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Technical Support Document for the Final Locomotive/Marine Rule: Air Quality Modeling Analyses

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U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Air Quality Assessment Division
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I. Introduction

This document describes the air quality modeling performed by EPA in support of the final Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less than 20 Liters per Cylinder (Locomotive/Marine) rule. A national scale air quality modeling analysis was performed to estimate the effect of the rule on future annual fine particulate matter ($PM_{2.5}$) concentrations, future 8-hour ozone concentrations, and future visibility levels. To estimate the air quality changes expected to result from this rule we used the Community Multiscale Air Quality (CMAQ) model[1]. The CMAQ model simulates the multiple physical and chemical processes involved in the formation, transport, and destruction of fine particulate matter and ozone.

The overall CMAQ modeling platform has been revised from what was used at proposal. A modeling platform is a structured system of connected modeling-related tools and data that provide a consistent and transparent basis for assessing the air quality response to changes in emissions and/or meteorology. A platform typically consists of a specific air quality model, base year and future year baseline emissions estimates, and a set of meteorological model inputs. The final Locomotive/Marine rule modeling analyses were based on a 2002 modeling platform which reflects: a) an updated version of the CMAQ model, b) higher resolution $PM_{2.5}$ modeling, c) a longer period of ozone modeling, and d) updated emissions and meteorological data. These updates from the previous 2001 platform will be described in more detail in subsequent sections of this technical support document (TSD).

II. CMAQ Model Version, Inputs and Configuration

A. Model version

CMAQ is a non-proprietary computer model that simulates the formation and fate of photochemical oxidants, including $PM_{2.5}$ and ozone, for given input sets of meteorological conditions and emissions. This analysis employed a version of CMAQ based on the latest publicly-released version of CMAQ available at the time of the final Locomotive/Marine rule modeling (i.e., version 4.6)[2]. CMAQ version 4.6 reflects recent updates intended to improve the underlying science from version 4.5, which was used in the proposal. These model enhancements include:

1) an updated Carbon Bond chemical mechanism (CB-05) and associated Euler Backward Iterative (EBI) solver was added;

[1] Byun, D.W., and K. L. Schere, 2006: Review of the Governing Equations, Computational Algorithms, and Other Components of the Models-3 Community Multiscale Air Quality (CMAQ) Modeling System. Applied Mechanics Reviews, Volume 59, Number 2 (March 2006), pp. 51-77.

[2] CMAQ version 4.6 was released on September 30, 2006. It is available from the Community Modeling and Analysis System (CMAS) at: http://www.cmascenter.org .

2) an updated version of the ISORROPIA aerosol thermodynamics module was added;

3) the heterogeneous N_2O_5 reaction probability is now temperature- and humidity-dependent;

4) the gas-phase reactions involving N_2O_5 and H_2O are now included; and

5) an updated version of the vertical diffusion module was added (ACM2).

Additionally, there were a few minor changes made to the release version of CMAQ v4.6 by the EPA model developers subsequent to its release. The relatively minor changes and new features of this internal version that was ultimately used in this analysis (version 4.6.1i) are described elsewhere.[3]

B. Model domain and grid resolution

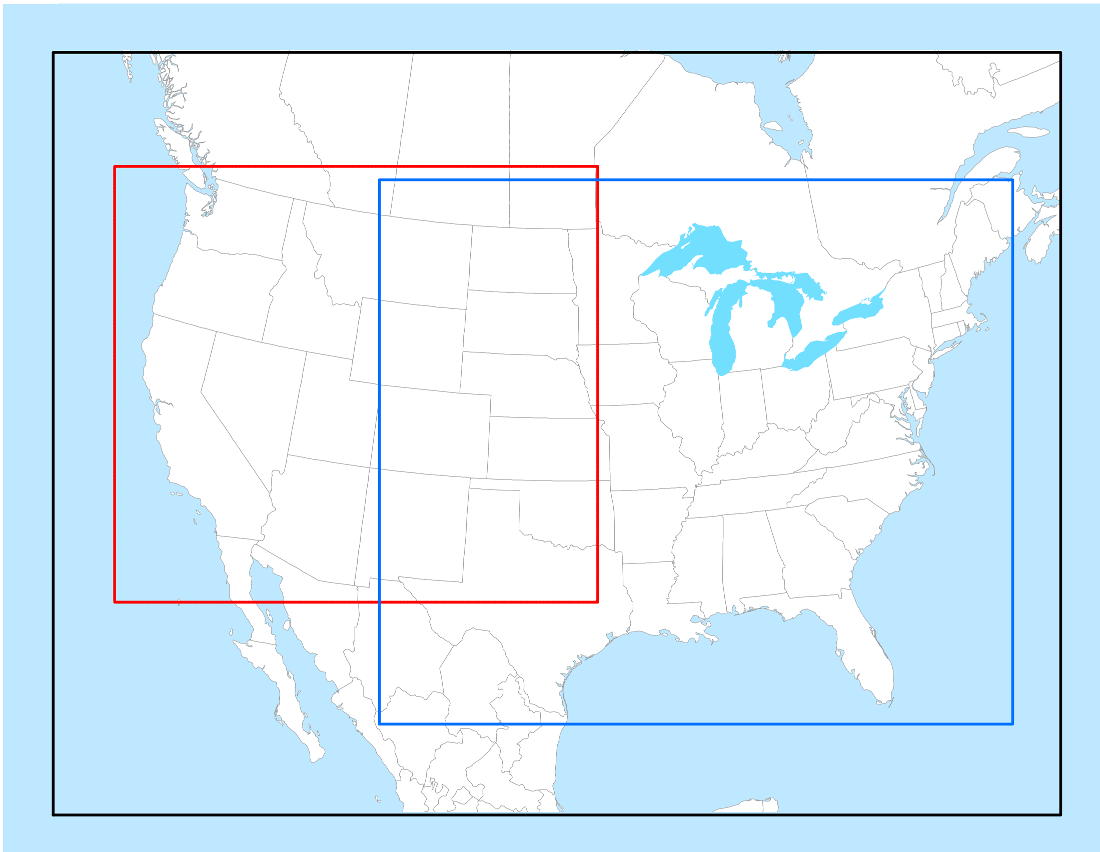
The CMAQ modeling analyses were performed for a domain covering the continental United States, as shown in Figure II-1. This domain has a parent horizontal grid of 36 km with two finer-scale 12 km grids over portions of the eastern and western U.S. The model extends vertically from the surface to 100 millibars (approximately 15 km) using a sigma-pressure coordinate system. Air quality conditions at the outer boundary of the 36 km domain were taken from a global model and did not change over the simulations. In turn, the 36 km grid was only used to establish the incoming air quality concentrations along the boundaries of the 12 km grids. All of the modeling results assessing the emissions reductions from the Locomotive/Marine rule were taken from the 12 km grids. Table II-1 provides some basic geographic information regarding the CMAQ domains.

Table II-1. Geographic elements of domains used in Locomotive/Marine modeling.

	CMAQ Modeling Configuration		
	National Grid	**Western U.S. Fine Grid**	**Eastern U.S. Fine Grid**
Map Projection	Lambert Conformal Projection		
Grid Resolution	36 km	12 km	12 km
Coordinate Center	97 deg W, 40 deg N		
True Latitudes	33 deg N and 45 deg N		
Dimensions	148 x 112 x 14	213 x 192 x 14	279 x 240 x 14
Vertical extent	14 Layers: Surface to 100 millibar level (see Table II-3)		

[3] See the 4/09/07 e-mail from Shawn Roselle, Office of Research and Development to Carey Jang, Office of Air Quality Planning and Standards which is included in the docket for this rulemaking.

Figure II-1. Map of the CMAQ modeling domain. The black outer box denotes the 36 km national modeling domain; the red inner box is the 12 km western U.S. fine grid; and the blue inner box is the 12 km eastern U.S. fine grid.



C. Modeling Period / Ozone Episodes

The 36 km and both 12 km CMAQ modeling domains were modeled for the entire year of 2002.[4] All 365 model days were used in the calculations of the impacts of the locomotive/marine controls on annual average levels of $PM_{2.5}$. For the 8-hour ozone results, we are only using modeling results from the period between May 1 and September 30, 2002. This 153-day period generally conforms to the ozone season across most parts of the U.S. and contains the majority of days with observed high ozone concentrations in 2002.

D. Model Inputs: Emissions, Meteorology and Boundary Conditions

1. Base Year and Future Baseline Emissions: As noted in the introduction section, a 2001-based platform was used for the proposed rule modeling and a 2002-based platform was used for the final rule modeling. The 2002-based platform builds upon the general concepts, tools and emissions modeling data from the 2001-based

[4] We also modeled 10 days at the end of December 2001 as a modeled "ramp up" period. These days are used to minimize the effects of initial conditions and are not considered as part of the output analyses.

platform, while updating and enhancing many of the emission inputs and tools. A summary of the emissions inventory development is described below. More detailed documentation on the methods and data summaries of the 2002-based platform emissions for base and future years is also available separately.[5]

We used version 3 of the 2002-based platform which takes emission inventories from the 2002 National Emissions Inventory (NEI) version 3.0. These inventories, with the exception of California, include monthly onroad and nonroad emissions generated from the National Mobile Inventory Model (NMIM) using versions of MOBILE6.0 and NONROAD2005 consistent with recent national rule analyses.[6,7,8] The locomotive and marine inventories are based on national level estimates developed for the proposed rule making.[9] That is, the base year emissions for locomotive and marine sectors did not change between the proposal and final modeling. The 2002-based platform and its associated chemical mechanism (CB05) employs updated speciation profiles using data included in the SPECIATE4.0 database.[10] In addition, the 2002-based platform incorporates several temporal profile updates for both mobile and stationary sources.

The 2002-based platform includes emissions for a 2002 base year model evaluation case, a 2002 base case and several projection years. The projection years include 2020 and 2030, which were used as the future years for the locomotive/marine rule analyses. The model evaluation case uses prescribed burning and wildfire emissions specific to 2002, which were developed and modeled as day-specific, location-specific emissions using an updated version of Sparse Matrix Operator Kernel Emissions (SMOKE) system, version 2.3, which computes plume rise and vertically allocates the fire emissions. It also includes continuous emissions monitoring (CEM) data for 2002 for electric generating units (EGUs) with CEMs. The 2002 and projection year baselines

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[5] Technical Support Document: Preparation of Emissions Inventories for the 2002-based Platform, Version 3.0, Criteria Air Pollutants, January 2008. This file is available in the docket for this rulemaking.

[6] The California Air Resources Board submitted annual emissions for California. These were allocated to monthly resolution prior to emissions modeling using data from the National Mobile Inventory Model (NMIM).

[7] MOBILE6 version was used in the Mobile Source Air Toxics Rule: *Regulatory Impact Analysis for Final Rule: Control of Hazardous Air Pollutants from Mobile Sources*, U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Assessment and Standards Division, Ann Arbor, MI 48105, EPA420-R-07-002, February 2007.

[8] NONROAD2005 version was used in the proposed rule for small spark ignition (SI) and marine SI rule: Draft Regulatory Impact Analysis: *Control of Emissions from Marine SI and Small SI Engines, Vessels, and Equipment* , U.S. Environmental Protection Agency, Office of Transportation and Air Quality, Office of Transportation and Air Quality, Assessment and Standards Division, Ann Arbor, MI, EPA420-D-07-004, April 2007.

[9] U.S. Environmental Protection Agency, Draft Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder, EPA420-D-07-001, January 2007.

[10] See http://www.epa.gov/ttn/chief/software/speciate/index.html for more details.

include an average fire sector and temporally averaged emissions (i.e., no CEM data) for EGUs. Projections from 2002 were developed to account for the expected impact of national regulations, consent decrees or settlements, known plant closures, and, for some sectors, activity growth. For 2030, stationary sources used 2020 projections (i.e., no activity growth between 2020 and 2030). For the locomotive and marine sectors, the baseline emissions have not changed from the proposal modeling. Percent reductions were applied to the 2020 and 2030 baseline emissions to reflect the impacts of the final Locomotive/Marine rulemaking as shown in Tables II-2a and II-2b. The first five source sectors are locomotive sectors and the last three are marine sectors.

Table II-2a. Percentage reductions applied to locomotive/marine sectors in 2020 to reflect the impacts of the final rule.

Pollutant	VOC	NO_X	PM10	$PM_{2.5}$	SO_2
Class I Railroads	49%	19%	41%	41%	0%
Class II/III Railroads	0%	0%	0%	0%	0%
Commuter Railroads	51%	19%	43%	43%	0%
Passenger Railroads	51%	19%	43%	43%	0%
Switch Railroads	19%	8%	21%	21%	0%
Commercial Marine Vessels	28%	26%	29%	29%	5%
Pleasure Craft: Inboard	7%	5%	3%	3%	0%
Pleasure Craft: Outboard	13%	13%	8%	8%	0%

Table II-2b. Percentage reductions applied to locomotive/marine sectors in 2030 to reflect the impacts of the final rule.

Pollutant	VOC	NO_X	PM10	$PM_{2.5}$	SO_2
Class I Railroads	69%	52%	63%	63%	0%
Class II/III Railroads	0%	0%	0%	0%	0%
Commuter Railroads	72%	53%	66%	66%	0%
Passenger Railroads	72%	53%	66%	66%	0%
Switch Railroads	35%	23%	38%	38%	0%
Commercial Marine Vessels	60%	54%	58%	58%	16%
Pleasure Craft: Inboard	14%	11%	8%	8%	0%
Pleasure Craft: Outboard	23%	29%	17%	17%	0%

2. Meteorological Input Data: The gridded meteorological input data for the entire year of 2002 were derived from simulations of the Pennsylvania State University / National Center for Atmospheric Research Mesoscale Model. This model, commonly referred to as MM5, is a limited-area, nonhydrostatic, terrain-following system that solves for the full set of physical and thermodynamic equations which govern atmospheric motions.[11] Meteorological model input fields were prepared separately for each of the domains shown in Figure II-1. The MM5 simulations were run on the same

[11] Grell, G., J. Dudhia, and D. Stauffer, 1994: A Description of the Fifth-Generation Penn State/NCAR Mesoscale Model (MM5), NCAR/TN-398+STR., 138 pp, National Center for Atmospheric Research, Boulder CO.

map projection as CMAQ. The 36 km national domain was modeled using MM5 v.3.6.0 using land-surface modifications that were added in v3.6.3. The 12 km eastern U.S grid was modeled with MM5 v3.7.2. These two sets of meteorological inputs were developed by EPA. For the 12 km western U.S. domain, we utilized existing MM5 meteorological model data prepared by the Western Regional Air Partnership (WRAP).[12]

The three meteorological model runs used similar sets of physics options. All three simulations used the Pleim-Xiu planetary boundary layer and vertical diffusion scheme, the RRTM longwave radiation scheme, and the Reisner 1 microphysics scheme. The EPA simulations used the Kain-Fritsch 2 subgrid convection scheme while the WRAP simulation used the Betts-Miller scheme for subgrid convection. In the EPA simulations, analysis nudging was utilized above the boundary layer for temperature and water vapor, and in all locations for the wind components using relatively weak nudging coefficients. The WRAP runs employed similar four-dimensional data assimilation, but also included observational nudging of surface winds. All three sets of model runs were conducted in 5.5 day segments with 12 hours of overlap for spin-up purposes. All three domains contained 34 vertical layers with an approximately 38 m deep surface layer and a 100 millibar top. The MM5 and CMAQ vertical structures are shown in Table II-3 and do not vary by horizontal grid resolution.

Table II-3. Vertical layer structure for MM5 and CMAQ (heights are layer top).

CMAQ Layers	MM5 Layers	Sigma P	Approximate Height (m)	Approximate Pressure (mb)
0	0	1.000	0	1000
1	1	0.995	38	995
2	2	0.990	77	991
3	3	0.985	115	987
	4	0.980	154	982
4	5	0.970	232	973
	6	0.960	310	964
5	7	0.950	389	955
	8	0.940	469	946
6	9	0.930	550	937
	10	0.920	631	928
	11	0.910	712	919
7	12	0.900	794	910
	13	0.880	961	892
	14	0.860	1,130	874
8	15	0.840	1,303	856
	16	0.820	1,478	838
	17	0.800	1,657	820
9	18	0.770	1,930	793
	19	0.740	2,212	766

[12] Kemball-Cook, S., Y. Jia, C. Emery, R. Morris, Z. Wang and G. Tonnesen. 2004. 2002 Annual MM5 Simulation to Support WRAP CMAQ Visibility Modeling for the Section 308 SIP/TIP – MM5 Sensitivity Simulations to Identify a More Optimal MM5 Configuration for Simulating Meteorology in the Western United States. Western Regional Air Partnership, Regional Modeling Center. December 10. (http://pah.cert.ucr.edu/aqm/308/reports/mm5/MM5SensitivityRevRep_Dec_10_2004.pdf)

10	20	0.700	2,600	730
	21	0.650	3,108	685
11	22	0.600	3,644	640
	23	0.550	4,212	595
12	24	0.500	4,816	550
	25	0.450	5,461	505
	26	0.400	6,153	460
13	27	0.350	6,903	415
	28	0.300	7,720	370
	29	0.250	8,621	325
	30	0.200	9,625	280
14	31	0.150	10,764	235
	32	0.100	12,085	190
	33	0.050	13,670	145
	34	0.000	15,674	100

The meteorological outputs from all three MM5 sets were processed to create model-ready inputs for CMAQ using the Meteorology-Chemistry Interface Processor (MCIP), version 3.1, to derive the specific inputs to CMAQ.[13]

Before initiating the air quality simulations, it is important to identify the biases and errors associated with the meteorological modeling inputs. The 2002 MM5 model performance evaluations used an approach which included a combination of qualitative and quantitative analyses to assess the adequacy of the MM5 simulated fields. The qualitative aspects involved comparisons of the model-estimated synoptic patterns against observed patterns from historical weather chart archives. Qualitatively, the model fields closely matched the observed synoptic patterns, which is expected given the use of nudging. The operational evaluation included statistical comparisons of model/observed pairs (e.g., mean normalized bias, mean normalized error, index of agreement, root mean square errors, etc.) for multiple meteorological parameters. For this portion of the evaluation, four meteorological parameters were investigated: temperature, humidity, wind speed, and wind direction. The operational piece of the analyses focuses on surface parameters. The Atmospheric Model Evaluation Tool (AMET) was used to conduct the analyses as described in this report.[14] The three individual MM5 evaluations are described elsewhere.[15,16,17] It was ultimately determined that the bias and error values

[13] Byun, D.W., and Ching, J.K.S., Eds, 1999. Science algorithms of EPA Models-3 Community Multiscale Air Quality (CMAQ modeling system, EPA/600/R-99/030, Office of Research and Development).

[14] Gilliam, R. C., W. Appel, and S. Phillips. The Atmospheric Model Evaluation Tool (AMET): Meteorology Module. Presented at 4th Annual CMAS Models-3 Users Conference, Chapel Hill, NC, September 26 - 28, 2005.

[15] Brewer J., P. Dolwick, and R. Gilliam. Regional and Local Scale Evaluation of MM5 Meteorological Fields for Various Air Quality Modeling Applications, Presented at the 87th Annual American Meteorological Society Annual Meeting, San Antonio, TX, January 15-18, 2007.

[16] Dolwick, P, R. Gilliam, L. Reynolds, and A. Huffman. Regional and Local-scale Evaluation of 2002 MM5 Meteorological Fields for Various Air Quality Modeling Applications, Presented at 6th Annual CMAS Models-3 Users Conference, Chapel Hill, NC, October 1 - 3, 2007.

associated with all three sets of 2002 meteorological data were generally within the range of past meteorological modeling results that have been used for air quality applications.[18]

3. Initial and Boundary Conditions: The lateral boundary and initial species concentrations are provided by a three-dimensional global atmospheric chemistry model, the GEOS-CHEM model.[19] The global GEOS-CHEM model simulates atmospheric chemical and physical processes driven by assimilated meteorological observations from the NASA's Goddard Earth Observing System (GEOS). This model was run for 2002 with a grid resolution of 2.0 degree x 2.5 degree (latitude-longitude) and 20 vertical layers. The predictions were used to provide one-way dynamic boundary conditions at three-hour intervals and an initial concentration field for the CMAQ simulations. More information is available about the GEOS-CHEM model and other applications using this tool at: http://www-as.harvard.edu/chemistry/trop/geos.

E. CMAQ Base Case Model Performance Evaluation

An operational model performance evaluation for ozone and $PM_{2.5}$ and its related speciated components was conducted using 2002 State/local monitoring sites data in order to estimate the ability of the CMAQ modeling system to replicate the base year concentrations for the 12-km eastern and western domains. In summary, model performance statistics were calculated for observed-predicted pairs of daily, monthly, seasonal, and annual concentrations. Statistics were generated for the following geographic groupings: the entire 12-km Eastern US domain (EUS), the entire 12-km Western US domain (WUS), and five large subregions: Midwest, Northeast, Southeast, Central, and West U.S.[20] The "acceptability" of model performance was judged by comparing our CMAQ 2002 performance results to the range of performance found in the 2001 CMAQ results used in the proposal, as well as recent regional ozone and $PM_{2.5}$ model applications (e.g., Clean Air Interstate Rule, Final PM NAAQS Rule).[21] These

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[17] Kemball-Cook, S., Y. Jia, C. Emery, R. Morris, Z. Wang, and G. Tonnesen. Annual 2002 MM5 Meteorological Modeling to Support Regional Haze Modeling of the Western United States, Prepared for The Western Regional Air Partnership (WRAP), 1515 Cleveland Place, Suite 200 Denver, CO 80202, March 2005.

[18] Environ, Enhanced Meteorological Modeling and Performance Evaluation for Two Texas Episodes, August 2001.

[19] Yantosca, B., 2004. GEOS-CHEMv7-01-02 User's Guide, Atmospheric Chemistry Modeling Group, Harvard University, Cambridge, MA, October 15, 2004.

[20] The subregions are defined by States where: Midwest is IL, IN, MI, OH, and WI; Northeast is CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, and VT; Southeast is AL, FL, GA, KY, MS, NC, SC, TN, VA, and WV; Central is AR, IA, KS, LA, MN, MO, NE, OK, and TX; West is CA, OR, WA, AZ, NM, CO, UT, WY, SD, ND, MT, ID, and NV.

[21] See: U.S. Environmental Protection Agency; Technical Support Document for the Final Clean Air Interstate Rule: Air Quality Modeling; Office of Air Quality Planning and Standards; RTP, NC; March 2005 (CAIR Docket OAR-2005-0053-2149); and U.S. Environmental Protection Agency, 2006. Technical Support Document for the Final PM NAAQS Rule: Office of Air Quality Planning and Standards, Research Triangle Park, NC

other modeling studies represent a wide range of modeling analyses which cover various models, model configurations, domains, years and/or episodes, chemical mechanisms, and aerosol modules.

There are various statistical metrics available and used by the scientific community for model performance evaluation. The principal evaluation statistics used to evaluate CMAQ performance were two bias metrics, normalized mean bias and fractional bias; and two error metrics, normalized mean error and fractional error. Normalized mean bias (NMB) is used as a normalization to facilitate a range of concentration magnitudes. This statistic averages the difference (model - observed) over the sum of observed values. NMB is a useful model performance indicator because it avoids over inflating the observed range of values, especially at low concentrations. Normalized mean bias is defined as:

$$\text{NMB} = \frac{\sum_{1}^{n}(P - O)}{\sum_{1}^{n}(O)} * 100$$, where P = predicted concentrations and O = observed

Normalized mean error (NME) is also similar to NMB, where the performance statistic is used as a normalization of the mean error. NME calculates the absolute value of the difference (model - observed) over the sum of observed values. Normalized mean error is defined as:

$$\text{NME} = \frac{\sum_{1}^{n}|P - O|}{\sum_{1}^{n}(O)} * 100$$, where P = predicted concentrations and O = observed

Fractional bias is defined as:

$$\text{FB} = \frac{1}{n}\left(\frac{\sum_{1}^{n}(P - O)}{\sum_{1}^{n}\left(\frac{(P + O)}{2}\right)}\right) * 100$$, where P = predicted concentrations and O = observed

FB is a useful model performance indicator because it has the advantage of equally weighting positive and negative bias estimates. The single largest disadvantage in this estimate of model performance is that the estimated concentration (i.e., prediction, P) is found in both the numerator and denominator.

