Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Vol. III: Appendices

Appendices to:
Vol. II: Analysis of Problems, Control Actions
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

The State of Alaska's State Air Quality Control Plan Volume III, Appendix to Volume II of this plan, is amended to include the following documents:

Volume II, Section II. Air Quality Control Program is amended by removing the following regulations:

- 18 AAC 50 Air Quality Control as amended through November 6th, 2010;

and replacing them with the following regulations currently under public review and comment:

- 18 AAC 50 Air Quality Control as amended through {*Adoption Date of Regulations*}.

Appendices to Volume II, Section III. K: Areawide Pollutant Control Program for Regional Haze, adopted into the State Air Quality Control Plan {*Adoption Date of Regulations*}, are added as follows:

- Appendix III.K.1- no appendix;
- Appendix III.K.2 -IMPROVE Algorithms;
- Appendix III.K.3- Overview of Alaska Air Quality;
- Appendix III.K.4.a- Alaska Volcano Observatory Events near Simeonoff Class 1 Area: Examples from 2002-2006;
- Appendix III.K.4.b- Maps of Wildfires affecting Alaska's Class 1 Areas;
- Appendix III.K.5- Emission Inventory;
- Appendix III.K.6- no appendix;
- Appendix III.K.7- Air Quality Modeling of Source Regions;
- Appendix III.K.8- Alaska Enhanced Smoke Management Plan;
- Appendix III.K.9- Reasonable Progress Goals;
- Appendix III.K.10- no appendix;
- Appendix III.K.11.a- Consultation: Regional Planning WRAP Meetings and Conference Calls;
- Appendix III.K.11.b- Consultation: Federal Land Manager Review; and
- Appendix III.K.11.c- Consultation: Public Participation and Review.

DEPARTMENT OF

ENVIRONMENTAL CONSERVATION

18 AAC 50

Air Quality Control

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The lead in language of 18 AAC 50.030 is amended to read:

18 AAC 50.030. State air quality control plan. Volumes II and III of the *State Air Quality Control Plan* for implementing and enforcing the provisions of AS 46.14 and this chapter, as amended through ***{adoption date of these proposed regulations}*** [NOVEMBER 6, 2009], are adopted by reference. The plan includes the following documents which are also adopted by reference:

. . .

(Eff. 1/18/97, Register 141; am 6/21/98, Register 146; am 9/4/98, Register 147; am 1/1/2000; Register 152; am 12/30/2000; Register 156; am 9/21/2001, Register 159; am 1/27/2002, Register 161; am 3/2/2002, Register 161; am 5/3/2002, Register 162; am 2/20/2004, Register 169; am 6/24/2004, Register 170; am 10/1/2004, Register 171; am 12/14/2006, Register 180; am 12/30/2007, Register 184; am 5/17/2008, Register 186; am 7/25/2008, Register 187; am, 11/9/2008, Register 188; am 5/6/2009, Register 190; am 11/4/2009, Register 192; am 4/1/2010, Register 193; am__/__/____, Register ___)

Authority:	AS 46.03.020	AS 46.14.030	Sec. 30, ch. 74, SLA 1993
	AS 46.14.020	AS 46.14.140	

18 AAC 50.245(a) is amended to read:

18 AAC 50.245. Air episodes and advisories. (a) The department may declare an air episode and prescribe and publicize curtailment action if the concentration of an air pollutant in the ambient air has reached, or is likely in the immediate future to reach, any of the concentrations established in Table 6 in this subsection.

Table 6.
Concentrations Triggering an Air Episode

Episode Type	Air Pollutant	Concentration in micrograms per cubic meter {and in ppm where applicable}
Air alert	Sulfur dioxide	365 (24-hour average) {0.14 ppm}
	PM-2.5	**56 (24-hour average)**
	PM-10	150 (24-hour average)
	PM-10 from wood burning (wood smoke control areas)	92 (24-hour average)
	Carbon monoxide	10,000 (8-hour average) {8.7 ppm}
Air warning	Sulfur dioxide	800 (24-hour average) {0.31 ppm}
	PM-2.5	**141 (24-hour average)**
	PM-10	350 (24-hour average)
	Carbon monoxide	17,000 (8-hour average) {15 ppm}
Air emergency	Sulfur dioxide	1,600 (24-hour average) {0.61 ppm}

