

Appendix V: Regional Haze
Adjusted Reasonable Progress Goals

Background

40 CFR 51.308(f)(3)(i) requires that states establish reasonable progress goals (RPG), expressed in deciviews (dv), that reflect the visibility conditions that are projected to be achieved by the end of the applicable implementation period (2028) as a result of those enforceable emission limits. Natural (i.e., biogenic, wildland fire), nonpoint source emissions, and agricultural burning emissions from Hawaii were held constant at 2016 levels in the EPA platform, and thus the same emissions are reported for 2016 and 2028 for these categories.

Purpose

The purpose of this appendix is to determine the visibility conditions in 2028 that will result from implementation of the long term strategy (LTS) with enforceable limits set for 2028 and describe DOH-CAB's post-modeling approach to estimate this change in reasonable progress goals (dv) that reflects the reduction in emissions (tpy) through these enforceable emission limits.

**Table V.1
Projected 2028 Reasonable Progress Goals (RPG)
For Haleakala NP**

LTS Emission Limit(s)	No	Yes	No	Yes
MID/Clearest Days	MID	MID	Clearest Days	Clearest Days
RPG Projection in 2028 (dv)^a	7.10	7.08	0.50	0.50
Adjustment Factor^a	0.9600	0.9600	1.0248	1.0248
EPA's 2028 Projection (dv)	7.10		0.50	
DOH-CAB 2028 Projection (dv)^b	7.40	7.38	0.49	0.48
AmmNO₃ Scale^d	1.0000	0.9782	1.0000	0.9782
Adj AmmNO₃ (Mm⁻¹)	0.650	0.636	0.130	0.127
AmmNO₃ (Mm⁻¹)	0.65	0.65	0.13	0.13
AmmSO₄ Scale^d	1.0000	0.9979	1.0000	0.9979
Adj AmmSO₄ (Mm⁻¹)	8.990	8.971	0.720	0.718
AmmSO₄ (Mm⁻¹)	8.99	8.99	0.72	0.72
CM Scale	1.0000	1.0000	1.0000	1.0000
Adj CM (Mm⁻¹)	0.700	0.700	0.210	0.210
CM (Mm⁻¹)	0.7	0.7	0.21	0.21
EC Scale^d	1.0000	0.9997	1.0000	0.9997
Adj EC (Mm⁻¹)	0.210	0.210	0.040	0.040
EC (Mm⁻¹)	0.21	0.21	0.04	0.04
OMC Scale	1.0000	1.0000	1.0000	1.0000
Adj OMC (Mm⁻¹)	0.600	0.600	0.170	0.170
OMC (Mm⁻¹)	0.6	0.6	0.17	0.17
SeaSalt Scale	1.0000	1.0000	1.0000	1.0000
Adj SeaSalt (Mm⁻¹)	0.640	0.640	0.190	0.190
SeaSalt (Mm⁻¹)	0.64	0.64	0.19	0.19
Soil Scale	1.0000	1.0000	1.0000	1.0000
Adj Soil (Mm⁻¹)	0.160	0.160	0.040	0.040
Soil (Mm⁻¹)	0.16	0.16	0.04	0.04
Rayleigh Scattering	9	9	9	9

