UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

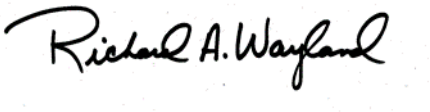
OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

06/03/2020

MEMORANDUM

SUBJECT: Recommendation for the Use of Patched and Substituted Data and Clarification of Data Completeness for Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program

FROM: Richard A. Wayland, Division Director
Air Quality Assessment Division



TO: Regional Air Division Directors, Regions 1 – 10

Through this memorandum, the United States Environmental Protection Agency (EPA) is communicating recommendations on ambient data completeness criteria for the Regional Haze program. The baseline period for tracking progress is specified in the 2017 Regional Haze Rule[1] as 2000-2004. Visibility progress is tracked through time, starting with the 5-year average for the 2000-2004 baseline period, using 5-year running averages of ambient visibility data from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network.

The IMPROVE program determines annual data completeness for each monitoring site following the data completeness criteria contained in the 2003 Guidance for Tracking Progress Under the Regional Haze Rule[2] (hereafter the "Tracking Guidance"). This Tracking Guidance recommends annual data recovery of greater than 50% for all four quarters, greater than 75% annual data completeness, and no more than 10 consecutive missing daily samples. The Tracking Guidance also recommends a minimum of 3 years of data meeting the above data completeness criteria to calculate the average for each 5-year period. The Regional Haze program has used these criteria since 2003 to track visibility progress. The EPA continues to believe that these data completeness criteria are appropriate for use in the current IMPROVE ambient data calculations under the 2017 Regional Haze Rule because they balance the need for flexibility when monitoring issues arise with the representativeness of ambient sampling frequency to quantify long-term visibility changes.

[1] *See*, Protection of Visibility: Amendments to Requirements for State Plans, Final Rule, 82 FR 3078 (January 10, 2017).
[2]The 2003 Guidance for Tracking Progress Under the Regional Haze Rule can be accessed at https://www3.epa.gov/ttnamti1/files/ambient/visible/tracking.pdf.

To maximize the sample periods upon which visibility can be tracked without significantly degrading the calculation, administrators of the IMPROVE database have implemented two approaches to fill missing data. The first approach follows the Tracking Guidance which describes a process (hereafter "data patching") for testing the feasibility of patching quarterly median concentrations from the current year and each of the previous 4 years for missing daily concentrations in that quarter. This patching procedure has recently been updated to allow for patching up to two missing species.[3] The second approach (hereafter "data substitution") involves using co-located measurements of proxies for the missing species or scaled data from a suitable nearby site to fill missing daily concentrations. In the current implementation of data patching and substitution of the IMPROVE data, data patching occurs prior to data substitution. A more comprehensive description of the currently implemented data patching and substitution of the IMPROVE data can be found on the IMPROVE website.[4]

The EPA believes that both data patching and substitution are appropriate for use in the current IMPROVE ambient data calculations for the second implementation period under the 2017 Regional Haze Rule. On the IMPROVE website,[5] users can download summary data for the Regional Haze Rule that includes routinely performed data patching and substitution. To ensure that the patched and substituted data are included in the analysis, users should include records with a "good_year" variable of both "1" and "2."

The most recent IMPROVE datasets include the updated patching procedures, which may lead to small changes in historical data completeness, regional haze baseline data, current data (most recent 5 years) and natural conditions values. While we encourage using the most recent IMPROVE datasets, because states may have initiated visibility tracking calculations for the second implementation period prior to the release and availability of these datasets, states may use older datasets that do not incorporate the latest data updates. Regardless of the approach, EPA recommends that states document the version of the IMPROVE data used.