	PM-2.5	**211 (24-hour average)**
	PM-10	420 (24-hour average)
	PM-10 from wood burning (wood smoke control areas)	During an air alert, a concentration measured or predicted to exceed 92 (24-hour average), and to continue to increase beyond the concentration that triggered the air alert
	Carbon monoxide	34,000 (8-hour average) {30 ppm}

(Eff. 1/18/97, Register 141; am 10/1/2004, Register 171; am__/__/____, Register ___)

Authority: AS 46.03.020 AS 46.14.020 Sec. 30, ch. 74, SLA 1993

AS 46.14.010 AS 46.14.030

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Amendments to:
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Volume III: Appendix III.K.1
No Appendix- Placeholder

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Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.2
IMPROVE Algorithms

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

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IMPROVE Algorithms

Aerosol type equations

The IMPROVE network measures mass concentration data for many different aerosol species. Standard formulas are applied to derive additional visibility-related aerosol species. Typical Aerosol Type Equations are presented below [1]. Brackets indicate the mass concentration of the aerosol species or element. More detailed discussion on these aerosol type equations is found in Malm et al, 1994[2], the 2000 IMPROVE report[3] and the 1996 IMPROVE report[4].

SPECIES	Abbrev.	FORMULA	ASSUMPTIONS
Ammonium Sulfate	**SULFATE**	4.125[S]	All elemental S is from sulfate. All sulfate is from ammonium sulfate.
Ammonium Nitrate	**NITRATE**	1.29[NO_3]	Denuder efficiency is close to 100%. All nitrate is from ammonium nitrate.
Total Organic Carbon	**OC**	OC1+OC2+OC3+OC4+OP (see definitions below)	
Organic Mass by Carbon	**OMC**	1.4 * OC	Average organic molecule is 70% carbon.
Organic Carbon by Hydrogen	**OCH**	(11 * (H - 0.25 * S))	assumes all sulfur is ammonium sulfate and there is no hydrogen from nitrate. Organic mass is equal to 1.4*OCH
Light absorbing Carbon	**LAC**	EC1+EC2+EC3-OP	
fine soil	**SOIL**	2.2[Al]+2.49[Si]+1.63[Ca] +2.42[Fe]+1.94[Ti]	[Soil K]=0.6[Fe]. FeO and Fe_2O_3 are equally abundant. A factor of 1.16 is used for MgO, Na_2O, H_2O, CO_2.
reconstructed fine mass	**RCFM**	[SULFATE]+[NITRATE] +[LAC]+[OMC]+[SOIL]	Represents dry ambient fine aerosol mass for continental sites.
coarse mass	**CM**	[PM_{10}] - [$PM_{2.5}$]	Consists only of insoluble soil particles.

Light Extinction Equations (IMPROVE algorithms)

Chemically different aerosols affect visibility differently. Concentrations of aerosols (in µg/m3, from aerosol type equations) are converted to light extinction (visibility) by means of light extinction equations. There are currently two IMPROVE algorithms (or equations) used to convert measured aerosol concentrations to light extinction; these are referred to as the original (or old) and the revised (or new) IMPROVE algorithms. Both use mass concentration measurements and relative humidity estimates to calculate light extinction. Sulfate and nitrate are hygroscopic, taking on water and having greater light-scattering efficiencies under higher RH conditions. Relative humidity (RH) adjustment factors [f(RH)] are used to increase the Sulfate and nitrate particle's extinction efficiency with increasing RH. Further discussions of the two IMPROVE algorithms may be found in cited documents [4, 5].

Applications to Regional Haze Analysis

In Regional Haze analysis IMPROVE algorithms are used in describing Baseline visibility conditions, in defining Natural Visibility conditions to be attained by 2064, and in evaluating anticipated 2018 visibility improvement. For projected light extinctions (e.g. 2018 and 2064) the natural species concentration estimates used are from the NAPAP State of Science Report 24 by Trijonis[6].

Original IMPROVE Algorithm

The EPA adopted the original IMPROVE algorithm in their 2003 guidance document on *Tracking Progress Under the Regional Haze Rule* [7]. The equation for total light extinction combines extinctions by each chemical species, as measured by the IMPROVE aerosol monitors combined with the effects of Relative Humidity (RH), to estimate the scattering of light by fine and coarse particles.

