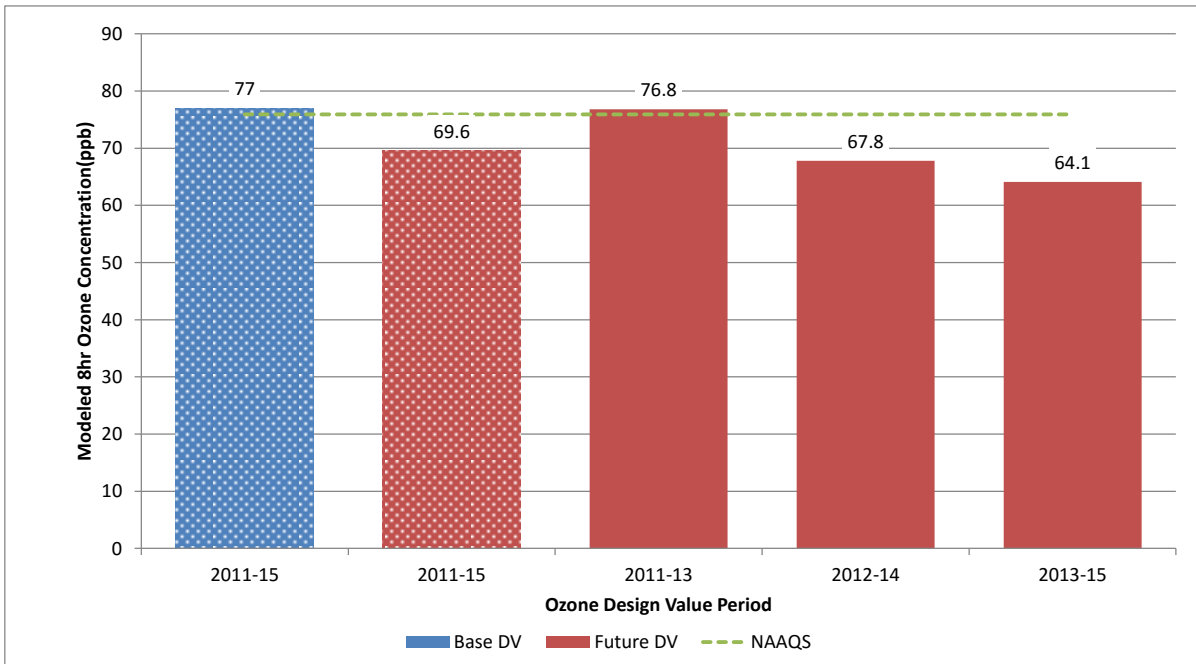
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2011-15	83	<- Alternate Base Year (2011) Design Value Average
2011-15	74.5	<- Alternate Future Year (2017) Design Value Average
2011-13	80.2	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	73.0	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	70.3	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



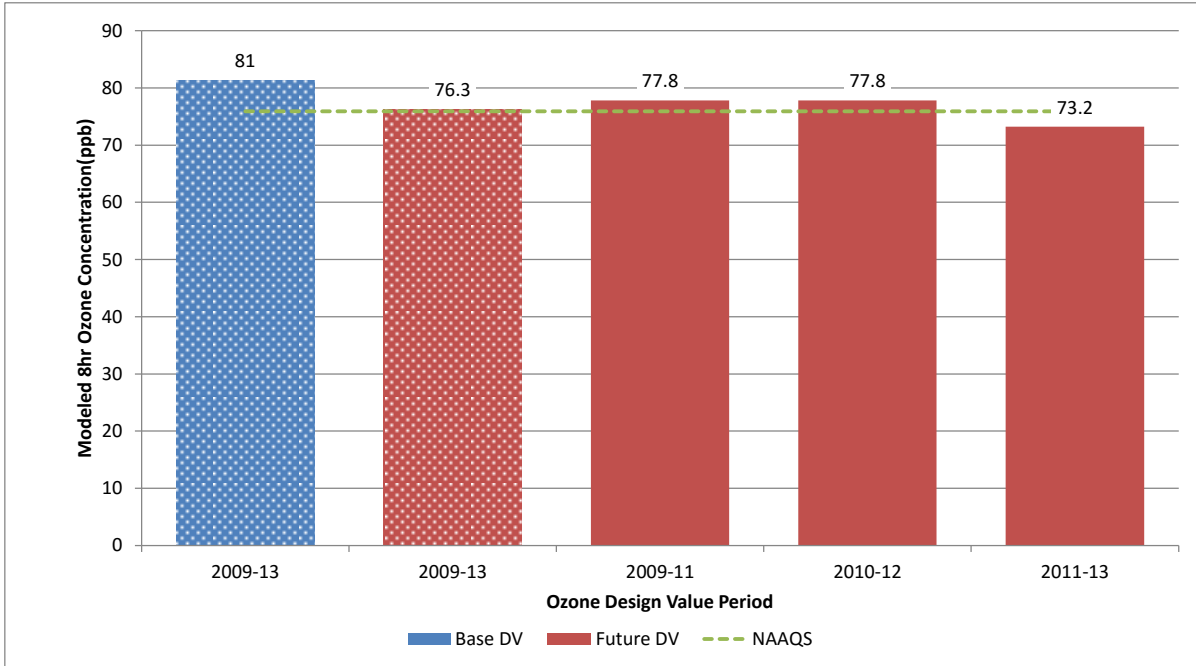
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2009-11	83.1	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	84.0	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	76.8	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



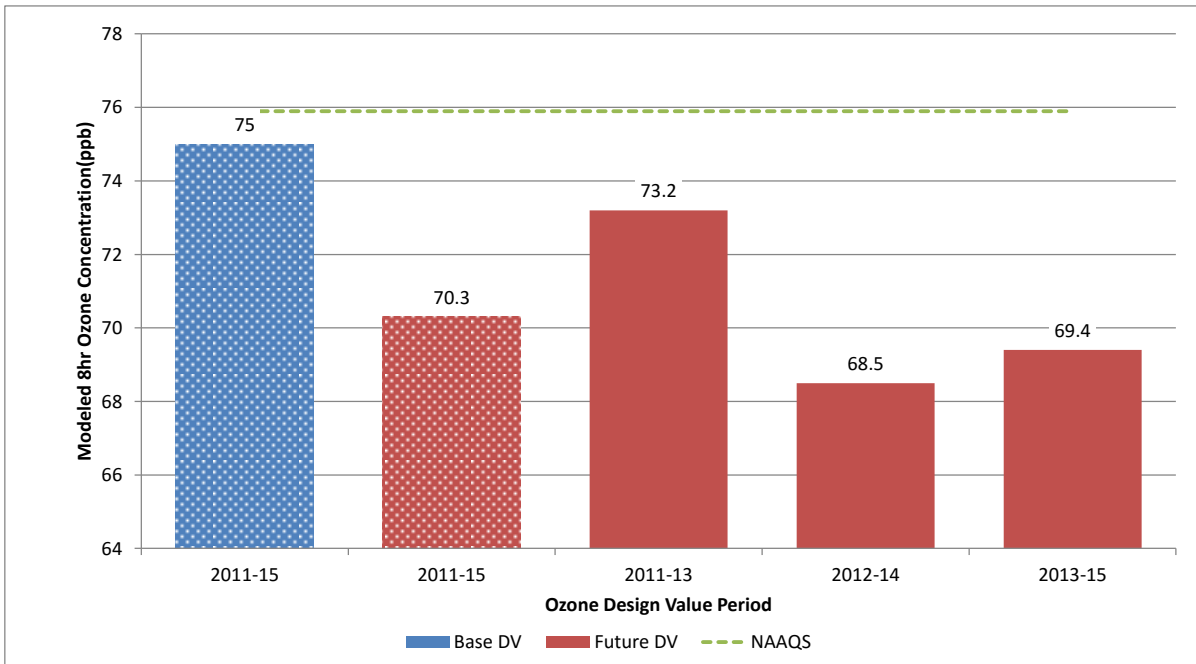
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2011-15	77	<- Alternate Base Year (2011) Design Value Average
2011-15	69.6	<- Alternate Future Year (2017) Design Value Average
2011-13	76.8	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	67.8	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	64.1	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



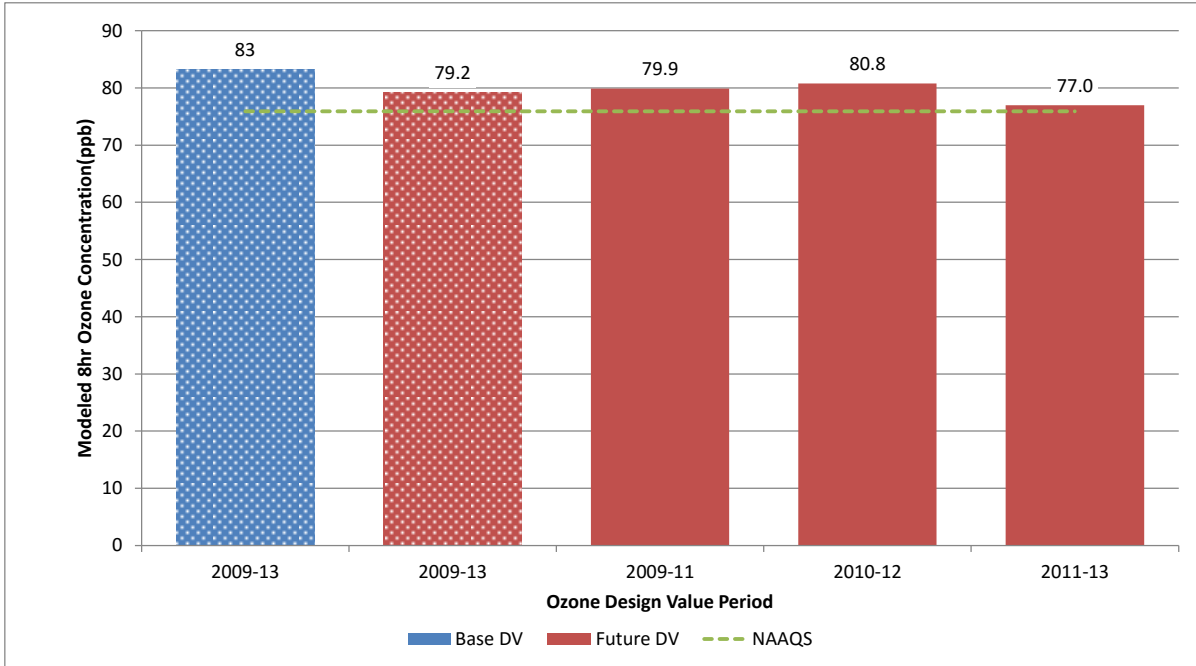
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2009-13	76.3	<- CSAPR Future Year (2017) Design Value Average
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2010-12	77.8	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	73.2	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