**Table V.2
Projected 2028 Reasonable Progress Goals (RPG)
For Hawaii Volcanoes NP**

LTS Emission Limit(s)	No	Yes	No	Yes	
MID/Clearest Days	MID	MID	Clearest Days	Clearest Days	
RPG Projection in 2028 (dv) ^a	16.10	16.08	3.40	3.39	
Adjustment Factor ^a	0.9901	0.9901	1.2416	1.2416	
EPA's 2028 Projection (dv)	16.1		3.4		
DOH-CAB 2028 Projection (dv) ^b	16.3	16.2	2.7	2.7	
Visibility Extinction Components^c	AmmNO3 Scale^d	1.0000	0.9782	1.000	0.9782
	Adj AmmNO3 (Mm⁻¹)	0.450	0.440	0.300	0.293
	AmmNO3 (Mm⁻¹)	0.45	0.45	0.3	0.3
	AmmSO4 Scale^d	1.0000	0.9979	1.0000	0.9979
	Adj AmmSO4 (Mm⁻¹)	37.460	37.381	1.630	1.627
	AmmSO4 (Mm⁻¹)	37.46	37.46	1.63	1.63
	CM Scale	1.0000	1.0000	1.0000	1.0000
	Adj CM (Mm⁻¹)	0.670	0.670	0.600	0.600
	CM (Mm⁻¹)	0.67	0.67	0.6	0.6
	EC Scale^d	1.0000	0.9997	1.0000	0.9997
	Adj EC (Mm⁻¹)	0.520	0.520	0.070	0.070
	EC (Mm⁻¹)	0.52	0.52	0.07	0.07
	OMC Scale	1.0000	1.0000	1.0000	1.0000
	Adj OMC (Mm⁻¹)	1.210	1.210	0.300	0.300
	OMC (Mm⁻¹)	1.21	1.21	0.3	0.3
	SeaSalt Scale	1.0000	1.0000	1.0000	1.0000
	Adj SeaSalt (Mm⁻¹)	1.440	1.440	1.220	1.220
	SeaSalt (Mm⁻¹)	1.44	1.44	1.22	1.22
	Soil Scale	1.0000	1.0000	1.0000	1.0000
	Adj Soil (Mm⁻¹)	0.090	0.090	0.030	0.030
Soil (Mm⁻¹)	0.09	0.09	0.03	0.03	
Rayleigh Scattering	9	9	9	9	

Footnotes to Tables V.1 & V.2:

^a 2028 RPG projections are adjusted to account for differences in assumptions between EPA's 2028 RPG projection and DOH-CAB 2028 projection. The adjustment factor is illustrated by using the following expression:

$$\text{Adjustment Factor} = [\text{EPA's 2028 Projection (dv)}] / [\text{DOH-CAB 2028 Projection (dv)}]$$

^b DOH-CAB 2028 Projection (dv) = [10 x ln(∑ each modeled visibility extinction component/10)].

^c The light extinction values for each visibility extinction component was taken from Western Regional Air Partnership (WRAP) technical support system (TSS) website and proportionally scaled using a post-modeling RPG scaling factor to reflect emission changes from imposing enforceable control measures as a long term strategy (LTS).

^d Scaled factors for the reduced emissions from imposing LTS control measures are developed in Table V.3.

^e Acronyms used are listed below:

CM	Coarse mass
dv	Deciveiws
EC	Elemental Carbon
LTS	Long term strategy
MID	Most impaired days
Mm⁻¹	Inverse mega meters
NP	National Park
OMC	Organic Mass Carbon

**Table V.3
Scaled Reduction of Emissions Relative to Total Projected Emissions**

Source Category	2016 Baseline Emissions Projected for 2028 ^a (tpy)			2018 to 2028 Reductions in Emissions ^b (tpy)			2028 Adjusted Projected Emissions (tpy)		
	SO ₂	NO _x	PM ₁₀	SO ₂	NO _x	PM ₁₀	SO ₂	NO _x	PM ₁₀
	Anthropogenic Sources			Anthropogenic Sources			Anthropogenic Sources		
Point Sources	19,248	23,585	2,280	4,371	1,100	130	14,877	22,485	2,150
Area Sources ^c	98	464	37,780	0	0	0	98	464	37,780
Agricultural Burning ^d	30	55	93	0	0	0	30	55	93
Prescribed Burning ^c	-	-	-	0	0	0	-	-	-
On-Road Mobile Sources	63	10,387	630	0	0	0	63	10,387	630
Non-Road Mobile Sources	8	3,442	339	0	0	0	8	3,442	339
Marine ^e	267	8,984	185	0	0	0	267	8,984	185
Total Anthropogenic	19,715	46,917	41,307	4,371	1,100	130	15,344	45,817	41,177
	Natural Sources			Natural Sources			Natural Sources		
Volcano ^f	2,062,813	-	-	-	-	-	2,062,813	-	-
Sea Spray ^g	-	-	382,637	-	-	-	-	-	382,637
Windblown Dust ^g	-	-	46,808	-	-	-	-	-	46,808
Wildfire ^c	258	3,374	11,340	-	-	-	258	3,374	11,340
Biogenic	-	237	-	-	-	-	-	237	-
Total Natural	2063071	3,611	440,785	-	-	-	2063071	3,611	440,785
Total Projected Emissions	2,082,786	50,528	482,091	Reduced Emissions→			2,078,415	49,428	481,961
				Scaling Factors→			0.9979	0.9782	0.9997