Fractional error (FE) is similar to fractional bias except the absolute value of the difference is used so that the error is always positive. Fractional error is defined as:

$$\text{FE} = \frac{1}{n}\left(\frac{\sum_{1}^{n}|P-O|}{\sum_{1}^{n}\left(\frac{(P+O)}{2}\right)}\right)$$ *100, where P = predicted concentrations and O = observed

Overall, the bias and error statistics shown in Table II-4 below indicate that the base case model ozone and $PM_{2.5}$ concentrations are within the range or close to that found in recent OAQPS applications. The CMAQ model performance results give us confidence that our applications of CMAQ using this 2002 modeling platform provide a scientifically credible approach for assessing ozone and $PM_{2.5}$ concentrations for the purposes of the final Locomotive/Marine rule. A detailed summary of the CMAQ model performance evaluation is available in the docket for this rulemaking.[22] A summary of the $PM_{2.5}$ and ozone evaluation is presented here.

1. $PM_{2.5}$: The $PM_{2.5}$ evaluation focuses on $PM_{2.5}$ total mass and its components including sulfate (SO_4), nitrate (NO_3), total nitrate (TNO_3=NO_3+HNO_3), ammonium (NH_4), elemental carbon (EC), and organic carbon (OC). The $PM_{2.5}$ performance statistics were calculated for each month and season individually and for the entire year, as a whole. Seasons were defined as: winter (December-January-February), spring (March-April-May), summer (June-July-August), and fall (September-October-November). $PM_{2.5}$ ambient measurements for 2002 were obtained from the following networks for model evaluation: **S**peciation **T**rends **N**etwork (STN- total of 199 sites), **I**nteragency **M**onitoring of **PRO**tected **V**isual **E**nvironments (IMPROVE- total of 150), and **C**lean **A**ir **S**tatus and **T**rends **Net**work (CASTNet- total of 83). For $PM_{2.5}$ species that are measured by more than one network, we calculated separate sets of statistics for each network. For brevity, Table II-4 provides annual model performance statistics for $PM_{2.5}$ and its component species for the 12-km Eastern domain, 12-km Western domain, and five subregions defined above (Midwest, Northeast, Southeast, Central, and West U.S.).

Table II-4. Summary of 2002 CMAQ annual $PM_{2.5}$ species model performance statistics.

CMAQ 2002 Annual			No. of Obs.	NMB (%)	NME (%)	FB (%)	FE (%)
$PM_{2.5}$ Total Mass	STN	12-km EUS	10307	10.8	42.8	5.4	42.6
		12-km WUS	3000	-5.8	46.9	-3.1	45.0

[22] Technical Support Document: 2002 CMAQ Model Performance Evaluation for Ozone and Particulate Matter, January 2008. This file is available in the docket for this rulemaking.

		Northeast	1516	14.9	35.6	13.2	34.4
		Midwest	2780	20.5	48.2	16.6	42.6
		Southeast	2554	-3.9	36.0	-10.0	39.7
		Central	2738	14.5	49.1	6.0	49.4
		West	2487	-7.4	46.8	-4.5	44.8
	IMPROVE	12-km EUS	8436	-2.3	49.0	-5.7	51.4
		12-km WUS	10123	-26.4	53.5	-26.3	57.5
		Northeast	592	8.6	41.5	2.4	41.0
		Midwest	2060	21.0	59.4	17.4	51.6
		Southeast	1803	-13.1	41.2	-19.8	49.9
		Central	1624	-13.1	49.4	-17.6	57.0
		West	9543	-27.8	53.1	-27.1	57.2
Sulfate	STN	12-km EUS	10157	-3.9	33.6	-9.7	38.4
		12-km WUS	2926	-20.6	41.9	-12.2	43.5
		Northeast	1487	3.6	34.9	-2.9	36.2
		Midwest	2730	-4.3	29.1	-8.8	33.6
		Southeast	2541	-7.6	33.4	-16.3	38.8
		Central	2686	-3.2	39.2	-7.2	44.3
		West	2446	-26.1	44.9	-15.8	44.8
	IMPROVE	12-km EUS	8532	-10.8	33.0	-7.2	40.6
		12-km WUS	10232	-7.5	42.4	7.6	45.7
		Northeast	597	-4.9	29.9	-10.0	35.7
		Midwest	2070	-12.3	30.1	-9.9	36.1
		Southeast	1805	-9.5	32.9	-16.8	40.5
		Central	1671	-16.1	35.0	-16.0	42.4
		West	9645	-5.5	43.5	8.6	45.9
	CASTNet	12-km EUS	3173	-11.3	20.5	-16.3	26.1
		12-km WUS	1158	-21.3	34.6	-11.2	35.9
		Northeast	663	-8.3	19.3	-16.3	24.3
		Midwest	839	-12.3	17.9	-15.6	21.6
		Southeast	1085	-11.2	21.5	-17.8	27.2
		Central	229	-20.7	27.3	-27.4	33.6
		West	1118	-20.4	35.3	-10.7	36.1
Nitrate	STN	12-km EUS	8770	18.3	65.9	-29.1	84.5
		12-km WUS	2726	-45.0	63.1	-70.6	95.0
		Northeast	1488	17.4	59.1	-5.0	67.3
		Midwest	2731	32.7	70.4	-10.9	78.1
		Southeast	2540	8.6	84.6	-64.7	107.5
		Central	1298	12.7	52.5	-13.4	69.1
		West	2446	-47.5	62.8	-73.8	95.4
	IMPROVE	12-km EUS	8514	48.4	106.8	-52.8	116.4
		12-km WUS	10110	-34.8	80.67	-101.0	130.0

		Northeast	597	43.0	86.0	-37.0	102.8
		Midwest	2069	122.2	153.8	3.5	107.5
		Southeast	1803	33.5	112.2	-78.5	130.8
		Central	1672	18.1	81.0	-59.6	114.1
		West	9522	-39.6	81.1	-104.0	131.1
Total Nitrate (NO_3+HNO_3)	CASTNet	12-km EUS	3171	24.4	37.3	16.8	35.1
		12-km WUS	1157	-19.5	44.2	-12.0	46.0
		Northeast	662	20.5	29.4	16.3	25.3
		Midwest	839	39.1	46.5	29.0	39.7
		Southeast	1085	22.9	39.5	15.8	37.2
		Central	229	6.2	35.6	0.6	36.2
		West	1117	-20.4	45.8	-12.1	46.6
Ammonium	STN	12-km EUS	10157	11.9	40.6	14.4	45.2
		12-km WUS	2926	-23.6	55.7	7.2	58.1
		Northeast	1488	16.0	39.6	21.8	42.8
		Midwest	2731	12.3	38.4	19.2	42.4
		Southeast	2540	7.3	38.4	6.0	41.8
		Central	2685	15.0	46.6	14.3	52.1
		West	2446	-30.6	56.7	2.9	59.7
	CASTNet	12-km EUS	3166	5.3	30.8	2.7	31.6
		12-km WUS	1156	-16.8	42.5	-13.0	41.1
		Northeast	661	15.3	27.6	13.6	25.2
		Midwest	837	9.8	34.7	11.9	33.9
		Southeast	1085	-7.7	30.1	-9.7	33.6
		Central	229	7.4	33.1	3.0	35.6
		West	1116	-21.1	43.5	-14.4	41.4
Elemental Carbon	STN	12-km EUS	10031	45.0	78.9	22.1	56.9
		12-km WUS	2975	43.1	82.6	18.2	61.3
		Northeast	1498	37.1	58.9	24.5	48.3
		Midwest	2744	53.1	76.7	26.3	54.7
		Southeast	2506	16.9	66.0	7.2	51.7
		Central	2570	91.7	118.0	41.0	68.1
		West	2475	49.0	86.2	17.1	62.7
	IMPROVE	12-km EUS	8282	-15.0	49.2	-23.4	52.8
		12-km WUS	10069	-14.1	67.2	-29.5	62.1
		Northeast	599	-22.6	37.5	-27.4	46.5
		Midwest	2056	11.6	57.5	0.5	50.8
		Southeast	1795	-32.4	44.6	-42.0	55.6
		Central	1532	-24.3	47.6	-29.8	55.9
		West	9493	-15.5	67.8	-31.3	62.7
Organic Carbon	STN	12-km EUS	9726	-39.9	58.0	-41.1	70.5
		12-km WUS	2903	-37.6	60.3	-40.4	69.3

		Northeast	1447	-45.2	60.9	-41.6	73.1
		Midwest	2641	-26.5	61.7	-19.7	67.6
		Southeast	2474	-47.4	55.3	-53.7	70.7
		Central	2504	-43.6	54.0	-51.3	69.7
		West	2408	-36.3	61.4	-37.9	70.2
	IMPROVE	12-km EUS	8287	-32.4	60.5	-37.1	67.9
		12-km WUS	10082	-34.8	60.0	-31.2	63.0
		Northeast	598	-42.4	54.8	-40.2	63.8
		Midwest	2057	-6.4	68.2	-0.7	60.8
		Southeast	1800	-46.1	58.4	-69.7	81.3
		Central	1531	-47.9	61.6	-61.2	79.6
		West	9508	-34.5	59.6	-29.7	61.9

2. Ozone: The ozone evaluation focuses on the observed and predicted hourly ozone concentrations and eight-hour daily maximum ozone concentrations using a (observation) threshold of 40 ppb. This ozone model performance was limited to the period used in the calculation of projected design values within the analysis, that is: May, June, July, August, and September. Ozone ambient measurements for 2002 were obtained from the Air Quality System (AQS) Aerometric Information Retrieval System (AIRS). A total of 1178 ozone measurement sites were included for evaluation. These ozone data were measured and reported on an hourly basis.

Table II-5 and II-6 provide hourly and eight-hour daily maximum ozone model performance statistics, respectively, for the 12-km Eastern and Western U.S. domain and the five subregions. Generally, hourly and eight-hour ozone model performance are under-predicted in both the 12-km EUS and WUS when applying a threshold of 40 ppb for the modeled ozone season (May-September). For the 12-km EUS and WUS domain, the bias and error statistics are comparable for the aggregate of the ozone season and for each individual ozone month modeled.

Table II-5. Summary of CMAQ 2002 hourly ozone model performance statistics

CMAQ 2002 Hourly Ozone: Threshold of 40 ppb		No. of Obs.	NMB (%)	NME (%)	FB (%)	FE (%)
May	12-km EUS	241185	-0.7	15.9	-2.0	17.1
	12-km WUS	124931	-3.7	15.9	-5.0	17.3
	Northeast	51055	1.2	17.1	-0.3	18.2
	Midwest	55859	3.3	16.2	2.4	16.9
	Southeast	69073	-2.5	14.1	-3.1	14.8
	Central	41728	-6.4	17.3	-9.2	20.3
	West	111385	-3.9	16.1	-5.2	17.6
June	12-km EUS	256263	-7.5	16.8	-9.0	18.6
	12-km WUS	125662	-8.4	17.7	-9.3	19.1
	Northeast	61354	-8.5	17.3	-9.9	19.1

	Midwest	54515	-7.2	17.9	-8.3	19.6
	Southeast	67867	-7.2	15.3	-7.6	16.3
	Central	46026	-10.0	17.5	-13.5	21.2
	West	109157	-8.8	18.2	-9.9	19.7
July	12-km EUS	257076	-5.3	17.7	-6.6	19.2
	12-km WUS	116785	-12.0	21.5	-14.9	24.3
	Northeast	66774	-3.9	17.0	-4.8	18.0
	Midwest	59360	-10.5	19.4	-12.3	21.7
	Southeast	68619	-3.6	16.5	-3.9	17.2
	Central	36021	-3.6	18.7	-6.3	21.1
	West	104321	-13.6	21.8	-16.8	24.9
August	12-km EUS	235090	-8.7	17.8	-10.2	19.7
	12-km WUS	125575	-7.9	20.1	-10.2	22.1
	Northeast	53837	-6.4	16.7	-7.4	18.0
	Midwest	54179	-10.8	19.1	-12.4	21.4
	Southeast	62506	-9.4	17.3	-9.9	18.5
	Central	41456	-9.3	18.7	-12.8	22.4
	West	110225	-8.5	20.6	-11.1	22.8
September	12-km EUS	179156	-9.9	17.2	-11.8	19.5
	12-km WUS	99710	-10.7	19.0	-12.7	21.1
	Northeast	44678	-8.7	16.3	-10.6	18.4
	Midwest	34285	-11.4	18.5	-12.9	20.4
	Southeast	41627	-8.2	16.5	-9.0	17.8
	Central	41549	-12.8	18.8	-16.6	22.8
	West	83921	-11.7	20.0	-13.8	22.1
Seasonal Aggregate	12-km EUS	1168770	-6.4	17.1	-7.7	18.8
	12-km WUS	592663	-8.4	18.8	-10.3	20.7
	Northeast	277698	-5.4	16.9	-6.5	18.4
	Midwest	258198	-7.3	18.3	-8.4	20.0
	Southeast	309692	-6.0	15.9	-6.4	16.8
	Central U	206780	-8.6	18.2	-11.9	21.6
	West	519009	-9.2	19.3	-11.2	21.3

Table II-6. Summary of CMAQ 2002 eight-hour daily maximum ozone model performance statistics.

CMAQ 2002 Eight-Hour Maximum Ozone: Threshold of 40 ppb		**No. of Obs.**	**NMB (%)**	**NME (%)**	**FB (%)**	**FE (%)**
May	12-km EUS	19172	3.9	12.7	4.3	12.6
	12-km WUS	9223	0.2	12.6	0.6	12.8
	Northeast	4255	6.7	14.3	6.8	14.2
	Midwest	4198	7.8	13.7	8.2	13.5
	Southeast	5470	0.6	10.9	1.1	11.0

	Central	3379	0.3	12.3	0.7	12.4
	West	8155	-0.1	12.8	0.3	12.9
June	12-km EUS	19462	-3.9	12.3	-3.3	12.4
	12-km WUS	9029	-4.9	14.1	-4.2	14.2
	Northeast	4608	-5.3	12.5	-4.7	12.7
	Midwest	4104	-3.2	12.7	-2.2	12.8
	Southeast	5110	-4.8	11.8	-4.1	11.9
	Central	3603	-4.5	12.2	-4.4	12.7
	West	7818	-5.3	14.5	-4.7	14.7
July	12-km EUS	20565	-1.6	13.5	-1.0	13.6
	12-km WUS	8809	-7.4	17.1	-8.1	18.0
	Northeast	5380	-0.7	13.0	-0.2	12.9
	Midwest	4368	-6.5	14.2	-5.8	14.4
	Southeast	5633	-0.9	13.0	-0.1	13.0
	Central	3114	1.3	14.4	1.2	14.7
	West	7784	-9.0	17.2	-9.9	18.2
August	12-km EUS	19260	-5.1	13.2	-4.4	13.4
	12-km WUS	9551	-2.8	15.8	-3.1	16.1
	Northeast	4667	-2.9	12.4	-2.2	12.4
	Midwest	4012	-8.1	13.9	-7.5	14.2
	Southeast	5067	-6.4	13.4	-5.4	13.4
	Central	3543	-4.0	13.5	-3.9	14.1
	West	8311	-3.2	16.1	-3.6	16.5
September	12-km EUS	15865	-6.2	12.6	-5.9	12.9
	12-km WUS	8185	-6.7	15.0	-6.9	15.5
	Northeast	4074	-6.0	11.8	-6.0	12.3
	Midwest	3120	-7.2	13.3	-6.5	13.3
	Southeast	3671	-4.5	12.6	-3.8	12.7
	Central	3492	-8.5	13.8	-8.7	14.5
	West	6911	-7.3	15.9	-7.6	16.4
Seasonal Aggregate	12-km EUS	94324	-2.6	12.9	-1.9	13.0
	12-km WUS	44797	-4.3	14.9	-4.2	15.3
	Northeast	22984	-1.9	12.8	-1.2	12.9
	Midwest	19802	-3.6	13.6	-2.5	13.7
	Southeast	24951	-3.1	12.4	-2.3	12.4
	Central	17131	-3.3	13.2	-3.1	13.7
	West	38979	-4.9	15.3	-5.0	15.7

F. CMAQ Locomotive/Marine Modeling Scenarios

The CMAQ modeling system was used to calculate annual $PM_{2.5}$ concentrations, daily 8-hour ozone concentrations, and visibility estimates for each of the following seven emissions scenarios:

1) 2002 base case
2) 2020 future baseline
3) 2020 future control case – locomotive and marine controls
4) 2020 future control case – marine controls only
5) 2030 future baseline
6) 2030 future control case – locomotive and marine controls
7) 2030 future control case – marine controls only

Model predictions are used in a relative sense to estimate scenario-specific, future-year design values of $PM_{2.5}$ and ozone. This is done by calculating the simulated air quality ratios between any particular future year simulation and the 2002 base. These predicted change ratios are then applied to ambient base year design values. The design value projection methodology used in this analysis followed EPA guidance for such analyses[23] We used the 5-year weighted average 2000-2004 design values as the starting point for the projections. Additionally, the raw model outputs are also used in a relative sense for creating inputs to the health and welfare impact functions of the benefits analysis.

III. CMAQ Model Results

A. Impacts of Locomotive/Marine Rule on Future $PM_{2.5}$ Annual Averages

This section summarizes the results of our modeling of $PM_{2.5}$ air quality impacts in the future due to the reductions in locomotive and commercial marine diesel emissions. Appendix A contains annual average $PM_{2.5}$ design values by county for each modeling scenario. The modeling results indicate that the emissions reductions from this rule will contribute to lower ambient $PM_{2.5}$ levels in future years. Tables III-1 and III-2 show the projected improvements in average annual $PM_{2.5}$ design values, for various years as a result of the Locomotive/Marine control scenarios discussed in Section II.F.

[23] U.S. EPA, Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS; EPA-454/R-05-002; Research Triangle Park, NC; October 2005.

Table III-1. Model-projected change in annual average $PM_{2.5}$ design values resulting from the Locomotive/Marine modeling scenarios for several categories of counties. Units are $\mu g/m^3$.

Average change	2020 marine controls only	2020 locomotive and marine controls	2030 marine controls only	2030 locomotive and marine controls
Average change in all counties	-0.02	-0.04	-0.04	-0.08
Average change in counties whose base year design value is above the NAAQS	-0.03	-0.06	-0.05	-0.11
Average change in counties whose base year design value is within 10% of the NAAQS	-0.03	-0.06	-0.06	-0.12
Average change in counties whose projection year design value is above the NAAQS	-0.06	-0.10	-0.14	-0.22
Average change in counties whose projection year design value is within 10% of the NAAQS	-0.04	-0.09	-0.09	-0.18

Table III-2. Model-projected, population-weighted, change in annual average $PM_{2.5}$ design values resulting from the Locomotive/Marine modeling scenarios for several categories of counties. Units are $\mu g/m^3$.

Average change	2020 marine controls only	2020 locomotive and marine controls	2030 marine controls only	2030 locomotive and marine controls
Average change in all counties	-0.03	-0.06	-0.08	-0.12
Average change in counties whose base year design value is above the NAAQS	-0.05	-0.08	-0.11	-0.16
Average change in counties whose base year design value is within 10% of the NAAQS	-0.04	-0.08	-0.10	-0.16
Average change in counties whose projection year design value is above the NAAQS	-0.07	-0.11	-0.16	-0.21
Average change in counties whose projection year design value is within 10% of the NAAQS	-0.05	-0.09	-0.12	-0.18

The modeling projects that 11 counties will have design values greater than 15.0 $\mu g/m^3$ in 2020 and 2030. Over 24 million people are projected to live in a $PM_{2.5}$ nonattainment county in the future. The controls from the final Locomotive/Marine rule modeling are enough to bring one of those counties (Merced Co., CA) into attainment by 2030. As can be seen from Table III-1, the final Locomotive/Marine rule controls will lower $PM_{2.5}$ concentrations on average by 0.04 $\mu g/m^3$ in 2020 and 0.08 $\mu g/m^3$ in 2030. Greater improvements in $PM_{2.5}$ air quality are projected in areas where present-day and future-projected $PM_{2.5}$ levels are above or near the NAAQS. For instance, when considering only those counties whose future year design values are projected to exceed the NAAQS, the average improvement resulting from this rule is 0.10 $\mu g/m^3$ in 2020 and 0.22 $\mu g/m^3$ in 2030. Additionally, as shown in Table III-2, the improvements resulting from the rule are larger when population-weighted. The greatest impacts from the final

Locomotive/Marine rule emissions reductions tend to occur in areas with high populations. The largest reduction in annual average $PM_{2.5}$ occurs in Houston TX (Harris Co.) where the rule is projected to result in a 0.38 $\mu g/m^3$ improvement in 2020 and 0.81 $\mu g/m^3$ in 2030. The largest reduction in an area that is projected to exceed the $PM_{2.5}$ NAAQS in 2020 and 2030 is in the Los Angeles region (Riverside Co.) where the annual average $PM_{2.5}$ design value is projected to drop from 22.67 to 22.48 $\mu g/m^3$ in 2020, and 22.54 to 22.13 $\mu g/m^3$ in 2030 as a result of the final Locomotive/Marine rule. The modeling indicated that both the locomotive and marine components of the rule improved $PM_{2.5}$ air quality relatively equally.

Figures III-1 through III-4 display the projected county-level, annual $PM_{2.5}$ design value changes expected from various locomotive/marine control scenarios and years associated with this rule. The largest impacts tend to be in areas near water, where commercial marine source contributions can be large.

Figure III-1. Model-projected change in annual $PM_{2.5}$ design values from the Locomotive/Marine control scenario in 2020. Units are $\mu g/m^3$.

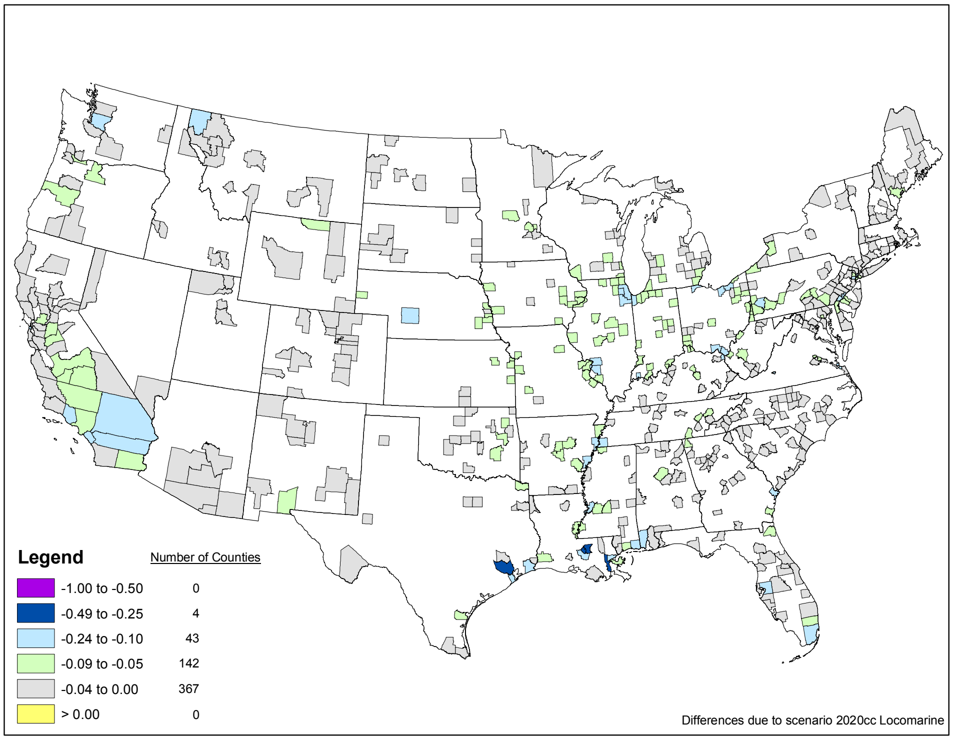


Figure III-2. Model-projected change in annual $PM_{2.5}$ design values from the Marine-only control scenario in 2020. Units are $\mu g/m^3$.