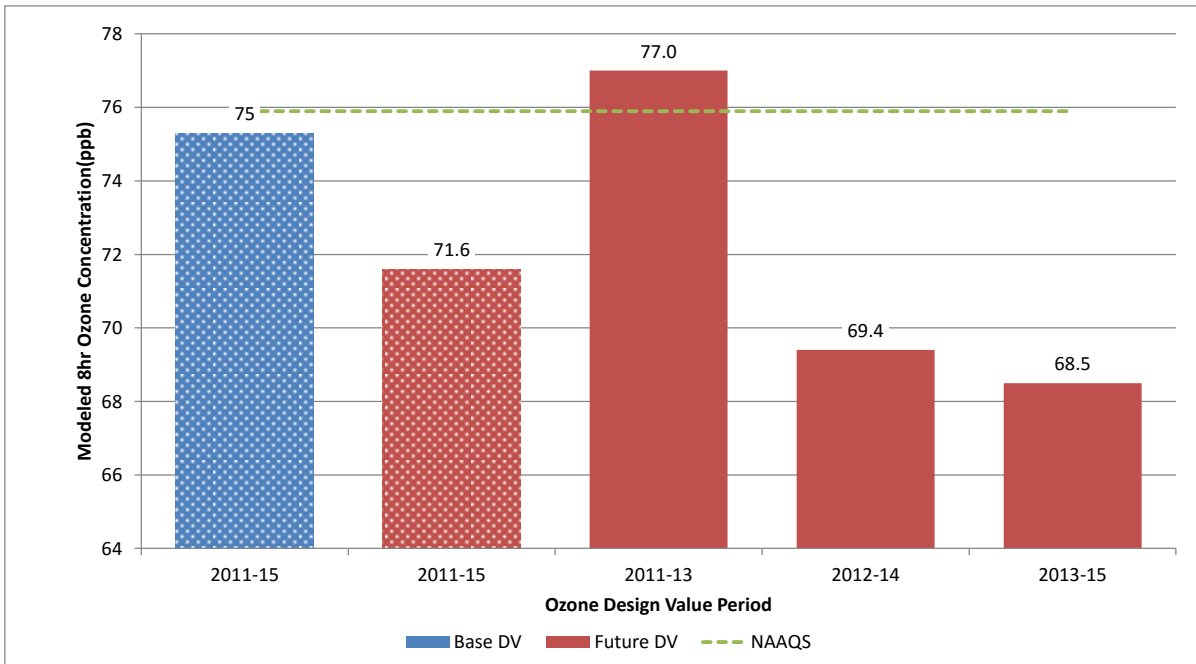
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2011-15	75	<- Alternate Base Year (2011) Design Value Average
2011-15	70.3	<- Alternate Future Year (2017) Design Value Average
2011-13	73.2	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	68.5	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	69.4	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