Additionally, the EPA has received questions about which years should be used in the calculation of visibility impairment for the baseline 2000-2004 period for sites with incomplete monitoring data as described at the end of 51.308(f)(1)(i) in the 2017 Regional Haze Rule:

> *(i)…For mandatory Class I Federal areas with incomplete monitoring data for 2000-2004, the State must establish baseline values using the 5 complete years of monitoring data closest in time to 2000-2004.*

Based on the recommendations in the Tracking Guidance as reaffirmed above, this memo reiterates that it is appropriate to define complete monitoring data for mandatory Class I areas as 3 or more valid years of data within a 5-year period with the patched IMPROVE dataset utilized where applicable. Following these long-standing data completeness requirements, current

[3]The Copeland (2019) presentation recommending an increase (from one to two) in the number of patchable daily concentrations values and an update to the Natural Conditions II estimates can be accessed at http://vista.cira.colostate.edu/DataWarehouse/IMPROVE/Data/SummaryData/RHR_2018/Changes%20to%20IMPROVE%20RHR%20Metric%20Data%20Processing%20since%2010_2019.pptx.

[4]http://vista.cira.colostate.edu/Improve/impairment/

[5]Summary data for the Regional Haze Rule can be accessed at http://vista.cira.colostate.edu/Improve/rhr-summary-data/

patching/substitution practices, and EPA default site combinations listed in Appendix A, our calculations show that all mandatory Class I Federal areas are represented by an IMPROVE site with complete data for the 2000-2004 period. Regulatory decisions on whether to combine sites and appropriate combination dates should be made in consultation between state and local air agencies, Federal Land Managers, and the EPA.

Appendix A of this memo updates the Appendix A of the 2018 Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program[6] (hereafter the "2018 Technical Guidance") giving the deciview values of the baseline (2000-2004) and current (2012-2016) visibility conditions for the first implementation period approach and the approach recommended for the second implementation period and their associated natural condition estimates. The values for some sites have been updated to include the patched and substituted values within the Regional Haze Rule summary data from the IMPROVE website, as well as incorporating recent updates[7] to the Natural Conditions II estimates. For additional information such as the deciview values of the baseline period (2000-2004), most recent period (2014-2018), and natural condition estimates on the 20% clearest and 20% most impaired days and updated figures through 2018 from Appendix B of the 2018 Technical Guidance, please see the Technical Addendum[8] to this memo.

If anyone has questions or needs more clarification on the technical approach, feel free to contact Brett Gantt (gantt.brett@epa.gov) of my staff.

[6]The 2018 Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program can be accessed at https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf.

[7]The Copeland (2019) presentation recommending an increase (from one to two) in the number of patchable daily concentrations values and an update to the Natural Conditions II estimates can be accessed at http://vista.cira.colostate.edu/DataWarehouse/IMPROVE/Data/SummaryData/RHR_2018/Changes%20to%20IMPROVE%20RHR%20Metric%20Data%20Processing%20since%2010_2019.pptx.

[8]The Technical Addendum to this memo can be accessed at https://www.epa.gov/visibility/memo-and-technical-addendum-ambient-data-usage-and-completeness-regional-haze-program.

Appendix A. Summary of the baseline, current, and natural visibility condition estimates for each IMPROVE site representing a Class I area for the Regional Haze Program

