III.K.13.D. ASSESSMENT OF AMBIENT DATA FOR CLASS I AREAS

The RH Rule requires that states improve visibility at Class I areas to levels defined as "natural conditions," which are defined as the conditions that would prevail in the absence of any human impacts on visibility. The specific requirement is that states improve the 20% most impaired days (MID) while maintaining no worsening in visibility of the clearest days. To address the requirements of the RH Rule, states must determine natural conditions as defined by the RH Rule; natural conditions are the endpoint goal by 2064. To meet this goal, states must demonstrate continued progress towards the endpoint without visibility degradation on the clearest days. States must also measure initial, baseline visibility conditions; this defines the starting point from which improvement is measured.

This section describes the determination of baseline, natural and current visibility conditions at each IMPROVE monitor representing Alaska Class I areas. The current conditions are defined by the 5 most recent years of available data which cover the period 2014-2018 except for TUXE1 and KPBO1. The TUXE1 IMPROVE site stopped operating in 2014 and the KPBO1 site came online later; the 3 most recent years of available data (2012 to 2014 for TUXE1 and 2016 to 2018 for KPBO1) are used instead. Due to the remote location of the Bering Sea Class I area, there is no representative IMPROVE monitoring site, so no baseline is established for this Class I area. Available IMPROVE measurement periods for Alaska Class I areas are listed in Table III.K.13.D-1.

Table III.K.13.D-1. Period of IMPROVE measurements.

Class I Area	IMPROVE Site	Operating Period	Baseline Period	Current Period
Denali National Park and Preserve	Denali Headquarters Site (DENA1)	2000 - Present	2000 - 2004	2014 - 2018
	Trapper Creek Site (TRCR1)	2002 - Present	2002 - 2004	2014 - 2018
Simeonof National Wildlife Refuge/National Wilderness Area	Simeonof (SIME1)	2002 - Present	2002 - 2004	2014 - 2018
Tuxedni National Wildlife Refuge/National Wilderness Area	Tuxedni (TUXE1)	2002 - 2014	2002 - 2004	2012 – 2014
	Kenai Peninsula Borough (KPBO1)	2016 - Present	Not available	2016 – 2018

1. VISIBILITY REQUIREMENT

The required content of RH SIPs is specified in 40 CFR §51.308(f), which was revised in 2017. The RH Rule established the concept of state-set RPGs for the 20% most anthropogenically impaired days as a regulatory construct promulgated to implement the statutory requirements for visibility protection. These RPGs reflect the visibility conditions that are projected to be achieved by the end of the applicable implementation period as a result of its own and other states' long-term strategies.

The 2017 RH Rule requires states to determine the rate of improvement in visibility that would need to be maintained during each implementation period in order to reach natural conditions by 2064 for the 20% MID, given the starting point of the 2000-2004 baseline visibility condition. The "glidepath," or Uniform Rate of Progress (URP), is the amount of visibility improvement that would be needed to stay on a linear path from the baseline period to natural conditions in 2064. Progress is tracked using ambient concentration measurements from the IMPROVE network expressed in units of deciview (dv) which is proportional to the logarithm of the atmospheric light extinction (Bext, in units of inverse megameters [Mm^{-1}]):

$$\text{Deciview index} = 10 \ln (\text{Bext}/10\ \text{Mm}^{-1})$$

The 2017 RH Rule also requires states to determine the baseline (2000-2004) visibility condition for the 20% clearest days and requires that the LTS and RPGs ensure no degradation in visibility for the clearest days since the baseline period.

Title 40 CFR §51.308(f)(1)(i)-(vi) contains three metrics of visibility for either the MID or the clearest days:

- baseline conditions are the average of the five annual averages for the period 2000 to 2004;
- current conditions represent the average of the five annual averages for the most recent period (e.g., 2014-2018) for which data are available; and
- natural conditions are the average of individual values of daily natural visibility unique to each Class I area.

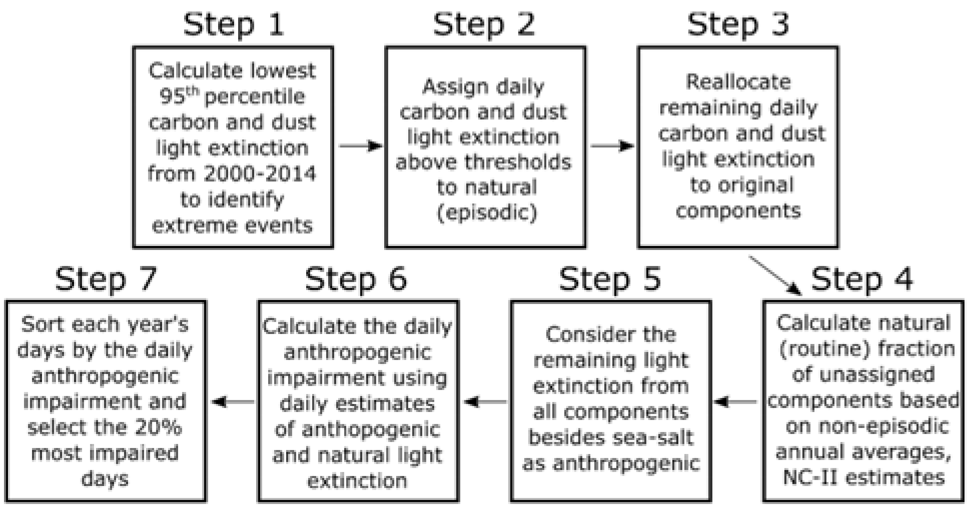
Under the 2017 RH Rule revisions, states must select the MID each year at each Class I area based on daily anthropogenic impairment. The MID are those days with the highest anthropogenic visibility impairment defined as:

$$\Delta\, dv_{\text{anthropogenic visibility impairment}} = dv_{\text{total}} - dv_{\text{natural}}$$

where dv_{total} is the overall deciview value for a day, and $dv_{natural}$ is the natural portion of the deciview value for a day. The EPA 2018 Technical Guidance describes how these values are determined.

In general, the recommended approach to splitting daily light extinction into natural and anthropogenic fractions is to estimate the natural contribution to daily light extinction and then attribute the remaining light extinction to anthropogenic sources. The natural contributions are grouped into two types - “episodic” and “routine.” The episodic natural contributions are those that occur relatively infrequently and likely result from extreme events like wildfires and dust storms that are identified by a site-specific threshold of carbon (organic mass + elemental carbon) and dust (fine soil + coarse mass) based on observed IMPROVE 95th percentile values from 2000 through 2014. The non-episodic extinction values for each day are then allocated to the routine natural conditions based on the ratio of the Natural Conditions II (NC-II) estimates and non-episodic annual average for each chemical species. Any remaining extinction after removing the episodic and routine natural extinction is considered anthropogenic in origin. The 20% MID have the highest anthropogenic extinction relative to the natural extinction. The steps in determining the 20% MID are summarized in Figure III.K.13.D-1.

Figure III.K.13.D-1. Flow chart of the 7 steps involved in calculating the 20% most impaired days.



EPA offered as a starting point a “default” natural visibility target for each Class I area. These default conditions are based on broad regional estimates and data analysis with an expectation that the estimates would be refined over time. Glidepaths based on EPA’s default natural condition estimates are termed ‘default glidepaths’ in this RH SIP.

The 2017 RH Rule includes a provision that allows states to propose an adjustment to the URP to account for impacts from anthropogenic sources outside the United States, if the adjustment has been developed through scientifically valid data and methods. EPA’s visibility guidance[1] states “to calculate the proposed adjustment(s), the State must add the estimated impact(s) to the natural visibility condition and compare the baseline visibility”.

[1] EPA, 2018. Technical Guidance on Tracking Visibility Progress for the Second Implementation Period of the Regional Haze Program. Web access: https://www.epa.gov/sites/production/files/2018-12/documents/technical_guidance_tracking_visibility_progress.pdf

A. Alternative MID

In the EPA approach, the MID are selected by screening out days with estimated high fire (using specific threshold of carbon) and dust contributions and identifying the 20% days that are most likely impaired by anthropogenic emissions under the assumption that ammonium sulfate and ammonium nitrate are mainly anthropogenic in origin. However, multiple volcanoes located near the Alaska IMPROVE sites are active providing episodic natural events impacting visibility similar to fire and dust contributions. To account for these episodic natural emissions, Alaska has adopted a modified approach which mirrors the draft/ad hoc EPA approach for Hawaii's two Class I areas with similar episodic visibility impairment.[2] This modified approach does not affect the 20% clearest days. Appendix III.K.13.I will apply the same sulfate-screening method to Alaska and discuss how that impacts the URP.

2. NATURAL VISIBILITY CONDITIONS

Natural visibility conditions represent the long-term degree of visibility estimated to exist in the absence of anthropogenic impairment. Natural events such as windstorms, wildfires, volcanic activity, biogenic emissions, and even sea salt from sea breezes introduce particles from natural sources that contribute to haze in the atmosphere. Individual natural events can lead to high short-term concentrations of visibility-impairing pollutants.

EPA, states, and regional planning organizations have progressed in their efforts to improve the approach for determining natural conditions in Class I areas. New research is examining the increasing prevalence of wildfires in the western United States. The frequency of dust storms and their impact on areas disturbed by human vs. wildlife activities are being investigated, as well as global transport of dust from natural desert storms in Africa and Asia. The EPA initially calculated default natural visibility conditions for all Class I areas but allowed states to develop more refined calculations. Alaska has an interest in understanding international emissions and their impact on the State. Section III.K.13.I describes how Alaska accounts for international contributions to visibility in the 2064 MID endpoint.

The natural conditions for the 20% clearest days are given as the NC-II values and can be obtained from the IMPROVE Committee website.[3] The natural conditions for the 20% MID were obtained from the 2064 Endpoint File[4] on the same website. The natural visibility conditions for the 20% most anthropogenically impaired days and for the 20% clearest days for each IMPROVE site are summarized in **Table III.K.13.D-2**.