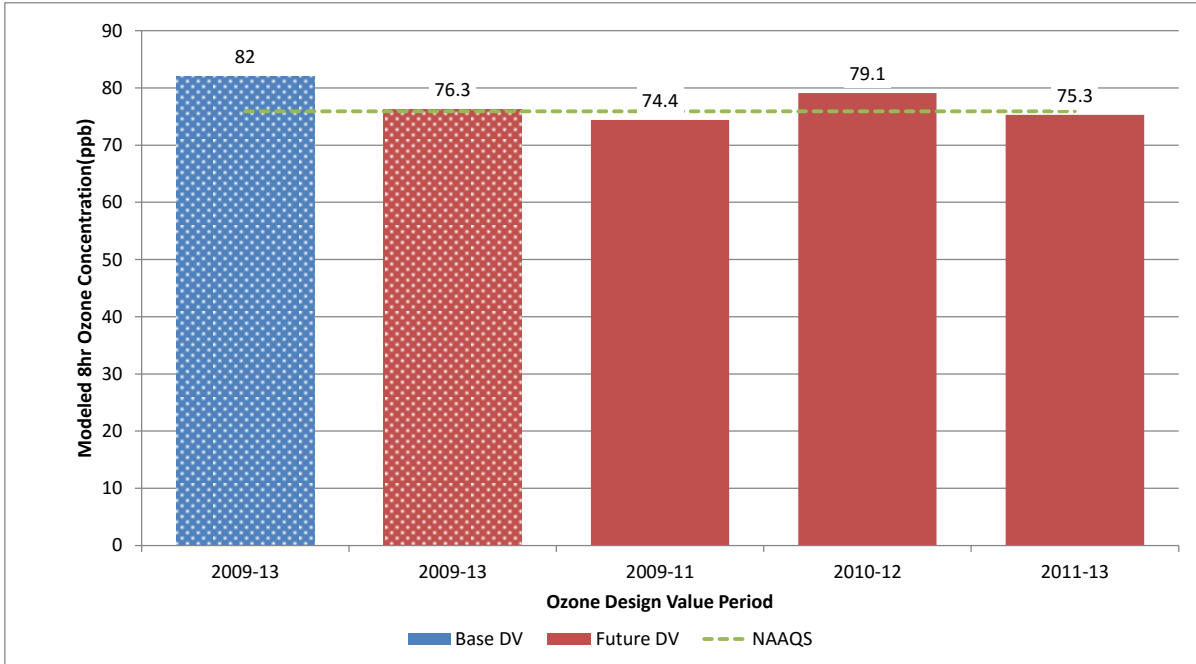
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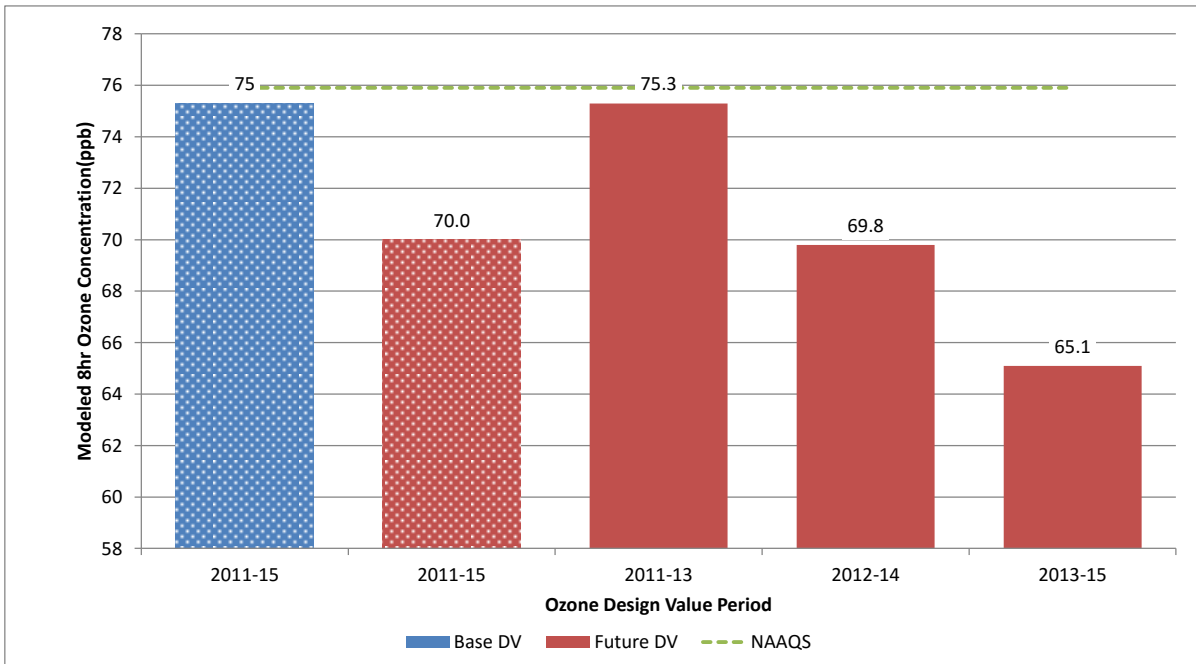
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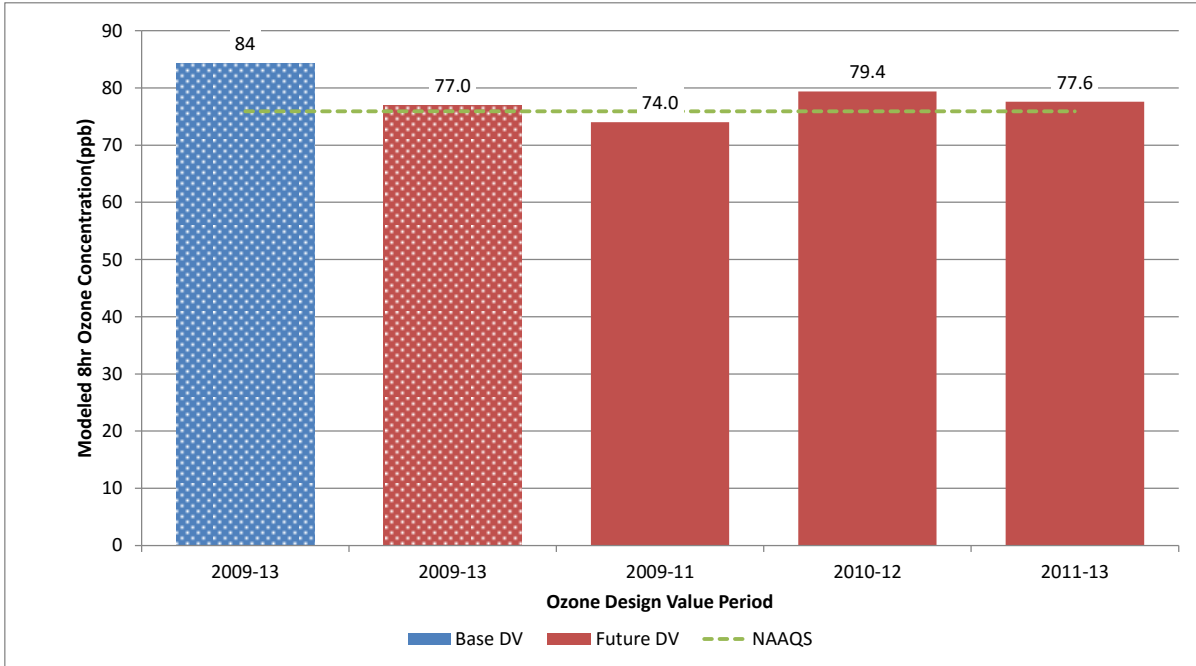
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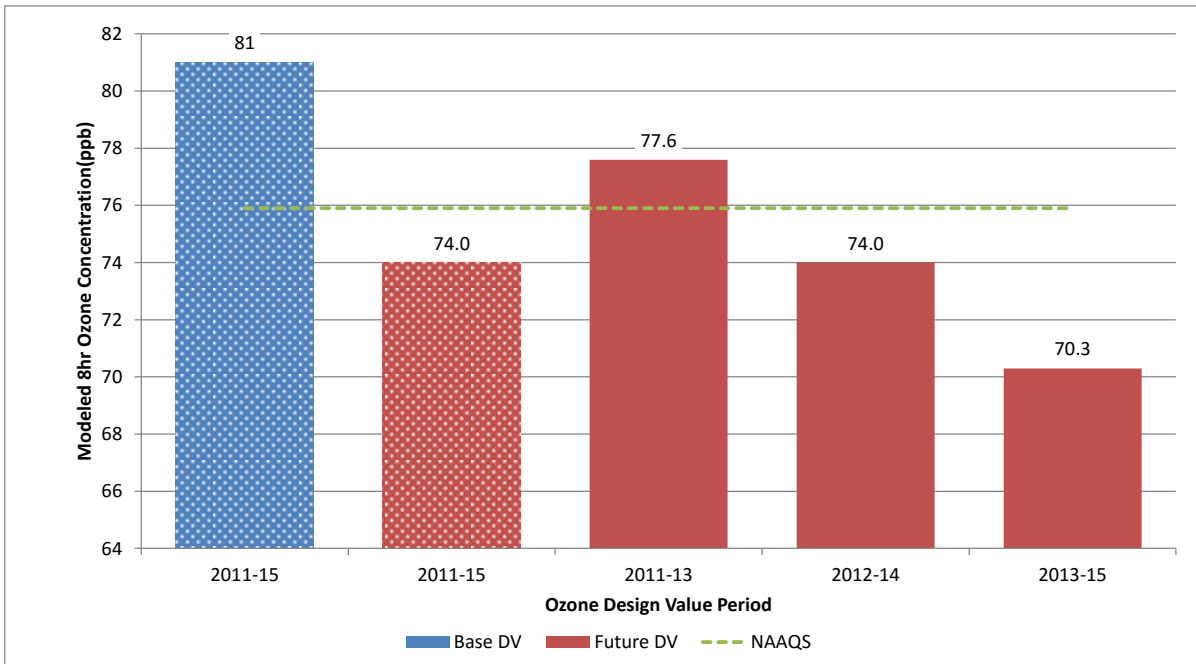
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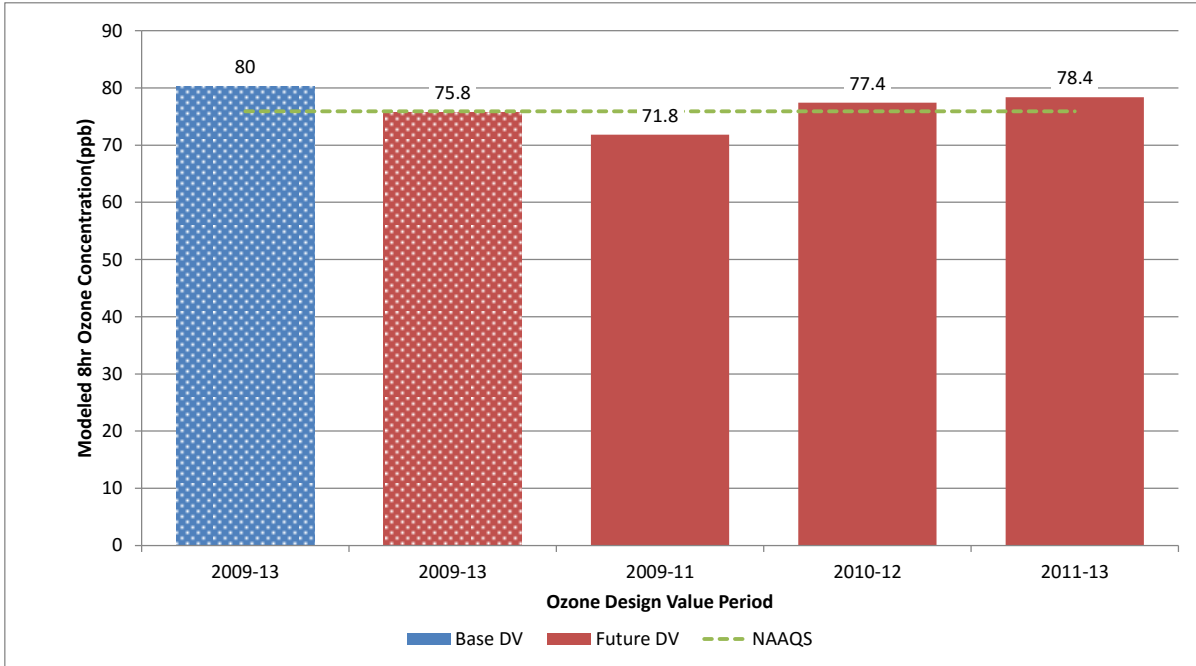
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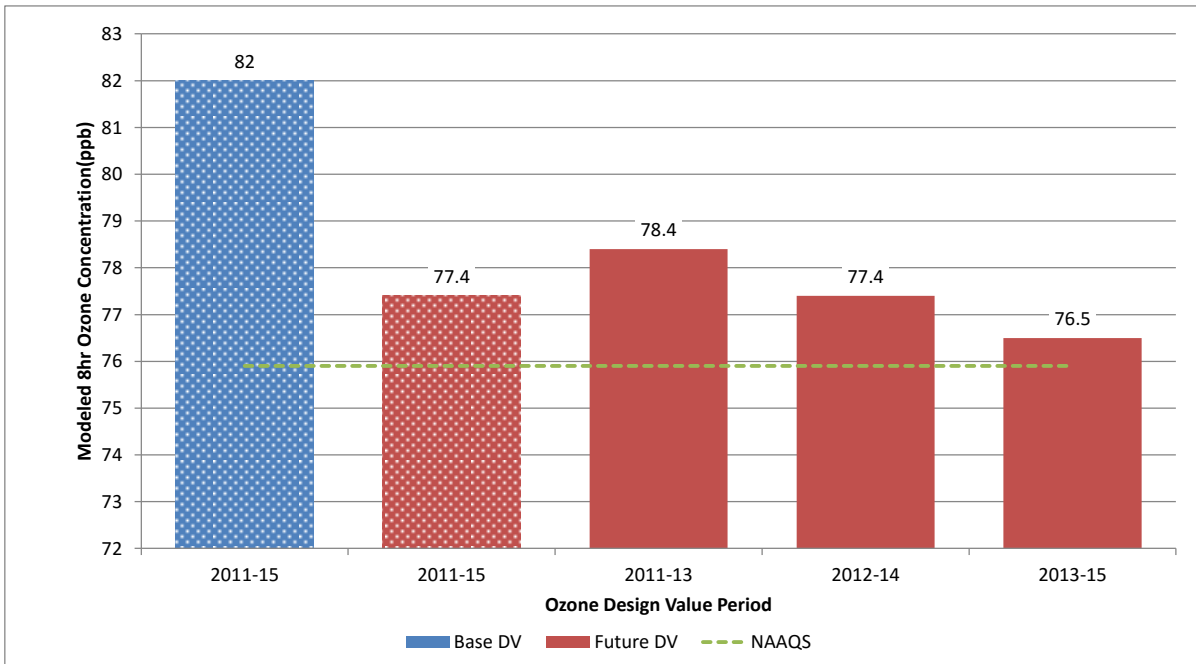
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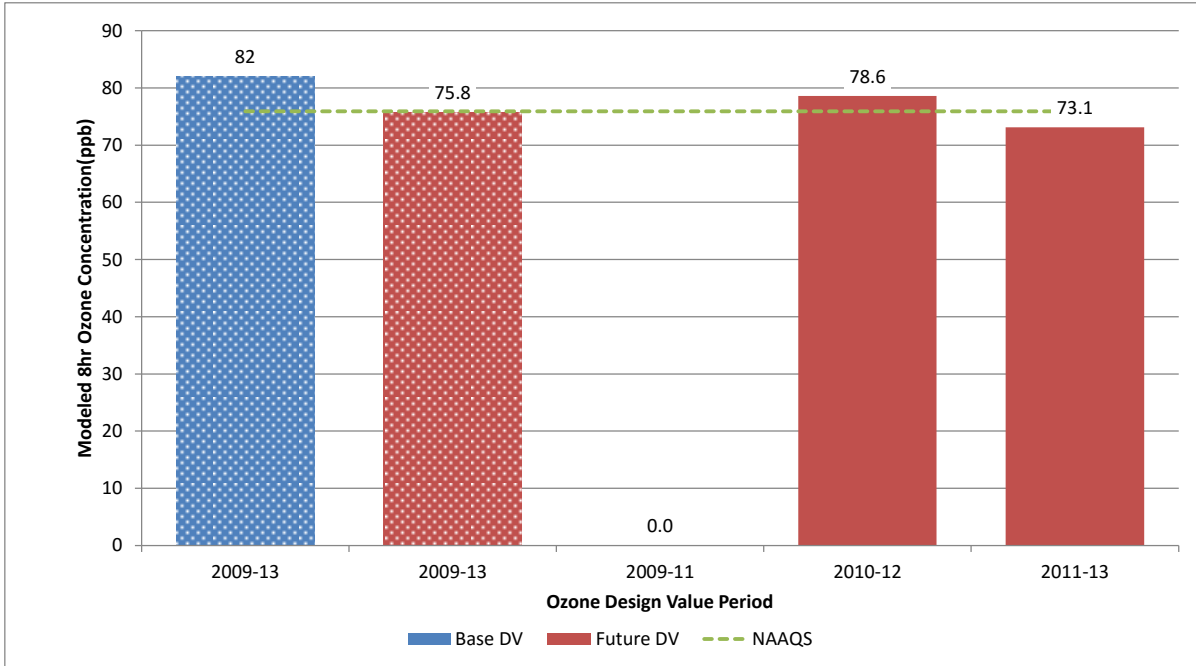
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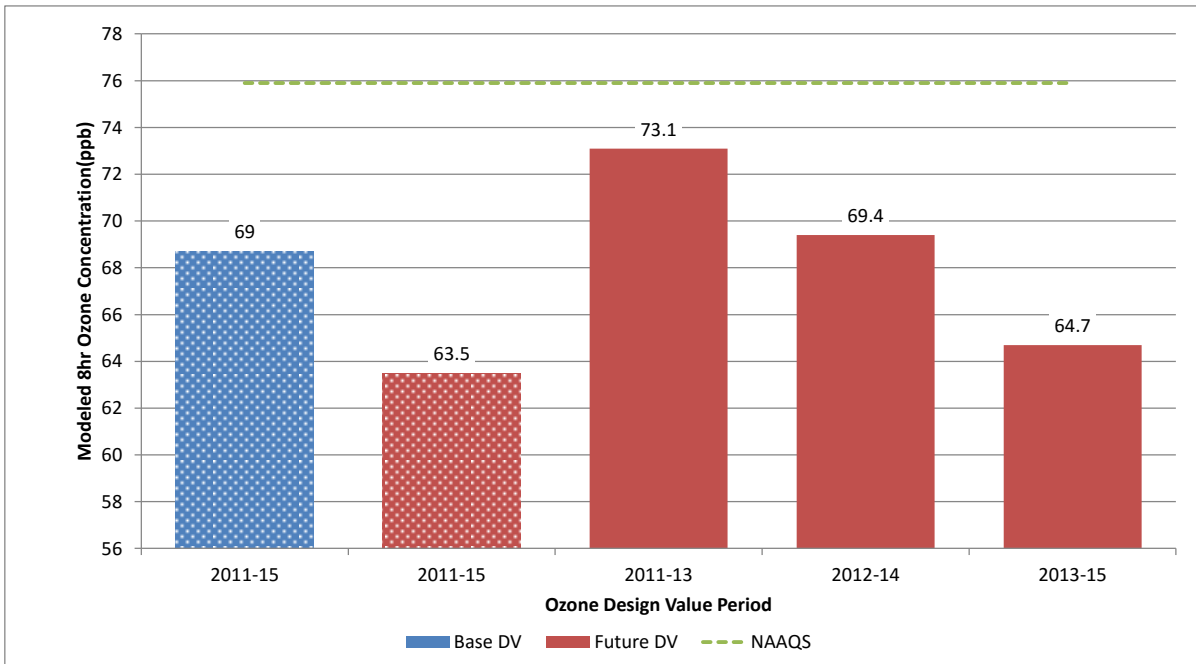
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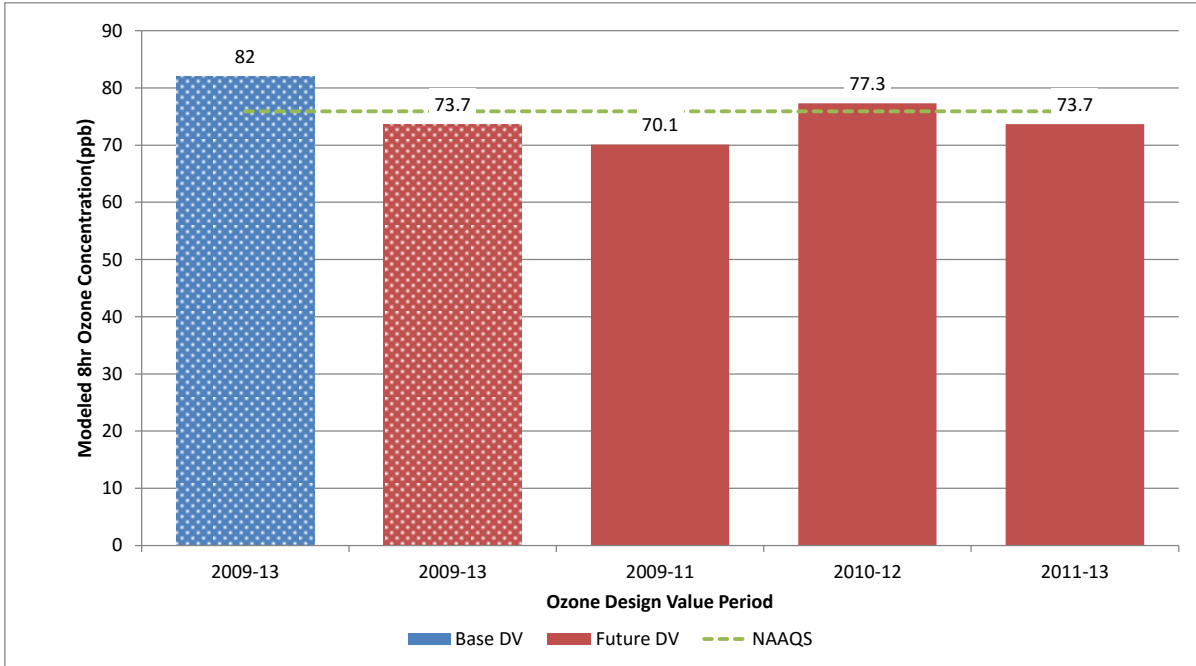
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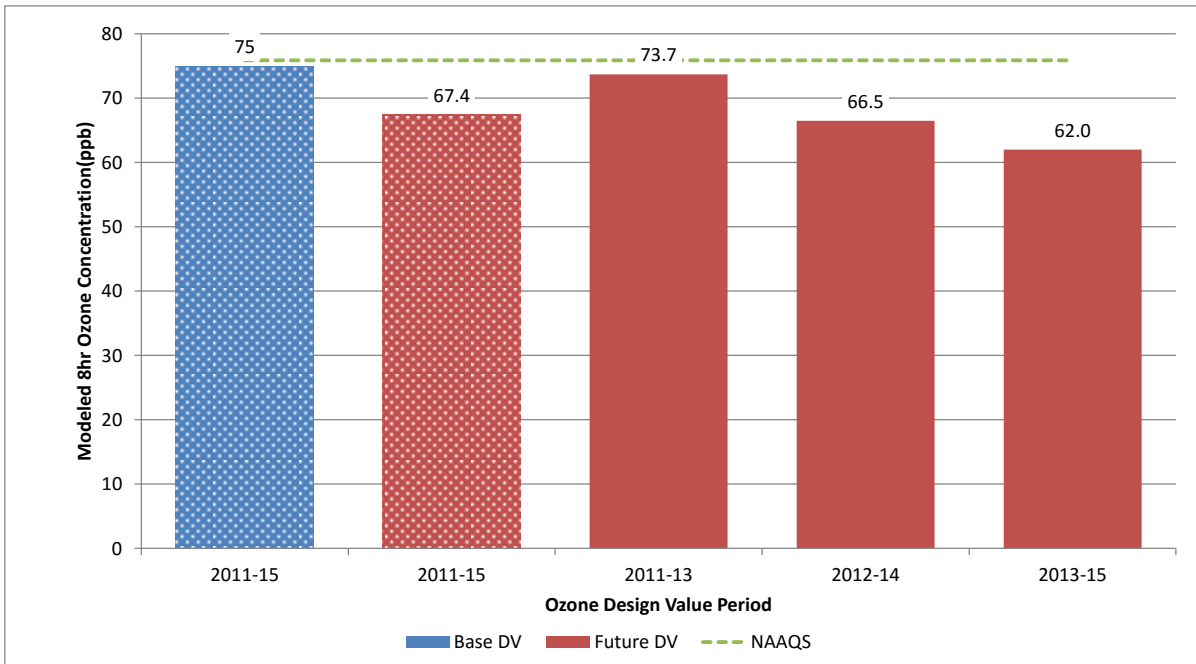
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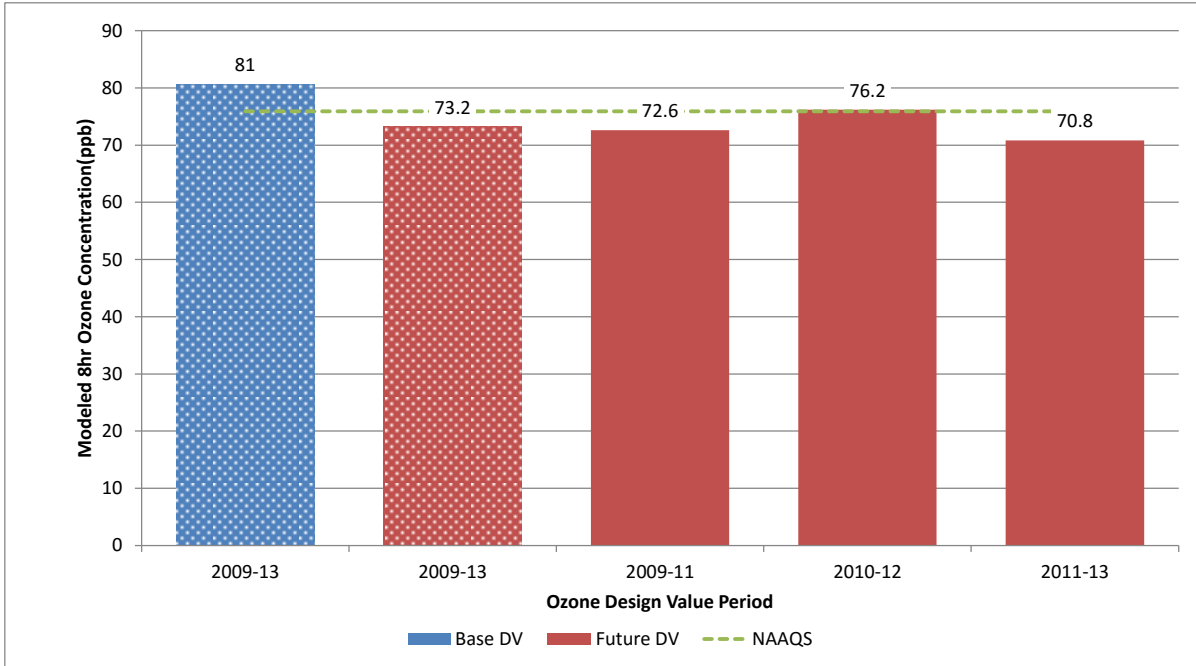
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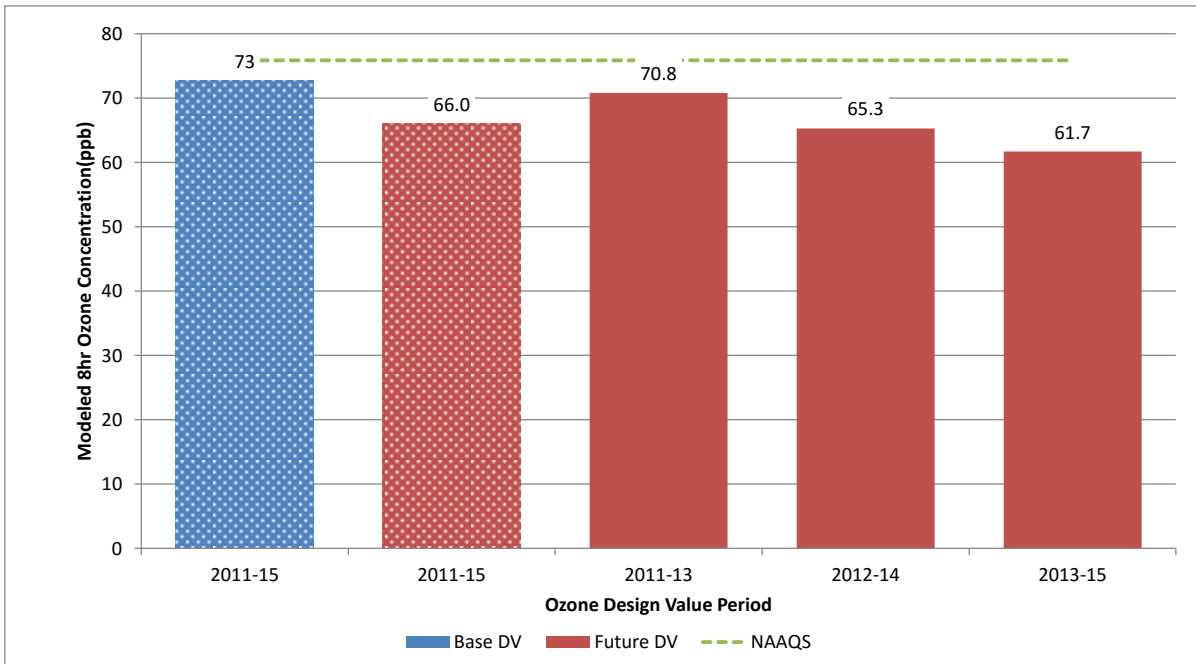
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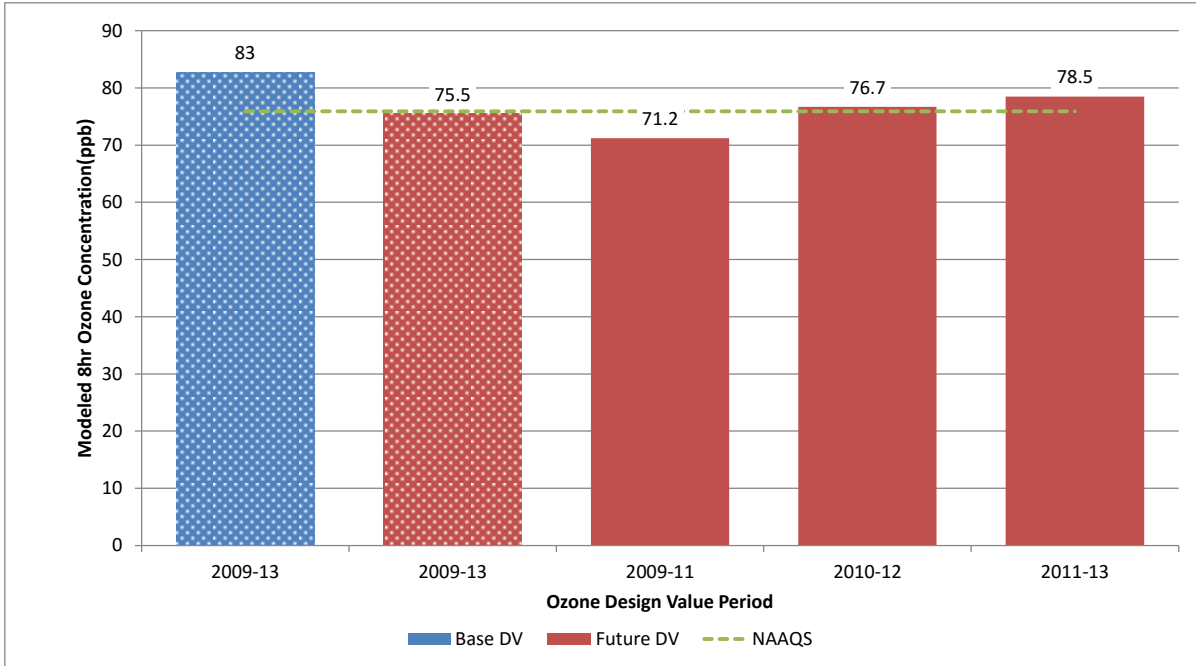
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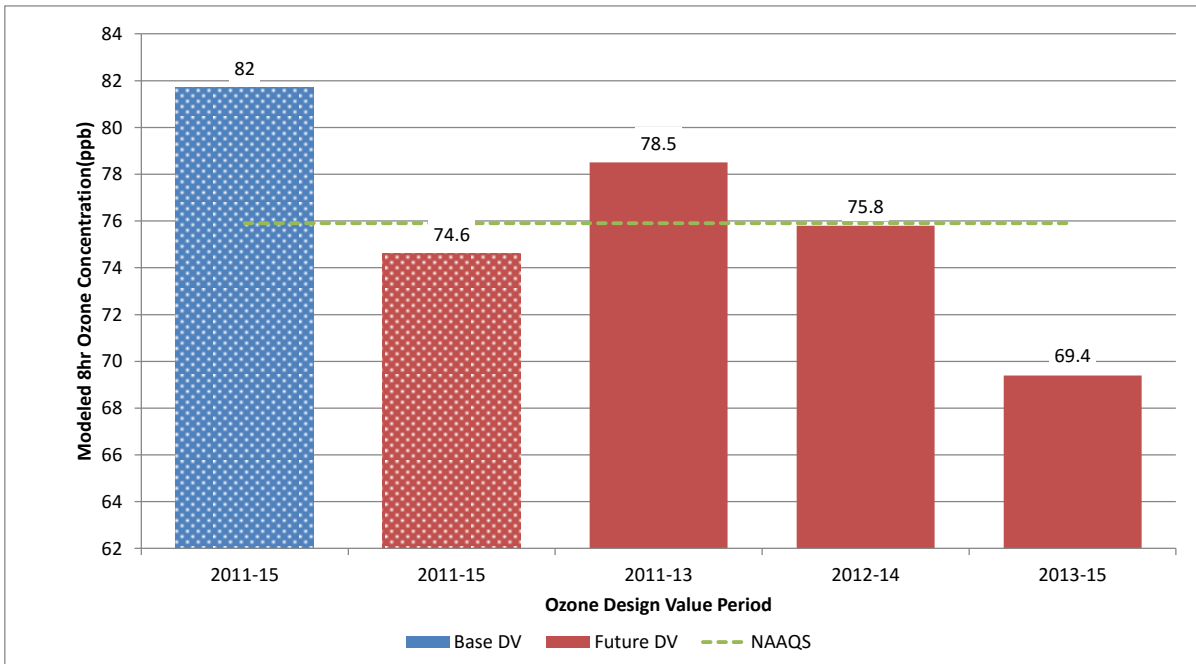
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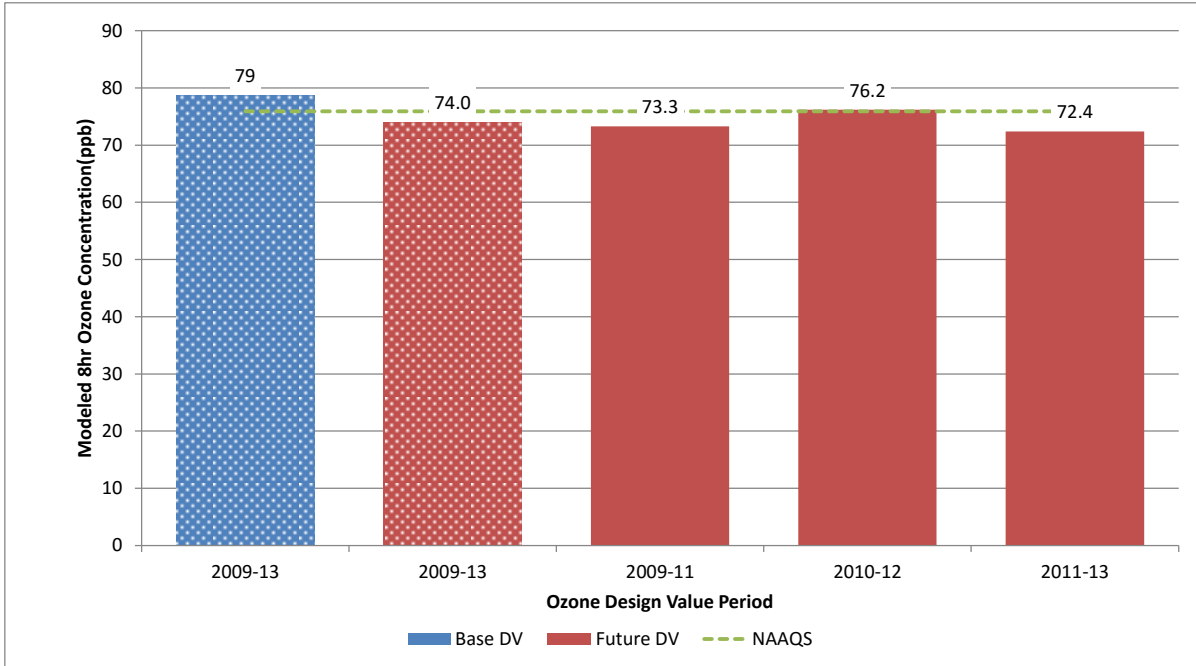
DV Period	Design Value (ppb)	Description
2009-13	83	<- CSAPR Base Year (2011) Design Value Average
2009-13	75.5	<- CSAPR Future Year (2017) Design Value Average
2009-11	71.2	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	76.7	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	78.5	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