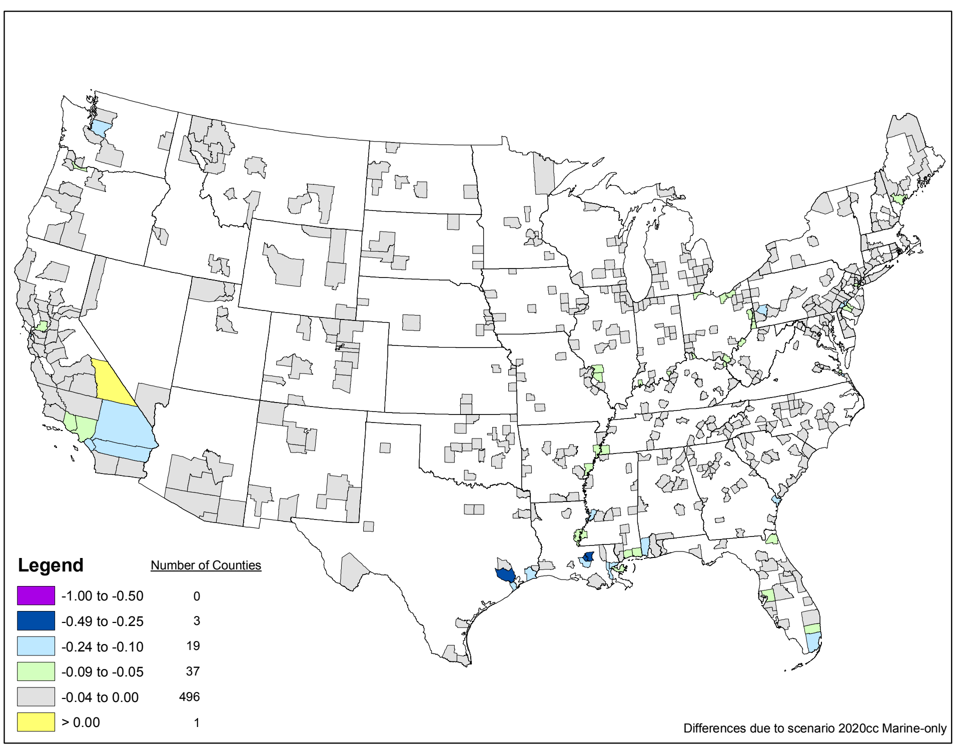


Figure III-3. Model-projected change in annual $PM_{2.5}$ design values from the Locomotive/Marine control scenario in 2030. Units are µg/m^3.

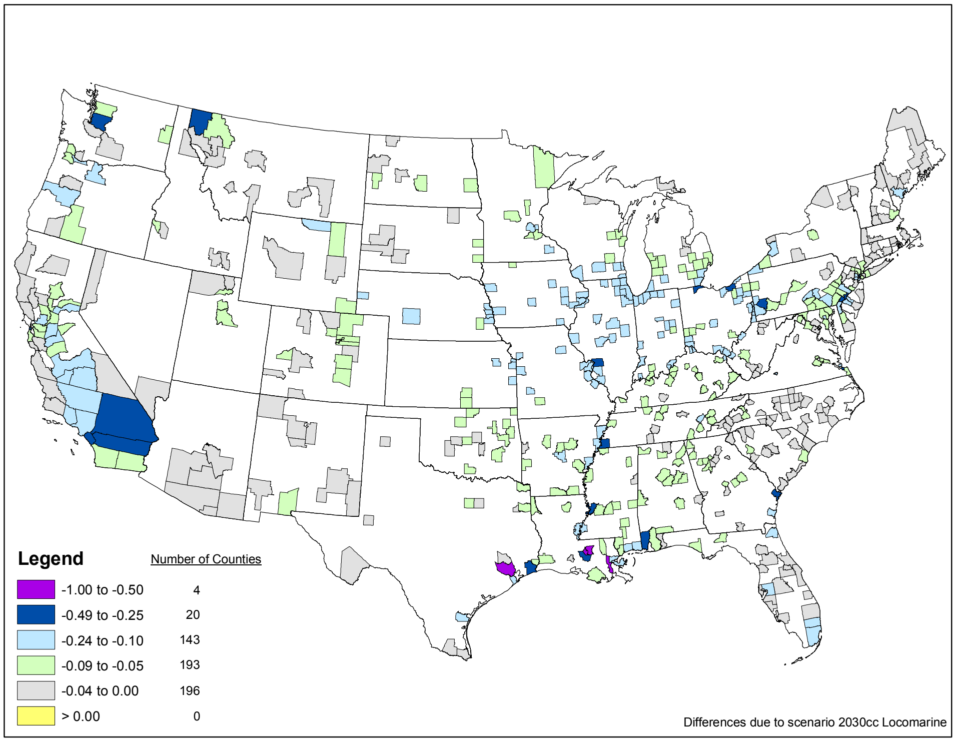
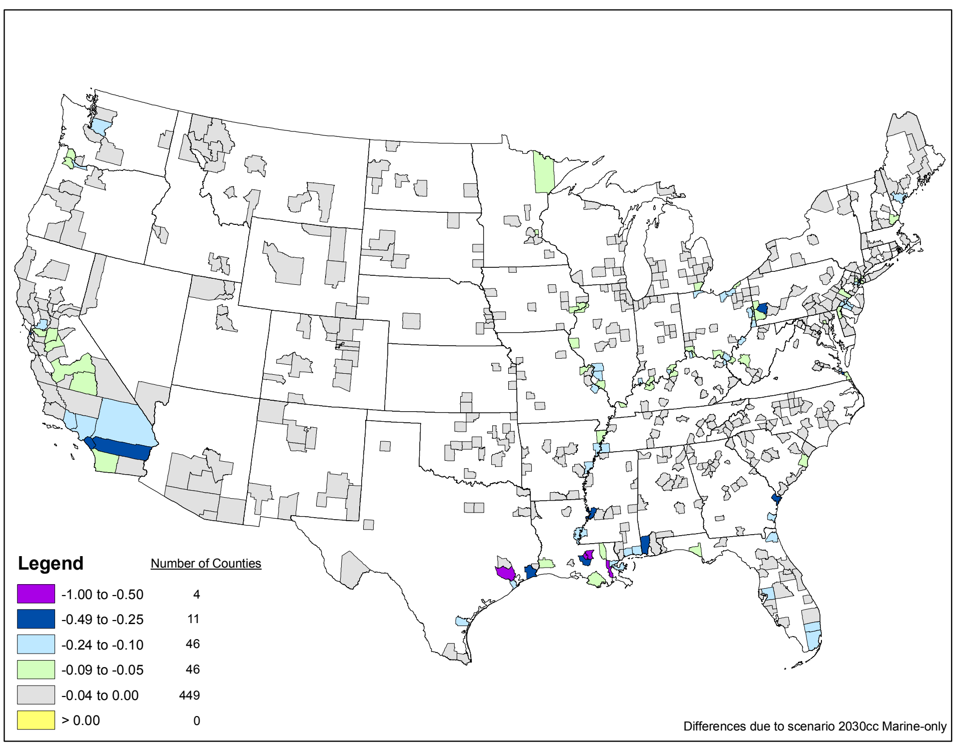


Figure III-4. Model-projected change in annual $PM_{2.5}$ design values from the Marine-only control scenario in 2030. Units are µg/m^3.



B. Impacts of the Locomotive/Marine Rule on Future 8-Hour Ozone Levels

This section summarizes the results of our modeling of ozone air quality impacts in the future due to the reductions in locomotive and commercial marine diesel emissions. Appendix B contains 8-hour ozone design values by county for each modeling scenario. The modeling results indicate that the emissions reductions from this rule will contribute to lower ambient 8-hour ozone design values in future years. Tables III-3 and III-4 show the projected improvements in average 8-hour ozone design values, for various years as a result of the four Locomotive/Marine control scenarios.

Table III-3. Model-projected change in average 8-hour ozone design values resulting from the Locomotive/Marine modeling scenarios for several categories of counties. Units are ppb.

Average change	2020 marine controls only	2020 locomotive and marine controls	2030 marine controls only	2030 locomotive and marine controls
Average change in all counties	-0.23	-0.45	-0.51	-1.15
Average change in counties whose base year design value is above the NAAQS	-0.22	-0.45	-0.51	-1.18
Average change in counties whose base year design value is within 10% of the NAAQS	-0.23	-0.46	-0.53	-1.18
Average change in counties whose projection year design value is above the NAAQS	0.00	-0.19	0.00	-0.50
Average change in counties whose projection year design value is within 10% of the NAAQS	-0.20	-0.41	-0.65	-1.24

Table III-4. Model-projected, population-weighted, change in average 8-hour ozone design values resulting from the Locomotive/Marine modeling scenarios for several categories of counties. Units are ppb.

Average change	2020 marine controls only	2020 locomotive and marine controls	2030 marine controls only	2030 locomotive and marine controls
Average change in all counties	-0.12	-0.30	-0.32	-0.85
Average change in counties whose base year design value is above the NAAQS	-0.09	-0.27	-0.26	-0.78
Average change in counties whose base year design value is within 10% of the NAAQS	-0.12	-0.31	-0.32	-0.86
Average change in counties whose projection year design value is above the NAAQS	-0.01	-0.13	-0.24	-0.62
Average change in counties whose projection year design value is within 10% of the NAAQS	+0.05	-0.08	-0.42	-0.79

The modeling projects that 9 counties will have design values greater than 0.08 ppm in 2020 and 6 counties will exceed that level in 2030. Based on this modeling, over 22 million people are projected to live in a ozone nonattainment county in 2020. The controls from the final Locomotive/Marine rule modeling are enough to bring one of those counties (Kenosha Co., WI) into attainment by 2020. Further, two of the nine counties will be at least 10 percent closer to a design value of less than 85 ppb, and on average all nine counties will be about 18 percent closer to a design value of less than 85 ppb (including Kenosha Co., WI).

As can be seen from Table III-3, the final Locomotive/Marine rule controls will lower ozone design values on average by 0.30 ppb in 2020 and 0.85 ppb in 2030. Unlike $PM_{2.5}$, there are instances in which the final Locomotive/Marine rule controls are projected to increase ozone levels. As a result of where these "disbenefit" areas are located, the improvements resulting from the rule are smaller when population-weighted. The largest increase in a county-level 8-hour ozone design values occurs in the Los Angeles area (Orange Co.) where the rule is projected to result in an increase of 2.6 ppb in 2020 and 5.5 ppb in 2030. This increase is highly localized. The county with the second largest increase from the rule is Riverside Co. CA which is projected to have an 0.5 ppb increase from the rule in 2030. The largest county-level decrease resulting from the rule is north of the Los Angeles area (Santa Barbara Co.) where ozone levels are projected to drop by 1.8 and 4.6 ppb, respectively, in 2020 and 2030. Again, the modeling indicated that both the locomotive and marine components of the rule improved air quality relatively equally, but it was the marine reductions that tended to lead to the "disbenefit" regions.

Figures III-5 through III-8 display the projected county-level, 8-hour ozone design value changes expected from the final Locomotive/Marine rule control scenarios. The largest impacts tend to be in areas near water, where commercial marine source contributions can be large.

Figure III-5. Model-projected change in annual 8-hour ozone design values from the Locomotive/Marine control scenario in 2020. Units are ppb.

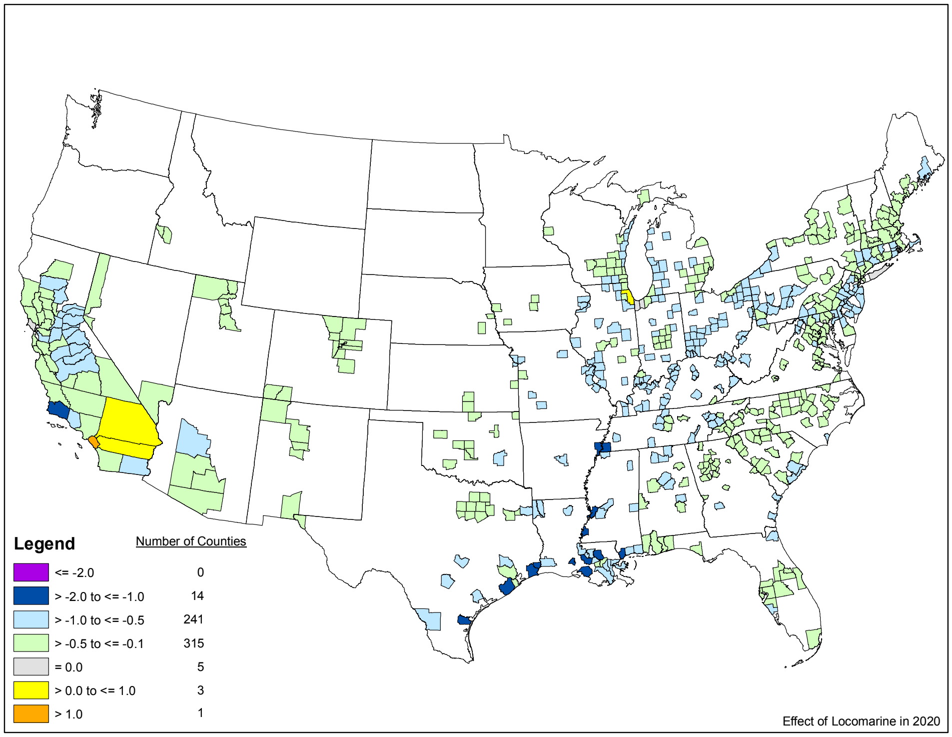


Figure III-6. Model-projected change in annual 8-hour ozone design values from the marine-only control scenario in 2020. Units are ppb.

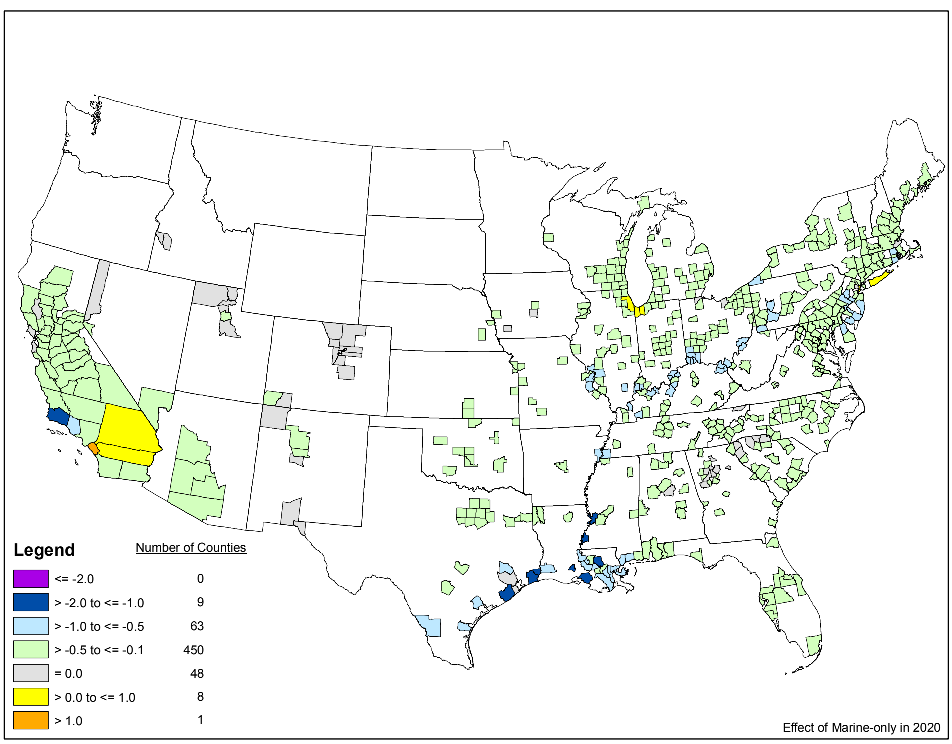


Figure III-7. Model-projected change in annual 8-hour ozone design values from the Locomotive/Marine control scenario in 2030. Units are ppb.

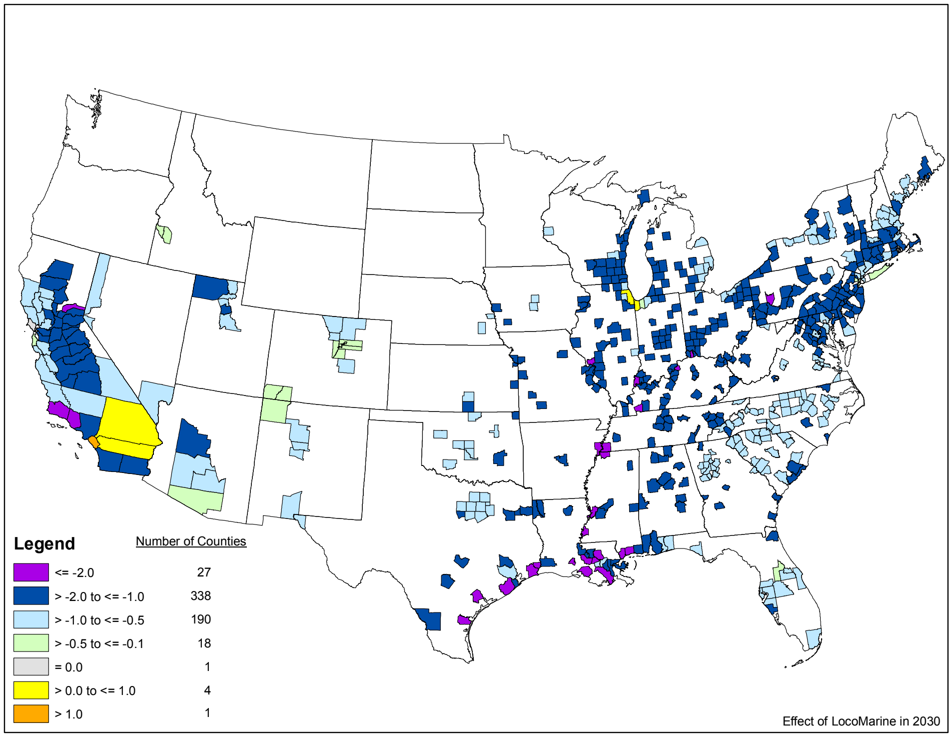
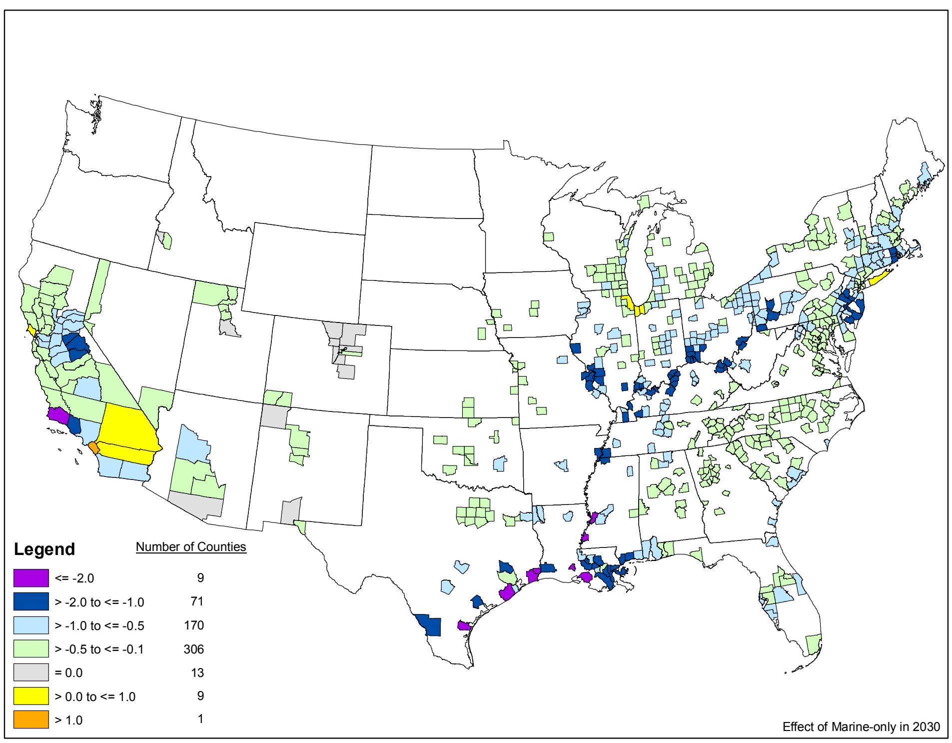


Figure III-8. Model-projected change in annual 8-hour ozone design values from the marine-only control scenario in 2030. Units are ppb.



C. Impacts of the Locomotive/Marine Rule on Visibility

The modeling conducted for the Locomotive/Marine rule was also used to project the impacts of the reductions on visibility conditions over 133 mandatory class I federal areas across the U.S. in 2020 and 2030. The results indicate that reductions in regional haze would occur in all 133 of these federal areas. The model projects that average visibility on the 20% worst days would improve by 0.02 deciviews.[24] The average deciview improvement on the 20% worst days is 0.06 in 2030. The greatest visibility improvement due to this rule would occur at the San Gorgonio Wilderness where a 0.24 deciview improvement is projected by 2030 as a result of the locomotive/marine controls in this rule. Appendix C contains the visibility results from the locomotive/marine scenario over the 133 Class 1 areas.

[24] The level of visibility impairment in an area is based on the light-extinction coefficient and a unit less visibility index, called a "deciview", which is used in the valuation of visibility. The deciview metric provides a scale for perceived visual changes over the entire range of conditions, from clear to hazy. Under many scenic conditions, the average person can generally perceive a change of one deciview. The higher the deciview value, the worse the visibility. Thus, an improvement in visibility is a decrease in deciview value.