Table III.K.13.D-2. Natural haze indices (dv) for all Alaska IMPROVE sites.

[2] U.S. Environmental Protection Agency, 2020. Technical Support Document for EPA's Updated 2028 Regional Haze Modeling for Hawaii, Virgin Islands, and Alaska. Office of Air Quality Planning and Standards. July.
[3] http://vista.cira.colostate.edu/IMPROVE/Data/NaturalConditions/nc2_4_20.csv (April 2020).
[4] http://vista.cira.colostate.edu/DataWarehouse/IMPROVE/Data/SummaryData/Endpoint/glideslope_and_2064_endpt_4_20_2.csv (April 2020).

Class I Area	IMPROVE Site	Clearest Day Haze Index	Most Impaired Haze Index
Denali National Park and Preserve	DENA1	1.8	4.7
	TRCR1	2.7	6.4
Simeonof National Wildlife Refuge/ National Wilderness Area	SIME1	5.3	8.5
Tuxedni National Wildlife Refuge/ National Wilderness Area	TUXE1	3.1	7.0
	KPBO1	4.6	Not available

3. BASELINE VISIBILITY CONDITIONS

Baseline visibility is calculated using the actual pollutant concentrations measured at the IMPROVE monitors for the period of 2000-2004. The 20% MID deciviews (roughly corresponding to the 24 days having the worst visibility after excluding data with high wildfire and windblown dust impacts) are averaged each year. These five yearly values are then averaged to determine the MID's visibility in deciviews for the 2000-2004 baseline period. The same process is used to get the clearest day baseline visibility value in deciviews from the annual 20% clearest days over the baseline years.

For several Alaska Class I area sites, monitoring began in late 2001. Therefore, only three complete years of monitoring data, 2002-2004, are available to define the baseline period (see Table III.K.13.D-1).

The movement of the IMPROVE monitor representing the Tuxedni Class I area from TUXE1 to KPBO1 has resulted in an emissions profile shift that was significant enough to result in a data discrepancy between the two monitors. ADEC has determined it is most appropriate to treat the KPBO1 and TUXE1 sites as different sites and not as a continuation. The change in deciview readings at the KPBO1 site, along with the different Weighted Emissions Potential (WEP) and Area of Influence (AOI) readings presented in Section III.K.13.G, provides the requisite data for the state to argue that the two monitoring sites should not be treated as a continuation on the same glideslope and instead should be recalculated moving into the progress report and the next implementation period.[5] In this RH SIP, ADEC used the available data from the TUXE1 site to

[5] For more information regarding this discrepancy in TUXE1-KPB01 emissions profiles, see III.K.13.G.4.E.iv (Tuxedni), and refer to III.K.13.G.4 for general discussion of TUXE1-KPB01 discrepancy.

construct an analysis which would meet EPA requirements under the RH Rule. It should be noted that, because the TUXE1 site has been offline for five years and a new baseline will be established for the progress report in three years, the TUXE1 glideslope will not be used after this report.

As the KPBO1 monitor has only been in operation since mid-2015, there are not enough years of data to allow for the establishment of a new baseline for the Second Implementation Period or for the calculation of the MID visibility metric. (See Table III.K.13.D-3 through Table III.K.13.D-7 for baseline haze indices.)

Table III.K.13.D-3. Baseline haze indices (dv) for the Denali IMPROVE site (DENA1).

Year	Clearest Day Haze Index	Most Impaired Haze Index
2000	2.7	6.8
2001	2.5	6.8
2002	2.3	7.7
2003	2.2	7.7
2004	2.5	6.3
Average	2.4	7.1

Table III.K.13.D-4. Baseline haze indices (dv) for the Trapper Creek IMPROVE site. (TRCR1).

Year	Clearest Day Haze Index	Most Impaired Haze Index
2000	Not available	Not available
2001	Not available	Not available
2002	3.4	9.5
2003	3.2	9.6
2004	3.7	8.2
Average	3.5	9.1

Table III.K.13.D-5. Baseline haze indices (dv) for the Simeonof IMPROVE site (SIME1).

Year	Clearest Day Haze Index	Most Impaired Haze Index
2000	Not available	Not available
2001	Not available	Not available
2002	7.8	14.1
2003	6.8	13.4
2004	8.3	13.5
Average	7.6	13.7

Table III.K.13.D-6. Baseline haze indices (dv) for the Tuxedni IMPROVE site (TUXE1).

Year	Clearest Day Haze Index	Most Impaired Haze Index
2000	Not available	Not available

2001	Not available	Not available
2002	4.2	10.3
2003	3.8	10.9
2004	4.0	10.2
Average	4.0	10.5

Table III.K.13.D-7. Baseline haze indices (dv) for all Alaska IMPROVE sites.

Class I Area	IMPROVE Site	Clearest Day Haze Index	Most Impaired Haze Index
Denali National Park and Preserve	DENA1	2.4	7.1
	TRCR1	3.5	9.1
Simeonof Wilderness Area	SIME1	7.6	13.7
Tuxedni National Wildlife Refuge	TUXE1	4.0	10.5
	KPBO1	Not available	Not available

4. CURRENT VISIBILITY CONDITIONS

The current visibility period (2014-2018) represents the most up-to-date visibility data for all Class I areas in Alaska. Similar to the baseline conditions, the 20% MID deciviews are averaged each year during the current period. As shown in Table III.K.13.D-1, data for the TUXE1 monitor during the current visibility period is only available for 2014 so period 2012-2014 is used. Data for the KPBO1 monitor is available from 2015 through the end of the current visibility period in 2018. This three-year timeframe is the start of the baseline reset for the Tuxedni glideslope after the move from the old TUXE1 monitoring station near Chisik Island.

Using the available years (2016-2018), the current cleanest days baseline at KPBO1 is six deciviews, a decline of two deciviews compared with the baseline visibility condition at the TUXE1 monitoring site. This reflects the changed conditions at the KPBO1 site of local population size, community sizes, and industrial activities. It will be possible for the state to establish a formalized baseline, glideslope, and URP for clearest and MID at KPBO1 by the progress report in three years. (See Table III.K.13.D-8 for the current haze indices for all IMPROVE sites.)

Table III.K.13.D-8. Current haze indices (dv) for all Alaska IMPROVE sites.

Class I Area	IMPROVE Site	Clearest Day Haze Index	Most Impaired Haze Index
Denali National Park and Preserve	DENA1	2.2	6.6
	TRCR1	3.4	8.8

Simeonof Wilderness Area	SIME1	7.7	13.9
Tuxedni National Wildlife Refuge	TUXE1	3.9	10.0
	KPBO1	6.0	Not available

5. ANNUAL AND SEASONAL SPECIATION TREND

This section presents 2000-2018 annual average light extinction by species and 2014-2018 seasonal light extinction by species for each IMPROVE site in Alaska.

a. Denali– DENA1

Figure III.K.13.D-2 shows that the largest fractions of total light extinction on the MID at DENA1 are $(NH_4)_2SO_4$ and OMC, with CM and EC contributing to a lesser extent. DENA1 is adjacent to a local coal-fired electrical generating plant (i.e., the Healy Power Plant), which produces significant amounts of $(NH_4)_2SO_4$ and NH_4NO_3. DENA1 has a greater presence of OM than other Class I areas in the state due to the park location in Southcentral Alaska with large forests surrounding the area so is more influenced by secondary organic aerosol from biogenic emissions and wildfires.

Except for an increase in extinction in 2009, there was no noticeable decline in extinction during 2000-2018 at DENA1. The 2009 increase in visibility extinction was noted as a result of the local wildfire and volcano activities that year which impacted the overall air quality in the Class I area for the year. Comparing the baseline with the current visibility period, local visibility has improved slightly, with visibility falling towards five deciviews by the end of the current visibility period. This downward trend in visibility degradation indicates that haze-causing species, $(NH_4)_2SO_4$ predominantly, have improved since the baseline period.

Other than $(NH_4)_2SO_4$, local EC has fallen compared to where it was measured at the start of the baseline period. This indicates that either wildfire activity has not generated the same level of EC or that other potential sources of this haze species have declined since 2000. CM remained relatively consistent, potentially indicating that any increases in local tourist activity over unpaved roads within the parks have not caused significant visibility declines.

Light extinction on the clearest days at DENA1 shown in Figure III.K.13.D-3 indicates improvement between the baseline period and current visibility period, with $(NH_4)_2SO_4$ levels falling to roughly 0.5 Mm^{-1} light extinction. OMC showed a slight increase during 2010-2012, but it otherwise remained at consistent levels through all three monitoring periods. CM showed reductions from the baseline through current visibility period.