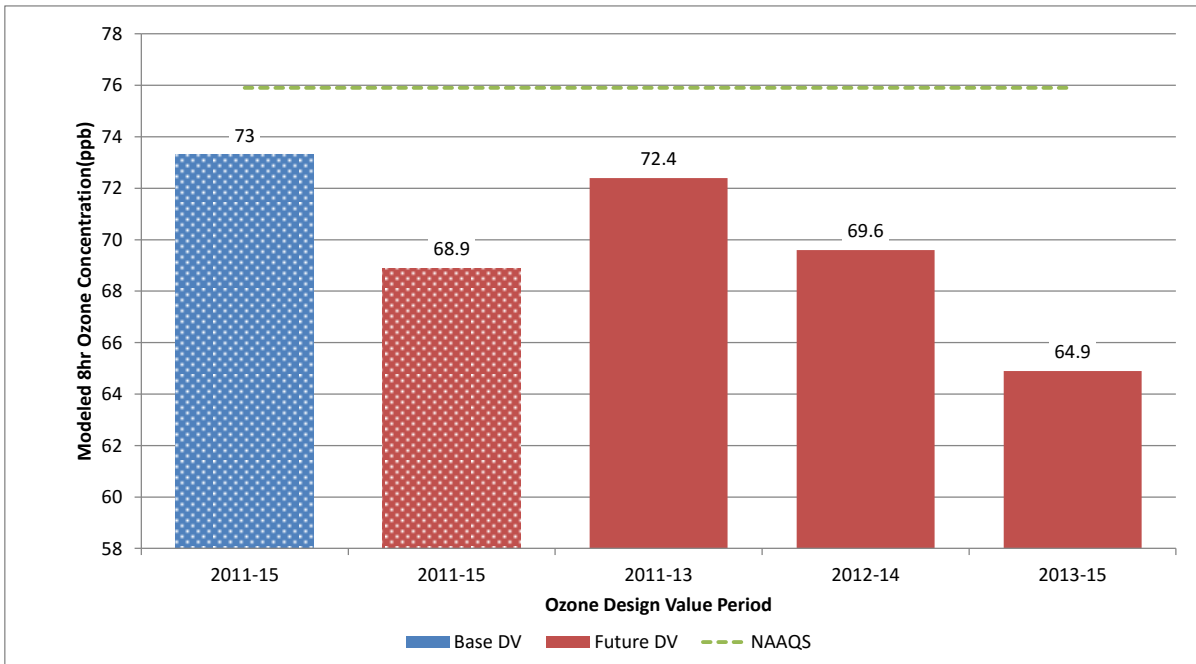
DV Period	Design Value (ppb)	Description
2011-15	82	<- Alternate Base Year (2011) Design Value Average
2011-15	74.6	<- Alternate Future Year (2017) Design Value Average
2011-13	78.5	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	75.8	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	69.4	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