Appendix A: Annual Average $PM_{2.5}$ Design Values for Locomotive/Marine Scenarios (units are $\mu g/m^3$)

State Name	County Name	Baseline DV	2020 Base	2020 Marine only	2020 Locomotive / Marine	2030 Base	2030 Marine only	2030 Locomotive / Marine
Alabama	Baldwin Co	11.38	9.14	9.13	9.12	9.19	9.15	9.14
Alabama	Clay Co	13.50	10.45	10.44	10.41	10.45	10.44	10.38
Alabama	Colbert Co	13.02	10.23	10.22	10.20	10.24	10.22	10.19
Alabama	DeKalb Co	14.86	11.21	11.20	11.18	11.20	11.19	11.15
Alabama	Escambia Co	12.82	10.48	10.47	10.46	10.50	10.48	10.44
Alabama	Etowah Co	15.69	12.02	12.01	11.98	11.99	11.98	11.92
Alabama	Jefferson Co	18.36	15.00	14.99	14.95	14.95	14.94	14.88
Alabama	Madison Co	14.20	10.74	10.74	10.72	10.75	10.73	10.71
Alabama	Mobile Co	12.80	10.72	10.58	10.56	10.95	10.64	10.62
Alabama	Montgomery Co	14.50	11.76	11.75	11.72	11.75	11.75	11.69
Alabama	Morgan Co	13.36	10.35	10.34	10.32	10.36	10.34	10.30
Alabama	Russell Co	16.04	13.15	13.14	13.13	13.14	13.13	13.10
Alabama	Shelby Co	14.50	11.36	11.36	11.32	11.38	11.37	11.31
Alabama	Sumter Co	12.26	9.78	9.77	9.75	9.81	9.78	9.74
Alabama	Talladega Co	14.96	11.48	11.48	11.44	11.47	11.46	11.38
Arizona	Cochise Co	6.97	6.60	6.60	6.60	6.61	6.61	6.60
Arizona	Gila Co	9.52	8.89	8.89	8.88	8.87	8.87	8.86
Arizona	Maricopa Co	11.45	10.30	10.30	10.29	10.31	10.31	10.28
Arizona	Pima Co	6.75	6.13	6.13	6.12	6.12	6.12	6.10
Arizona	Pinal Co	8.14	7.45	7.45	7.42	7.59	7.59	7.55
Arizona	Santa Cruz Co	11.74	11.24	11.24	11.23	11.27	11.27	11.27
Arkansas	Arkansas Co	12.13	10.08	10.06	10.03	10.09	10.06	10.00
Arkansas	Ashley Co	12.14	10.28	10.26	10.24	10.33	10.29	10.26
Arkansas	Crittenden Co	12.91	10.66	10.60	10.55	10.93	10.81	10.73
Arkansas	Faulkner Co	12.40	10.33	10.32	10.28	10.34	10.33	10.26
Arkansas	Mississippi Co	11.84	9.66	9.62	9.60	9.73	9.65	9.62
Arkansas	Phillips Co	12.16	10.20	10.12	10.10	10.38	10.19	10.17
Arkansas	Polk Co	11.08	9.02	9.02	9.00	9.04	9.02	8.99
Arkansas	Pope Co	12.23	10.13	10.12	10.10	10.12	10.11	10.06
Arkansas	Pulaski Co	14.12	11.63	11.61	11.55	11.60	11.57	11.46
Arkansas	Sebastian Co	12.33	10.33	10.33	10.31	10.33	10.32	10.29
Arkansas	Union Co	12.64	11.01	10.99	10.98	11.04	11.01	10.97
Arkansas	White Co	11.63	9.57	9.56	9.52	9.57	9.54	9.48
California	Alameda Co	11.76	10.77	10.75	10.73	10.68	10.64	10.60

California	Butte Co	13.69	11.84	11.83	11.80	11.76	11.75	11.69
California	Calaveras Co	8.85	7.83	7.82	7.80	7.84	7.82	7.79
California	Colusa Co	9.44	8.78	8.78	8.77	8.75	8.74	8.72
California	Contra Costa Co	11.32	10.53	10.50	10.49	10.57	10.50	10.48
California	Fresno Co	20.02	17.54	17.52	17.47	17.14	17.09	16.97
California	Humboldt Co	8.48	7.34	7.33	7.33	7.36	7.34	7.33
California	Imperial Co	14.44	13.92	13.91	13.87	13.97	13.95	13.88
California	Inyo Co	6.17	5.94	5.95	5.94	5.96	5.96	5.95
California	Kern Co	21.77	19.28	19.26	19.21	18.87	18.83	18.70
California	Kings Co	18.77	16.82	16.80	16.76	16.55	16.52	16.43
California	Lake Co	5.03	4.73	4.72	4.72	4.73	4.73	4.72
California	Los Angeles Co	23.16	20.69	20.64	20.61	20.86	20.75	20.72
California	Mendocino Co	8.00	7.22	7.21	7.21	7.20	7.19	7.18
California	Merced Co	16.47	15.15	15.14	15.11	15.11	15.08	15.02
California	Monterey Co	8.23	7.74	7.73	7.72	7.75	7.74	7.73
California	Nevada Co	7.97	7.25	7.25	7.23	7.31	7.31	7.26
California	Orange Co	18.27	15.73	15.60	15.58	15.93	15.68	15.65
California	Placer Co	11.65	10.21	10.20	10.17	10.07	10.04	9.97
California	Riverside Co	27.15	22.67	22.53	22.48	22.54	22.21	22.13
California	Sacramento Co	12.56	11.47	11.46	11.43	11.36	11.33	11.27
California	San Bernardino Co	24.63	21.79	21.69	21.66	21.97	21.75	21.71
California	San Diego Co	15.65	14.64	14.61	14.60	14.91	14.83	14.82
California	San Francisco Co	11.58	11.08	10.94	10.93	11.58	11.27	11.26
California	San Joaquin Co	14.84	13.58	13.54	13.51	13.57	13.48	13.41
California	San Luis Obispo Co	9.20	8.79	8.79	8.78	8.85	8.84	8.82
California	San Mateo Co	10.58	9.77	9.76	9.74	9.70	9.68	9.65
California	Santa Barbara Co	9.32	9.06	9.05	9.05	9.12	9.10	9.09
California	Santa Clara Co	11.33	10.10	10.09	10.08	9.95	9.93	9.91
California	Santa Cruz Co	8.17	7.38	7.38	7.37	7.30	7.29	7.28
California	Shasta Co	9.01	7.74	7.74	7.73	7.76	7.76	7.73
California	Solano Co	12.03	11.64	11.58	11.57	11.88	11.76	11.74
California	Sonoma Co	9.91	9.22	9.21	9.21	9.21	9.21	9.20
California	Stanislaus Co	16.49	14.57	14.54	14.50	14.30	14.23	14.13
California	Sutter Co	11.39	10.14	10.13	10.10	10.07	10.06	9.98
California	Tulare Co	21.33	18.71	18.69	18.64	18.24	18.19	18.07
California	Ventura Co	14.34	12.54	12.45	12.44	12.59	12.40	12.38
California	Yolo Co	10.04	9.11	9.10	9.08	8.99	8.97	8.92
Colorado	Adams Co	10.29	8.91	8.91	8.87	8.80	8.80	8.74

Colorado	Arapahoe Co	8.70	7.76	7.76	7.74	7.80	7.80	7.75
Colorado	Archuleta Co	5.99	5.55	5.55	5.55	5.54	5.54	5.54
Colorado	Boulder Co	9.27	8.20	8.19	8.17	8.19	8.19	8.14
Colorado	Delta Co	8.26	7.44	7.44	7.42	7.40	7.40	7.35
Colorado	Denver Co	10.58	9.22	9.22	9.19	9.12	9.11	9.06
Colorado	El Paso Co	7.86	7.16	7.16	7.14	7.14	7.14	7.09
Colorado	Elbert Co	4.33	3.92	3.92	3.91	3.98	3.98	3.95
Colorado	Gunnison Co	6.69	6.26	6.26	6.26	6.25	6.25	6.25
Colorado	Larimer Co	7.88	7.21	7.21	7.19	7.16	7.16	7.13
Colorado	Pueblo Co	7.79	7.16	7.16	7.13	7.16	7.16	7.11
Colorado	Routt Co	7.40	6.98	6.98	6.98	6.96	6.96	6.94
Colorado	San Miguel Co	5.33	4.99	4.99	4.99	4.98	4.98	4.97
Colorado	Weld Co	9.33	8.14	8.14	8.10	8.16	8.16	8.08
Connecticut	Fairfield Co	12.85	11.39	11.38	11.37	11.54	11.52	11.51
Connecticut	Hartford Co	11.50	9.84	9.84	9.84	9.86	9.85	9.85
Connecticut	New Haven Co	13.71	11.48	11.47	11.46	11.52	11.48	11.48
Connecticut	New London Co	11.57	9.60	9.60	9.60	9.66	9.65	9.64
Delaware	Kent Co	12.81	9.54	9.53	9.52	9.61	9.58	9.56
Delaware	New Castle Co	15.96	12.35	12.33	12.30	12.52	12.46	12.42
Delaware	Sussex Co	13.65	10.52	10.51	10.50	10.54	10.52	10.50
District of Columbia	District of Columbia	15.75	11.72	11.71	11.69	11.73	11.73	11.69
Florida	Alachua Co	10.12	7.71	7.71	7.71	7.70	7.70	7.69
Florida	Bay Co	11.04	9.01	8.98	8.98	9.03	8.98	8.97
Florida	Brevard Co	7.88	5.65	5.64	5.64	5.65	5.64	5.64
Florida	Broward Co	8.30	6.29	6.23	6.23	6.40	6.27	6.26
Florida	Citrus Co	9.13	6.73	6.73	6.72	6.73	6.72	6.72
Florida	Duval Co	10.64	8.49	8.43	8.43	8.62	8.49	8.48
Florida	Escambia Co	11.56	9.63	9.62	9.62	9.63	9.62	9.60
Florida	Hillsborough Co	11.25	8.40	8.31	8.30	8.57	8.38	8.37
Florida	Lee Co	8.42	6.10	6.10	6.10	6.08	6.08	6.08
Florida	Leon Co	12.67	10.19	10.18	10.16	10.13	10.12	10.08
Florida	Manatee Co	9.31	6.56	6.55	6.55	6.57	6.55	6.54
Florida	Marion Co	10.04	7.56	7.56	7.56	7.54	7.54	7.53
Florida	Miami-Dade Co	9.66	7.51	7.39	7.39	7.60	7.37	7.36
Florida	Orange Co	10.19	7.37	7.37	7.37	7.39	7.39	7.39
Florida	Palm Beach Co	7.54	5.75	5.75	5.75	5.80	5.79	5.79
Florida	Pinellas Co	10.46	7.84	7.83	7.82	7.84	7.83	7.82
Florida	Polk Co	10.36	7.49	7.49	7.49	7.52	7.51	7.50

Florida	Sarasota Co	9.28	6.70	6.70	6.70	6.69	6.68	6.68
Florida	Seminole Co	9.31	6.63	6.62	6.62	6.61	6.61	6.60
Florida	St. Lucie Co	8.61	6.26	6.26	6.26	6.26	6.26	6.25
Florida	Volusia Co	9.28	6.73	6.73	6.73	6.72	6.72	6.72
Georgia	Bibb Co	15.69	12.37	12.36	12.34	12.33	12.33	12.28
Georgia	Chatham Co	13.87	11.94	11.81	11.79	12.10	11.82	11.80
Georgia	Clarke Co	15.75	11.51	11.51	11.49	11.46	11.46	11.42
Georgia	Clayton Co	16.48	12.38	12.38	12.36	12.35	12.35	12.30
Georgia	Cobb Co	16.29	12.28	12.28	12.26	12.26	12.25	12.20
Georgia	DeKalb Co	16.22	12.43	12.43	12.42	12.48	12.48	12.45
Georgia	Dougherty Co	14.24	11.65	11.65	11.64	11.62	11.61	11.59
Georgia	Floyd Co	15.71	11.77	11.77	11.74	11.76	11.75	11.70
Georgia	Fulton Co	18.29	14.22	14.21	14.18	14.27	14.26	14.21
Georgia	Glynn Co	11.89	9.67	9.63	9.62	9.71	9.61	9.60
Georgia	Gwinnett Co	16.20	12.29	12.28	12.27	12.21	12.20	12.18
Georgia	Hall Co	15.14	11.71	11.71	11.69	11.70	11.70	11.67
Georgia	Houston Co	13.04	10.15	10.15	10.13	10.14	10.13	10.10
Georgia	Lowndes Co	12.14	9.85	9.85	9.83	9.82	9.82	9.78
Georgia	Muscogee Co	14.86	12.15	12.15	12.14	12.15	12.14	12.11
Georgia	Paulding Co	14.30	10.48	10.48	10.45	10.50	10.50	10.44
Georgia	Richmond Co	15.05	12.13	12.13	12.12	12.11	12.11	12.08
Georgia	Walker Co	15.44	11.79	11.77	11.74	11.79	11.76	11.71
Georgia	Washington Co	14.21	11.09	11.08	11.06	11.08	11.07	11.03
Georgia	Wilkinson Co	15.15	11.77	11.77	11.75	11.77	11.77	11.72
Idaho	Ada Co	9.17	8.56	8.55	8.54	8.53	8.52	8.49
Idaho	Bannock Co	8.56	8.31	8.31	8.29	8.30	8.30	8.27
Idaho	Canyon Co	9.26	8.31	8.31	8.28	8.22	8.22	8.15
Idaho	Power Co	9.82	9.53	9.53	9.51	9.52	9.52	9.48
Idaho	Shoshone Co	12.72	12.02	12.02	12.01	11.99	11.98	11.96
Illinois	Adams Co	12.88	10.63	10.61	10.54	10.58	10.53	10.41
Illinois	Champaign Co	12.56	10.26	10.25	10.21	10.21	10.19	10.11
Illinois	Cook Co	17.06	13.85	13.84	13.74	13.79	13.75	13.57
Illinois	DuPage Co	14.36	11.52	11.51	11.42	11.46	11.43	11.28
Illinois	Kane Co	13.93	11.27	11.26	11.18	11.19	11.16	11.03
Illinois	Lake Co	12.54	10.56	10.55	10.51	10.59	10.56	10.47
Illinois	Macon Co	13.87	11.29	11.28	11.23	11.23	11.21	11.11
Illinois	Madison Co	17.27	14.38	14.31	14.27	14.53	14.36	14.27
Illinois	McHenry Co	12.73	10.32	10.31	10.27	10.28	10.26	10.16

Illinois	McLean Co	13.41	10.80	10.79	10.74	10.73	10.70	10.61
Illinois	Peoria Co	13.83	11.35	11.33	11.29	11.27	11.23	11.15
Illinois	Randolph Co	12.41	9.78	9.76	9.71	9.78	9.73	9.65
Illinois	Rock Island Co	12.04	9.80	9.77	9.74	9.72	9.67	9.58
Illinois	Sangamon Co	13.14	10.65	10.63	10.60	10.55	10.52	10.44
Illinois	St. Clair Co	16.19	13.36	13.29	13.25	13.49	13.34	13.25
Illinois	Will Co	14.50	11.80	11.79	11.70	11.82	11.79	11.63
Illinois	Winnebago Co	12.87	10.56	10.55	10.51	10.44	10.42	10.33
Indiana	Allen Co	14.29	11.41	11.40	11.35	11.35	11.32	11.23
Indiana	Clark Co	16.33	12.96	12.92	12.91	13.13	13.05	13.02
Indiana	Delaware Co	14.34	11.08	11.06	11.03	11.02	10.99	10.91
Indiana	Dubois Co	15.84	12.46	12.44	12.41	12.45	12.41	12.37
Indiana	Elkhart Co	14.99	12.27	12.26	12.21	12.21	12.18	12.08
Indiana	Floyd Co	14.90	11.38	11.31	11.29	11.52	11.38	11.34
Indiana	Henry Co	13.26	10.08	10.07	10.04	10.04	10.01	9.95
Indiana	Howard Co	14.55	11.49	11.48	11.44	11.43	11.40	11.33
Indiana	Knox Co	13.75	10.60	10.58	10.54	10.58	10.54	10.46
Indiana	La Porte Co	13.25	10.88	10.86	10.80	10.86	10.82	10.70
Indiana	Lake Co	15.01	12.88	12.86	12.75	12.87	12.83	12.64
Indiana	Madison Co	14.54	11.21	11.20	11.16	11.15	11.12	11.05
Indiana	Marion Co	16.54	13.02	13.00	12.97	12.94	12.91	12.83
Indiana	Porter Co	13.75	11.48	11.46	11.39	11.51	11.47	11.34
Indiana	Spencer Co	14.02	10.67	10.64	10.62	10.69	10.63	10.60
Indiana	St. Joseph Co	14.08	11.43	11.42	11.37	11.38	11.35	11.26
Indiana	Vanderburgh Co	15.29	12.06	11.99	11.96	12.09	11.96	11.90
Indiana	Vigo Co	14.51	11.51	11.49	11.43	11.43	11.40	11.30
Iowa	Black Hawk Co	11.16	9.25	9.25	9.21	9.14	9.12	9.04
Iowa	Clinton Co	12.06	9.75	9.73	9.67	9.69	9.65	9.53
Iowa	Emmet Co	8.82	7.31	7.30	7.27	7.21	7.20	7.13
Iowa	Johnson Co	11.43	9.44	9.43	9.39	9.37	9.35	9.26
Iowa	Linn Co	11.00	9.15	9.14	9.08	9.07	9.05	8.93
Iowa	Muscatine Co	12.80	10.56	10.54	10.49	10.50	10.45	10.35
Iowa	Polk Co	10.52	8.60	8.60	8.56	8.47	8.46	8.37
Iowa	Pottawattamie Co	10.43	8.72	8.71	8.66	8.64	8.63	8.53
Iowa	Scott Co	12.33	10.00	9.97	9.93	9.92	9.87	9.78
Iowa	Van Buren Co	10.33	8.39	8.38	8.33	8.32	8.30	8.21
Iowa	Woodbury Co	10.07	8.46	8.46	8.41	8.38	8.38	8.28
Kansas	Johnson Co	11.54	9.59	9.59	9.53	9.52	9.51	9.41

Kansas	Linn Co	10.66	8.92	8.92	8.86	8.90	8.89	8.78
Kansas	Sedgwick Co	11.06	9.58	9.58	9.55	9.53	9.52	9.47
Kansas	Shawnee Co	10.86	9.17	9.17	9.11	9.07	9.07	8.95
Kansas	Sumner Co	10.19	8.79	8.79	8.76	8.79	8.78	8.72
Kansas	Wyandotte Co	13.55	11.42	11.41	11.33	11.51	11.48	11.32
Kentucky	Bell Co	14.64	10.97	10.97	10.94	10.97	10.96	10.92
Kentucky	Boyd Co	14.88	11.41	11.34	11.31	11.65	11.50	11.46
Kentucky	Bullitt Co	14.88	11.43	11.41	11.39	11.52	11.48	11.43
Kentucky	Campbell Co	14.00	10.24	10.19	10.15	10.31	10.22	10.15
Kentucky	Carter Co	12.18	8.84	8.83	8.80	8.89	8.85	8.81
Kentucky	Christian Co	13.47	10.47	10.46	10.44	10.49	10.46	10.43
Kentucky	Daviess Co	14.70	11.52	11.49	11.48	11.55	11.49	11.46
Kentucky	Fayette Co	15.60	11.94	11.93	11.89	11.72	11.70	11.64
Kentucky	Franklin Co	13.67	10.03	10.01	9.99	10.04	10.01	9.97
Kentucky	Hardin Co	13.97	10.50	10.48	10.46	10.51	10.49	10.45
Kentucky	Jefferson Co	16.58	13.65	13.62	13.61	13.92	13.87	13.84
Kentucky	Kenton Co	14.88	11.03	10.99	10.95	11.16	11.06	11.01
Kentucky	Laurel Co	12.20	8.89	8.88	8.85	8.88	8.87	8.81
Kentucky	Madison Co	13.53	9.86	9.85	9.81	9.93	9.91	9.84
Kentucky	McCracken Co	13.39	10.61	10.59	10.57	10.63	10.57	10.55
Kentucky	Perry Co	13.14	9.62	9.62	9.59	9.60	9.59	9.54
Kentucky	Pike Co	13.67	10.02	10.01	9.98	10.02	10.01	9.95
Kentucky	Warren Co	13.81	10.55	10.54	10.53	10.55	10.54	10.51
Louisiana	Caddo Parish	12.63	10.77	10.76	10.73	10.83	10.81	10.75
Louisiana	Calcasieu Parish	11.35	9.83	9.79	9.78	9.95	9.87	9.86
Louisiana	Concordia Parish	11.10	9.48	9.41	9.40	9.65	9.51	9.50
Louisiana	East Baton Rouge Parish	13.11	11.99	11.72	11.71	12.85	12.28	12.26
Louisiana	Iberville Parish	12.55	11.41	11.20	11.19	12.06	11.63	11.62
Louisiana	Jefferson Parish	12.17	10.32	10.08	10.07	10.87	10.37	10.35
Louisiana	Lafayette Parish	11.02	9.38	9.37	9.36	9.49	9.46	9.46
Louisiana	Orleans Parish	12.23	10.13	10.02	10.01	10.44	10.22	10.21
Louisiana	Ouachita Parish	11.46	9.80	9.79	9.76	9.84	9.81	9.77
Louisiana	St. Bernard Parish	10.69	8.74	8.66	8.65	8.94	8.76	8.74
Louisiana	Tangipahoa Parish	11.17	9.21	9.19	9.18	9.35	9.29	9.28
Louisiana	Terrebonne Parish	10.40	8.69	8.66	8.66	8.85	8.78	8.78
Louisiana	West Baton Rouge Parish	12.81	11.72	11.46	11.45	12.58	12.02	12.01
Maine	Androscoggin Co	10.73	9.40	9.40	9.40	9.38	9.38	9.38
Maine	Aroostook Co	11.29	10.60	10.59	10.59	10.59	10.59	10.59

Maine	Cumberland Co	11.59	10.27	10.21	10.20	10.43	10.30	10.30
Maine	Hancock Co	6.25	5.37	5.37	5.37	5.39	5.38	5.38
Maine	Kennebec Co	10.49	9.12	9.12	9.12	9.10	9.10	9.10
Maine	Oxford Co	10.13	8.99	8.99	8.99	8.98	8.97	8.97
Maine	Penobscot Co	10.06	8.71	8.71	8.71	8.73	8.72	8.72
Maryland	Anne Arundel Co	15.36	11.87	11.86	11.84	11.96	11.94	11.91
Maryland	Baltimore city	16.63	13.17	13.13	13.09	13.38	13.30	13.22
Maryland	Baltimore Co	15.01	11.15	11.14	11.11	11.19	11.17	11.13
Maryland	Harford Co	13.01	9.67	9.67	9.64	9.71	9.69	9.65
Maryland	Montgomery Co	12.82	9.39	9.38	9.37	9.39	9.38	9.35
Maryland	Washington Co	14.25	10.38	10.37	10.34	10.36	10.35	10.29
Massachusetts	Berkshire Co	11.72	10.46	10.45	10.44	10.46	10.45	10.43
Massachusetts	Hampden Co	13.30	11.59	11.59	11.58	11.60	11.59	11.58
Massachusetts	Plymouth Co	10.86	9.02	9.02	9.01	9.12	9.11	9.10
Massachusetts	Suffolk Co	13.68	11.79	11.77	11.76	11.83	11.79	11.78
Michigan	Allegan Co	12.29	10.14	10.13	10.10	10.15	10.12	10.06
Michigan	Bay Co	10.94	9.34	9.33	9.32	9.34	9.32	9.30
Michigan	Berrien Co	12.35	10.07	10.06	10.02	10.05	10.03	9.95
Michigan	Chippewa Co	8.09	7.45	7.44	7.44	7.49	7.49	7.48
Michigan	Genesee Co	12.37	10.29	10.29	10.26	10.23	10.22	10.18
Michigan	Ingham Co	13.13	10.77	10.76	10.73	10.75	10.73	10.67
Michigan	Kalamazoo Co	14.38	11.78	11.77	11.72	11.72	11.70	11.60
Michigan	Kent Co	13.55	10.95	10.94	10.90	10.84	10.82	10.75
Michigan	Macomb Co	13.13	10.68	10.67	10.65	10.67	10.65	10.60
Michigan	Monroe Co	14.99	11.74	11.70	11.65	11.78	11.71	11.60
Michigan	Muskegon Co	11.99	10.06	10.06	10.03	10.03	10.01	9.95
Michigan	Oakland Co	14.64	11.73	11.72	11.69	11.70	11.68	11.63
Michigan	Ottawa Co	13.14	10.73	10.72	10.69	10.67	10.65	10.58
Michigan	Saginaw Co	10.70	9.06	9.05	9.04	9.07	9.05	9.03
Michigan	St. Clair Co	13.77	11.65	11.64	11.62	11.68	11.66	11.62
Michigan	Washtenaw Co	14.39	11.31	11.30	11.27	11.30	11.27	11.21
Michigan	Wayne Co	19.32	16.60	16.59	16.55	16.59	16.56	16.49
Minnesota	Dakota Co	9.43	8.05	8.05	8.02	7.98	7.97	7.90
Minnesota	Hennepin Co	10.29	8.85	8.84	8.80	8.77	8.74	8.67
Minnesota	Mille Lacs Co	7.12	6.18	6.18	6.15	6.13	6.12	6.06
Minnesota	Olmsted Co	10.72	9.14	9.13	9.10	9.03	9.01	8.93
Minnesota	Ramsey Co	11.91	10.19	10.15	10.11	10.20	10.13	10.03
Minnesota	Scott Co	9.98	8.48	8.47	8.44	8.40	8.38	8.31