Site	First Implementation Period Approach			Recommended Approach			e3 (Mm^{-1})[9]		Years included in the Baseline Visibility Condition
	Baseline Visibility Condition for 20% Haziest Days (2000-2004)	Current Visibility Condition for 20% Haziest Days (2012-2016)	Natural Conditions (20% Haziest Days)	Baseline Visibility Condition for 20% Most Impaired Days (2000-2004)	Current Visibility Condition for 20% Most Impaired Days (2012-2016)	Natural Conditions (20% Most Impaired Days)[10]	carbon	dust	
ACAD1	22.89	16.46	12.43	22.01	15.26	10.39	10.44	3.11	2000,2001,2002,2003,2004
AGTI1	23.64	17.65	7.65	21.60	16.73	7.66	10.85	8.86	2001,2002,2003,2004
BADL1	17.14	14.71	8.06	14.98	12.56	6.09	9.17	7.49	2000,2001,2002,2003,2004
BALD1	11.85	10.17	6.40	8.80	7.56	4.18	6.65	5.37	2001,2002,2003,2004
BAND1	12.23	10.71	6.26	9.70	8.88	4.59	5.60	4.36	2000,2001,2002,2003,2004
BIBE1	17.30	15.29	7.16	15.57	14.25	5.33	7.60	8.59	2001,2002,2003,2004
BLIS1	12.63	12.57	6.05	10.06	9.35	4.91	11.14	2.84	2000,2001,2002,2003
BOAP1	13.80	13.85	6.73	11.61	11.02	5.39	9.38	7.83	2002,2003,2004
BOWA1	19.77	16.51	11.60	18.43	14.58	9.09	10.86	2.92	2000,2001,2002,2003,2004
BRCA1	11.91	9.22	6.80	8.42	6.68	4.08	6.13	4.26	2000,2001,2002,2003,2004
BRID1	11.12	10.77	6.45	8.01	6.62	3.92	7.94	2.83	2000,2001,2002,2003,2004
BRIG1	29.01	21.62	12.25	27.43	20.44	10.68	20.15	9.07	2000,2001,2002,2003,2004
BRIS1[a]	25.91	21.18	11.97	24.91	19.64	9.23	18.21	7.96	2001,2002,2003,2004
CABI1	14.09	14.23	7.53	10.73	9.97	5.64	13.14	4.13	2001,2002,2003,2004
CACR1	26.36	20.68	11.58	23.99	19.22	9.54	16.84	7.80	2002,2003,2004
CANY1	11.25	9.91	6.43	8.79	7.36	4.13	5.53	5.02	2000,2001,2002,2003,2004
CAPI1	10.89	9.97	6.09	8.78	7.28	4.00	5.07	5.14	2000,2001,2002,2003,2004
CHAS1	25.76	20.11	11.08	24.52	18.19	9.03	24.69	6.28	2000,2001,2002,2003,2004
CHIR1	13.43	11.90	7.21	10.50	9.75	4.93	4.81	7.87	2000,2001,2002,2003,2004
COHU1	30.25	20.15	11.00	29.12	18.54	9.88	18.17	3.98	2001,2002,2003,2004
CRLA1	13.74	13.11	7.62	9.36	8.31	5.16	8.67	2.37	2002,2003,2004
CRMO1	14.00	14.17	7.53	11.91	9.28	4.97	7.26	4.72	2001,2002,2003,2004
DENA1	12.44	9.25	7.31	7.08	6.97	4.72	3.58	1.60	2000,2001,2002,2003,2004
DOME1	19.43	17.95	7.46	17.20	15.42	6.19	14.13	11.58	2001,2002,2003,2004
DOSO1	29.05	19.99	10.39	28.29	18.94	8.92	13.57	3.40	2000,2001,2002,2003,2004
EVER1	22.42	18.76	12.15	19.52	15.28	8.33	10.00	7.90	2001,2002,2003,2004
GAMO1	11.29	10.94	6.38	8.95	7.47	4.53	10.17	3.03	2001,2002,2003,2004
GICL1	13.09	11.84	6.66	8.96	7.99	4.20	5.73	4.40	2001,2002,2003,2004
GLAC1	22.26	16.91	9.22	15.89	13.64	6.90	22.24	7.50	2000,2001,2002,2003,2004
GRCA2	11.64	9.56	7.04	7.98	6.95	4.16	6.19	4.74	2000,2002,2003,2004
GRGU1	22.77	15.20	11.99	21.88	13.92	9.78	12.07	3.23	2001,2002,2003,2004
GRSA1	12.78	10.63	6.66	9.66	8.28	4.45	8.01	6.69	2000,2001,2002,2003,2004

[9]e3(extreme episodic event) represents the threshold above which daily carbon (OCM + LAC) and dust (FS + CM) extinction is considered natural episodic.
[10]These values (in deciviews) are based on natural extinction on the 20% most impaired days between 2000-2014 and represent the 2064 endpoint of the uniform rate of progress glidepath.