The original IMPROVE algorithm converts particulate species concentrations to light extinction as follows, with the brackets indicating the species concentration and the prefix "b" denoting extinction. The factors 3, 4, 1, and 0.6 are the specific scattering efficiencies for each of the respective species. A sulfate particle, for instance, is three times more effective in scattering light than a particle of soil.

$$\text{bSulfate} = 3 \times f(RH) \times [\text{Sulfate}]$$
$$\text{bNitrate} = 3 \times f(RH) \times [\text{Nitrate}]$$
$$\text{bEC} = 10 \times [\text{EC}]$$
$$\text{bOM} = 4 \times [\text{OMC}]$$
$$\text{bSoil} = 1 \times [\text{Soil}]$$
$$\text{bCM} = 0.6 \times [\text{CM}]$$

The total light extinction (bext) is defined to be the sum of light extinction due to the six PM species listed above plus Rayleigh (blue sky) background (bRay) that is assumed to be 10 Mm-1:

$$\text{bext} = \text{bRay} + \text{bSulfate} + \text{bNitrate} + \text{bEC} + \text{bOMC} + \text{bSoil} + \text{bCM}$$

or

$$b_{ext} = 3f(RH)[\text{sulfates}] + 3f(RH)[\text{nitrates}] + 4[\text{organics}] + 10[\text{elemental carbon}] + 1[\text{fine soil}] + 0.6[\text{coarse matter}] + 10$$

Two related Measures used in Regional Haze Analysis are Visual Range (VR) and deciviews. The total light extinction (bext) in Mm^{-1} is related to VR in km using the following relationship: VR = 3912 / bext. The Regional Haze Rule requires that visibility be expressed in terms of a haze index in units of deciviews (dv), which is calculated as follows: HI = 10 ln(bext/10)

Revised IMPROVE Algorithm

In December 2005, the IMPROVE Steering Committee voted to adopt an alternative, revised algorithm for use by IMPROVE. The IMPROVE light extinction equation was analyzed, revised, and approved by the IMPROVE Steering Committee during 2005. In December 2005, the Steering Committee voted to adopt the alternative, revised algorithm for use by IMPROVE. The WRAP Technical Analysis Forum now recommends the use of the revised IMPROVE light extinction equation as developed and approved in 2005 by the IMPROVE Steering Committee to convert from mass concentration measurements to light extinction for visibility analysis and regional haze planning at each WRAP region Class I area. Detailed discussions of the revised equation and the reasons for changing the original are found in IMPROVE program publications[8,9,11].

The new equation splits ammonium sulfate, ammonium nitrate, and organic carbon compound concentrations into two size fractions: small and large. The equation for estimating the light extinction for the RHR is:

$$\begin{gathered}
\text{bext} \approx 2.2 \times \text{fs(RH)} \times [\text{small sulfate}] + 4.8 \times \text{fL(RH)} \times [\text{large sulfate}] \\
+ 2.4 \times \text{fs(RH)} \times [\text{small nitrate}] + 5.1 \times \text{fL(RH)} \times [\text{large nitrate}] \\
+ 2.8 \times [\text{small organic mass}] + 6.1 \times [\text{large organic mass}] \\
+ 10 \times [\text{elemental carbon}] \\
+ 1 \times [\text{fine soil}] \\
+ 1.7 \times \text{fss(RH)} \times [\text{sea salt}] \\
+ 0.6 \times [\text{coarse mass}] \\
+ \text{Rayleigh scattering (site-specific)} \\
+ 0.33 \times [\text{NO2 (ppb)}]
\end{gathered}$$

Though not explicitly shown, the organic mass concentration used is 1.8 times the organic carbon mass concentration, (changed from 1.4 times carbon mass the original equation uses). New terms have also been added for sea salt and for absorption by NO2. The apportionment of the total concentration of sulfate compounds into the concentrations of small and large size fractions is accomplished using the following equations:

$$\begin{gathered}
[\textit{large sulfate}] = [\text{total sulfate}] \times [\text{total sulfate}], \text{ for } [\text{total sulfate}] < 20\ \mu g/m3 \\
[\textit{large sulfate}] = [\textit{total sulfate}], \textit{ for } [\textit{total sulfate}] \geq 20\ \mu g/m3 \\
[\textit{small sulfate}] = [\textit{total sulfate}] - [\textit{large sulfate}]
\end{gathered}$$