Minnesota	St. Louis Co	8.14	7.30	7.27	7.26	7.36	7.30	7.28
Minnesota	Stearns Co	9.21	7.93	7.92	7.88	7.86	7.85	7.77
Mississippi	Adams Co	11.20	9.34	9.29	9.28	9.49	9.38	9.37
Mississippi	Bolivar Co	12.56	10.74	10.72	10.71	10.79	10.75	10.73
Mississippi	DeSoto Co	12.60	10.23	10.22	10.18	10.34	10.32	10.25
Mississippi	Forrest Co	13.37	11.04	11.03	11.00	11.07	11.04	10.99
Mississippi	Hancock Co	10.34	8.33	8.32	8.30	8.42	8.39	8.36
Mississippi	Harrison Co	11.57	9.59	9.53	9.52	9.75	9.62	9.61
Mississippi	Hinds Co	13.38	11.19	11.18	11.14	11.22	11.20	11.14
Mississippi	Jackson Co	11.84	9.75	9.66	9.65	9.97	9.76	9.75
Mississippi	Jones Co	14.48	11.81	11.80	11.77	11.87	11.84	11.79
Mississippi	Lauderdale Co	13.16	10.57	10.57	10.54	10.60	10.59	10.54
Mississippi	Lee Co	12.48	9.98	9.97	9.95	9.99	9.97	9.94
Mississippi	Lowndes Co	13.36	10.75	10.74	10.73	10.75	10.74	10.71
Mississippi	Pearl River Co	11.70	9.59	9.57	9.55	9.66	9.62	9.58
Mississippi	Rankin Co	13.10	10.94	10.93	10.89	10.97	10.95	10.89
Mississippi	Scott Co	11.82	9.56	9.55	9.52	9.61	9.59	9.53
Mississippi	Warren Co	12.26	10.61	10.45	10.44	10.97	10.62	10.60
Missouri	Cass Co	11.22	9.33	9.33	9.26	9.31	9.30	9.17
Missouri	Cedar Co	11.45	9.38	9.37	9.33	9.35	9.33	9.25
Missouri	Clay Co	11.73	9.74	9.74	9.67	9.72	9.70	9.57
Missouri	Greene Co	12.11	10.08	10.08	10.04	10.04	10.03	9.96
Missouri	Jefferson Co	14.43	11.90	11.88	11.85	11.92	11.88	11.81
Missouri	Monroe Co	11.03	8.94	8.93	8.88	8.89	8.87	8.78
Missouri	St. Charles Co	14.08	11.43	11.40	11.36	11.46	11.39	11.31
Missouri	St. Louis city	15.16	12.45	12.38	12.34	12.57	12.42	12.34
Missouri	St. Louis Co	14.02	11.46	11.44	11.41	11.46	11.42	11.35
Missouri	Ste. Genevieve Co	13.66	10.94	10.90	10.86	10.98	10.88	10.80
Montana	Cascade Co	5.70	5.26	5.26	5.25	5.25	5.25	5.23
Montana	Flathead Co	10.01	9.36	9.36	9.32	9.34	9.34	9.25
Montana	Gallatin Co	8.40	7.96	7.96	7.95	7.94	7.93	7.93
Montana	Lake Co	9.41	8.69	8.69	8.68	8.66	8.66	8.64
Montana	Lincoln Co	15.85	14.72	14.71	14.55	14.66	14.65	14.34
Montana	Missoula Co	10.20	9.39	9.39	9.39	9.38	9.37	9.35
Montana	Rosebud Co	6.78	6.55	6.55	6.54	6.54	6.54	6.51
Montana	Sanders Co	6.48	6.17	6.17	6.16	6.15	6.15	6.14
Montana	Silver Bow Co	8.30	7.61	7.61	7.61	7.59	7.59	7.58
Montana	Yellowstone Co	7.43	6.86	6.86	6.85	6.86	6.86	6.84

Nebraska	Cass Co	10.26	8.61	8.61	8.55	8.58	8.58	8.47
Nebraska	Douglas Co	10.55	8.82	8.82	8.78	8.72	8.72	8.62
Nebraska	Lancaster Co	9.58	8.06	8.06	8.01	8.01	8.01	7.92
Nebraska	Lincoln Co	7.13	6.30	6.30	6.17	6.26	6.26	6.06
Nebraska	Sarpy Co	10.07	8.44	8.43	8.38	8.43	8.42	8.32
Nebraska	Scotts Bluff Co	5.96	5.41	5.41	5.33	5.38	5.38	5.25
Nebraska	Washington Co	9.71	8.15	8.15	8.10	8.09	8.09	7.99
Nevada	Clark Co	9.51	8.74	8.74	8.73	8.68	8.68	8.66
Nevada	Washoe Co	8.86	8.32	8.32	8.30	8.26	8.26	8.22
New Hampshire	Belknap Co	7.15	5.96	5.96	5.95	5.96	5.96	5.95
New Hampshire	Cheshire Co	11.68	10.07	10.07	10.07	10.08	10.08	10.07
New Hampshire	Coos Co	9.68	8.78	8.78	8.78	8.77	8.76	8.76
New Hampshire	Hillsborough Co	10.33	8.77	8.77	8.76	8.77	8.76	8.76
New Hampshire	Rockingham Co	9.49	8.05	8.03	8.02	8.13	8.08	8.08
New Hampshire	Sullivan Co	9.86	8.44	8.44	8.44	8.45	8.45	8.44
New Jersey	Atlantic Co	11.41	8.79	8.78	8.77	8.86	8.84	8.83
New Jersey	Bergen Co	13.65	10.94	10.92	10.91	11.01	10.97	10.94
New Jersey	Camden Co	14.31	11.12	11.04	11.03	11.33	11.16	11.14
New Jersey	Essex Co	13.68	10.75	10.72	10.70	10.84	10.77	10.74
New Jersey	Gloucester Co	13.68	10.45	10.39	10.38	10.72	10.58	10.56
New Jersey	Hudson Co	14.93	12.48	12.33	12.31	12.88	12.55	12.52
New Jersey	Mercer Co	13.91	10.74	10.72	10.71	10.87	10.83	10.81
New Jersey	Middlesex Co	12.46	9.52	9.51	9.50	9.58	9.56	9.55
New Jersey	Morris Co	12.38	9.52	9.52	9.51	9.59	9.57	9.55
New Jersey	Ocean Co	11.16	8.57	8.57	8.56	8.62	8.61	8.60
New Jersey	Passaic Co	13.09	10.26	10.25	10.23	10.30	10.27	10.25
New Jersey	Union Co	15.66	12.40	12.32	12.29	12.68	12.49	12.46
New Jersey	Warren Co	13.36	10.03	10.03	10.01	10.06	10.04	10.02
New Mexico	Bernalillo Co	6.55	6.03	6.03	6.02	6.02	6.02	6.01
New Mexico	Chaves Co	6.70	6.17	6.17	6.16	6.17	6.17	6.16
New Mexico	Dona Ana Co	11.29	10.29	10.29	10.23	10.14	10.14	10.06
New Mexico	Grant Co	6.13	5.84	5.84	5.84	5.84	5.84	5.83
New Mexico	Lea Co	6.75	6.13	6.13	6.12	6.12	6.12	6.12
New Mexico	San Juan Co	6.49	6.14	6.14	6.14	6.14	6.14	6.13
New Mexico	Sandoval Co	4.98	4.59	4.59	4.58	4.58	4.58	4.57
New Mexico	Santa Fe Co	4.93	4.59	4.59	4.58	4.60	4.60	4.60
New York	Bronx Co	15.78	13.01	12.98	12.97	13.05	12.99	12.97
New York	Chautauqua Co	10.71	8.17	8.16	8.14	8.16	8.14	8.10

New York	Erie Co	13.90	11.07	11.05	11.02	10.98	10.94	10.88
New York	Essex Co	6.39	5.48	5.47	5.47	5.49	5.49	5.49
New York	Kings Co	14.65	12.06	12.02	12.01	12.20	12.13	12.11
New York	Nassau Co	12.21	9.86	9.85	9.84	10.00	9.97	9.95
New York	New York Co	17.16	14.35	14.34	14.33	14.37	14.33	14.31
New York	Niagara Co	12.03	9.85	9.84	9.83	9.93	9.91	9.89
New York	Onondaga Co	10.56	10.13	10.13	10.10	10.11	10.10	10.06
New York	Orange Co	11.50	9.95	9.94	9.93	10.02	10.01	9.99
New York	Queens Co	13.23	10.76	10.75	10.75	10.96	10.94	10.93
New York	Richmond Co	12.13	10.80	10.73	10.72	10.97	10.83	10.81
New York	St. Lawrence Co	8.49	7.78	7.77	7.77	7.77	7.76	7.75
New York	Steuben Co	9.83	7.42	7.42	7.42	7.43	7.42	7.41
New York	Suffolk Co	12.11	10.05	10.04	10.03	10.65	10.63	10.62
New York	Westchester Co	12.33	10.06	10.05	10.04	10.32	10.29	10.27
North Carolina	Alamance Co	13.93	10.15	10.14	10.13	10.12	10.12	10.10
North Carolina	Buncombe Co	13.19	9.95	9.95	9.93	9.90	9.90	9.86
North Carolina	Cabarrus Co	14.68	10.75	10.74	10.72	10.76	10.75	10.72
North Carolina	Caswell Co	13.43	9.61	9.61	9.60	9.62	9.61	9.59
North Carolina	Catawba Co	15.60	11.52	11.52	11.50	11.47	11.47	11.43
North Carolina	Chatham Co	12.34	9.00	9.00	8.99	9.04	9.03	9.02
North Carolina	Cumberland Co	14.17	10.81	10.80	10.79	10.78	10.77	10.74
North Carolina	Davidson Co	15.94	11.96	11.96	11.93	12.01	12.01	11.97
North Carolina	Duplin Co	12.08	9.35	9.34	9.34	9.36	9.35	9.34
North Carolina	Durham Co	14.09	10.44	10.44	10.43	10.38	10.38	10.36
North Carolina	Forsyth Co	14.79	10.96	10.96	10.95	10.92	10.92	10.90
North Carolina	Gaston Co	14.23	10.55	10.55	10.53	10.55	10.55	10.52
North Carolina	Guilford Co	14.27	10.25	10.25	10.24	10.22	10.21	10.19
North Carolina	Haywood Co	13.48	10.58	10.58	10.57	10.57	10.56	10.55
North Carolina	Jackson Co	12.27	9.32	9.32	9.32	9.33	9.33	9.32
North Carolina	Lenoir Co	11.57	8.84	8.83	8.83	8.86	8.85	8.84
North Carolina	McDowell Co	14.41	10.72	10.72	10.69	10.71	10.71	10.65
North Carolina	Mecklenburg Co	15.19	12.48	12.48	12.48	12.89	12.89	12.87
North Carolina	Mitchell Co	13.56	10.22	10.22	10.19	10.23	10.22	10.17
North Carolina	Montgomery Co	12.40	9.08	9.08	9.07	9.09	9.09	9.06
North Carolina	Onslow Co	11.27	8.66	8.66	8.65	8.66	8.65	8.64
North Carolina	Orange Co	13.24	9.82	9.82	9.81	9.81	9.81	9.80
North Carolina	Pitt Co	12.40	9.85	9.85	9.84	9.88	9.88	9.86
North Carolina	Robeson Co	12.69	10.06	10.06	10.05	10.05	10.05	10.03

North Carolina	Swain Co	12.67	9.52	9.52	9.51	9.52	9.51	9.50
North Carolina	Wake Co	13.96	10.85	10.85	10.84	10.97	10.96	10.95
North Carolina	Watauga Co	11.55	8.30	8.30	8.29	8.28	8.28	8.27
North Carolina	Wayne Co	13.76	10.83	10.83	10.82	10.83	10.83	10.81
North Dakota	Billings Co	4.57	4.27	4.27	4.23	4.26	4.26	4.20
North Dakota	Burke Co	5.74	4.36	4.36	4.36	4.34	4.34	4.33
North Dakota	Burleigh Co	6.63	5.89	5.89	5.86	5.85	5.85	5.80
North Dakota	Cass Co	7.78	6.65	6.65	6.61	6.56	6.56	6.48
North Dakota	McKenzie Co	5.26	4.82	4.82	4.81	4.81	4.81	4.79
North Dakota	Mercer Co	6.20	4.98	4.98	4.97	4.96	4.96	4.93
Ohio	Athens Co	12.31	8.70	8.68	8.67	8.74	8.70	8.67
Ohio	Butler Co	16.12	12.68	12.66	12.62	12.68	12.64	12.57
Ohio	Clark Co	14.69	11.20	11.18	11.16	11.21	11.18	11.12
Ohio	Cuyahoga Co	18.36	14.52	14.44	14.39	14.60	14.42	14.34
Ohio	Franklin Co	16.52	12.50	12.49	12.44	12.41	12.38	12.29
Ohio	Hamilton Co	17.76	13.35	13.32	13.27	13.37	13.30	13.21
Ohio	Jefferson Co	17.48	13.38	13.33	13.31	13.42	13.32	13.28
Ohio	Lake Co	13.25	10.49	10.45	10.42	10.54	10.46	10.40
Ohio	Lawrence Co	15.70	12.55	12.48	12.42	12.67	12.52	12.43
Ohio	Lorain Co	13.60	10.47	10.40	10.36	10.59	10.44	10.37
Ohio	Lucas Co	14.70	11.51	11.43	11.36	11.51	11.34	11.22
Ohio	Mahoning Co	15.11	11.18	11.16	11.12	11.17	11.13	11.06
Ohio	Montgomery Co	15.73	12.09	12.08	12.05	12.01	11.99	11.94
Ohio	Portage Co	14.19	10.72	10.71	10.67	10.74	10.71	10.64
Ohio	Preble Co	13.34	10.07	10.06	10.03	10.11	10.08	10.03
Ohio	Scioto Co	17.11	13.07	13.04	12.97	13.13	13.05	12.95
Ohio	Stark Co	17.26	13.16	13.14	13.10	13.11	13.08	13.00
Ohio	Summit Co	16.42	12.61	12.60	12.57	12.61	12.59	12.54
Ohio	Trumbull Co	14.96	11.40	11.39	11.36	11.40	11.37	11.31
Oklahoma	Caddo Co	8.79	7.30	7.30	7.28	7.31	7.31	7.28
Oklahoma	Canadian Co	8.96	7.45	7.45	7.43	7.48	7.48	7.44
Oklahoma	Carter Co	10.10	8.27	8.27	8.25	8.29	8.28	8.24
Oklahoma	Cherokee Co	11.56	9.66	9.65	9.63	9.66	9.65	9.61
Oklahoma	Garfield Co	9.85	8.58	8.58	8.55	8.56	8.56	8.51
Oklahoma	Kay Co	10.64	9.43	9.43	9.40	9.44	9.44	9.38
Oklahoma	Lincoln Co	9.96	8.34	8.34	8.32	8.37	8.36	8.33
Oklahoma	Mayes Co	11.87	10.13	10.12	10.08	10.12	10.11	10.04
Oklahoma	Muskogee Co	12.05	10.26	10.25	10.21	10.25	10.24	10.17

Oklahoma	Oklahoma Co	10.44	8.49	8.49	8.47	8.42	8.41	8.37
Oklahoma	Ottawa Co	11.73	9.66	9.66	9.63	9.65	9.64	9.58
Oklahoma	Pittsburg Co	11.37	9.56	9.55	9.51	9.57	9.56	9.49
Oklahoma	Seminole Co	9.64	8.04	8.04	8.02	8.06	8.05	8.03
Oklahoma	Tulsa Co	11.73	9.87	9.86	9.84	9.85	9.84	9.80
Oregon	Columbia Co	6.29	5.87	5.84	5.83	5.99	5.94	5.91
Oregon	Jackson Co	11.39	10.68	10.68	10.67	10.67	10.66	10.66
Oregon	Klamath Co	10.69	10.09	10.09	10.07	10.07	10.06	10.02
Oregon	Lane Co	13.28	12.51	12.51	12.44	12.48	12.47	12.29
Oregon	Linn Co	8.23	7.90	7.90	7.89	7.90	7.90	7.89
Oregon	Multnomah Co	8.67	8.31	8.24	8.23	8.51	8.36	8.34
Oregon	Wasco Co	7.53	7.03	7.01	6.98	7.01	6.98	6.90
Oregon	Washington Co	7.77	7.39	7.37	7.37	7.44	7.39	7.39
Pennsylvania	Adams Co	13.31	9.37	9.36	9.34	9.36	9.35	9.31
Pennsylvania	Allegheny Co	20.99	16.21	16.08	16.03	16.34	16.06	15.98
Pennsylvania	Beaver Co	15.79	11.97	11.95	11.90	12.00	11.95	11.88
Pennsylvania	Berks Co	16.41	12.25	12.24	12.21	12.26	12.23	12.17
Pennsylvania	Bucks Co	14.10	11.04	11.01	11.00	11.35	11.27	11.25
Pennsylvania	Cambria Co	15.62	11.47	11.46	11.42	11.47	11.45	11.38
Pennsylvania	Centre Co	12.95	9.38	9.37	9.35	9.37	9.36	9.32
Pennsylvania	Chester Co	14.80	10.74	10.72	10.70	10.79	10.75	10.70
Pennsylvania	Cumberland Co	14.93	10.88	10.87	10.84	10.83	10.82	10.76
Pennsylvania	Dauphin Co	15.57	11.17	11.16	11.12	11.12	11.10	11.01
Pennsylvania	Delaware Co	15.31	11.91	11.80	11.78	12.26	12.03	11.99
Pennsylvania	Erie Co	13.14	10.18	10.16	10.13	10.18	10.14	10.08
Pennsylvania	Lackawanna Co	12.32	9.17	9.16	9.15	9.14	9.13	9.10
Pennsylvania	Lancaster Co	16.95	12.01	12.00	11.96	11.99	11.96	11.89
Pennsylvania	Lehigh Co	14.21	10.68	10.67	10.65	10.66	10.64	10.60
Pennsylvania	Luzerne Co	12.70	9.45	9.45	9.44	9.43	9.42	9.39
Pennsylvania	Mercer Co	14.00	10.48	10.47	10.44	10.48	10.45	10.40
Pennsylvania	Montgomery Co	13.74	10.36	10.35	10.33	10.55	10.52	10.49
Pennsylvania	Northampton Co	14.33	10.86	10.85	10.83	10.84	10.82	10.78
Pennsylvania	Perry Co	12.83	9.49	9.48	9.42	9.51	9.49	9.40
Pennsylvania	Philadelphia Co	15.97	12.73	12.63	12.61	13.00	12.76	12.74
Pennsylvania	Washington Co	15.37	11.14	11.11	11.07	11.31	11.24	11.17
Pennsylvania	Westmoreland Co	15.38	10.77	10.76	10.72	10.77	10.74	10.68
Pennsylvania	York Co	16.92	12.53	12.52	12.49	12.51	12.48	12.42
Rhode Island	Kent Co	8.62	6.98	6.98	6.97	7.03	7.03	7.02

Rhode Island	Providence Co	12.60	10.57	10.56	10.56	10.61	10.60	10.59
South Carolina	Beaufort Co	10.91	8.52	8.51	8.51	8.54	8.52	8.51
South Carolina	Charleston Co	11.80	9.23	9.22	9.21	9.24	9.22	9.20
South Carolina	Chesterfield Co	12.37	9.34	9.34	9.33	9.34	9.33	9.31
South Carolina	Edgefield Co	12.71	9.57	9.57	9.55	9.57	9.57	9.53
South Carolina	Florence Co	12.66	10.20	10.20	10.19	10.18	10.17	10.16
South Carolina	Georgetown Co	12.75	10.28	10.25	10.24	10.32	10.25	10.24
South Carolina	Greenville Co	15.73	11.94	11.94	11.92	11.89	11.89	11.87
South Carolina	Greenwood Co	13.36	9.99	9.99	9.96	9.98	9.97	9.93
South Carolina	Horry Co	11.22	8.79	8.78	8.78	8.78	8.77	8.76
South Carolina	Lexington Co	13.87	10.62	10.62	10.60	10.57	10.56	10.54
South Carolina	Oconee Co	10.76	7.72	7.71	7.71	7.70	7.70	7.68
South Carolina	Richland Co	13.86	10.65	10.65	10.63	10.60	10.59	10.56
South Carolina	Spartanburg Co	13.82	10.30	10.30	10.28	10.29	10.29	10.26
South Dakota	Brookings Co	9.44	8.05	8.05	8.03	7.97	7.97	7.91
South Dakota	Brookings Co	9.44	8.04	8.04	8.02	7.95	7.95	7.91
South Dakota	Brown Co	8.22	7.17	7.17	7.15	7.10	7.10	7.06
South Dakota	Brown Co	8.22	7.14	7.14	7.12	7.06	7.06	7.02
South Dakota	Jackson Co	5.44	5.06	5.06	5.04	5.04	5.04	5.02
South Dakota	Jackson Co	5.44	5.06	5.06	5.05	5.05	5.05	5.03
South Dakota	Meade Co	6.28	5.87	5.87	5.86	5.84	5.84	5.83
South Dakota	Meade Co	6.28	5.87	5.87	5.87	5.85	5.85	5.84
South Dakota	Minnehaha Co	9.84	8.12	8.12	8.09	8.02	8.01	7.95
South Dakota	Minnehaha Co	9.84	8.12	8.12	8.10	8.01	8.01	7.96
South Dakota	Pennington Co	7.55	7.05	7.05	7.04	7.02	7.02	7.01
South Dakota	Pennington Co	7.55	7.05	7.05	7.05	7.03	7.02	7.01
Tennessee	Blount Co	14.36	10.86	10.86	10.84	10.92	10.90	10.87
Tennessee	Davidson Co	14.44	11.25	11.23	11.21	11.30	11.26	11.22
Tennessee	Dyer Co	12.05	9.77	9.75	9.73	9.80	9.77	9.73
Tennessee	Hamilton Co	16.34	12.58	12.56	12.53	12.58	12.55	12.49
Tennessee	Knox Co	16.67	12.58	12.57	12.53	12.51	12.49	12.43
Tennessee	Lawrence Co	11.94	9.12	9.11	9.10	9.14	9.13	9.12
Tennessee	Maury Co	12.90	10.78	10.78	10.77	10.80	10.79	10.76
Tennessee	McMinn Co	14.85	10.89	10.89	10.86	10.88	10.87	10.81
Tennessee	Montgomery Co	13.21	10.40	10.39	10.38	10.43	10.40	10.37
Tennessee	Putnam Co	13.43	10.00	9.99	9.98	9.98	9.97	9.95
Tennessee	Roane Co	14.31	10.44	10.43	10.38	10.47	10.44	10.36
Tennessee	Shelby Co	14.12	11.68	11.60	11.56	11.84	11.65	11.59