Site	First Implementation Period Approach			Recommended Approach			e3 (Mm^{-1})[9]		Years included in the Baseline Visibility Condition
	Baseline Visibility Condition for 20% Haziest Days (2000-2004)	Current Visibility Condition for 20% Haziest Days (2012-2016)	Natural Conditions (20% Haziest Days)	Baseline Visibility Condition for 20% Most Impaired Days (2000-2004)	Current Visibility Condition for 20% Most Impaired Days (2012-2016)	Natural Conditions (20% Most Impaired Days)[10]	carbon	dust	
GRSM1	30.24	19.97	11.24	29.11	18.35	10.05	16.09	4.48	2000,2001,2002,2003,2004
GUMO1	17.19	14.93	6.66	14.60	12.86	4.83	6.25	12.95	2000,2001,2002,2003,2004
HACR1[b]	13.33	9.22	7.43	12.67	8.43	4.77	1.24	2.01	2001,2002,2003,2004
HAVO1	18.86	19.06	7.18	18.66	18.88	5.63	1.56	1.93	2001,2002,2003,2004
HECA1	18.55	17.17	8.32	16.51	13.09	6.57	13.88	5.00	2001,2002,2004
HEGL1	26.84	20.73	11.30	25.17	19.32	9.30	20.30	6.84	2002,2003,2004
HOOV1	12.82	11.82	7.71	8.93	7.88	4.90	8.92	4.00	2002,2003,2004
IKBA1	13.35	11.80	6.68	11.19	9.52	5.22	6.78	6.14	2001,2002,2003,2004
ISLE1	20.82	17.46	12.37	19.63	16.05	10.17	12.05	4.22	2000,2001,2002,2003,2004
JARB1	12.07	12.85	7.87	8.73	7.82	5.23	7.45	8.00	2001,2002,2003,2004
JARI1	29.12	20.20	11.13	28.08	18.67	9.47	26.22	2.94	2001,2002,2003,2004
JOSH1	19.62	14.97	7.19	17.74	13.15	6.09	7.82	9.81	2001,2002,2003,2004
KAIS1	15.71	15.75	7.20	12.93	11.47	6.06	11.16	5.19	2002,2003,2004
KALM1	16.14	14.42	9.44	13.34	12.16	7.78	12.46	2.43	2001,2002,2003,2004
KPBO1[c]	14.56	12.94	11.31	10.47	10.48	6.96	3.39	2.32	2002,2003,2004
LABE1	15.05	15.15	7.86	11.29	9.97	6.18	10.38	3.81	2001,2002,2003,2004
LAVO1	14.50	13.25	7.31	11.47	10.05	6.10	12.36	2.59	2000,2001,2002,2003,2004
LIGO1	28.77	19.14	11.23	28.05	17.38	9.70	18.22	2.83	2001,2002,2003,2004