Figure III.K.13.D-2. 2000-2018 Annual average light extinction on most impaired days at DENA1

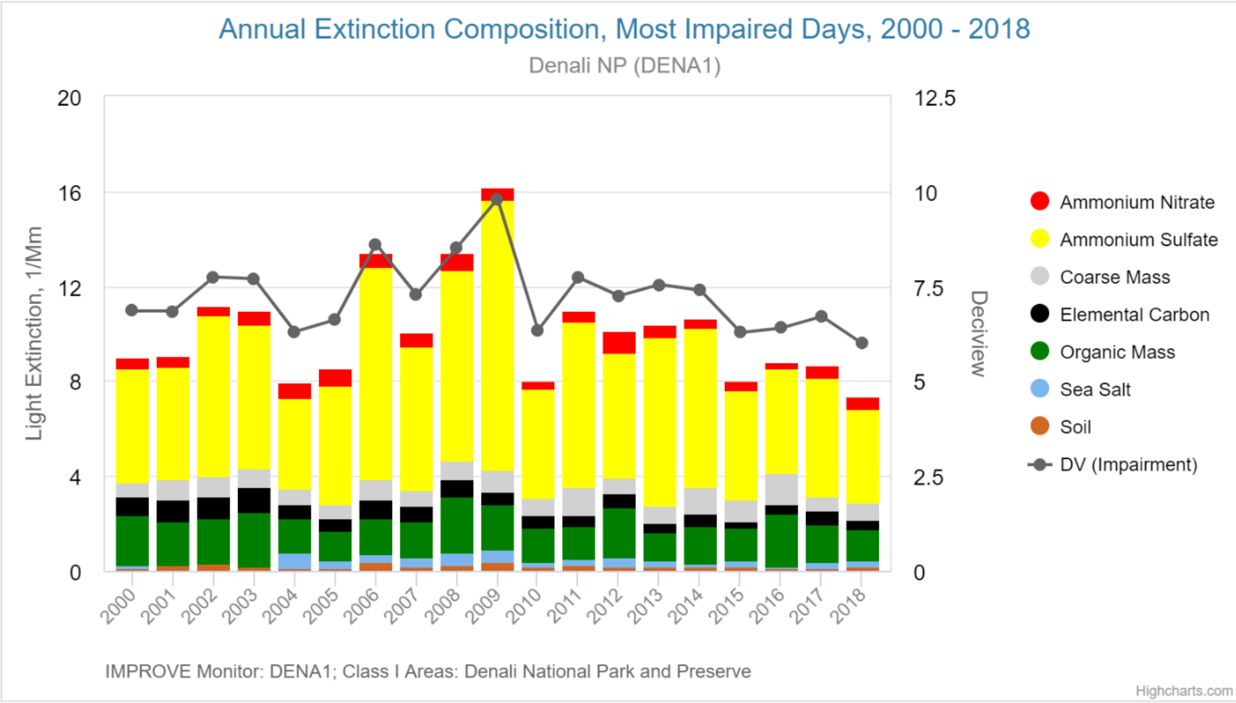
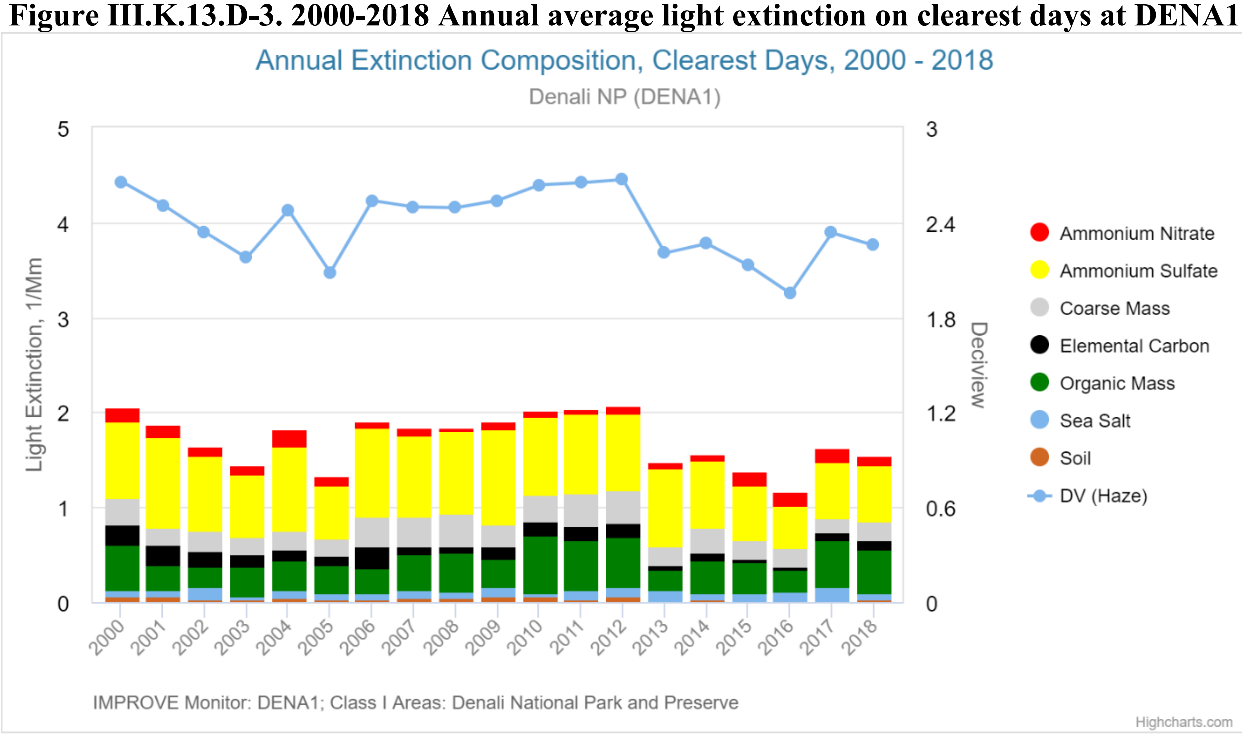


Figure III.K.13.D-3. 2000-2018 Annual average light extinction on clearest days at DENA1



During spring and summer months when wildfire activity is at its peak, both OMC and $(NH_4)_2SO_4$ levels on MID demonstrate the role these fires play in visibility degradation. High

OMC levels recorded during summer are likely associated with wildfire activities. For example, during 2015, 5.14 million acres burned throughout the state and caused significant air quality issues. It is likely that this OMC made it through the statistical procedures for screening out days influenced by wildfires in defining the IMPROVE MID and caused the higher extinction readings on the MID during summer of 2015 (e.g., June 14 and July 20). (Figure III.K.13.D-4). Wildfires likely account for elevated $(NH_4)_2SO_4$ levels on these days too.

The reading of higher CM could be caused by local unpaved road traffic in the national park, especially as tourist activity tends to peak during July and August with large numbers of tourists arriving in state. While during fall and winter, increased precipitation in the form of rain and snow suppresses dust from all sources. (Figure III.K.13.D-5)

$(NH_4)_2SO_4$ levels between spring and summer are almost identical. $(NH_4)_2SO_4$ levels further fell during fall and winter. The presence of NH_4NO_3 in the Denali airshed can be connected with anthropogenic sources.

Figure III.K.13.D-4. 2014-2018 Seasonal light extinction composition on most impaired days at DENA1

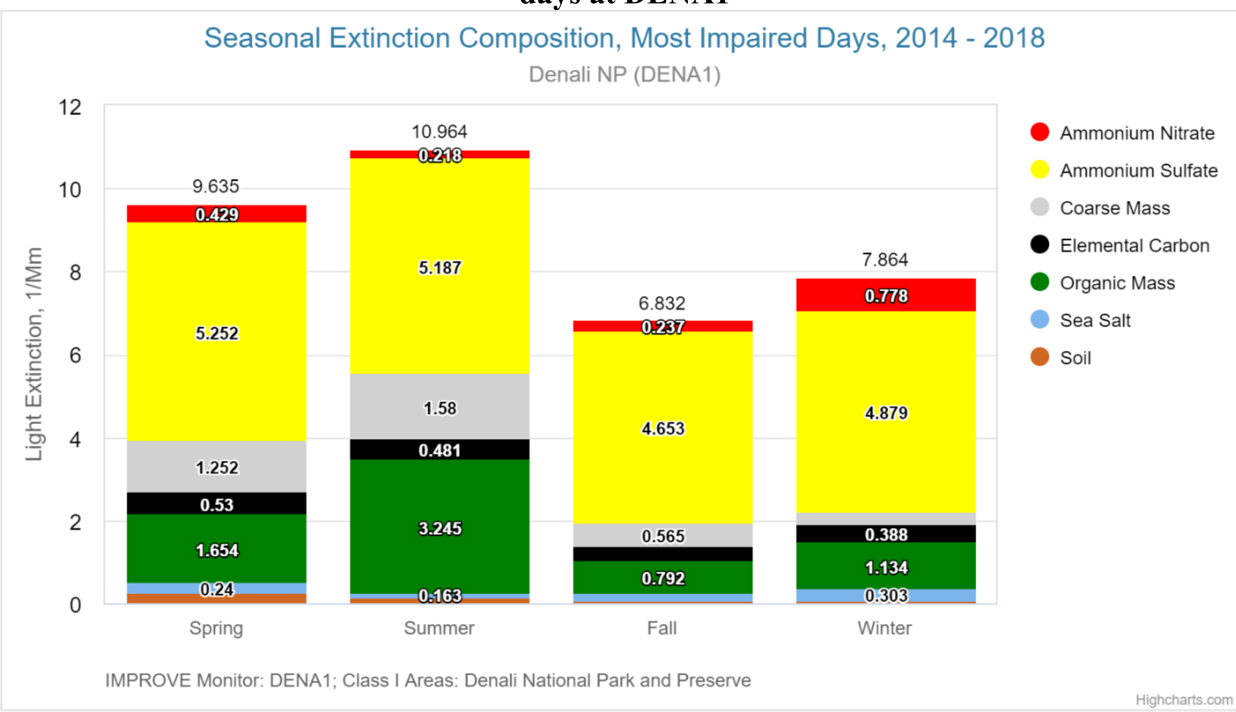
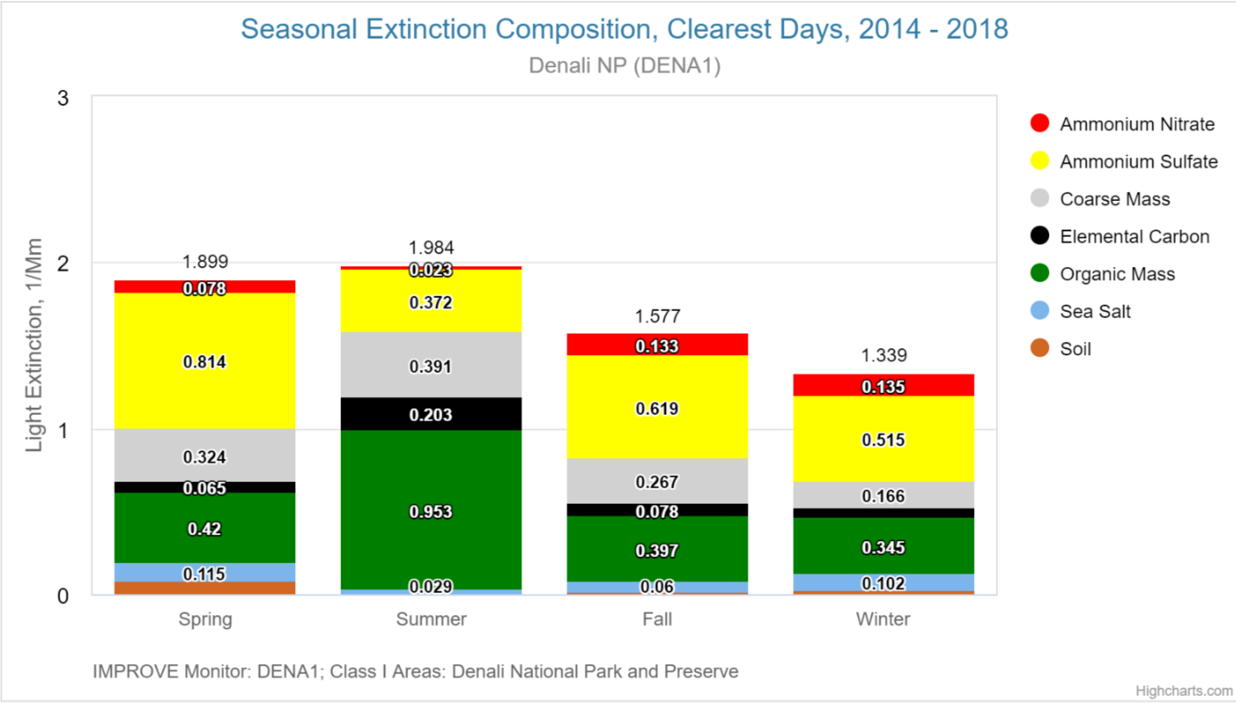