Tennessee	Sullivan Co	14.59	12.12	12.12	12.10	12.06	12.05	12.02
Tennessee	Sumner Co	13.58	10.45	10.44	10.42	10.47	10.44	10.41
Texas	Bowie Co	13.67	11.60	11.59	11.55	11.59	11.57	11.50
Texas	Brewster Co	4.98	4.52	4.52	4.51	4.52	4.52	4.51
Texas	Cameron Co	9.88	8.79	8.78	8.78	8.80	8.79	8.78
Texas	Dallas Co	13.67	11.35	11.35	11.34	11.43	11.42	11.41
Texas	Ector Co	7.67	6.76	6.76	6.76	6.77	6.77	6.76
Texas	Galveston Co	9.79	7.96	7.86	7.86	8.19	7.98	7.98
Texas	Gregg Co	12.37	10.36	10.35	10.33	10.40	10.38	10.36
Texas	Harris Co	14.22	12.88	12.51	12.50	13.61	12.81	12.80
Texas	Harrison Co	11.46	9.52	9.51	9.49	9.57	9.55	9.52
Texas	Hidalgo Co	10.81	9.67	9.67	9.66	9.65	9.65	9.64
Texas	Jefferson Co	11.20	9.91	9.73	9.73	10.35	9.97	9.96
Texas	Montgomery Co	11.23	9.70	9.69	9.68	9.84	9.81	9.80
Texas	Nueces Co	10.02	8.54	8.50	8.49	8.73	8.51	8.51
Texas	Orange Co	11.43	9.66	9.64	9.63	9.79	9.75	9.73
Texas	Potter Co	6.17	5.27	5.27	5.25	5.26	5.26	5.23
Texas	Tarrant Co	12.73	10.63	10.63	10.60	10.65	10.65	10.60
Utah	Box Elder Co	9.14	8.65	8.64	8.64	8.64	8.64	8.62
Utah	Cache Co	12.82	11.89	11.89	11.88	11.85	11.85	11.83
Utah	Salt Lake Co	12.89	11.81	11.81	11.78	11.63	11.62	11.55
Utah	Utah Co	10.89	9.80	9.80	9.78	9.87	9.86	9.80
Utah	Weber Co	12.81	11.78	11.78	11.76	11.84	11.84	11.78
Vermont	Chittenden Co	9.38	7.96	7.96	7.95	7.91	7.91	7.89
Virginia	Arlington Co	14.61	10.72	10.72	10.70	10.66	10.65	10.63
Virginia	Bristol city	14.51	10.99	10.98	10.96	10.92	10.92	10.88
Virginia	Charles City Co	12.80	9.33	9.32	9.30	9.35	9.34	9.30
Virginia	Chesterfield Co	13.73	9.73	9.72	9.70	9.73	9.72	9.67
Virginia	Fairfax Co	14.15	10.34	10.34	10.32	10.37	10.37	10.34
Virginia	Hampton city	12.51	9.82	9.73	9.72	9.96	9.77	9.76
Virginia	Henrico Co	13.80	10.04	10.03	9.99	10.05	10.04	9.98
Virginia	Loudoun Co	13.63	9.71	9.70	9.68	9.75	9.74	9.70
Virginia	Norfolk city	12.97	10.56	10.38	10.37	10.84	10.44	10.43
Virginia	Page Co	12.96	9.24	9.24	9.22	9.25	9.25	9.23
Virginia	Roanoke city	14.36	10.51	10.51	10.41	10.45	10.45	10.30
Virginia	Salem city	14.78	10.93	10.93	10.86	10.90	10.90	10.79
Virginia	Virginia Beach city	12.58	9.98	9.96	9.95	10.03	9.98	9.97
Washington	Clark Co	9.74	8.77	8.76	8.75	8.86	8.84	8.82

Washington	King Co	11.37	10.84	10.72	10.71	11.06	10.82	10.80
Washington	Pierce Co	10.92	10.66	10.65	10.64	10.72	10.70	10.69
Washington	Snohomish Co	11.20	11.14	11.13	11.12	11.21	11.18	11.16
Washington	Spokane Co	10.19	9.09	9.09	9.06	9.07	9.07	9.02
Washington	Yakima Co	10.38	9.08	9.08	9.07	9.06	9.05	9.04
West Virginia	Berkeley Co	16.23	12.35	12.35	12.31	12.33	12.32	12.25
West Virginia	Brooke Co	16.69	12.70	12.65	12.63	12.74	12.64	12.61
West Virginia	Cabell Co	16.54	13.07	13.04	13.00	13.33	13.25	13.20
West Virginia	Hancock Co	17.30	13.65	13.61	13.59	13.68	13.60	13.56
West Virginia	Harrison Co	13.99	10.28	10.28	10.27	10.29	10.28	10.27
West Virginia	Kanawha Co	17.08	13.32	13.30	13.27	13.37	13.31	13.28
West Virginia	Marion Co	15.32	11.25	11.24	11.23	11.25	11.23	11.21
West Virginia	Marshall Co	15.61	11.47	11.42	11.40	11.55	11.43	11.41
West Virginia	Mercer Co	12.67	9.20	9.20	9.18	9.26	9.26	9.22
West Virginia	Monongalia Co	14.81	10.44	10.43	10.42	10.44	10.42	10.40
West Virginia	Ohio Co	15.08	11.03	10.98	10.97	11.06	10.97	10.94
West Virginia	Raleigh Co	13.05	9.55	9.55	9.53	9.55	9.54	9.52
West Virginia	Summers Co	10.10	7.19	7.19	7.17	7.20	7.19	7.16
West Virginia	Wood Co	16.07	11.82	11.77	11.75	11.89	11.79	11.76
Wisconsin	Brown Co	11.27	9.91	9.90	9.88	9.87	9.86	9.81
Wisconsin	Dane Co	12.36	10.50	10.49	10.46	10.45	10.42	10.35
Wisconsin	Dodge Co	11.12	9.24	9.23	9.19	9.20	9.18	9.11
Wisconsin	Grant Co	11.36	9.45	9.44	9.38	9.38	9.35	9.24
Wisconsin	Kenosha Co	11.50	9.54	9.53	9.49	9.57	9.55	9.47
Wisconsin	Manitowoc Co	9.81	8.25	8.25	8.22	8.24	8.22	8.16
Wisconsin	Milwaukee Co	13.10	11.08	11.07	11.03	11.10	11.08	10.99
Wisconsin	Outagamie Co	10.70	9.17	9.17	9.14	9.16	9.14	9.08
Wisconsin	Vilas Co	6.40	5.63	5.62	5.61	5.61	5.60	5.57
Wisconsin	Waukesha Co	13.11	11.01	11.00	10.97	10.99	10.97	10.88
Wyoming	Campbell Co	6.30	6.09	6.09	6.07	6.09	6.09	6.04
Wyoming	Converse Co	3.66	3.51	3.51	3.49	3.50	3.50	3.47
Wyoming	Fremont Co	9.12	8.38	8.38	8.38	8.37	8.37	8.36
Wyoming	Laramie Co	4.95	4.57	4.57	4.53	4.57	4.57	4.49
Wyoming	Sheridan Co	10.49	9.87	9.87	9.79	9.82	9.82	9.69

Appendix B: 8-Hour Ozone Design Values for Locomotive/Marine Scenarios (units are ppb)

State Name	County Name	Baseline DV	2020 Base	2020 Marine only	2020 Locomotive / Marine	2030 Base	2030 Marine only	2030 Locomotive / Marine
Alabama	Baldwin	78.0	66.1	65.8	65.7	67.0	66.3	65.9
Alabama	Clay	79.3	57.7	57.6	57.3	56.3	56.1	55.3
Alabama	Elmore	76.7	55.9	55.8	55.4	53.9	53.7	52.7
Alabama	Etowah	75.0	55.2	55.1	54.8	53.8	53.6	52.8
Alabama	Jefferson	83.7	60.8	60.7	60.3	58.9	58.7	57.5
Alabama	Lawrence	76.3	56.2	56.0	55.7	54.9	54.6	53.8
Alabama	Madison	79.7	58.8	58.6	58.3	56.9	56.4	55.7
Alabama	Mobile	79.0	66.6	66.3	66.2	67.6	66.9	66.5
Alabama	Montgomery	75.0	55.7	55.6	55.3	54.0	53.9	52.9
Alabama	Morgan	82.0	61.8	61.6	61.3	60.6	60.1	59.2
Alabama	Shelby	88.0	62.6	62.6	62.1	60.6	60.4	59.1
Alabama	Sumter	71.7	52.3	52.2	52.0	51.2	50.9	50.2
Alabama	Tuscaloosa	75.5	53.3	53.2	52.9	51.8	51.5	50.5
Arizona	Maricopa	85.7	71.8	71.7	71.6	69.3	69.2	68.6
Arizona	Pima	74.0	64.5	64.4	64.3	63.0	63.0	62.6
Arizona	Pinal	82.0	66.5	66.4	66.2	64.6	64.5	63.9
Arizona	Yavapai	78.7	67.8	67.5	67.3	66.0	65.4	64.9
Arkansas	Crittenden	91.0	70.9	70.1	69.7	70.3	68.4	67.4
Arkansas	Pulaski	81.7	63.1	62.8	62.5	61.3	60.7	59.6
California	Alameda	82.7	72.6	72.3	72.1	70.0	69.2	68.8
California	Amador	85.7	71.6	71.3	71.0	67.9	67.1	66.4
California	Butte	88.7	73.1	72.9	72.5	68.7	68.3	67.1
California	Calaveras	91.0	76.8	76.4	76.1	73.4	72.4	71.6
California	Colusa	73.3	61.5	61.3	61.1	58.4	58.1	57.5
California	Contra Costa	79.3	72.9	72.7	72.6	71.1	70.4	70.1
California	El Dorado	105.0	86.2	86.0	85.6	80.7	80.2	78.9
California	Fresno	110.0	96.1	95.9	95.6	92.4	92.0	91.0
California	Glenn	72.3	61.2	61.1	60.9	58.3	58.0	57.4
California	Imperial	86.0	74.8	74.5	74.3	72.8	72.1	71.5
California	Inyo	80.7	71.4	71.3	71.1	69.5	69.1	68.6
California	Kern	114.3	100.9	100.8	100.6	97.6	97.4	96.7
California	Kings	95.7	81.5	81.3	81.1	77.8	77.4	76.8
California	Lake	64.3	56.2	56.2	56.1	54.5	54.3	54.0
California	Los Angeles	121.3	109.0	108.8	108.7	105.5	104.7	104.4

California	Madera	91.0	79.5	79.3	79.0	76.5	76.1	75.3
California	Marin	48.0	42.1	42.1	42.1	40.8	40.9	40.8
California	Mariposa	89.7	76.3	75.9	75.7	73.2	72.2	71.7
California	Mendocino	56.7	47.9	47.8	47.7	45.6	45.4	45.0
California	Merced	101.7	84.9	84.6	84.4	80.6	79.9	79.2
California	Monterey	66.0	57.2	57.1	57.0	54.9	54.6	54.3
California	Napa	64.7	53.3	53.1	53.0	50.7	50.3	50.0
California	Nevada	97.7	80.4	80.2	79.7	75.8	75.2	73.8
California	Orange	85.3	76.7	79.2	79.3	76.3	81.5	81.8
California	Placer	98.3	80.7	80.5	80.2	75.6	75.0	73.9
California	Riverside	115.0	103.1	103.5	103.5	101.9	102.5	102.4
California	Sacramento	99.0	82.1	81.9	81.6	76.8	76.2	75.3
California	San Benito	81.0	69.6	69.4	69.3	66.6	66.2	65.8
California	San Bernardino	128.7	124.7	125.3	125.1	123.0	123.9	123.4
California	San Diego	92.3	80.5	80.2	80.1	78.0	77.2	76.9
California	San Joaquin	81.0	71.0	70.7	70.5	68.6	67.7	67.3
California	San Luis Obispo	73.3	63.1	63.0	62.8	60.5	60.2	59.8
California	San Mateo	56.7	52.5	52.5	52.4	51.4	51.2	51.0
California	Santa Barbara	82.7	72.7	71.1	70.9	70.5	66.3	65.9
California	Santa Clara	84.0	70.1	70.0	69.9	66.4	66.1	65.7
California	Santa Cruz	65.0	57.1	57.0	56.9	55.0	54.8	54.5
California	Shasta	72.3	60.8	60.7	60.4	57.7	57.5	56.6
California	Solano	70.3	59.9	59.7	59.6	57.8	57.5	57.2
California	Sonoma	62.0	50.7	50.6	50.5	47.6	47.5	47.1
California	Stanislaus	95.0	81.9	81.6	81.5	78.4	77.7	77.1
California	Sutter	87.3	72.2	72.0	71.8	68.3	67.8	67.0
California	Tehama	84.0	69.7	69.6	69.1	66.0	65.8	64.4
California	Tulare	105.7	88.8	88.6	88.4	84.6	84.1	83.4
California	Tuolumne	91.0	77.3	76.9	76.7	74.0	73.0	72.4
California	Ventura	94.7	81.5	80.9	80.8	78.7	77.0	76.7
California	Yolo	81.7	68.3	68.1	67.9	64.6	64.2	63.6
Colorado	Adams	65.3	57.7	57.7	57.6	57.1	57.1	56.7
Colorado	Arapahoe	78.7	70.4	70.4	70.3	69.5	69.4	69.1
Colorado	Boulder	75.3	63.9	63.9	63.7	62.9	62.9	62.4
Colorado	Denver	74.0	65.4	65.4	65.3	64.7	64.7	64.3
Colorado	Douglas	83.0	73.8	73.8	73.7	72.7	72.7	72.3
Colorado	El Paso	72.3	63.2	63.2	63.0	62.6	62.6	62.1
Colorado	Jefferson	84.7	74.2	74.2	74.0	73.2	73.2	72.8

Colorado	La Plata	59.0	52.2	52.2	52.1	51.9	51.8	51.6
Colorado	Larimer	80.3	67.8	67.8	67.6	66.8	66.8	66.3
Colorado	Montezuma	68.0	63.0	62.9	62.9	62.6	62.5	62.3
Colorado	Weld	76.7	64.9	64.9	64.7	64.9	64.9	64.3
Connecticut	Fairfield	98.3	81.7	81.6	81.5	81.3	81.0	80.7
Connecticut	Hartford	88.0	67.9	67.6	67.5	66.8	66.1	65.7
Connecticut	Litchfield	86.0	66.7	66.3	66.2	66.2	65.4	65.1
Connecticut	Middlesex	95.7	75.6	75.3	75.2	74.8	74.1	73.8
Connecticut	New Haven	98.3	79.1	78.8	78.6	78.4	77.7	77.3
Connecticut	New London	90.0	70.9	70.6	70.5	70.2	69.6	69.3
Connecticut	Tolland	92.3	70.6	70.3	70.1	69.2	68.5	68.1
D.C.	Washington	92.7	70.5	70.4	70.1	68.9	68.6	68.0
Delaware	Kent	88.3	71.8	71.3	71.2	71.4	70.6	70.2
Delaware	New Castle	92.7	72.4	72.1	71.9	71.7	71.1	70.5
Delaware	Sussex	90.0	71.9	71.7	71.5	71.1	70.7	70.4
Florida	Bay	79.3	62.9	62.7	62.6	61.8	61.4	60.9
Florida	Brevard	72.7	52.8	52.5	52.5	51.7	51.2	50.9
Florida	Duval	74.0	54.3	53.9	53.6	53.4	52.5	51.9
Florida	Escambia	81.0	66.5	66.4	66.2	66.2	65.8	65.4
Florida	Hillsborough	78.7	67.1	67.0	66.9	66.2	65.9	65.7
Florida	Lake	76.0	56.3	56.2	56.1	55.4	55.2	55.0
Florida	Manatee	76.3	62.3	62.1	62.1	61.6	61.0	60.8
Florida	Miami-Dade	67.0	54.4	54.3	54.3	53.6	53.2	53.1
Florida	Orange	76.3	57.6	57.5	57.4	56.6	56.4	56.1
Florida	Pasco	76.7	58.8	58.6	58.5	57.7	57.3	57.0
Florida	Pinellas	74.7	62.1	61.9	61.9	61.4	60.9	60.7
Florida	Polk	76.3	59.8	59.5	59.4	59.0	58.3	58.1
Florida	Santa Rosa	81.3	65.3	65.2	65.0	65.0	64.6	64.1
Florida	Sarasota	79.7	62.2	61.8	61.7	61.6	60.8	60.6
Florida	Seminole	77.5	58.3	58.2	58.1	57.2	56.9	56.7
Georgia	Bibb	88.0	65.8	65.7	65.4	64.3	64.2	63.3
Georgia	Chatham	68.3	54.4	54.1	53.9	53.6	52.8	52.3
Georgia	Cherokee	78.0	54.7	54.6	54.4	52.0	51.9	51.3
Georgia	Clarke	78.0	55.0	55.0	54.8	52.6	52.4	51.8
Georgia	Cobb	91.0	64.9	64.9	64.7	61.8	61.6	61.0
Georgia	Coweta	88.7	66.3	66.3	66.1	64.4	64.2	63.6
Georgia	Dawson	80.0	57.3	57.3	57.1	55.0	54.9	54.3
Georgia	De Kalb	91.0	68.3	68.3	68.0	65.9	65.7	65.0

Georgia	Douglas	91.0	65.1	65.0	64.8	62.5	62.3	61.6
Georgia	Fayette	85.3	63.4	63.3	63.1	60.8	60.7	60.0
Georgia	Fulton	94.3	71.8	71.8	71.5	69.2	69.1	68.3
Georgia	Glynn	72.3	55.8	55.5	55.3	54.9	54.3	53.6
Georgia	Gwinnett	87.7	62.8	62.8	62.6	59.6	59.5	58.9
Georgia	Henry	91.7	65.9	65.8	65.6	63.2	63.1	62.3
Georgia	Murray	85.0	60.7	60.6	60.3	58.9	58.7	57.9
Georgia	Muscogee	75.0	54.9	54.8	54.6	53.4	53.2	52.4
Georgia	Paulding	88.0	61.4	61.3	61.1	59.2	59.0	58.4
Georgia	Richmond	84.3	65.3	65.2	65.0	63.3	63.1	62.6
Georgia	Rockdale	91.0	65.6	65.5	65.3	62.9	62.7	62.0
Georgia	Sumter	75.0	55.2	55.0	54.7	54.0	53.8	52.8
Idaho	Ada	76.0	69.9	69.9	69.8	68.7	68.6	68.4
Idaho	Canyon	68.0	59.6	59.6	59.5	58.0	58.0	57.8
Illinois	Adams	75.3	61.4	61.0	60.7	60.8	59.8	58.9
Illinois	Champaign	75.0	59.8	59.6	59.3	58.9	58.5	57.6
Illinois	Clark	73.0	54.4	54.2	54.0	53.8	53.4	52.9
Illinois	Cook	85.3	75.0	75.1	75.1	74.3	74.6	74.5
Illinois	Du Page	71.7	63.1	63.0	62.8	62.7	62.4	61.9
Illinois	Effingham	74.7	58.3	58.1	57.9	57.4	57.0	56.3
Illinois	Hamilton	79.3	60.6	60.0	59.8	60.2	58.9	58.3
Illinois	Jersey	87.7	69.5	68.9	68.7	68.5	67.1	66.5
Illinois	Kane	77.0	65.3	65.1	64.7	64.7	64.3	63.2
Illinois	Lake	84.7	73.7	73.6	73.4	73.2	73.0	72.3
Illinois	Macon	75.0	59.3	59.1	58.9	58.6	58.1	57.4
Illinois	Macoupin	78.0	58.6	58.3	58.1	57.7	57.0	56.3
Illinois	Madison	85.7	68.0	67.5	67.3	67.0	65.8	65.2
Illinois	McHenry	82.0	69.7	69.5	69.1	69.0	68.7	67.5
Illinois	McLean	76.0	59.4	59.2	58.9	58.4	57.9	57.1
Illinois	Peoria	78.0	65.2	65.0	64.7	64.3	63.7	63.1
Illinois	Randolph	77.7	60.9	60.5	60.2	60.2	59.3	58.6
Illinois	Rock Island	68.7	56.3	56.1	55.8	55.1	54.6	53.8
Illinois	Sangamon	75.3	54.8	54.6	54.4	53.6	53.2	52.6
Illinois	St Clair	83.0	67.7	67.3	67.0	66.7	65.5	64.9
Illinois	Will	78.3	63.9	63.8	63.4	63.1	62.8	61.8
Illinois	Winnebago	75.0	60.2	60.0	59.6	59.0	58.6	57.5
Indiana	Allen	87.0	68.7	68.5	68.1	67.4	66.9	65.8
Indiana	Boone	88.0	69.4	69.2	68.9	68.2	67.8	67.1

Indiana	Carroll	83.0	64.2	63.9	63.6	63.1	62.6	61.8
Indiana	Clark	90.0	70.3	69.8	69.5	69.7	68.4	67.8
Indiana	Delaware	85.5	66.2	66.0	65.6	64.9	64.4	63.5
Indiana	Elkhart	87.0	69.2	69.0	68.6	68.1	67.7	66.6
Indiana	Floyd	84.3	68.1	67.6	67.4	67.5	66.3	65.8
Indiana	Gibson	73.0	52.5	52.2	52.1	51.7	51.2	50.7
Indiana	Greene	87.0	63.9	63.6	63.3	63.0	62.3	61.6
Indiana	Hamilton	93.7	72.0	71.8	71.6	70.4	69.9	69.3
Indiana	Hancock	91.3	69.4	69.2	69.0	67.8	67.2	66.6
Indiana	Hendricks	84.7	66.8	66.6	66.4	65.3	64.9	64.2
Indiana	Huntington	83.3	65.7	65.5	65.2	64.5	64.1	63.1
Indiana	Jackson	83.3	64.0	63.6	63.4	63.3	62.4	61.7
Indiana	Johnson	85.3	66.3	66.1	65.9	65.2	64.7	64.1
Indiana	La Porte	90.3	76.1	76.0	75.8	75.4	75.2	74.6
Indiana	Lake	88.3	78.5	78.6	78.5	77.7	77.9	77.8
Indiana	Madison	91.7	69.5	69.3	69.1	67.9	67.4	66.7
Indiana	Marion	90.0	70.7	70.5	70.3	69.2	68.7	68.1
Indiana	Morgan	85.0	67.4	67.2	67.0	66.2	65.8	65.1
Indiana	Porter	86.3	76.0	76.1	76.0	75.3	75.4	75.2
Indiana	Posey	84.0	63.5	62.9	62.6	62.7	61.4	60.7
Indiana	Shelby	91.3	71.0	70.8	70.6	69.3	68.8	68.1
Indiana	St Joseph	90.3	72.5	72.3	71.8	71.5	71.0	69.8
Indiana	Vanderburgh	82.7	62.0	61.4	61.2	61.1	59.9	59.4
Indiana	Vigo	85.0	68.0	67.8	67.5	67.1	66.7	65.9
Indiana	Warrick	84.0	65.5	65.1	64.9	64.9	64.1	63.6
Iowa	Clinton	76.3	64.2	63.9	63.6	63.4	62.9	62.0
Iowa	Harrison	75.7	63.5	63.4	63.1	62.8	62.6	61.7
Iowa	Montgomery	67.0	57.0	57.0	56.7	56.5	56.3	55.4
Iowa	Polk	57.3	47.5	47.5	47.2	45.7	45.5	45.0
Iowa	Scott	77.7	63.0	62.7	62.4	61.8	61.2	60.4
Iowa	Story	60.7	49.6	49.5	49.3	47.8	47.6	47.0
Kansas	Linn	74.3	61.3	61.2	60.9	60.6	60.4	59.5
Kansas	Sedgwick	79.0	65.0	64.9	64.7	63.2	63.1	62.3
Kansas	Sumner	75.7	63.6	63.5	63.3	62.5	62.3	61.5
Kansas	Wyandotte	79.0	64.2	64.1	63.7	63.0	62.8	61.7
Kentucky	Bell	82.3	57.4	57.3	57.0	55.5	55.3	54.5
Kentucky	Boone	83.7	64.8	64.3	64.1	64.4	63.3	62.7
Kentucky	Boyd	88.3	73.1	72.5	72.2	73.3	72.2	71.4