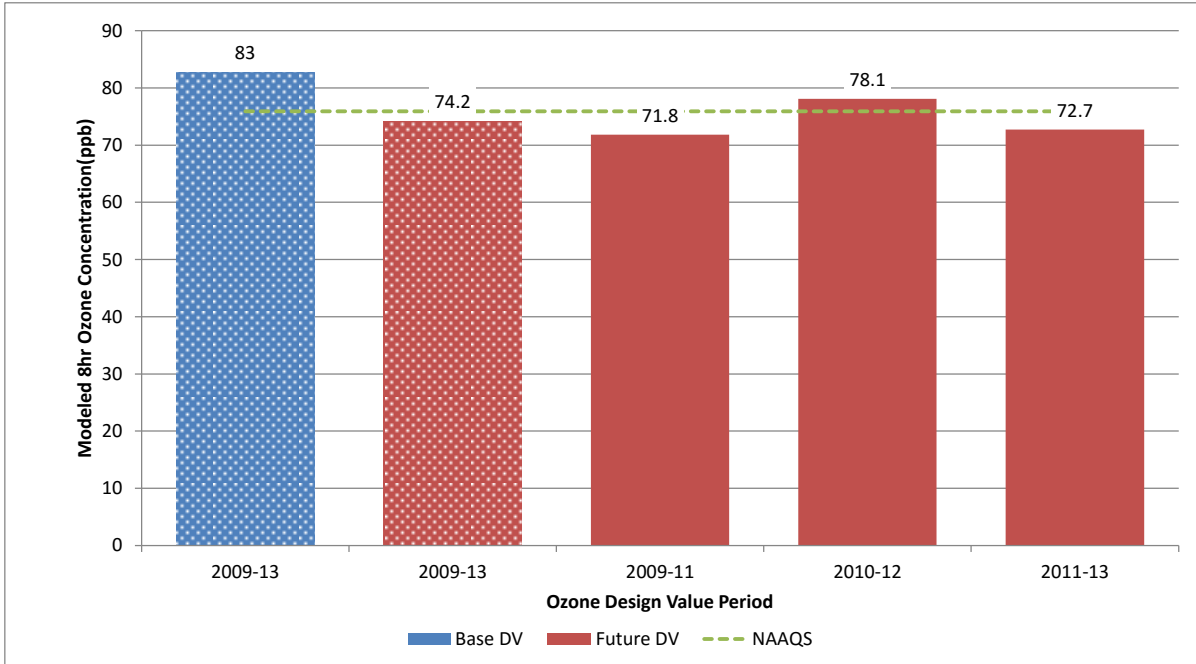
DV Period	Design Value (ppb)	Description
2009-13	79	<- CSAPR Base Year (2011) Design Value Average
2009-13	74.0	<- CSAPR Future Year (2017) Design Value Average
2009-11	73.3	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	76.2	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	72.4	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