Figure III.K.13.D-5. 2014-2018 Seasonal light extinction composition on clearest days at DENA1



B. Trapper Creek – TRCR1

Like other Class I areas in the state, the primary haze species of concern for TRCR1 is $(NH_4)_2SO_4$, and its levels track closely with those detected at the DENA1 monitoring station (Figure III.K.13.D-6). Unlike DENA1, TRCR1 is not near coal-fired power plants. However, Denali is located equidistant between large military installations in Anchorage and Fairbanks, which includes extremely active flight lines, and emissions are generated above the surface mixing layer which limits visibility impacts.

Two large yearly annual increases in 2006 and 2009 match up with significant wildfire years in the Alaska interior and are mirrored at the DENA1 monitoring site. 2009, the year with the highest MID extinction, is a significant fire year in the Alaska interior when some 2.9 million acres burned. 2009 was also a peak record of volcanic activities, including the eruption of the Redoubt volcano.

Visibility at the TRCR1 monitor during the current visibility period MID averaged roughly between eight and nine deciviews, or 13 Mm^{-1} extinction. The highest extinction readings were in 2009 and 2014; most of which came from high $(NH_4)_2SO_4$ levels. Extinction levels for 2015-18 were roughly 11 Mm^{-1}, which can be considered an improvement compared to baseline years (e.g., almost 15 Mm^{-1} in 2002 and 2003).

Clearest days levels remained near or below 3 Mm^{-1} light extinction and approached estimated natural conditions for the monitoring site (Figure III.K.13.D-7).

Figure III.K.13.D-6. 2002-2018 Annual average light extinction on most impaired days at TRCR1

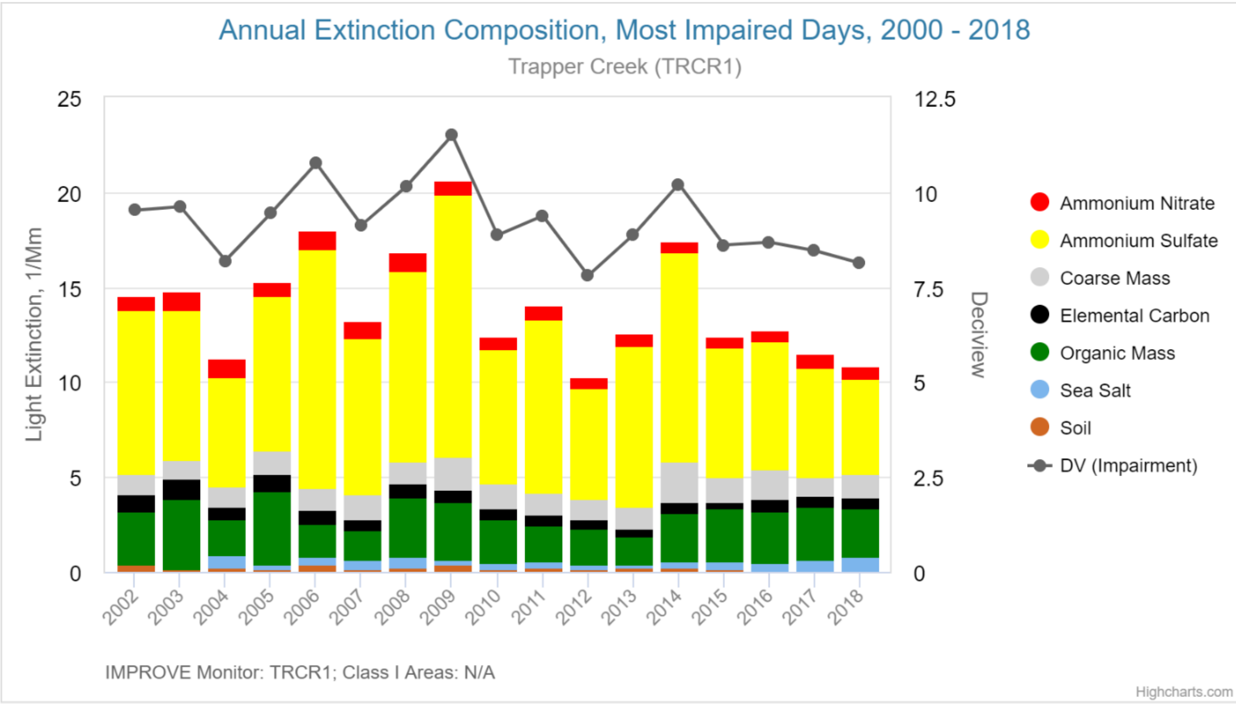
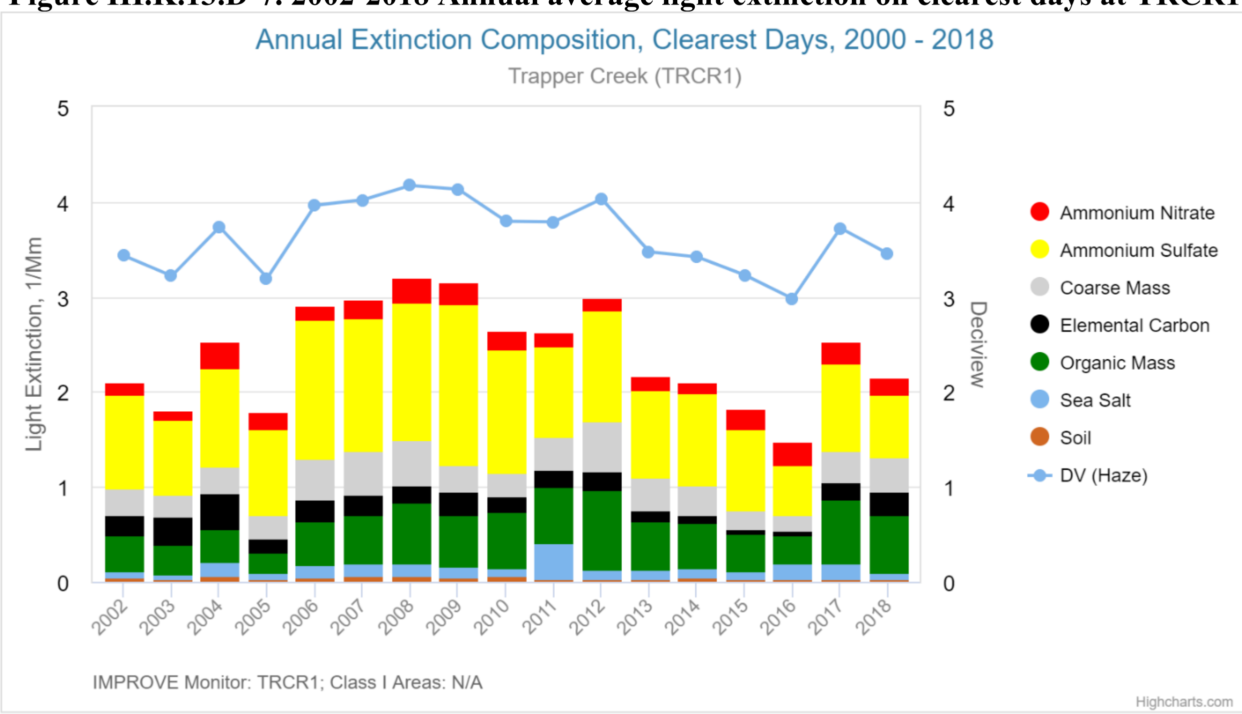


Figure III.K.13.D-7. 2002-2018 Annual average light extinction on clearest days at TRCR1



Seasonal extinction for MID at the TRCR1 monitor was recorded at its highest during summer, with a maximum average of 16.5 Mm^{-1}(Figure III.K.13.D-8). High levels of recorded OMC indicate some amount of wildfire smoke contributed to extinction on the MID that were not eliminated from MID by the MID statistical screening approach of the IMPROVE data. Higher NH_4NO_3 and $(NH_4)_2SO_4$ can potentially also be tied to the increased wildfire activity, which took place in the summer of 2015, weighting the average towards these species over the current visibility period MID.