The same equations are used to apportion total nitrate and total organic mass into small and large size fractions. Sea salt is calculated as 1.8 x [*chloride*], or 1.8 x [*chlorine*] if the chloride measurement is below detection limits, missing, or invalid. The new equation contains three distinct water growth terms, designated fS, fL, and fSS for the small and large sulfate and nitrate fractions, and for sea salt, respectively.

The new IMPROVE equation for estimating light extinction for the RHR contains five major revisions from the original equation[10]:

1) A sea salt term has been added. Sea salt is a particular concern for coastal locations where the sum of the major components of light extinction and mass has been deficient.
2) The assumed organic mass to organic carbon ratio has been changed from 1.4 to 1.8, to reflect more recent peer-reviewed literature on the subject.
3) The Rayleigh scattering factor has been changed from a network-wide constant to a site-specific value. This factor is based on the elevation and annual average temperature of individual monitoring sites.
4) A split component extinction efficiency model for sulfate, nitrate, and organic carbon components has been developed. The model includes new water growth terms for sulfate and nitrate to better estimate light extinction at the high and low extremes of the range of extinction.
5) An NO2 light absorption term has been added. This term can only be used at sites with available NO2 concentration data.

Use of the Revised IMPROVE Algorithm for Alaska's Regional Haze Analysis

Alaska has chosen to apply the revised IMPROVE algorithm for computing light extinctions. This follows the recommendation of the WRAP Technical Analysis Forum.

Several improvements in the revised algorithm affect Alaska specifically. The original IMPROVE equation tends to underestimate the highest extinction values and overestimate the lowest extinction values. Air at Alaska's Class 1 Areas is very clear, among the lowest extinction values nationwide, and impairment was overestimated by the original algorithm. In addition, three of Alaska's four Class 1 Areas are coastal, and visibility impairment from sea salt is extremely important at these sites. A sea salt term has been added to the revised algorithm.

Citations:

1 IMPROVE. available at: http://vista.cira.colostate.edu/improve/Tools/AerTypeEqs.htm

2 Malm, W. C., J. F. Sisler, D. Huffman, R. A. Eldred, and T. A. Cahill, Spatial and seasonal trends in particle concentration and optical extinction in the United States, J. Geophys. Res., 99, 1347-1370, 1994.

3 James F. Sisler. 2000. Aerosol Mass Budgets and Spatial Distributions, Chapter 2 *in* Spatial and Seasonal Patterns and Temporal Variability of Haze and its Constituents in the United States: Report III, Principle Author: W. C. Malm.
Available at: http://vista.cira.colostate.edu/improve/Publications/Reports/2000/2000.htm

4 James F. Sisler. 1996. Optical and Aerosol Data, Chapter 2 *in* Spatial and Seasonal Patterns and Long Term Variability of the Composition of the Haze in the United States: An Analysis of Data from the IMPROVE Network, Report II. 1996, Principle Author: J. F. Sisler.
Available at : http://vista.cira.colostate.edu/improve/Publications/Reports/1996/1996.htm

5 Pitchford M. ; W. Malm; B. Schichtel; N. Kumar; D. Lowenthal; J. Hand. Revised algorithm for estimating light extinction from IMPROVE particle speciation data. J Air & Waste Manag Assoc 57 (11), pp. 1326-1336. 2007.

6 Trijonis, J.C., Malm, W.C., Pitchford, M.L., White, W.H., Charlson, R., and Husar, R. (1990) Visibility: Existing Conditions and Historical Conditions - Causes and Effects. *National Acid Precipitation Assessment Program State of the Science and Technology Volume III*, Report 24.

7 EPA Guidance for Tracking Progress Under the Regional Haze Rule. EPA-454/B-03-004 . September 2003. available at: http://www.epa.gov/ttn/oarpg/t1/memoranda/rh_tpurhr_gd.pdf).

8 http://vista.cira.colostate.edu/improve/Publications/NewsLetters/IMPNews4thQtr2005.pdf.