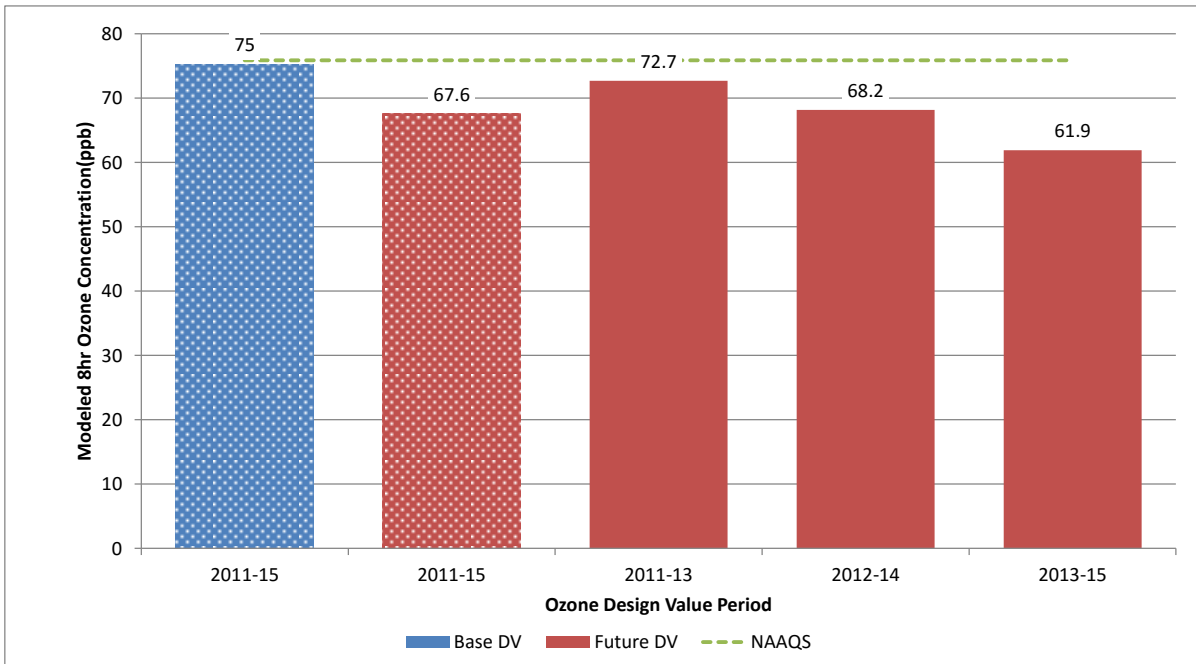
DV Period	Design Value (ppb)	Description
2011-15	73	<- Alternate Base Year (2011) Design Value Average
2011-15	68.9	<- Alternate Future Year (2017) Design Value Average
2011-13	72.4	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	69.6	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	64.9	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



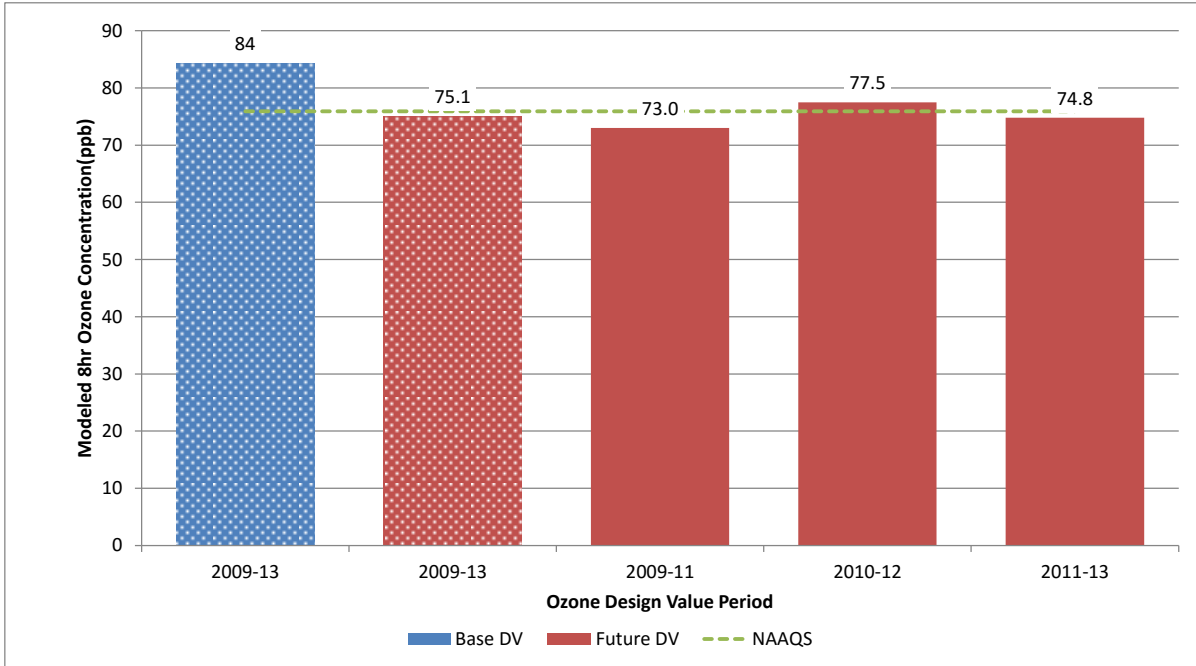
DV Period	Design Value (ppb)	Description
2009-13	83	<- CSAPR Base Year (2011) Design Value Average
2009-13	74.2	<- CSAPR Future Year (2017) Design Value Average
2009-11	71.8	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	78.1	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	72.7	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



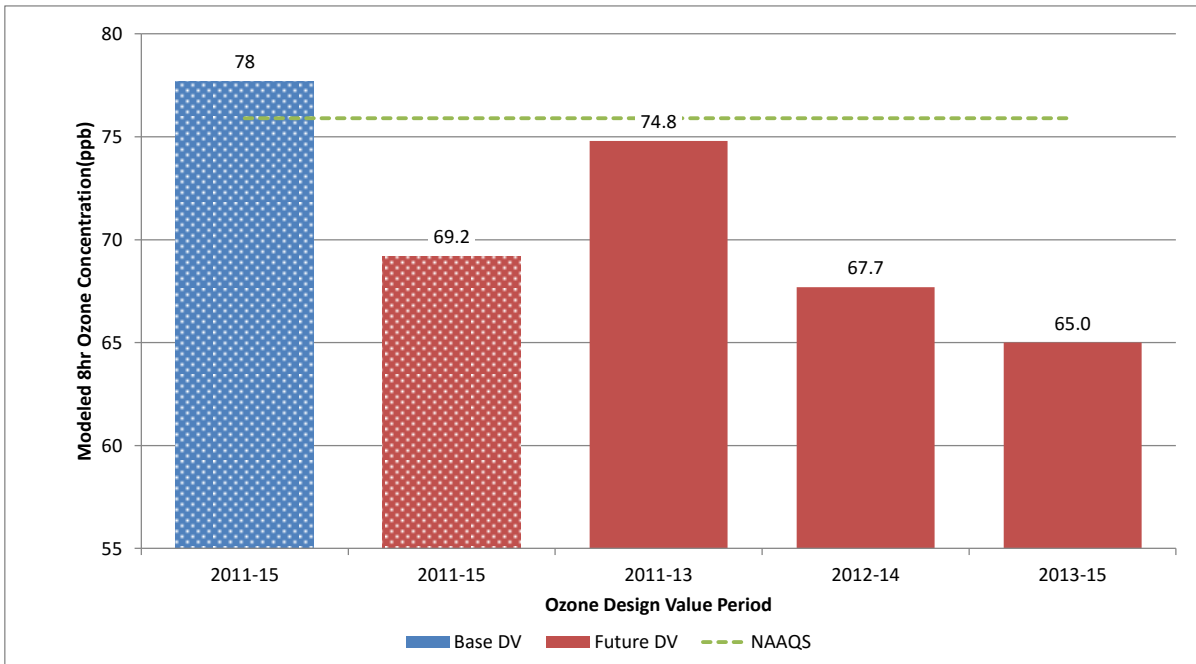
DV Period	Design Value (ppb)	Description
2011-15	75	<- Alternate Base Year (2011) Design Value Average
2011-15	67.6	<- Alternate Future Year (2017) Design Value Average
2011-13	72.7	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	68.2	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	61.9	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



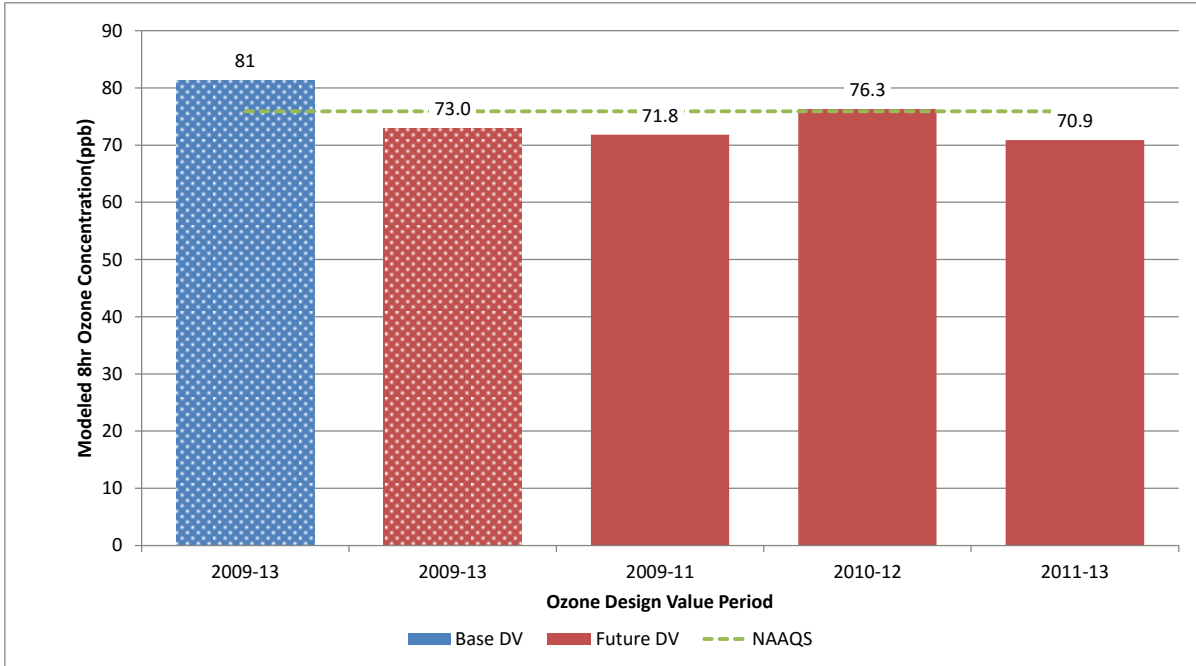
DV Period	Design Value (ppb)	Description
2009-13	84	<- CSAPR Base Year (2011) Design Value Average
2009-13	75.1	<- CSAPR Future Year (2017) Design Value Average
2009-11	73.0	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	77.5	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	74.8	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