On clearest days, the distribution of light extinction among species for site TRCR1 and DENA1 is very similar, while TRCR1 had slightly higher total light extinction (Figure III.K.13.D-9).

Figure III.K.13.D-8. 2014-2018 Seasonal light extinction composition on most impaired days at TRCR1

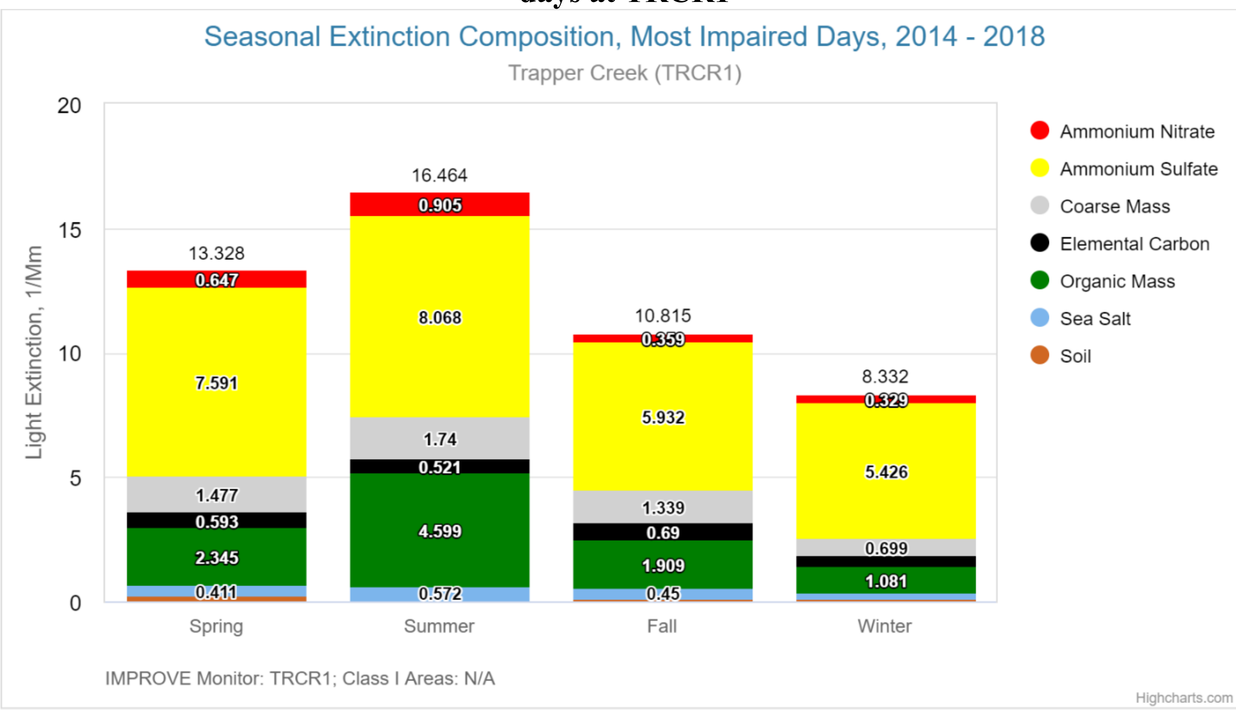
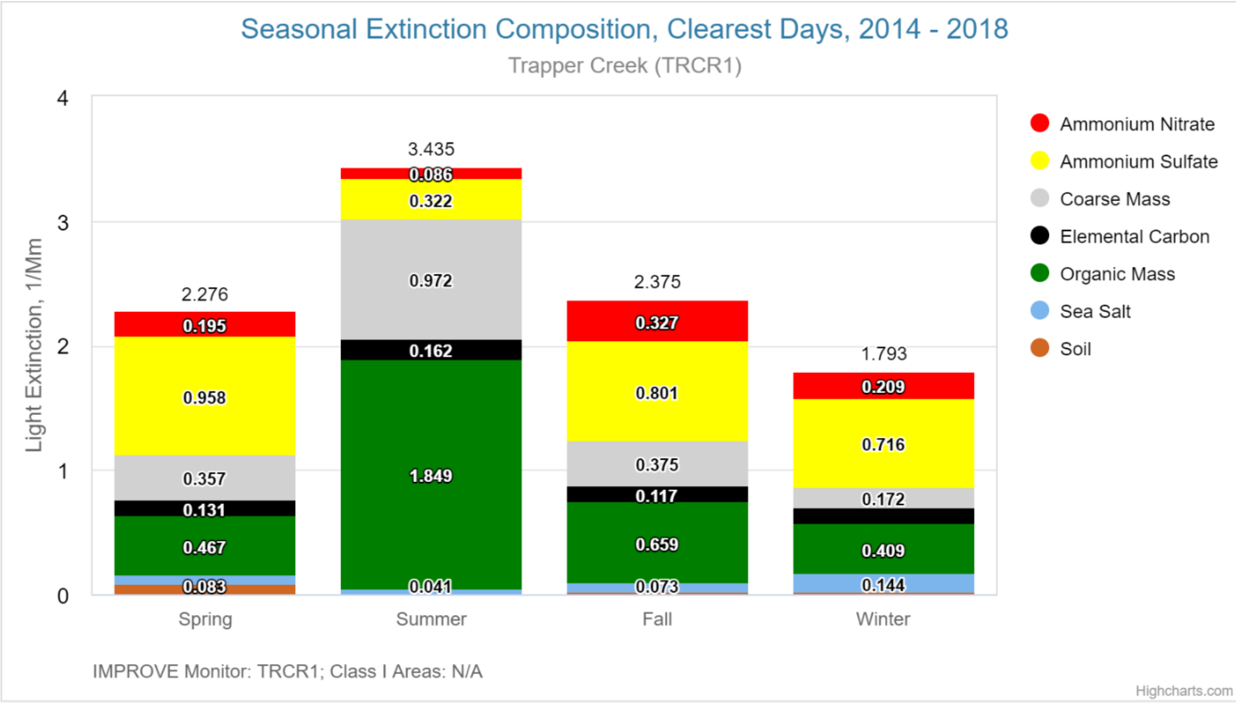


Figure III.K.13.D-9. 2014-2018 Seasonal light extinction composition on clearest days at TRCR1



C. Simeonof– SIME1

Figure III.K.13.D-10 shows that at SIME1 $(NH_4)_2SO_4$ is the dominate haze species on the MID, with sea salt, OMC, and CM contributing to a lesser extent. It cannot be determined from the monitoring observations what the source of the measured sulfate is. The Simeonof area is adjacent to both a large international maritime shipping lane as well as to several active and semi-active volcanoes which off-gas sulfur and other compounds and periodically erupt, which can potentially impact local visibility. Naturally occurring DMS emissions also occur from the ocean that can be a precursor to sulfate.

The total light extinction at SIME1 on the MID from the start of the baseline period through 2018 fluctuated around 30 Mm^{-1}, with three years 2007, 2009, and 2012 where visibility extinction increased toward 40 Mm^{-1}. Monitored OMC could be from trans-boundary from elsewhere in Alaska, or from international sources, or even biogenic VOC emissions due to the absence of large wildfires in the vicinity of the SIME monitoring station.

On the clearest days, visibility extinction was roughly split between $(NH_4)_2SO_4$ and sea salt, a naturally occurring and uncontrollable haze species from oceanic activity (Figure III.K.13.D-11). As on the MID, visibility on the clearest days remained consistent with extinction remaining around 10 Mm^{-1}. The clearest days extinction increased to just under 12 Mm^{-1} in 2011, with significant amounts of that increase originating from sea salt and CM rather than $(NH_4)_2SO_4$. The slightly elevated levels of CM as observed could indicate influence from local unpaved roads located near the monitoring station in Sand Point.

Comparing current conditions to baseline, overall, there is a slight decline in visibility for both MID and clearest days.

Figure III.K.13.D-10. 2002-2018 Annual average light extinction on most impaired days at SIME1