Kentucky	Bullitt	81.0	63.3	62.8	62.6	62.5	61.5	60.9
Kentucky	Campbell	90.7	72.3	71.8	71.6	71.6	70.5	69.7
Kentucky	Carter	77.0	59.7	59.2	59.0	60.1	59.1	58.3
Kentucky	Christian	84.0	59.1	58.7	58.5	58.7	57.8	57.2
Kentucky	Daviess	75.3	60.1	59.6	59.5	59.7	58.7	58.3
Kentucky	Edmonson	80.3	60.5	60.1	59.9	59.6	58.9	58.2
Kentucky	Fayette	75.0	58.6	58.4	58.1	57.1	56.6	55.8
Kentucky	Graves	79.0	61.1	60.7	60.5	60.3	59.3	58.7
Kentucky	Greenup	81.3	67.2	66.6	66.3	67.6	66.6	65.8
Kentucky	Hancock	81.7	64.9	64.4	64.2	64.6	63.5	63.0
Kentucky	Hardin	78.3	59.3	58.8	58.6	58.6	57.6	57.1
Kentucky	Henderson	79.3	61.8	61.4	61.2	61.2	60.4	59.9
Kentucky	Jefferson	82.7	66.4	66.0	65.8	65.7	64.7	64.2
Kentucky	Jessamine	76.3	58.6	58.4	58.1	57.4	56.9	56.1
Kentucky	Kenton	85.0	67.7	67.1	66.9	67.1	65.9	65.1
Kentucky	Livingston	82.7	63.2	62.7	62.5	62.8	61.6	61.0
Kentucky	McCracken	79.0	65.3	64.9	64.7	64.7	63.8	63.4
Kentucky	McLean	82.0	60.5	60.2	60.0	59.9	59.1	58.6
Kentucky	Oldham	85.3	65.0	64.4	64.2	64.5	63.2	62.5
Kentucky	Perry	75.7	56.7	56.5	56.2	55.9	55.5	54.7
Kentucky	Pike	73.3	56.1	55.8	55.6	55.3	54.9	54.1
Kentucky	Pulaski	77.3	59.9	59.8	59.4	59.0	58.6	57.7
Kentucky	Scott	68.7	51.9	51.6	51.3	51.5	50.7	49.9
Kentucky	Simpson	79.7	57.9	57.6	57.4	56.6	56.1	55.4
Kentucky	Trigg	73.0	54.6	53.9	53.8	54.4	52.8	52.3
Kentucky	Warren	82.0	61.4	61.1	60.8	60.5	59.8	59.1
Louisiana	Ascension	79.3	70.8	70.0	69.9	70.9	69.1	68.8
Louisiana	Bossier	79.7	62.2	62.0	61.6	60.9	60.4	59.5
Louisiana	Caddo	77.3	60.0	59.7	59.4	58.9	58.3	57.4
Louisiana	Calcasieu	78.7	68.1	67.5	67.3	68.1	66.9	66.4
Louisiana	East Baton Rouge	87.0	78.1	77.7	77.6	77.9	77.1	76.8
Louisiana	Iberville	84.3	75.0	74.1	74.0	75.1	73.2	72.9
Louisiana	Jefferson	83.0	72.3	71.7	71.5	72.4	71.0	70.6
Louisiana	Lafayette	79.3	68.1	67.1	66.9	68.6	66.4	66.0
Louisiana	Lafourche	78.0	67.4	66.6	66.5	67.5	65.9	65.5
Louisiana	Livingston	79.7	70.8	69.8	69.7	70.9	69.0	68.6
Louisiana	Orleans	69.7	60.2	59.6	59.5	60.3	59.0	58.7
Louisiana	Ouachita	77.7	62.6	62.2	62.0	61.8	60.9	60.2

Louisiana	Pointe Coupee	73.3	65.1	64.6	64.5	65.0	64.1	63.8
Louisiana	St Bernard	78.0	65.9	65.3	65.1	65.8	64.6	64.2
Louisiana	St Charles	78.7	69.3	68.5	68.4	69.5	68.1	67.7
Louisiana	St James	74.0	65.4	65.2	65.1	65.2	64.6	64.3
Louisiana	St John The Baptist	78.7	69.9	69.6	69.5	69.4	69.1	68.8
Louisiana	St Mary	74.7	63.9	62.6	62.5	64.5	61.8	61.4
Louisiana	West Baton Rouge	84.0	75.6	74.9	74.8	75.6	74.0	73.7
Maine	Cumberland	84.3	65.2	65.0	64.9	64.2	63.8	63.3
Maine	Hancock	91.7	73.1	72.8	72.6	72.2	71.6	71.1
Maine	Kennebec	78.0	61.6	61.4	61.3	60.6	60.2	59.8
Maine	Knox	83.7	65.0	64.8	64.6	64.1	63.7	63.2
Maine	Sagadahoc	79.0	61.2	61.1	60.9	60.4	60.0	59.6
Maine	York	88.3	68.5	68.3	68.1	67.5	67.0	66.5
Maryland	Anne Arundel	98.3	74.1	74.0	73.7	72.8	72.5	71.9
Maryland	Baltimore	91.3	72.4	72.3	72.1	71.6	71.3	70.7
Maryland	Carroll	88.7	66.8	66.6	66.3	65.5	65.1	64.4
Maryland	Cecil	97.7	73.2	73.0	72.7	72.1	71.7	70.9
Maryland	Charles	93.0	66.7	66.5	66.3	65.2	64.9	64.2
Maryland	Frederick	87.3	67.2	67.0	66.8	66.1	65.6	64.9
Maryland	Harford	100.3	78.9	78.7	78.5	78.0	77.6	77.0
Maryland	Kent	95.3	71.7	71.5	71.2	70.6	70.2	69.5
Maryland	Montgomery	86.7	65.8	65.7	65.5	64.6	64.3	63.6
Maryland	Prince Georges	94.0	71.0	70.9	70.7	69.4	69.1	68.4
Maryland	Washington	85.3	65.4	65.2	64.9	64.1	63.6	62.8
Massachusetts	Barnstable	92.0	73.8	73.4	73.2	73.4	72.6	72.2
Massachusetts	Berkshire	87.0	70.3	70.1	70.0	69.1	68.7	68.1
Massachusetts	Bristol	91.0	71.9	71.7	71.5	71.5	70.8	70.4
Massachusetts	Essex	90.0	72.8	72.7	72.5	72.0	71.7	71.4
Massachusetts	Hampden	92.0	70.3	70.1	69.9	69.0	68.4	68.0
Massachusetts	Hampshire	86.7	68.1	67.9	67.8	67.0	66.5	66.1
Massachusetts	Middlesex	85.7	66.5	66.3	66.1	65.2	64.8	64.2
Massachusetts	Norfolk	91.0	76.2	76.2	76.1	75.4	75.3	74.9
Massachusetts	Suffolk	88.7	71.6	71.5	71.4	70.9	70.8	70.4
Massachusetts	Worcester	85.5	66.9	66.6	66.5	65.9	65.3	64.9
Michigan	Allegan	94.0	77.2	77.0	76.5	76.4	75.9	74.5
Michigan	Benzie	85.7	69.7	69.5	69.2	68.9	68.5	67.5
Michigan	Berrien	88.0	74.0	73.9	73.6	73.4	73.1	72.4
Michigan	Cass	90.7	71.7	71.5	71.0	70.5	70.0	68.7

Michigan	Clinton	82.7	66.7	66.5	66.2	65.5	65.2	64.3
Michigan	Genesee	86.3	68.5	68.3	68.0	67.1	66.8	65.9
Michigan	Huron	83.0	70.8	70.7	70.5	70.3	70.0	69.6
Michigan	Ingham	82.3	65.9	65.8	65.5	64.8	64.4	63.5
Michigan	Kalamazoo	82.7	65.1	64.9	64.5	63.9	63.5	62.4
Michigan	Kent	84.7	67.4	67.2	66.9	66.2	65.8	64.8
Michigan	Lenawee	85.0	69.4	69.2	69.0	68.6	68.2	67.4
Michigan	Macomb	92.3	76.6	76.5	76.3	75.6	75.4	74.8
Michigan	Mason	86.0	68.9	68.7	68.3	67.8	67.4	66.1
Michigan	Missaukee	78.3	64.0	63.8	63.5	63.1	62.7	61.9
Michigan	Muskegon	90.0	73.4	73.2	72.7	72.5	72.0	70.7
Michigan	Oakland	87.7	74.2	74.1	73.9	73.3	73.1	72.6
Michigan	Ottawa	86.0	69.3	69.1	68.7	68.3	67.8	66.7
Michigan	Schoolcraft	77.0	65.0	64.9	64.6	64.5	64.1	63.3
Michigan	St Clair	88.0	72.5	72.3	72.1	71.5	71.2	70.6
Michigan	Washtenaw	87.3	71.4	71.3	71.1	70.5	70.2	69.5
Michigan	Wayne	86.0	72.9	72.8	72.6	71.9	71.7	71.2
Mississippi	Adams	77.7	63.1	61.9	61.7	63.2	60.8	60.2
Mississippi	De Soto	83.3	64.0	63.6	63.2	62.8	61.8	60.8
Mississippi	Hancock	81.0	66.1	65.4	65.1	65.7	64.1	63.5
Mississippi	Harrison	80.3	65.1	64.4	64.2	65.0	63.5	62.9
Mississippi	Hinds	72.7	52.1	51.8	51.4	50.1	49.5	48.3
Mississippi	Jackson	80.0	68.6	68.3	68.1	68.5	67.9	67.5
Mississippi	Lauderdale	73.3	52.3	52.1	51.8	50.9	50.6	49.8
Mississippi	Lee	78.3	57.4	57.1	56.8	56.2	55.6	54.7
Mississippi	Madison	74.3	55.2	54.9	54.5	53.7	53.1	51.9
Mississippi	Warren	73.7	54.9	53.6	53.4	54.9	52.4	51.7
Missouri	Cass	77.7	61.9	61.8	61.5	60.9	60.7	59.7
Missouri	Cedar	79.7	64.8	64.6	64.2	63.7	63.4	62.3
Missouri	Clay	83.7	66.7	66.5	66.0	65.0	64.6	63.3
Missouri	Greene	74.5	59.8	59.6	59.3	58.6	58.2	57.4
Missouri	Jefferson	84.7	68.9	68.4	68.2	67.6	66.4	65.8
Missouri	Monroe	76.7	61.9	61.6	61.3	61.2	60.5	59.5
Missouri	Platte	80.3	65.0	64.9	64.5	64.0	63.7	62.6
Missouri	St Charles	90.0	73.0	72.6	72.4	71.6	70.5	69.9
Missouri	St Louis	88.3	72.6	72.1	71.8	71.3	70.0	69.4
Missouri	St Louis City	87.7	72.9	72.4	72.2	71.8	70.5	69.9
Missouri	Ste Genevieve	82.7	66.8	66.4	66.1	66.0	65.1	64.4

Nebraska	Douglas	67.3	57.3	57.2	57.0	56.6	56.4	55.7
Nebraska	Lancaster	55.0	46.6	46.5	46.3	45.8	45.6	45.0
Nevada	Clark	84.7	74.9	74.8	74.6	74.0	73.8	73.3
Nevada	Douglas	69.0	61.1	61.0	60.9	59.4	59.2	58.8
Nevada	Washoe	73.3	65.0	65.0	64.9	63.6	63.5	63.1
New Hampshire	Belknap	76.5	61.5	61.4	61.2	60.4	60.2	59.8
New Hampshire	Cheshire	74.3	58.4	58.2	58.1	57.6	57.1	56.8
New Hampshire	Hillsborough	85.3	66.7	66.5	66.3	65.6	65.1	64.7
New Hampshire	Merrimack	74.7	59.1	58.9	58.8	58.2	57.8	57.3
New Hampshire	Rockingham	83.5	65.9	65.7	65.5	65.2	64.7	64.3
New Hampshire	Strafford	78.5	61.1	60.9	60.8	60.2	59.8	59.4
New Jersey	Atlantic	88.0	69.9	69.3	69.2	69.5	68.3	68.0
New Jersey	Bergen	91.3	76.2	76.0	75.9	75.5	75.3	74.9
New Jersey	Camden	99.7	79.6	79.1	78.9	78.9	77.9	77.4
New Jersey	Cumberland	94.0	73.7	73.2	73.0	73.3	72.2	71.7
New Jersey	Essex	67.0	54.1	54.1	54.0	53.5	53.4	53.1
New Jersey	Gloucester	98.0	77.9	77.6	77.4	77.4	76.7	76.1
New Jersey	Hudson	84.0	67.7	67.8	67.7	66.9	67.1	66.7
New Jersey	Hunterdon	94.7	73.6	73.1	73.0	72.5	71.5	71.1
New Jersey	Mercer	97.7	78.2	77.7	77.5	77.5	76.2	75.8
New Jersey	Middlesex	96.0	75.4	75.0	74.9	74.4	73.5	73.1
New Jersey	Monmouth	95.3	75.6	75.3	75.1	75.0	74.2	73.8
New Jersey	Morris	95.3	73.2	72.9	72.7	72.2	71.3	70.8
New Jersey	Ocean	105.7	82.1	81.5	81.3	81.1	79.8	79.3
New Jersey	Passaic	86.7	69.2	69.0	68.9	68.3	67.8	67.3
New Mexico	Bernalillo	76.3	66.4	66.3	66.1	64.5	64.4	63.7
New Mexico	Dona Ana	78.3	70.2	70.2	70.0	66.8	66.8	66.2
New Mexico	San Juan	74.3	70.4	70.4	70.3	70.0	70.0	69.7
New Mexico	Sandoval	74.0	64.9	64.8	64.6	63.1	63.0	62.3
New Mexico	Valencia	67.5	58.0	58.0	57.7	56.6	56.5	55.7
New York	Albany	83.0	66.2	66.0	65.8	64.9	64.4	63.8
New York	Bronx	82.7	71.1	71.1	70.9	70.7	70.6	70.2
New York	Chautauqua	93.0	75.4	75.0	74.7	75.0	74.1	73.2
New York	Chemung	80.3	63.1	63.0	62.7	61.9	61.6	60.9
New York	Dutchess	92.0	71.0	70.7	70.5	70.4	69.5	69.1
New York	Erie	95.7	77.7	77.3	77.0	77.1	76.3	75.5
New York	Essex	89.0	70.6	70.4	70.2	69.6	69.2	68.6
New York	Herkimer	74.0	60.3	60.1	59.9	59.4	59.1	58.6

New York	Jefferson	91.3	74.9	74.7	74.5	74.3	73.9	73.3
New York	Madison	79.7	63.7	63.6	63.3	62.5	62.3	61.6
New York	Monroe	84.0	68.8	68.7	68.5	67.5	67.3	66.7
New York	Niagara	91.7	77.2	77.0	76.8	76.8	76.4	75.9
New York	Oneida	79.7	64.5	64.3	64.1	63.6	63.2	62.6
New York	Onondaga	84.0	68.8	68.7	68.5	67.9	67.6	67.0
New York	Orange	84.7	65.6	65.3	65.2	64.5	63.9	63.4
New York	Oswego	68.0	55.1	55.0	54.8	54.4	54.1	53.6
New York	Putnam	91.3	73.4	73.1	72.9	72.9	72.1	71.7
New York	Queens	84.5	71.6	71.5	71.4	71.1	70.8	70.4
New York	Rensselaer	86.0	68.4	68.2	68.0	67.0	66.5	65.8
New York	Richmond	93.0	75.3	75.4	75.2	74.1	74.2	73.8
New York	Saratoga	87.0	68.8	68.6	68.4	67.4	66.8	66.1
New York	Schenectady	77.7	62.8	62.6	62.4	61.2	60.8	60.2
New York	Suffolk	97.0	82.0	82.1	82.0	81.4	81.6	81.3
New York	Ulster	81.3	65.2	65.0	64.8	64.2	63.8	63.3
New York	Wayne	84.0	67.5	67.3	67.1	66.3	66.0	65.4
New York	Westchester	91.3	76.3	76.1	76.0	75.7	75.3	74.9
North Carolina	Alexander	87.0	63.2	63.1	62.9	61.5	61.3	60.8
North Carolina	Avery	77.7	60.1	60.0	59.8	58.8	58.6	57.9
North Carolina	Buncombe	80.0	61.6	61.5	61.3	59.9	59.8	59.3
North Carolina	Caldwell	83.3	61.8	61.7	61.4	60.2	59.9	59.3
North Carolina	Caswell	87.7	62.0	61.9	61.7	60.1	59.9	59.3
North Carolina	Chatham	81.3	59.9	59.8	59.6	58.5	58.3	57.7
North Carolina	Cumberland	86.0	63.1	63.0	62.7	61.1	60.9	60.1
North Carolina	Davie	91.3	65.5	65.4	65.2	63.7	63.5	62.9
North Carolina	Duplin	80.0	60.6	60.5	60.3	59.2	59.0	58.3
North Carolina	Durham	88.7	62.8	62.7	62.5	60.6	60.4	59.8
North Carolina	Edgecombe	87.3	64.6	64.5	64.3	62.7	62.5	61.8
North Carolina	Forsyth	91.3	64.8	64.7	64.5	62.7	62.6	62.1
North Carolina	Franklin	89.7	64.7	64.6	64.3	62.2	62.0	61.4
North Carolina	Granville	92.3	65.8	65.7	65.5	64.2	63.9	63.3
North Carolina	Guilford	88.7	61.3	61.2	61.0	58.7	58.5	57.9
North Carolina	Haywood	84.7	65.8	65.7	65.5	64.5	64.2	63.6
North Carolina	Jackson	86.0	64.9	64.8	64.5	63.6	63.3	62.5
North Carolina	Johnston	84.3	61.4	61.3	61.1	59.1	58.9	58.3
North Carolina	Lenoir	80.0	61.2	61.1	60.9	59.8	59.5	58.9
North Carolina	Lincoln	90.7	65.7	65.6	65.4	63.8	63.6	63.1

North Carolina	Martin	81.0	61.3	61.2	61.0	60.0	59.7	59.1
North Carolina	Mecklenburg	97.3	73.0	72.9	72.7	70.8	70.6	70.1
North Carolina	New Hanover	77.3	58.0	57.7	57.5	56.9	56.2	55.7
North Carolina	Northampton	84.0	63.2	63.1	62.9	62.0	61.6	61.0
North Carolina	Person	89.3	64.0	63.9	63.8	63.1	62.8	62.4
North Carolina	Pitt	82.0	60.5	60.4	60.2	58.6	58.4	57.7
North Carolina	Randolph	83.5	58.9	58.8	58.6	56.7	56.5	55.9
North Carolina	Rockingham	88.3	63.0	62.9	62.7	61.6	61.5	60.9
North Carolina	Rowan	97.3	70.1	70.0	69.8	67.8	67.7	66.9
North Carolina	Swain	73.0	54.6	54.5	54.2	53.4	53.1	52.5
North Carolina	Union	87.0	63.5	63.4	63.2	61.1	61.0	60.3
North Carolina	Wake	92.5	65.8	65.7	65.5	62.9	62.7	62.1
North Carolina	Yancey	83.0	64.1	64.0	63.8	62.5	62.2	61.6
Ohio	Allen	88.0	69.7	69.4	69.2	68.7	68.2	67.4
Ohio	Ashtabula	95.7	78.9	78.6	78.3	78.6	77.9	77.1
Ohio	Butler	89.7	70.1	69.6	69.3	69.2	68.1	67.3
Ohio	Clark	88.3	68.1	67.9	67.6	67.4	66.7	66.0
Ohio	Clermont	89.3	70.8	70.3	70.1	70.0	69.0	68.2
Ohio	Clinton	94.3	71.4	71.0	70.6	70.4	69.4	68.5
Ohio	Cuyahoga	88.0	70.4	70.3	70.1	70.1	69.8	69.2
Ohio	Delaware	89.0	68.4	68.2	67.9	67.0	66.5	65.6
Ohio	Franklin	93.0	70.8	70.5	70.2	69.0	68.5	67.5
Ohio	Geauga	99.0	79.5	79.2	78.9	78.6	77.9	77.0
Ohio	Greene	87.7	68.0	67.6	67.3	67.2	66.4	65.6
Ohio	Hamilton	90.3	71.3	70.8	70.5	70.3	69.3	68.4
Ohio	Jefferson	84.3	65.0	64.7	64.5	64.5	63.8	63.3
Ohio	Knox	87.0	66.5	66.3	66.0	65.1	64.7	63.8
Ohio	Lake	92.7	75.3	75.2	75.0	75.0	74.7	74.1
Ohio	Lawrence	81.7	67.5	66.9	66.6	68.0	66.9	66.1
Ohio	Licking	88.0	67.2	67.0	66.7	65.7	65.2	64.3
Ohio	Lorain	87.0	69.8	69.8	69.6	69.3	69.2	68.7
Ohio	Lucas	90.0	72.8	72.8	72.5	71.9	71.8	71.1
Ohio	Madison	88.7	67.2	66.9	66.7	66.3	65.6	64.9
Ohio	Mahoning	87.0	67.1	66.8	66.5	66.0	65.4	64.5
Ohio	Medina	87.0	69.7	69.5	69.2	69.3	68.7	68.0
Ohio	Miami	87.0	66.5	66.2	66.0	65.2	64.7	63.9
Ohio	Montgomery	86.5	67.5	67.3	67.0	66.4	65.8	65.0
Ohio	Portage	91.0	71.1	70.7	70.4	70.0	69.2	68.3

Ohio	Preble	80.0	62.0	61.7	61.5	61.1	60.6	59.9
Ohio	Stark	88.3	67.8	67.6	67.3	66.5	66.0	65.2
Ohio	Summit	93.3	73.6	73.4	73.1	72.7	72.1	71.2
Ohio	Trumbull	92.0	70.8	70.5	70.2	69.7	69.0	68.0
Ohio	Warren	90.7	70.3	70.0	69.7	69.3	68.5	67.7
Ohio	Washington	85.7	63.2	62.7	62.5	63.1	61.8	61.3
Ohio	Wood	87.7	70.4	70.1	69.7	69.5	68.9	67.8
Oklahoma	Canadian	76.0	58.1	58.0	57.8	56.0	55.7	55.1
Oklahoma	Cleveland	75.3	61.3	61.1	60.9	60.3	59.9	59.4
Oklahoma	Comanche	77.3	62.4	62.2	62.0	61.7	61.4	60.8
Oklahoma	Dewey	71.0	59.3	59.1	59.0	58.9	58.5	58.1
Oklahoma	Kay	75.0	61.6	61.5	61.2	61.0	60.8	60.1
Oklahoma	Mc Clain	77.0	63.0	62.8	62.6	62.2	61.8	61.3
Oklahoma	Oklahoma	80.3	62.4	62.3	62.1	59.8	59.6	58.9
Oklahoma	Ottawa	78.0	63.5	63.4	63.1	62.7	62.4	61.5
Oklahoma	Pittsburg	73.0	61.6	61.4	61.1	61.0	60.5	59.7
Oklahoma	Tulsa	83.0	67.7	67.6	67.4	65.6	65.4	64.8
Pennsylvania	Adams	80.0	61.0	60.7	60.5	59.9	59.5	58.8
Pennsylvania	Allegheny	91.3	73.9	73.6	73.3	73.3	72.4	71.8
Pennsylvania	Armstrong	90.7	70.3	69.6	69.4	69.8	68.4	67.8
Pennsylvania	Beaver	91.3	72.8	72.5	72.3	72.1	71.5	71.0
Pennsylvania	Berks	88.7	67.4	67.2	67.0	66.2	65.8	65.1
Pennsylvania	Blair	83.3	62.3	62.0	61.8	61.5	60.9	60.1
Pennsylvania	Bucks	99.0	80.7	80.1	80.0	80.1	78.9	78.4
Pennsylvania	Cambria	85.0	65.1	64.8	64.5	64.4	63.7	63.0
Pennsylvania	Centre	84.7	63.7	63.5	63.2	62.7	62.2	61.4
Pennsylvania	Chester	95.0	72.9	72.7	72.5	71.9	71.4	70.6
Pennsylvania	Clearfield	87.3	66.7	66.3	66.1	66.0	65.2	64.6
Pennsylvania	Dauphin	86.7	66.6	66.4	66.2	65.4	65.1	64.4
Pennsylvania	Delaware	91.7	72.7	72.4	72.2	72.2	71.6	71.1
Pennsylvania	Erie	89.0	73.2	72.7	72.5	72.9	72.0	71.2
Pennsylvania	Franklin	90.7	68.8	68.5	68.2	67.3	66.8	66.0
Pennsylvania	Greene	87.7	65.5	65.0	64.8	65.2	64.2	63.7
Pennsylvania	Lackawanna	83.3	63.3	63.2	63.0	62.0	61.6	61.1
Pennsylvania	Lancaster	91.0	69.2	69.1	68.8	68.0	67.6	66.8
Pennsylvania	Lawrence	78.3	59.2	59.0	58.7	58.3	57.8	57.0
Pennsylvania	Lehigh	90.7	68.6	68.4	68.2	67.3	66.8	66.3
Pennsylvania	Luzerne	83.7	63.5	63.4	63.2	62.3	61.9	61.3