9 Applying_Monitoring_Metrics_for_Regional_Haze_Planning_%201_5_2007%20final%20draft.pdf available at http://vista.cira.colostate.edu/tss/Planning/InformationExchange.aspx

10 WRAP Technical Analysis Forum's Technical Recommendations on Monitoring Metrics for Regional Haze Planning 1/5/07 Final Draft.

11 http://vista.cira.colostate.edu/improve/Publications/GrayLit/019_RevisedIMPROVEeq/RevisedIMPROVEAlgorithm3.doc),

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.3
Overview of Alaska and Air Quality

Appendix to
Section III. K: Areawide Pollutant Control Program
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Arctic Haze

The scientific knowledge of Arctic haze was first codified by Drs. Rahn and Shaw.[1] Other summations were later made by Dr. Barrie in 1986[2] and by Drs. Shaw and Khalil in 1989.[3]

During the winter, the Arctic atmosphere becomes contaminated with anthropogenic pollution transported primarily from sources in Europe and Russia.[1] This unusual form of regional air pollution is commonly referred to as "Arctic haze." Sulfur oxides and soot are its main ingredients, although many metal and organic compounds can be found in Arctic haze samples.[4] Arctic haze is absent during summer, but begins to appear in the early winter. Photochemical oxidation of sulfur dioxide into sulfate aerosols after polar sunrise and seasonal meteorological conditions cause Arctic haze to reach its peak intensity in March, after which levels sharply decline.

The haze is composed of particles no larger than 2 μm because these particles have low settling velocities and are capable of remaining suspended in the atmosphere for weeks. This allows the particles to travel into the Arctic, which has few local aerosol sources.[5] The size of the Arctic haze aerosols is approximately the same as the wavelength of visible light (0.39-0.76 μm), allowing the aerosol to scatter light and therefore diminish visibility very effectively.

Arctic haze is often layered, a consequence of the small thermal lapse rate of the Arctic atmosphere in the winter. The shallow lapse rate dampens vertical mixing and therefore allows pollution to spread horizontally much faster than vertically.[6] Arctic haze occurs throughout the height of the Arctic troposphere as a result of the tendency of air parcels to move along surfaces of constant potential temperature causing pollution from lower latitudes to enter the Arctic at higher altitudes.[7]

Mitchell first characterized the haze in the 1950s.[8] Mitchell's early observations of pollution in the Arctic air mass were strictly visual; he saw large brown layers of haze. The name "Arctic haze" seemed an obvious and appropriate title, and has since come to be the standard title for the abnormally intense pollution found in the Arctic during winter and spring. Its definition as a visual phenomenon was cemented by the fact that the re-discovery and research into it during the 1970s were carried out with sun photometers.[9,10] However, it must be recognized that the pollution transported into the Arctic is comprised of both gaseous and aerosol components, and that by defining Arctic haze as a visual phenomenon it covers only the aerosol component of that pollution. The distinction is often difficult to make. For example, Khalil and Rasmussen[11] discuss the pollutant gases as "gaseous tracers of Arctic haze" or "trace gases in Arctic haze."

Episodes of high concentrations of aerosol pollution are not always coincident with high concentrations of gaseous pollution. In fact, the two have a slightly offset seasonality, with the gases tending to reach their highest concentrations in January-February due to decreased photochemistry and mixing in the Arctic, while aerosol pollution reaches its maximum in March-April due to increased airflow from central Eurasia and increased gas-to-particle conversion.

The particulate component of Arctic haze, is mostly comprised of sulfate aerosols, which make up approximately 90% of the haze's mass,[4] and soot.[12] There are also many other elemental constituents, such as lead, arsenic, nickel, copper, cadmium, vanadium, manganese and other metals, nitrate, sodium, magnesium and chloride.[2] Coal burning and metal smelting seem to be the primary contributors to Arctic haze, based on both its composition and the source regions.