Footnotes to Table V.3:

- a Point source emissions provided by Ramboll's email dated June 14, 2022, are from the 2016 NEI data for Hawaii from the EPA's Emissions Inventory System (EIS) Gateway, which in 2016 only includes point sources. All other emissions are from the EPA 2016 Regional Haze Modeling v1 emissions platform (2016fh) for Hawaii (EPA, 2020) unless otherwise noted below. These emissions were extracted directly from the EPA model-ready emission files for the 3 kilometer resolution HI modeling domain, which were provided by Kirk Baker at the EPA on May 20, 2020.**
- b Refer to Table V.4 for reductions in emissions from imposed limits.**
- c Area sources include nonpoint sources, fugitive dust, agricultural ammonia sources, and residential wood combustion.**
- d The agricultural burning emissions reported here are the point source agricultural fires in the modeling platform. Wildland fire and prescribed burning emissions are provided in a single model emissions file and thus could not be disaggregated. The total wild and prescribed fire emissions are reported as wildfire emissions here.**
- e Marine emissions reported here are the domain-wide total from C1 and C2 and C3 commercial marine vessels in the model-ready emission files for the HI 3 km resolution modeling domain, including emissions from outside state waters. This is inconsistent with the emissions reported in the 2014 and 2017 NEI, and thus the 2016 and 2028 marine emissions should not be directly compared to emissions reported for 2014 and 2017.**
- f Based on SO₂ emission rates reported by USGS for Kilauea volcano. Volcano emissions were included for determining the reasonable progress goal adjustment because the impact would not be completely screened out after adjusting the IMPROVE data for episodic events due to the continuous nature of the Kilauea eruption. Therefore, projections from scaling 2028 modeling results with the observed 2014 to 2017 IMPROVE data on the most impaired days would still be influenced by volcanic activity.**
- g Sea spray and windblown dust emissions were estimated for Hawaii as part of emission inventory work by ENVIRON International Corporation for the years 2005 and 2008 (ENVIRON, 2010). These emissions are reported here and are assumed to be representative of all years.**

**Table V.4
Point Source Emission Reductions Scaled on Actual 2016 Emissions**

Point Sources	2016 SLEIS ^a Emissions Inventory Report (TPY)			2028 Emissions After Control Measures (TPY)			2016-2028 Emission Reductions (TPY)		
	(a)			(b) ^c			(c) = (a) - (b)		
	NO _x	PM ₁₀ ^b	SO ₂	NO _x	PM ₁₀	SO ₂	NO _x	PM ₁₀	SO ₂
Maalaea Generating Station	2,532	174	557	2,176	176	557	356	-3	0
Kahului Generating Station	473	61	1,701	0	0	0	473	61	1,701
Kanoelehua-Hill Generating Station	806	75	2,770	552	10	230	254	65	2,540
Puna Generating Station	25	9	160	9	2	29	16	7	131
	Total Reductions						1,100	130	4,371

Footnotes to Table V.4

- ^a State & Local Emissions Inventory System (SLEIS).
- ^b PM₁₀ are based on filterable + condensable.
- ^c (b) = (a) x Point Source Scaling Factor from Table V.5.

**Table V.5
Scaling of Point Source Emission Reductions**

Point Sources with Regional Haze Control Measures	Emissions Before Enforceable Control Measures (TPY) ^a			Emissions After Enforceable Control Measures (TPY) ^a			Scaling Factors		
	(a)			(b)			(c) = (b)/(a)		
	NO _x	PM ₁₀	SO ₂	NO _x	PM ₁₀	SO ₂	NO _x	PM ₁₀	SO ₂
Maalaea Generating Station	13,306	832	3,524	11,433	844	3,524	0.859	1.014	1.000
Kahului Generating Station	1,472	1,207	5,219	0	0	0	0.000	0.000	0.000
Kanoelehua-Hill Generating Station	3,556	800	3,872	2,434	108	322	0.684	0.135	0.083
Puna Generating Station	1,025	399	2,882	375	102	524	0.366	0.256	0.182
Total	19,359	3,237	15,497	14,242	1,054	4,370	0.736	0.325	0.282

Footnotes to Table V.5

- ^a Emission before and after enforceable control measures are imposed are based on potential to emit (PTE) calculations in the Project Emissions section of the respective technical support documents for permit amendments.