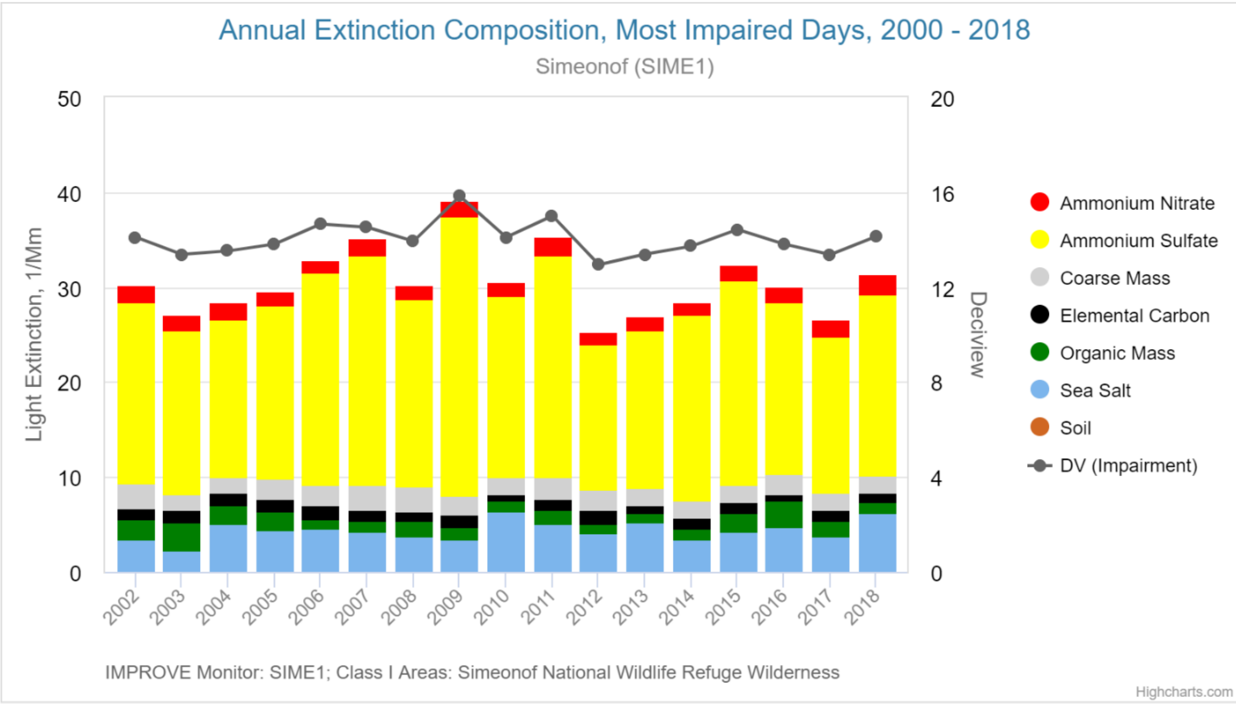
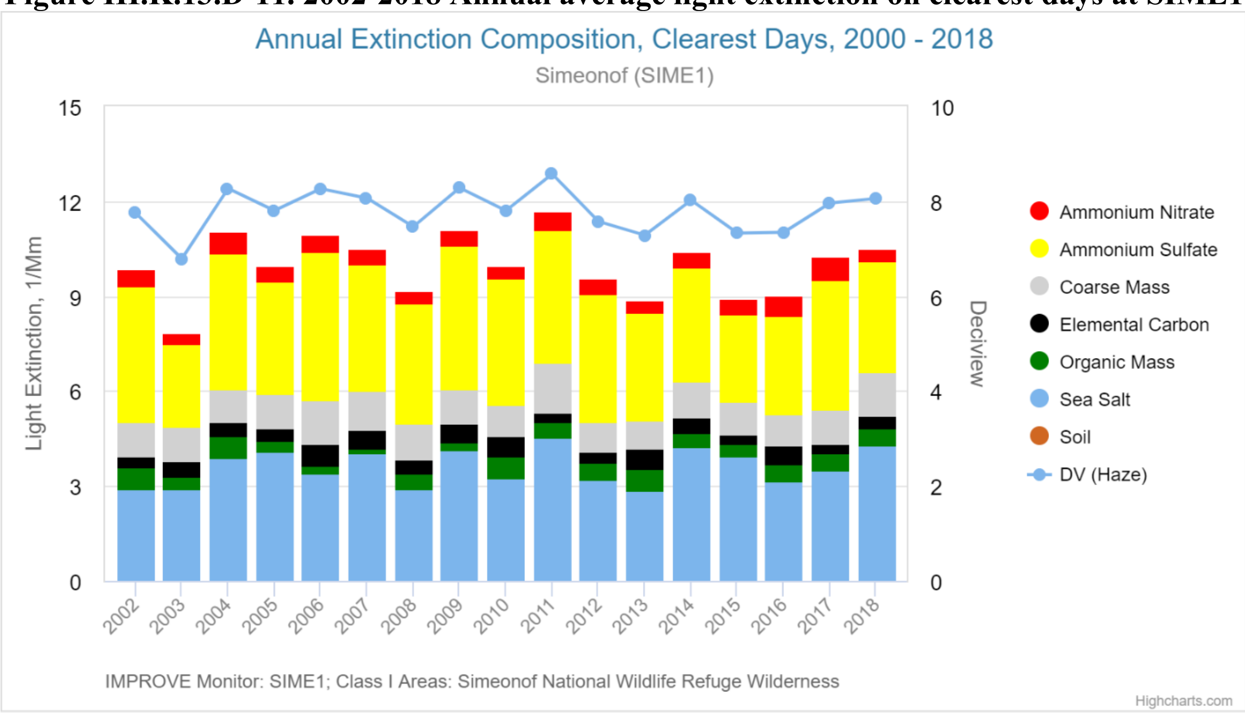


Figure III.K.13.D-11. 2002-2018 Annual average light extinction on clearest days at SIME1



As shown in Figure III.K.13.D-12 seasonal average species extinction composition on the MID, $(NH_4)_2SO_4$ level was highest during fall, when there was also the largest increase in OMC readings, indicating potentially a significant influx of wildfire smoke from outside the state. OMC levels dropped to near zero during winter, and rose again in spring, indicating the beginning of wild and prescribed fire season in the Alaska interior and the Russian Far East. The highest extinction was measured in fall, which coincides with increases in CM and $(NH_4)_2SO_4$. It is likely that this was caused by significant wildfire activity in the Russian Far East and Siberia during that period in 2016, which threw off the rest of the average for the other years in the current visibility period. Sea salt extinction has high levels recorded in spring and fall. The spring increase in sea salt could coincide with extremely late winter storms, or some early spring storms increasing ocean activity and thus sea salt contributions on the MID. The fall increase coincides with fall storm activity.

On the clearest days, during fall and winter, sea salt was the greatest contributor to extinction. Sea salt level was lowest during summer, when $(NH_4)_2SO_4$ level was highest (Figure III.K.13.D-13).

Figure III.K.13.D-12. 2014-2018 Seasonal light extinction composition on most impaired days at SIME1

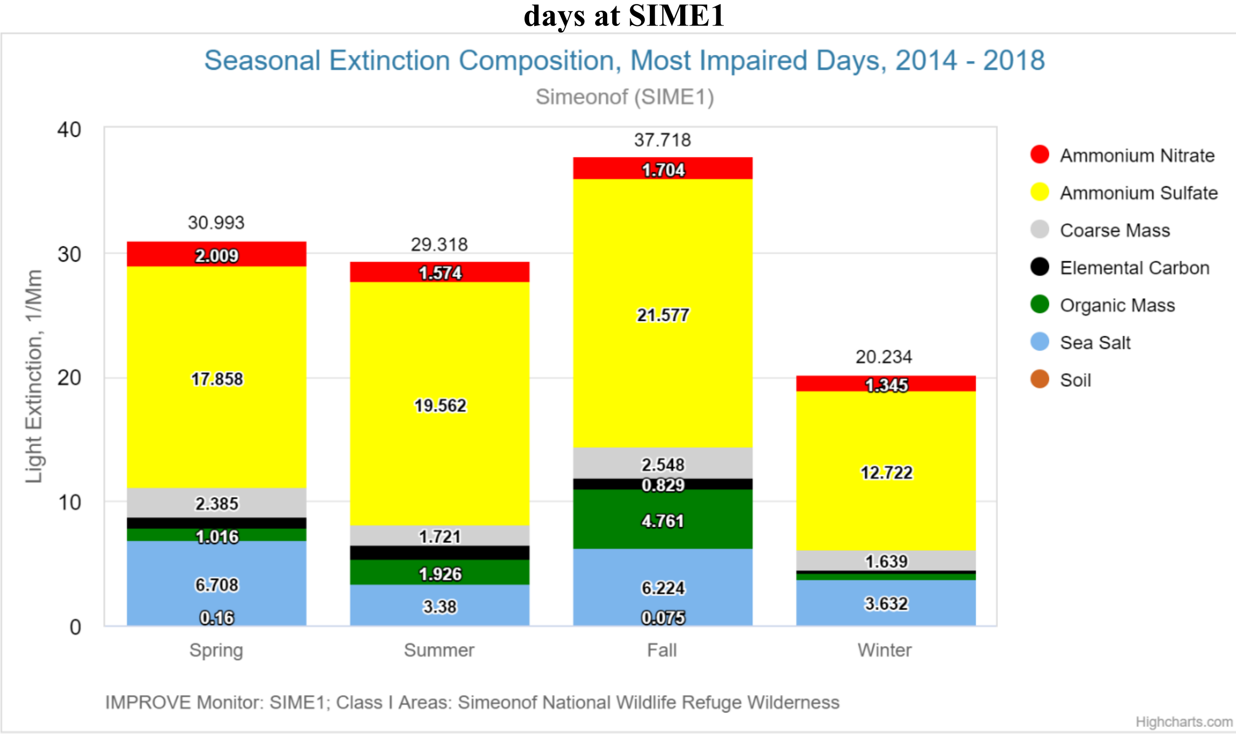
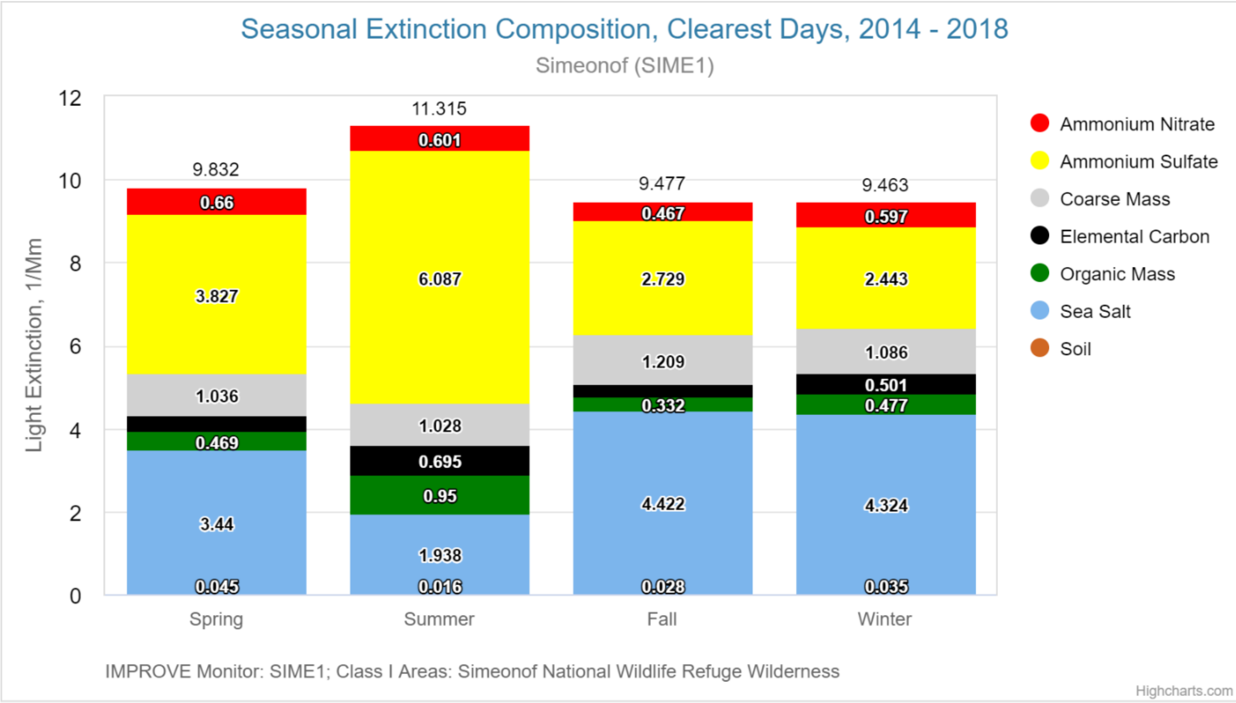