Pennsylvania	Lycoming	82.0	62.7	62.5	62.3	61.7	61.3	60.7
Pennsylvania	Mercer	91.3	70.1	69.7	69.4	69.0	68.3	67.3
Pennsylvania	Montgomery	92.3	73.4	73.1	72.9	72.7	72.1	71.6
Pennsylvania	Northampton	90.0	68.2	68.0	67.8	66.8	66.2	65.7
Pennsylvania	Perry	83.3	63.1	63.0	62.7	62.0	61.6	60.8
Pennsylvania	Philadelphia	96.7	79.7	79.2	79.0	79.2	78.0	77.6
Pennsylvania	Tioga	85.0	66.4	66.2	66.0	65.4	65.0	64.4
Pennsylvania	Washington	86.3	68.2	68.0	67.8	67.7	67.1	66.5
Pennsylvania	Westmoreland	88.0	70.9	70.3	70.1	70.3	69.1	68.5
Pennsylvania	York	89.0	68.5	68.4	68.1	67.4	67.0	66.3
Rhode Island	Kent	93.0	72.6	72.2	72.0	72.1	71.0	70.7
Rhode Island	Providence	92.0	72.0	71.5	71.4	71.4	70.4	70.0
Rhode Island	Washington	92.7	73.7	73.2	73.1	73.3	72.2	71.8
South Carolina	Abbeville	82.3	61.5	61.4	61.2	59.6	59.4	58.7
South Carolina	Aiken	82.7	62.7	62.6	62.3	60.9	60.7	60.1
South Carolina	Anderson	85.3	64.8	64.8	64.6	62.3	62.2	61.6
South Carolina	Barnwell	79.3	60.0	59.9	59.6	58.4	58.2	57.5
South Carolina	Berkeley	71.5	54.5	54.1	53.9	53.6	52.8	52.2
South Carolina	Charleston	72.5	56.3	55.9	55.7	55.5	54.6	54.0
South Carolina	Cherokee	83.7	62.2	62.2	62.0	60.6	60.4	59.8
South Carolina	Chester	82.7	60.6	60.5	60.3	58.9	58.7	58.2
South Carolina	Chesterfield	80.0	60.1	60.0	59.7	58.6	58.4	57.7
South Carolina	Colleton	77.7	59.4	59.3	59.1	58.2	57.9	57.3
South Carolina	Darlington	82.7	62.5	62.4	62.2	61.0	60.8	60.1
South Carolina	Edgefield	79.7	60.3	60.2	60.0	58.7	58.5	57.9
South Carolina	Oconee	83.7	61.8	61.7	61.5	59.8	59.6	59.1
South Carolina	Pickens	83.0	61.0	61.0	60.8	58.9	58.7	58.1
South Carolina	Richland	89.3	67.8	67.7	67.5	65.3	65.1	64.4
South Carolina	Spartanburg	87.0	63.7	63.7	63.4	61.4	61.3	60.6
South Carolina	Union	79.7	59.9	59.8	59.6	58.1	57.9	57.3
South Carolina	Williamsburg	71.7	53.4	53.3	53.1	52.3	52.0	51.4
South Carolina	York	83.0	60.8	60.8	60.6	59.1	58.9	58.4
Tennessee	Anderson	87.0	60.2	60.0	59.7	57.6	57.3	56.4
Tennessee	Blount	92.3	66.6	66.4	66.1	64.4	64.0	63.0
Tennessee	Davidson	77.7	58.2	57.9	57.6	56.7	56.1	55.4
Tennessee	Hamilton	88.3	63.7	63.5	63.1	61.3	60.9	59.6
Tennessee	Haywood	83.5	61.5	61.2	61.0	60.4	59.8	59.1
Tennessee	Jefferson	91.0	63.4	63.3	63.0	60.2	59.9	59.0

Tennessee	Knox	92.0	63.4	63.3	62.9	59.9	59.6	58.5
Tennessee	Lawrence	77.0	57.8	57.6	57.3	56.9	56.3	55.6
Tennessee	Meigs	89.0	62.8	62.7	62.3	60.8	60.5	59.5
Tennessee	Putnam	84.0	63.1	63.0	62.8	61.9	61.6	60.9
Tennessee	Rutherford	80.7	59.5	59.3	59.1	58.1	57.6	56.9
Tennessee	Sevier	92.3	68.0	67.8	67.5	66.3	65.9	65.0
Tennessee	Shelby	87.7	68.3	67.5	67.2	67.6	65.8	64.9
Tennessee	Sullivan	86.7	67.3	67.3	67.0	66.0	65.8	65.1
Tennessee	Sumner	85.7	63.5	63.3	63.0	61.9	61.3	60.6
Tennessee	Williamson	84.3	62.1	61.8	61.6	60.5	59.9	59.2
Tennessee	Wilson	82.0	61.6	61.4	61.2	60.2	59.8	59.1
Texas	Bexar	88.7	70.6	70.4	70.1	69.4	68.9	68.3
Texas	Brazoria	94.0	80.2	79.1	78.9	80.6	78.1	77.7
Texas	Collin	90.0	71.4	71.2	71.0	70.3	70.0	69.4
Texas	Dallas	90.0	70.5	70.4	70.2	69.7	69.4	68.8
Texas	Denton	97.3	76.2	76.1	75.9	75.4	75.1	74.5
Texas	El Paso	79.3	70.5	70.5	70.3	67.3	67.2	66.5
Texas	Ellis	85.0	64.4	64.3	64.1	63.3	63.1	62.5
Texas	Galveston	89.7	76.6	76.6	76.4	76.6	76.0	75.5
Texas	Gregg	84.3	69.0	68.8	68.6	68.2	67.8	67.2
Texas	Harris	102.0	92.4	92.4	92.3	92.1	92.0	91.6
Texas	Harrison	78.5	62.8	62.5	62.3	62.1	61.5	60.8
Texas	Hood	83.0	59.6	59.5	59.2	58.1	57.8	57.1
Texas	Jefferson	91.0	78.6	77.4	77.2	79.0	76.5	76.0
Texas	Johnson	89.7	67.3	67.2	67.0	66.0	65.7	65.1
Texas	Kaufman	72.0	56.0	55.9	55.6	55.3	55.0	54.4
Texas	Montgomery	88.3	77.3	76.7	76.6	77.3	76.0	75.7
Texas	Nueces	80.3	68.9	68.0	67.8	69.2	67.2	66.7
Texas	Orange	81.0	69.6	68.6	68.4	69.8	67.7	67.2
Texas	Parker	87.0	64.8	64.7	64.5	63.6	63.4	62.8
Texas	Rockwall	82.0	63.2	63.1	62.9	62.2	61.9	61.3
Texas	Smith	82.0	65.1	64.9	64.7	64.2	63.8	63.0
Texas	Tarrant	98.7	77.0	76.9	76.7	76.2	75.9	75.4
Texas	Travis	84.7	65.7	65.4	65.2	64.5	63.9	63.3
Texas	Victoria	77.7	65.1	64.4	64.2	65.0	63.5	63.0
Texas	Webb	64.7	55.3	54.8	54.7	55.2	54.1	53.8
Utah	Box Elder	77.5	67.0	67.0	66.7	66.2	66.1	65.2
Utah	Cache	69.3	58.7	58.7	58.4	57.5	57.4	56.7

Utah	Davis	81.0	72.8	72.8	72.6	71.7	71.6	70.9
Utah	Salt Lake	79.7	72.8	72.7	72.4	72.2	72.1	71.2
Utah	Utah	77.7	69.3	69.3	69.0	68.3	68.3	67.7
Utah	Weber	79.3	68.1	68.1	67.8	66.8	66.7	65.9
Vermont	Bennington	79.3	62.5	62.3	62.1	61.1	60.7	60.0
Virginia	Alexandria City	90.0	68.1	68.0	67.8	66.7	66.5	65.8
Virginia	Arlington	96.7	74.2	74.1	73.8	72.6	72.3	71.6
Virginia	Caroline	82.3	60.7	60.6	60.3	59.5	59.2	58.5
Virginia	Charles City	89.3	70.2	70.1	69.9	69.1	68.9	68.4
Virginia	Chesterfield	84.7	67.6	67.5	67.4	66.7	66.4	66.0
Virginia	Fairfax	96.7	73.2	73.1	72.8	71.6	71.4	70.7
Virginia	Fauquier	79.3	59.7	59.5	59.3	58.8	58.4	57.7
Virginia	Frederick	82.7	63.3	63.1	62.8	62.2	61.7	61.0
Virginia	Hampton City	88.3	72.9	72.7	72.5	72.4	72.0	71.6
Virginia	Hanover	92.0	71.2	71.1	70.9	70.0	69.7	69.2
Virginia	Henrico	88.3	68.9	68.8	68.6	67.7	67.4	67.0
Virginia	Loudoun	90.0	68.5	68.3	68.1	67.4	67.0	66.3
Virginia	Madison	84.7	64.2	64.1	63.9	63.2	62.9	62.4
Virginia	Page	79.7	59.3	59.1	58.9	58.3	57.9	57.5
Virginia	Prince William	85.0	64.9	64.7	64.5	63.8	63.4	62.6
Virginia	Roanoke	83.7	63.2	63.1	62.8	61.6	61.3	60.5
Virginia	Rockbridge	76.7	58.0	57.9	57.7	57.0	56.7	56.1
Virginia	Stafford	86.0	64.8	64.7	64.2	63.5	63.3	62.1
Virginia	Suffolk City	87.0	72.0	71.8	71.6	71.7	71.3	70.8
West Virginia	Berkeley	83.0	63.7	63.5	63.2	62.5	62.0	61.2
West Virginia	Cabell	85.7	70.9	70.5	70.3	71.7	71.1	70.4
West Virginia	Hancock	84.7	65.5	65.3	65.1	65.0	64.4	63.9
West Virginia	Kanawha	84.0	63.6	63.2	63.0	63.1	62.4	61.8
West Virginia	Monongalia	78.7	56.7	56.5	56.4	56.2	55.8	55.3
West Virginia	Ohio	83.3	64.6	64.2	64.1	64.3	63.5	63.0
West Virginia	Wood	85.7	63.9	63.3	63.1	63.8	62.5	62.0
Wisconsin	Brown	80.3	67.9	67.8	67.5	67.4	67.1	66.4
Wisconsin	Columbia	76.3	62.1	61.9	61.7	61.1	60.7	60.0
Wisconsin	Dane	76.0	62.6	62.5	62.2	61.6	61.2	60.5
Wisconsin	Dodge	79.3	65.7	65.5	65.3	65.1	64.7	64.0
Wisconsin	Door	91.0	75.0	74.8	74.4	74.4	74.0	72.9
Wisconsin	Fond Du Lac	77.3	63.7	63.6	63.4	63.0	62.8	62.1
Wisconsin	Jefferson	80.0	65.0	64.9	64.6	64.1	63.7	62.9

Wisconsin	Kenosha	98.3	85.0	84.9	84.7	84.4	84.2	83.4
Wisconsin	Kewaunee	89.3	74.3	74.1	73.8	73.9	73.4	72.3
Wisconsin	Manitowoc	87.0	72.2	72.0	71.6	71.6	71.2	70.2
Wisconsin	Milwaukee	91.0	77.2	77.1	76.8	76.6	76.3	75.4
Wisconsin	Ozaukee	93.0	78.0	77.9	77.5	77.3	77.0	75.9
Wisconsin	Racine	91.7	78.0	77.9	77.7	77.4	77.1	76.4
Wisconsin	Rock	81.7	66.1	65.9	65.5	64.7	64.2	63.1
Wisconsin	Sauk	72.0	59.4	59.3	59.0	58.6	58.3	57.6
Wisconsin	Sheboygan	97.0	81.1	80.9	80.5	80.4	79.9	78.7
Wisconsin	St Croix	71.3	61.2	61.1	61.0	60.7	60.5	60.0
Wisconsin	Walworth	81.3	66.3	66.2	65.8	65.4	65.0	64.1
Wisconsin	Washington	80.3	67.4	67.2	67.0	66.9	66.5	65.9
Wisconsin	Waukesha	79.0	66.0	65.9	65.6	65.5	65.1	64.4

Appendix C: Visibility Levels on 20% Worst Days for Locomotive/Marine Scenario (units are deciviews)

Class 1 Area	State	Baseline Visibility	2020 Base	2020 Locomotive / Marine	2030 Base	2030 Locomotive / Marine	Natural Background
Sipsey Wilderness	AL	29.03	23.78	23.73	23.77	23.66	10.99
Caney Creek Wilderness	AR	26.36	22.11	22.05	22.06	21.92	11.58
Upper Buffalo Wilderness	AR	26.27	22.41	22.35	22.34	22.19	11.57
Chiricahua NM	AZ	13.43	13.09	13.09	13.10	13.09	7.21
Chiricahua Wilderness	AZ	13.43	13.09	13.09	13.10	13.09	7.21
Galiuro Wilderness	AZ	13.43	13.08	13.07	13.11	13.09	7.21
Grand Canyon NP	AZ	11.66	11.13	11.09	11.15	11.08	7.14
Mazatzal Wilderness	AZ	13.35	12.74	12.72	12.77	12.73	6.68
Petrified Forest NP	AZ	13.21	12.90	12.83	12.87	12.75	6.49
Pine Mountain Wilderness	AZ	13.35	12.59	12.58	12.59	12.54	6.68
Saguaro NM	AZ	14.83	14.50	14.47	14.49	14.44	6.46
Sierra Ancha Wilderness	AZ	13.67	13.22	13.20	13.18	13.15	6.59
Sycamore Canyon Wilderness	AZ	15.25	14.96	14.94	14.98	14.93	6.69
Agua Tibia Wilderness	CA	23.50	21.23	21.14	21.16	20.94	7.64
Caribou Wilderness	CA	14.15	13.62	13.60	13.55	13.51	7.31
Cucamonga Wilderness	CA	19.94	17.42	17.36	17.14	17.10	7.06
Desolation Wilderness	CA	12.63	12.15	12.13	12.15	12.12	6.12
Dome Land Wilderness	CA	19.43	18.37	18.34	18.20	18.11	7.46
Emigrant Wilderness	CA	17.63	17.22	17.21	17.24	17.19	7.64
Hoover Wilderness	CA	12.87	12.73	12.72	12.75	12.74	7.91
Joshua Tree NM	CA	19.62	17.95	17.93	17.85	17.71	7.19
Lassen Volcanic NP	CA	14.15	13.56	13.54	13.48	13.43	7.31
Lava Beds NM	CA	15.05	14.45	14.42	14.40	14.32	7.86
Mokelumne Wilderness	CA	12.63	12.32	12.30	12.34	12.31	6.12
Pinnacles NM	CA	18.46	17.37	17.36	17.16	17.09	7.99
Point Reyes NS	CA	22.81	22.01	21.99	21.87	21.79	15.77
Redwood NP	CA	18.45	17.89	17.86	17.86	17.79	13.91
San Gabriel Wilderness	CA	19.94	17.30	17.25	17.01	16.93	7.06
San Gorgonio Wilderness	CA	22.17	20.28	20.22	19.94	19.70	7.30
San Jacinto Wilderness	CA	22.17	19.92	19.87	19.61	19.55	7.30
South Warner Wilderness	CA	15.05	14.61	14.59	14.57	14.52	7.86

Thousand Lakes Wilderness	CA	14.15	13.54	13.52	13.46	13.41	7.31
Ventana Wilderness	CA	18.46	17.67	17.64	17.67	17.62	7.99
Yosemite NP	CA	17.63	17.16	17.14	17.15	17.11	7.64
Black Canyon of the Gunnison NM	CO	10.33	9.80	9.79	9.79	9.77	6.24
Eagles Nest Wilderness	CO	9.61	9.05	9.03	8.99	8.96	6.54
Flat Tops Wilderness	CO	9.61	9.31	9.31	9.32	9.31	6.54
Great Sand Dunes NM	CO	12.78	12.36	12.36	12.37	12.36	6.66
La Garita Wilderness	CO	10.33	9.90	9.89	9.89	9.88	6.24
Maroon Bells-Snowmass Wilderness	CO	9.61	9.24	9.24	9.24	9.24	6.54
Mesa Verde NP	CO	13.03	12.40	12.39	12.40	12.37	6.83
Mount Zirkel Wilderness	CO	10.52	10.06	10.05	10.07	10.04	6.44
Rawah Wilderness	CO	10.52	10.04	10.04	10.06	10.04	6.44
Rocky Mountain NP	CO	13.83	13.10	13.08	13.06	13.01	7.24
Weminuche Wilderness	CO	10.33	9.86	9.86	9.86	9.86	6.24
West Elk Wilderness	CO	9.61	9.24	9.24	9.24	9.23	6.54
Chassahowitzka	FL	26.09	21.96	21.94	21.96	21.91	11.21
Everglades NP	FL	22.30	19.75	19.77	19.97	19.94	12.15
St. Marks	FL	26.03	21.84	21.82	21.88	21.83	11.53
Cohutta Wilderness	GA	30.30	23.36	23.33	23.34	23.28	11.14
Okefenokee	GA	27.13	23.46	23.42	23.50	23.40	11.44
Wolf Island	GA	27.13	23.40	23.37	23.40	23.32	11.44
Craters of the Moon NM	ID	14.00	13.00	12.97	12.90	12.82	7.53
Sawtooth Wilderness	ID	13.78	13.64	13.63	13.64	13.63	6.43
Mammoth Cave NP	KY	31.37	25.53	25.48	25.54	25.44	11.08
Acadia NP	ME	22.89	19.79	19.77	19.86	19.81	12.43
Moosehorn	ME	21.72	18.65	18.63	18.68	18.64	12.01
Roosevelt Campobello International Park	ME	21.72	18.47	18.45	18.51	18.47	12.01
Isle Royale NP	MI	20.74	19.15	19.10	19.16	19.04	12.37
Seney	MI	24.16	21.77	21.72	21.78	21.66	12.65
Voyageurs NP	MN	19.27	17.62	17.58	17.53	17.43	12.06
Hercules-Glades Wilderness	MO	26.75	23.00	22.93	22.96	22.81	11.30
Anaconda-Pintler Wilderness	MT	13.41	13.15	13.14	13.13	13.11	7.43
Bob Marshall Wilderness	MT	14.48	14.14	14.13	14.11	14.08	7.74
Cabinet Mountains Wilderness	MT	14.09	13.57	13.54	13.52	13.46	7.53
Gates of the Mountains Wilderness	MT	11.29	10.92	10.91	10.89	10.87	6.45
Medicine Lake	MT	17.72	16.25	16.22	16.18	16.12	7.90
Mission Mountains Wilderness	MT	14.48	14.06	14.04	14.02	13.99	7.74
Scapegoat Wilderness	MT	14.48	14.17	14.16	14.14	14.12	7.74

Selway-Bitterroot Wilderness	MT	13.41	13.06	13.04	13.02	12.99	7.43
UL Bend	MT	15.14	14.66	14.64	14.62	14.58	8.16
Linville Gorge Wilderness	NC	28.77	22.48	22.45	22.47	22.41	11.22
Swanquarter	NC	25.49	21.17	21.15	21.20	21.15	11.94
Lostwood	ND	19.57	17.73	17.70	17.67	17.60	8.00
Theodore Roosevelt NP	ND	17.74	16.65	16.54	16.61	16.42	7.79
Great Gulf Wilderness	NH	22.82	19.48	19.45	19.50	19.46	11.99
Presidential Range-Dry River Wilderness	NH	22.82	19.48	19.45	19.50	19.46	11.99
Brigantine	NJ	29.01	24.88	24.85	24.99	24.91	12.24
Bandelier NM	NM	12.22	11.43	11.41	11.38	11.34	6.26
Bosque del Apache	NM	13.80	12.96	12.90	12.94	12.81	6.73
Gila Wilderness	NM	13.11	12.55	12.54	12.55	12.54	6.69
Pecos Wilderness	NM	10.41	10.01	10.00	10.02	10.01	6.44
Salt Creek	NM	18.03	16.61	16.59	16.58	16.52	6.81
San Pedro Parks Wilderness	NM	10.17	9.53	9.52	9.53	9.52	6.08
Wheeler Peak Wilderness	NM	10.41	9.96	9.95	9.97	9.96	6.44
White Mountain Wilderness	NM	13.70	13.07	13.05	13.07	13.04	6.86
Jarbidge Wilderness	NV	12.07	11.86	11.86	11.86	11.85	7.87
Wichita Mountains	OK	23.81	20.67	20.62	20.68	20.55	7.53
Crater Lake NP	OR	13.74	13.29	13.27	13.26	13.20	7.84
Diamond Peak Wilderness	OR	13.74	13.25	13.20	13.22	13.12	7.84
Eagle Cap Wilderness	OR	18.57	17.86	17.83	17.79	17.71	8.92
Gearhart Mountain Wilderness	OR	13.74	13.39	13.37	13.36	13.33	7.84
Hells Canyon Wilderness	OR	18.55	17.26	17.20	17.18	17.04	8.32
Kalmiopsis Wilderness	OR	15.51	15.00	14.98	14.97	14.93	9.44
Mount Hood Wilderness	OR	14.86	14.19	14.13	14.28	14.14	8.44
Mount Jefferson Wilderness	OR	15.33	14.80	14.77	14.82	14.76	8.79
Mount Washington Wilderness	OR	15.33	14.77	14.75	14.78	14.72	8.79
Mountain Lakes Wilderness	OR	13.74	13.26	13.24	13.23	13.17	7.84
Strawberry Mountain Wilderness	OR	18.57	17.77	17.73	17.69	17.60	8.92
Three Sisters Wilderness	OR	15.33	14.84	14.82	14.84	14.79	8.79
Cape Romain	SC	26.48	22.77	22.74	22.77	22.71	12.12
Badlands NP	SD	17.14	15.87	15.84	15.80	15.75	8.06
Wind Cave NP	SD	15.84	14.94	14.91	14.94	14.87	7.71
Great Smoky Mountains NP	TN	30.28	23.96	23.93	23.93	23.86	11.24
Joyce-Kilmer-Slickrock Wilderness	TN	30.28	23.46	23.43	23.43	23.37	11.24
Big Bend NP	TX	17.30	16.15	16.13	16.18	16.15	7.16
Carlsbad Caverns NP	TX	17.19	15.93	15.92	15.92	15.90	6.68

Guadalupe Mountains NP	TX	17.19	15.89	15.88	15.89	15.86	6.68
Arches NP	UT	11.24	11.14	11.11	11.05	11.03	6.43
Bryce Canyon NP	UT	11.65	11.36	11.34	11.34	11.31	6.86
Canyonlands NP	UT	11.24	10.84	10.81	10.83	10.82	6.43
Zion NP	UT	13.24	12.96	12.92	12.89	12.81	6.99
James River Face Wilderness	VA	29.12	23.43	23.34	23.43	23.26	11.13
Shenandoah NP	VA	29.31	22.83	22.80	22.83	22.76	11.35
Lye Brook Wilderness	VT	24.45	21.10	21.08	21.17	21.11	11.73
Alpine Lake Wilderness	WA	17.84	16.77	16.71	16.72	16.60	8.43
Glacier Peak Wilderness	WA	13.96	13.62	13.60	13.69	13.67	8.01
Goat Rocks Wilderness	WA	12.76	12.06	12.05	12.07	12.03	8.36
Mount Adams Wilderness	WA	12.76	12.03	12.01	12.02	11.97	8.36
Mount Rainier NP	WA	18.24	17.27	17.24	17.27	17.21	8.55
North Cascades NP	WA	13.96	13.58	13.57	13.68	13.67	8.01
Olympic NP	WA	16.74	15.85	15.82	15.95	15.89	8.44
Pasayten Wilderness	WA	15.23	14.85	14.84	14.83	14.81	8.26
Dolly Sods Wilderness	WV	29.04	22.38	22.35	22.38	22.33	10.39
Otter Creek Wilderness	WV	29.04	22.31	22.29	22.32	22.27	10.39
Bridger Wilderness	WY	11.12	10.81	10.81	10.80	10.80	6.58
Fitzpatrick Wilderness	WY	11.12	10.86	10.85	10.86	10.84	6.58
Grand Teton NP	WY	11.76	11.36	11.35	11.33	11.31	6.51
North Absaroka Wilderness	WY	11.45	11.17	11.16	11.15	11.13	6.86
Red Rock Lakes	WY	11.76	11.44	11.43	11.42	11.39	6.51
Teton Wilderness	WY	11.76	11.41	11.40	11.39	11.36	6.51
Washakie Wilderness	WY	11.45	11.18	11.17	11.16	11.14	6.86
Yellowstone NP	WY	11.76	11.39	11.38	11.36	11.34	6.51

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