LOST1	19.57	18.41	8.00	18.27	16.37	5.87	10.17	9.28	2000,2001,2002,2003,2004
LYEB1[d]	24.45	17.12	11.73	23.57	16.10	10.24	11.44	2.75	2000,2001,2002,2003,2004
MACA1	31.37	23.05	11.09	29.83	22.04	9.80	19.44	4.28	2000,2001,2002,2003,2004
MELA1	17.72	17.75	7.90	16.62	15.50	5.95	9.14	9.09	2000,2001,2002,2003,2004
MEVE1	13.03	9.88	6.81	9.22	7.03	4.20	5.05	5.33	2000,2001,2002,2003,2004
MING1	27.92	22.34	11.43	26.28	20.74	9.18	23.82	10.81	2001,2002,2003,2004
MOHO1	14.86	13.14	8.44	12.10	9.74	6.59	7.75	2.74	2001,2002,2003,2004
MONT1	14.46	15.15	7.74	11.00	9.84	5.53	16.11	4.89	2001,2002,2003,2004
MOOS1	21.71	15.67	12.01	20.65	14.08	9.98	11.13	2.54	2000,2001,2002,2003,2004
MORA1	18.25	14.97	8.54	16.53	13.35	7.66	13.33	2.53	2000,2001,2002,2004
MOZI1	10.52	9.17	6.08	7.29	5.64	3.16	5.70	3.23	2001,2002,2003,2004
NOAB1	11.46	11.35	6.83	8.78	7.17	4.55	10.18	4.23	2002,2003,2004
NOCA1	16.01	12.65	8.40	12.57	10.43	6.89	8.20	1.97	2001,2002,2003,2004
OKEF1	27.38	20.73	11.44	25.34	18.74	9.45	20.65	5.50	2000,2001,2002,2003,2004
OLYM1	16.74	13.38	8.44	14.93	12.24	6.90	8.78	1.76	2002,2003,2004
PASA1	15.18	14.19	8.26	10.41	9.19	5.96	9.42	2.58	2001,2002,2003,2004
PEFO1	13.21	10.73	6.49	9.82	8.49	4.21	6.75	7.84	2000,2001,2002,2003,2004
PINN1	18.46	16.02	7.99	17.02	14.33	6.94	11.33	5.88	2000,2002,2003,2004
PORE1	22.81	19.95	15.77	19.38	15.89	9.74	6.78	8.23	2000,2002,2004
RAFA1	18.83	16.08	7.57	17.27	14.14	6.80	7.65	8.20	2000,2001,2002,2003,2004
REDW1	18.98	17.88	13.91	13.74	12.70	8.59	5.86	4.44	2000,2001,2002,2003,2004
ROMA1	26.48	20.18	12.13	25.25	18.33	9.78	23.38	5.35	2000,2001,2002,2003,2004
ROMO1	13.83	11.54	7.16	11.12	8.66	4.94	8.54	5.32	2000,2001,2002,2003,2004
SACR1	18.03	17.33	6.81	16.50	15.30	5.49	9.01	13.51	2001,2002,2003,2004