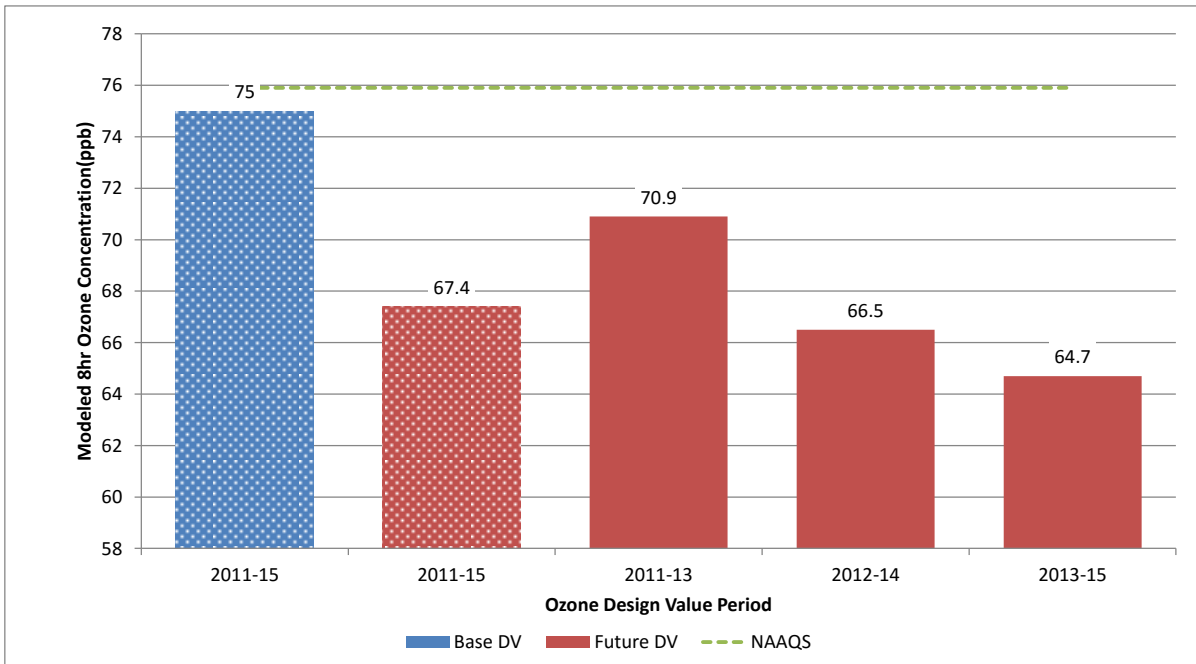
DV Period	Design Value (ppb)	Description
2011-15	78	<- Alternate Base Year (2011) Design Value Average
2011-15	69.2	<- Alternate Future Year (2017) Design Value Average
2011-13	74.8	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	67.7	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	65.0	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



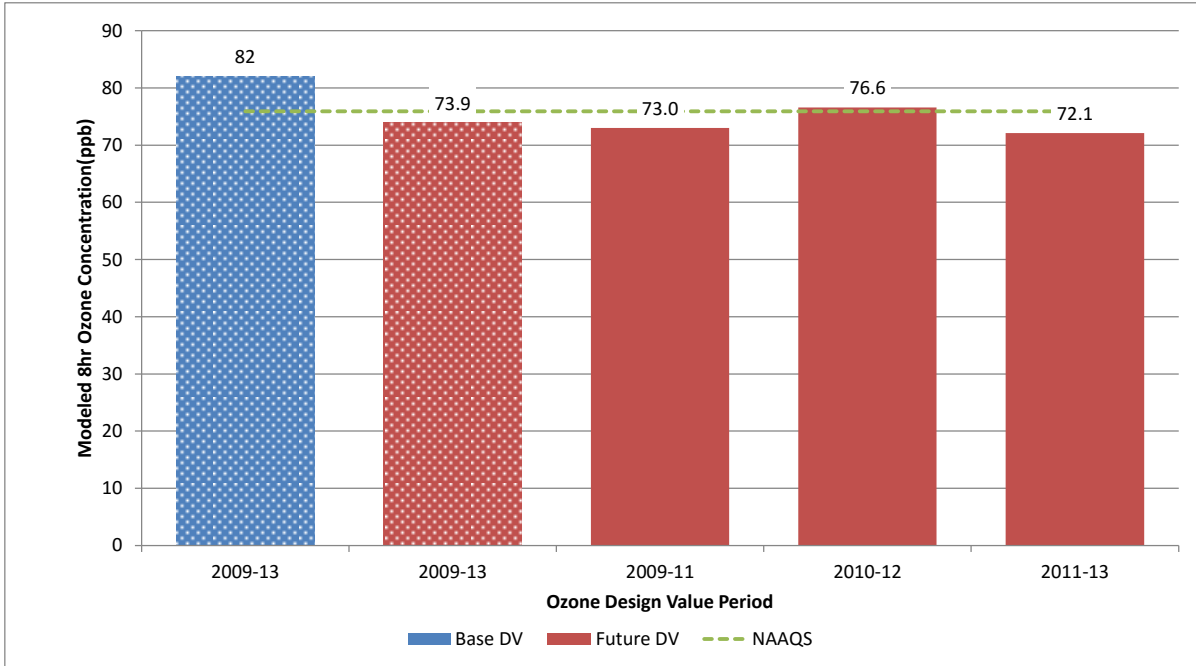
DV Period	Design Value (ppb)	Description
2009-13	81	<- CSAPR Base Year (2011) Design Value Average
2009-13	73.0	<- CSAPR Future Year (2017) Design Value Average
2009-11	71.8	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	76.3	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	70.9	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



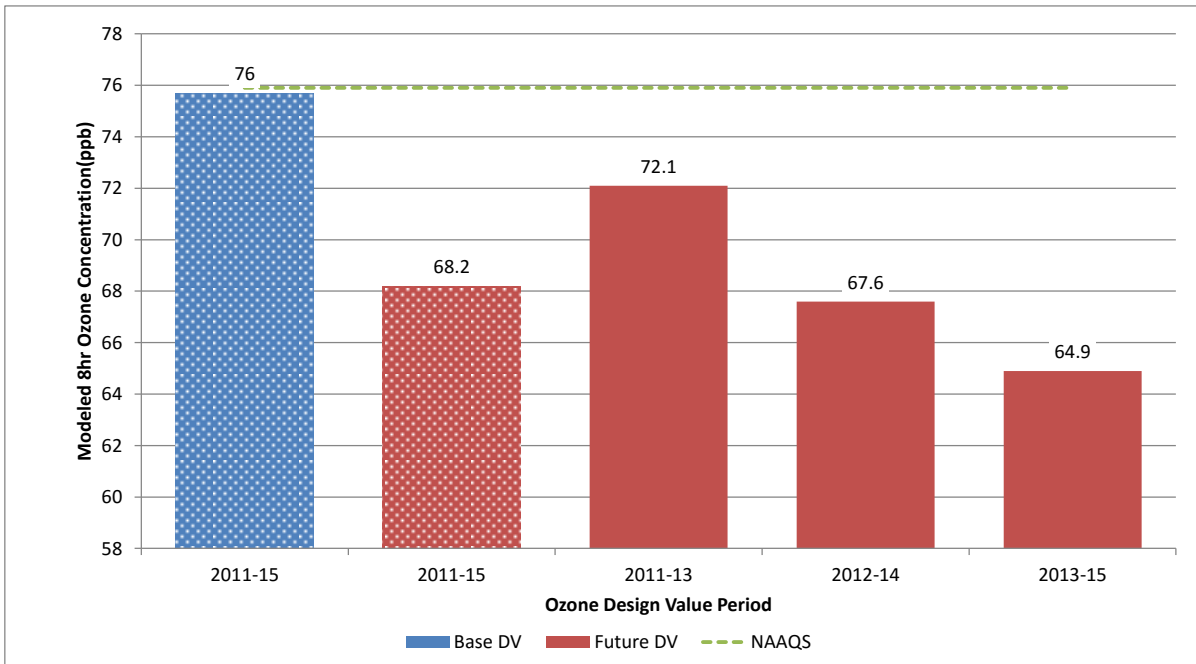
DV Period	Design Value (ppb)	Description
2011-15	75	<- Alternate Base Year (2011) Design Value Average
2011-15	67.4	<- Alternate Future Year (2017) Design Value Average
2011-13	70.9	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	66.5	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	64.7	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



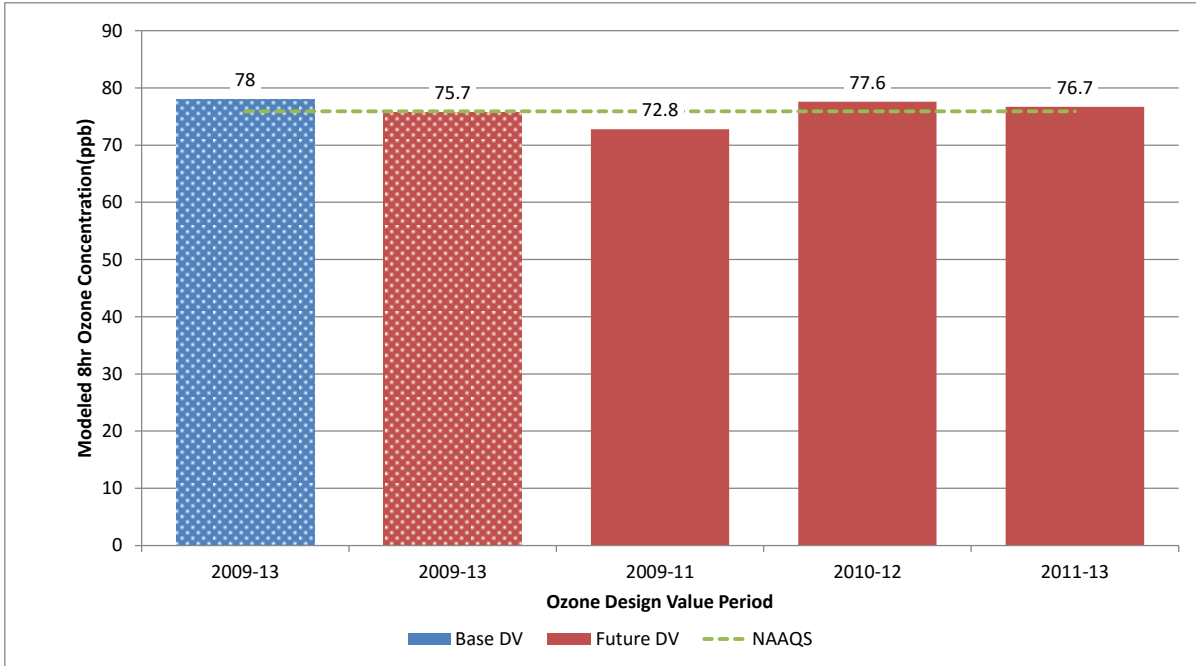
DV Period	Design Value (ppb)	Description
2009-13	82	<- CSAPR Base Year (2011) Design Value Average
2009-13	73.9	<- CSAPR Future Year (2017) Design Value Average
2009-11	73.0	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	76.6	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	72.1	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