Figure III.K.13.D-13. 2014-2018 Seasonal light extinction composition on clearest days at SIME1



D. Tuxedni – TUXE1

The driving species for 2000-2018 annual extinction on the MID at TUXE1 is $(NH_4)_2SO_4$, followed by sea salt, OM, CM, and NH_4NO_3 (Figure III.K.13.D-14). As with the three IMPROVE sites discussed above, visibility extinction increased at TUXE1 in 2009 which coincides with the large wildfires and active volcanic activities that year (e.g., nearby Redoubt eruption). Visibility improved in the subsequent years, indicating that this was likely a result of the episodic events, as with the other IMPROVE sites, and not tied to local anthropogenic emission increases. (Figure III.K.13.D-15)

Figure III.K.13.D-14. 2002-2014 Annual average light extinction on most impaired days at TUXE1

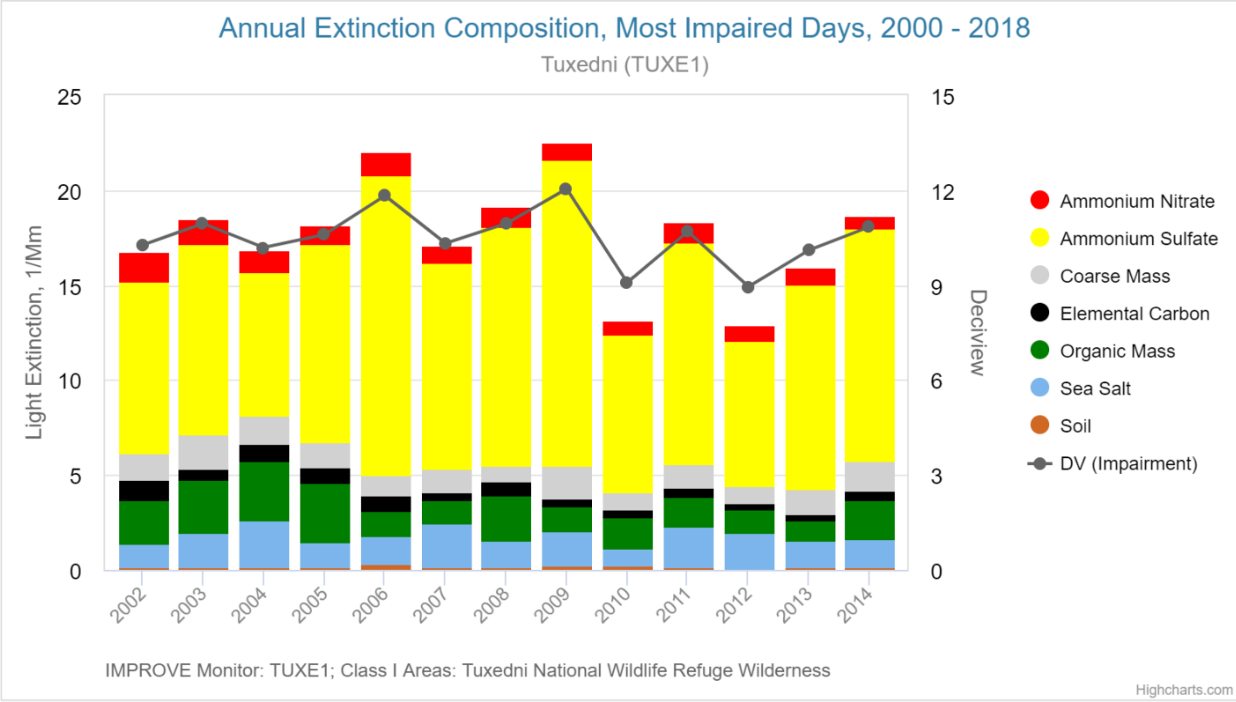
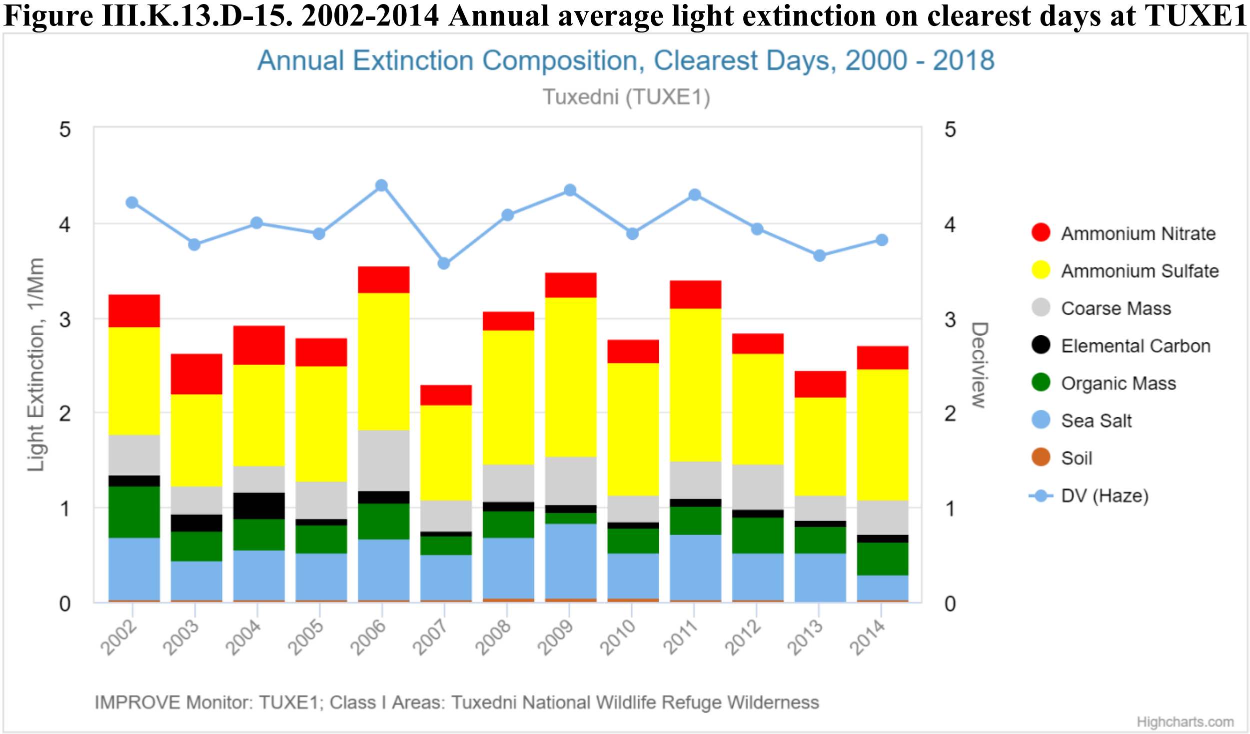


Figure III.K.13.D-15. 2002-2014 Annual average light extinction on clearest days at TUXE1



TUXE1 seasonal plots for the current years are based solely on 2014 IMPROVE data from its last year of operation. On the MID, $(NH_4)_2SO_4$ levels were high in spring and summer with a decline of 3 Mm^{-1} during fall and winter (Figure III.K.13.D-16). While on the clearest days, $(NH_4)_2SO_4$ levels were relatively consistent (Figure III.K.13.D-17). OMC and CM levels on the MID and clearest days peaked during the summer, coinciding with wildfire season. Other species, like NH_4NO_3, remained below 1 Mm^{-1}. Sea salt remained below 3 Mm^{-1} during the year and increased to its highest levels of visibility extinction during winter month, the inverse of sulfate contribution patterns across Class I Areas in Alaska.