Site	First Implementation Period Approach			Recommended Approach			e3 (Mm^{-1})[9]		Years included in the Baseline Visibility Condition
	Baseline Visibility Condition for 20% Haziest Days (2000-2004)	Current Visibility Condition for 20% Haziest Days (2012-2016)	Natural Conditions (20% Haziest Days)	Baseline Visibility Condition for 20% Most Impaired Days (2000-2004)	Current Visibility Condition for 20% Most Impaired Days (2012-2016)	Natural Conditions (20% Most Impaired Days)[10]	carbon	dust	
SAGA1	19.94	14.83	6.99	17.89	13.63	6.12	8.49	7.11	2002,2003,2004
SAGO1	22.17	15.98	7.31	20.43	14.80	6.20	11.94	7.77	2001,2002,2003,2004
SAGU1	14.83	12.69	6.46	12.64	10.96	5.14	6.15	9.62	2002,2003,2004
SAMA1	26.31	20.89	11.84	24.68	18.15	9.13	22.16	5.22	2001,2002,2003,2004
SAPE1	10.17	9.06	5.72	7.66	6.58	3.33	5.66	4.53	2001,2002,2003,2004
SAWT1	13.80	17.17	6.42	9.61	8.52	4.70	12.35	2.61	2001,2002,2003,2004
SENE1	24.12	19.26	12.65	23.58	18.50	11.11	13.67	2.52	2000,2001,2002,2003,2004
SEQU1	25.37	21.10	7.73	23.17	19.20	6.29	23.11	11.47	2000,2001,2002,2003,2004
SHEN1	29.31	19.71	11.35	28.32	18.40	9.52	15.06	3.92	2000,2001,2002,2003,2004
SHRO1	28.53	18.63	11.47	28.13	16.85	10.25	13.99	3.09	2001,2002,2003,2004
SIAN1	13.67	11.74	6.59	10.76	9.58	5.11	6.77	5.91	2001,2002,2003,2004
SIME1	18.56	16.91	15.60	13.67	13.66	8.51	3.42	4.63	2002,2003,2004
SIPS1	28.99	20.95	10.99	27.69	19.77	9.62	21.66	4.79	2001,2002,2003,2004
SNPA1	17.84	15.35	8.43	15.37	13.13	7.27	12.33	1.79	2001,2002,2003,2004
STAR1	18.57	14.54	8.92	14.53	11.53	6.58	13.10	5.66	2001,2002,2003,2004
SULA1	13.41	15.54	7.43	10.06	8.55	5.45	11.78	3.22	2001,2002,2003,2004
SWAN1	25.02	19.09	11.86	23.79	17.40	10.01	16.47	5.01	2001,2002,2003,2004
SYCA2[e]	15.26	14.84	6.66	12.16	11.33	4.68	13.12	15.93	2001,2002,2003,2004
THRO1	17.80	15.95	7.78	16.35	13.69	5.94	9.87	8.71	2000,2001,2002,2003,2004
THSI1	15.41	15.28	8.79	12.80	11.46	7.30	12.62	4.01	2000,2001,2002,2003,2004
TONT1	14.16	12.47	6.58	11.65	10.63	5.14	7.14	8.76	2001,2002,2003,2004
TRCR1	12.49	10.02	8.40	9.11	8.84	6.36	5.11	2.38	2002,2003,2004
TRIN1	17.63	16.72	8.27	11.92	10.64	6.48	10.36	3.61	2001,2002,2003,2004
ULBE1	15.14	14.31	8.16	12.76	10.79	5.87	9.82	6.17	2001,2002,2003,2004
UPBU1	26.28	20.56	11.58	24.21	18.84	9.41	17.58	7.02	2000,2001,2002,2003,2004
VIIS1	17.02	18.49	10.68	14.29	15.60	8.53	2.60	21.54	2001,2002,2003,2004
VOYA2	19.36	17.08	12.06	17.88	15.04	9.37	11.48	4.14	2000,2001,2002,2003,2004
WEMI1	10.33	9.17	6.21	7.78	6.74	3.97	6.51	3.64	2001,2002,2003,2004
WHIT1	13.70	13.21	6.80	11.31	10.41	4.89	7.16	7.13	2002,2003,2004
WHPA1	12.76	12.00	8.36	10.48	8.50	6.14	6.89	2.41	2001,2002,2003,2004
WHPE1	10.58	8.56	6.08	7.34	6.59	3.50	5.13	3.50	2002,2003,2004
WHRI1	9.61	7.93	6.07	6.30	5.18	3.02	4.92	3.56	2001,2002,2003,2004
WICA1	15.84	13.50	7.71	13.09	10.60	5.64	7.96	4.62	2000,2001,2002,2003,2004
WIMO1	23.81	19.53	7.53	22.15	18.79	6.92	13.95	9.94	2002,2003,2004
YELL2	11.76	12.53	6.44	8.30	7.65	3.97	10.08	3.06	2000,2001,2002,2003,2004
YOSE1	18.15	16.04	7.64	13.51	11.90	6.29	13.14	5.19	2000,2001,2002,2003,2004
ZICA1[f]	12.97	10.34	6.99	10.71	8.57	5.18	5.54	6.66	2001,2002,2003,2004

[a]Site data combined with BRET1 starting 01-01-08; [b]Site data combined with HALE1 starting 01-01-08; [c]Site data combined with TUXE1 starting 01-01-15; [d]Site data combined with LYBR1 starting 01-01-12; [e]Site data combined with SYCA1 starting 10-18-15; [f]Site data combined with ZION1 starting 01-01-04