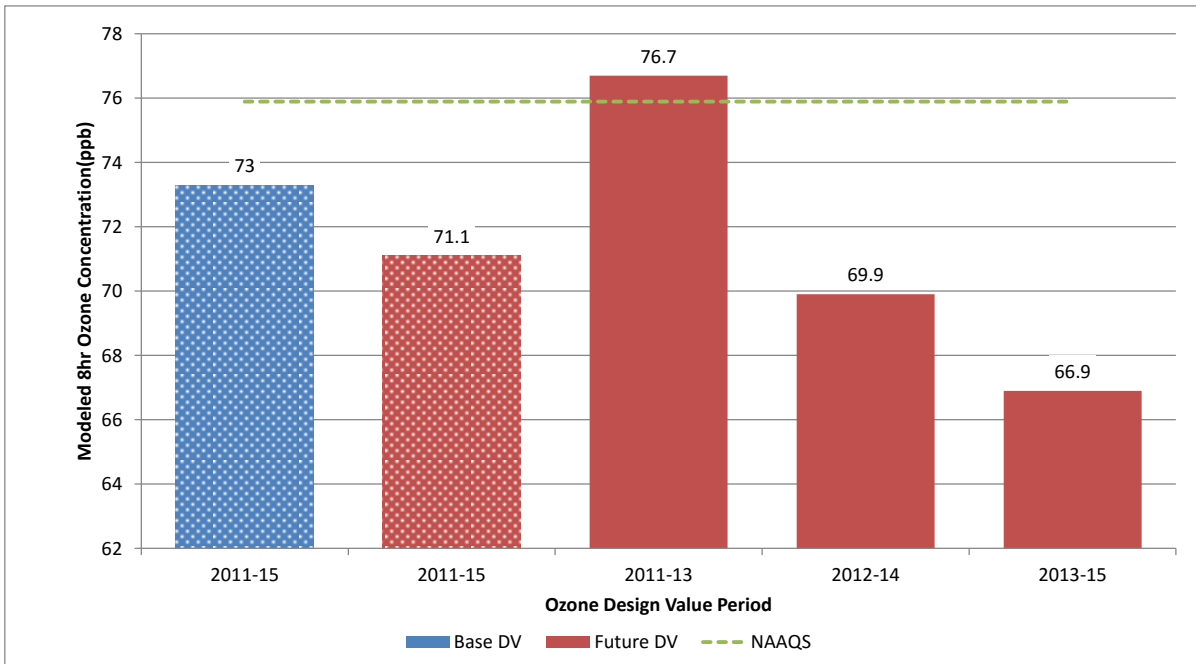
DV Period	Design Value (ppb)	Description
2011-15	76	<- Alternate Base Year (2011) Design Value Average
2011-15	68.2	<- Alternate Future Year (2017) Design Value Average
2011-13	72.1	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	67.6	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	64.9	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



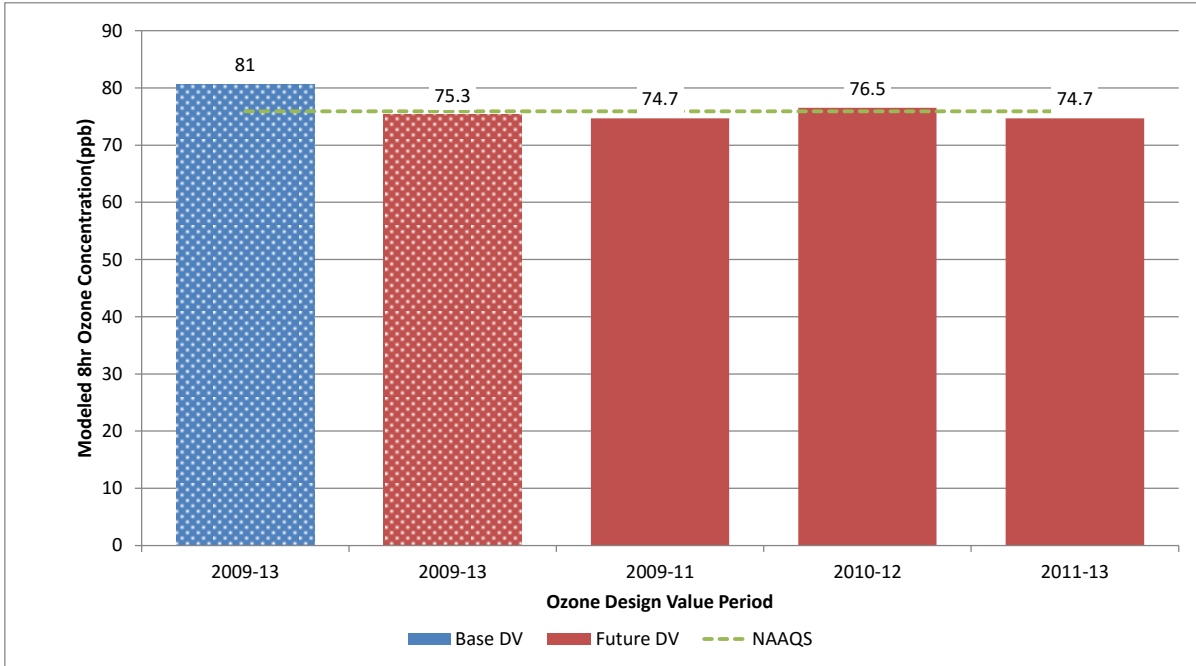
DV Period	Design Value (ppb)	Description
2009-13	78	<- CSAPR Base Year (2011) Design Value Average
2009-13	75.7	<- CSAPR Future Year (2017) Design Value Average
2009-11	72.8	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	77.6	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	76.7	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



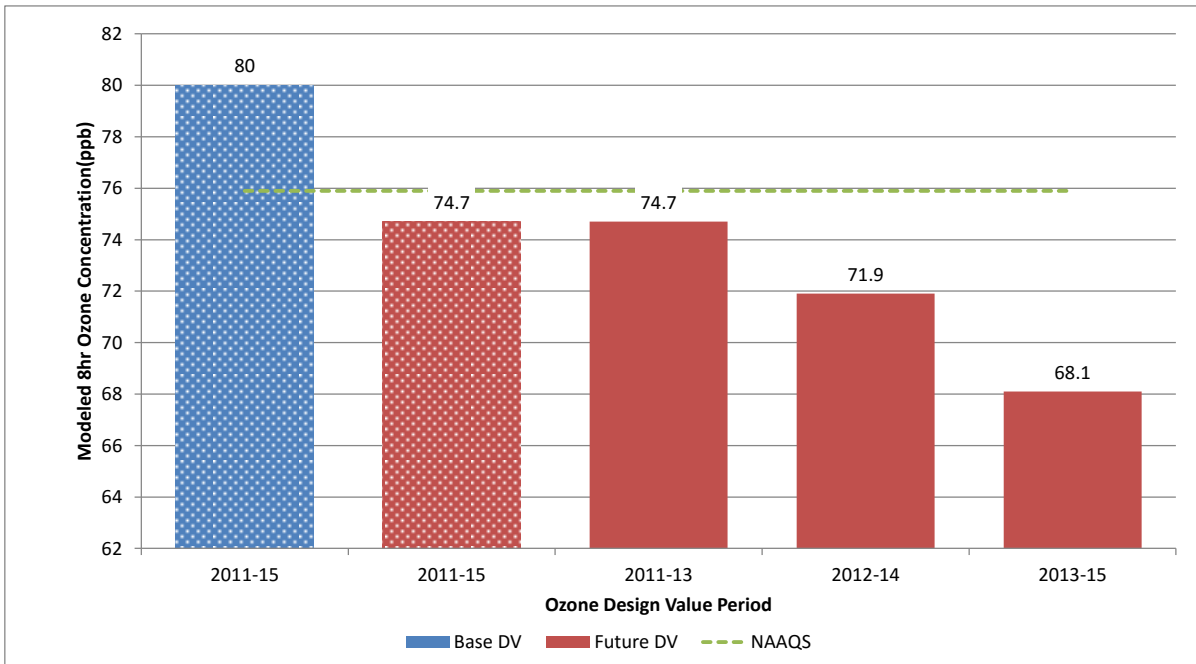
DV Period	Design Value (ppb)	Description
2011-15	73	<- Alternate Base Year (2011) Design Value Average
2011-15	71.1	<- Alternate Future Year (2017) Design Value Average
2011-13	76.7	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	69.9	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	66.9	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



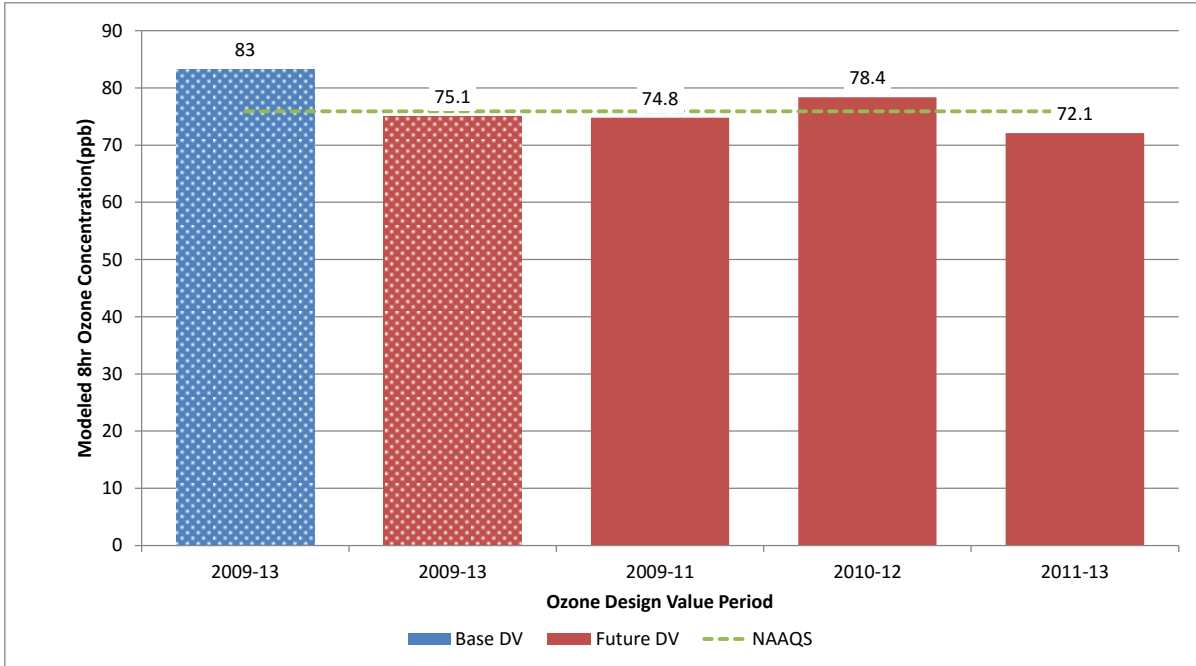
DV Period	Design Value (ppb)	Description
2009-13	81	<- CSAPR Base Year (2011) Design Value Average
2009-13	75.3	<- CSAPR Future Year (2017) Design Value Average
2009-11	74.7	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	76.5	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	74.7	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



DV Period	Design Value (ppb)	Description
2011-15	80	<- Alternate Base Year (2011) Design Value Average
2011-15	74.7	<- Alternate Future Year (2017) Design Value Average
2011-13	74.7	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	71.9	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	68.1	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value



DV Period	Design Value (ppb)	Description
2009-13	83	<- CSAPR Base Year (2011) Design Value Average
2009-13	75.1	<- CSAPR Future Year (2017) Design Value Average
2009-11	74.8	<- CSAPR 2009-2011 - 3yr Future Year (2017) Design Value
2010-12	78.4	<- CSAPR 2010-2012 - 3yr Future Year (2017) Design Value
2011-13	72.1	<- CSAPR 2011-2013 - 3yr Future Year (2017) Design Value



DV Period	Design Value (ppb)	Description
2011-15	76	<- Alternate Base Year (2011) Design Value Average
2011-15	68.2	<- Alternate Future Year (2017) Design Value Average
2011-13	72.1	<- Alternate 2011-2013 - 3yr Future Year (2017) Design Value
2012-14	67.6	<- Alternate 2012-2014 - 3yr Future Year (2017) Design Value
2013-15	64.9	<- Alternate 2013-2015 - 3yr Future Year (2017) Design Value