Figure III.K.13.D-16. 2014 Seasonal light extinction composition on most impaired days at TUXE1

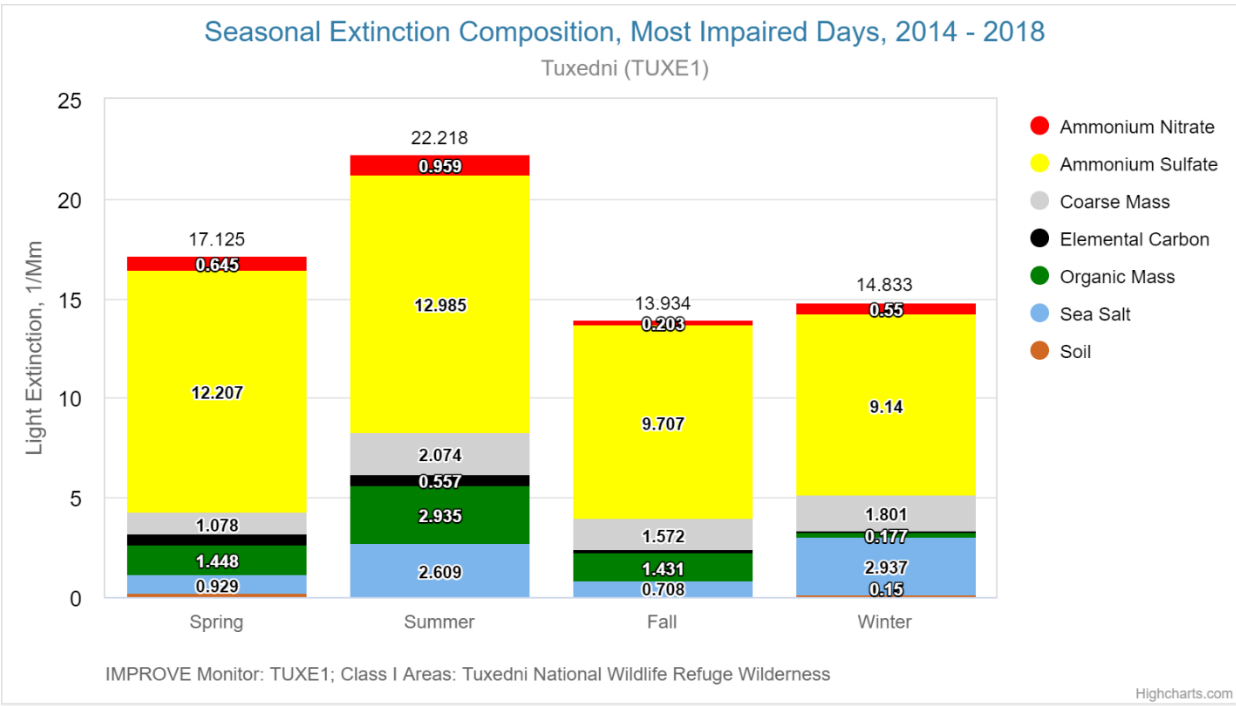
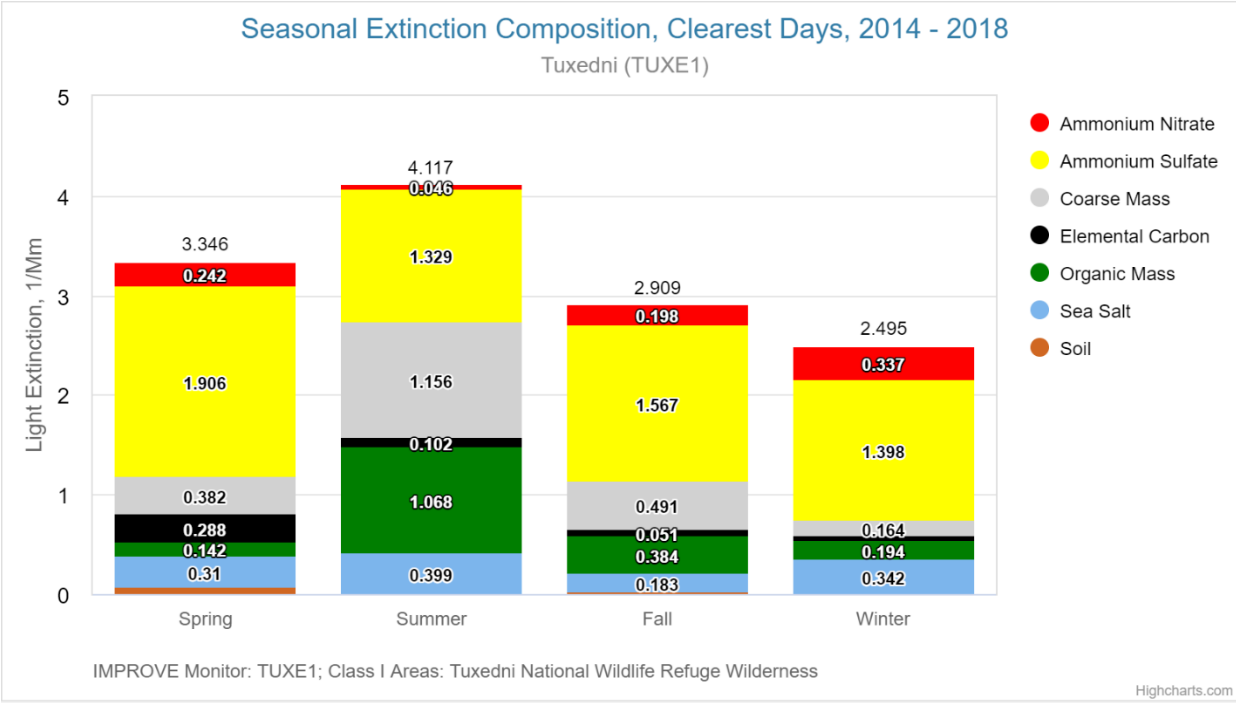


Figure III.K.13.D-17. 2014 Seasonal light extinction composition on clearest days at TUXE1



E. Kenai Peninsula Borough– KPBO1

Data for the KPBO1 monitor are available from 2016 through the end of the current visibility period in 2018. Because there is not enough data to provide the requisite data for a baseline visibility reading at the KPBO1 site, visibility conditions are not available for most impaired days, and the plots below only cover the clearest days.

Prior to the move, the TUXE1 monitor was located on the western side of Cook Inlet with a small population and little industry. The KPBO1 monitor is located on the eastern side of the inlet adjacent to several large population centers. The influence of larger stationary sources on the Kenai Peninsula and mobile sources from the Alaska state highway to KPBO1 is more apparent than at TUXE1. There are also a number of oil drilling platforms south of the KPBO1 site, as well as the Nikiski Oil Refinery, which have the potential to influence visibility and local air quality differently at the KPBO1 site compared with the location of TUXE1.

Just by comparing the annual and seasonal clearest days plots between KPBO1 and TUXE1, the difference in species and magnitudes of extinction between the two sites makes it obvious that they are sampling different air masses. The annual total light extinction at KPBO1 is roughly 3-4 Mm^{-1} higher than TUXE1, and it's more evenly distributed between $(NH_4)_2SO_4$, CM, OMC, and sea salt. Unlike TUXE1, $(NH_4)_2SO_4$ is not the dominant species on clearest days at KPBO1. (Figure III.K.13.D-18)

In spring and summer at KPBO1, CM levels rose while $(NH_4)_2SO_4$ levels went down. Sea salt peaked in spring and OMC and EC peaked during summer. Those patterns are very different from TUXE1. (Figure III.K.13.D-19)

Figure III.K.13.D-18. 2016-2018 Annual average light extinction on clearest days at KPBO1

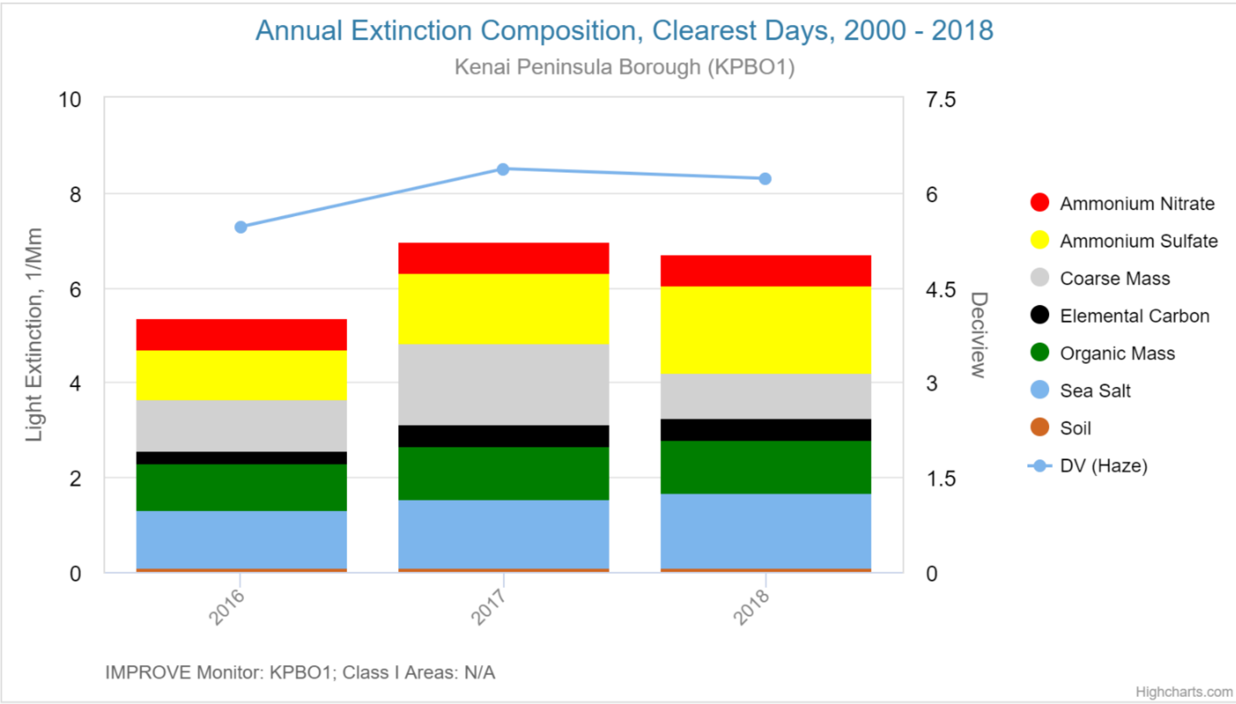


Figure III.K.13.D-19. 2016-2018 Seasonal light extinction composition on clearest days at KPBO1