The sulfur and nitrogen oxides in the Arctic air mass commonly form sulfuric and nitric acids. Hoff et al.[13] showed that Arctic haze aerosols exist as a spectrum, with acid sulfate aerosols comprising virtually 100% of the aerosol mass below 1 μm, sea salts ($MgCl_2$ and NaCl) comprising virtually 100% of the aerosol mass above 3 μm, and an acidified sea salt mixture existing between 1-3 μm. It is generally assumed in the literature that Arctic haze is mainly anthropogenic. There are many arguments for this, but two of the best use meteorology and isotope ratios. Iversen[14] showed how a high "meridinal index" (defined as a period of significant northward flow) over the North Atlantic coincides with low concentrations of sulfate aerosol at Bjørnøya and Ny Ålesund, while a high value over Europe or Asia coincides with higher sulfate levels.

The isotopic argument comes from Nriagu et al.,[15] who measured $\delta^{34}S$[1] in Arctic sulfate aerosol. According to Nriagu et al., $\delta^{34}S$ for anthropogenic sulfate in east-central North America ranges from 0 to $+5^0/_{00}$; the average $\delta^{34}S$ for sulfate in rainfall in the Soviet Union, $+5.9^0/_{00}$, was taken as an approximate average value for Europe. Sea salt sulfate contains a much higher $\delta^{34}S$, approximately $+20^0/_{00}$. Dimethyl sulfide (DMS), which accounts for the vast bulk of biogenic sulfur,[5] is thought to have a $\delta^{34}S$ less than $10^0/_{00}$, lighter than sea-salt sulfur. The $\delta^{34}S$ observed at Alert oscillates seasonally from a value of $\sim+9^0/_{00}$ in the summer to approximately $+6^0/_{00}$ in the spring. Ny Ålesund and Mould Bay have similar values, although far less detailed time series. The $\delta^{34}S$ ratios gathered by Nriagu et al. suggest that the sulfur collected in March is almost entirely anthropogenic, while the sulfur collected during the summer is substantially influenced by natural and biogenic sources.

Meteorological studies suggest that the pollution comprising Arctic haze comes mainly from Europe and Russia. Barrie et al.[16] used a chemical-transport model to determine the flux of anthropogenic sulfur across the Arctic Circle (66.33ºN) between 0 and 3.5 km altitude from July 1979 to June 1980. By calculating large numbers of back trajectories and matching them with precipitation data, they found that, of the 3.5 Mtonnes (1 Mtonne $= 10^9$ kg = 1 Tg) of anthropogenic sulfur that entered the Arctic, 52% came from Europe, 42% came from the Soviet Union, and 6% came from North America.

Most Russian pollution enters the Arctic between 20°E and 90°E,[16] indicating that it is transported into the Arctic by the blocking set up by a strong Siberian High, which typically only occurs in the spring.[14] Most of Europe's pollution, by contrast, enters the Arctic between 20°W and 40°,[16] indicating that its pollutants are primarily transported into the Arctic by North Atlantic dipole blockings.

[1] The ratio of ^{32}S to ^{34}S in the total in the total inventory of the Earth is 22.22. This sulfur isotope ratio is accepted as an international standard and assigned a value of 0.00. Deviations from this ratio are expressed as $\delta^{34}S$, with units of parts per thousand ($^0/_{00}$).

Shaw and Khalil[3] explain the relative absence of pollution from North America and the Orient as a consequence of their positions relative to the oceans. Pollution from China and Japan follows a northeastern track towards the Arctic and encounters the Aleutian Low, which scavenges pollutants from the air. Similarly, pollution from eastern North America encounters the Icelandic Low in the North Atlantic, which scavenges pollution. Pollution from Europe and Russia can move over land, avoiding an encounter with a strong scavenging system. Furthermore, the major industrial centers of Europe lie approximately 10º north of those in the US and the Orient; Russian industry lies yet farther north.

The emission latitude has an enormous impact on the amount of the pollution that enters the Arctic air mass. Iversen[17] found that for sulfur oxides emissions in Europe, every 15° north increased the mixing ratio of sulfur in the high Arctic (80°N) by a factor of 10. This multiplicative factor is highly variable, changing to about 3 for alkanes, 5 for alkenes, and 30 for nitrogen oxides, but it provides the necessary illustration as to the importance of latitude.

Shaw[18] suggested that Norilsk (Russia), might be responsible for generating a substantial portion of Arctic haze. He showed that periods of extreme Arctic haze in Alaska were associated with trajectories that crossed the Norilsk region.

The Kola Peninsula area is also a major source of pollutants into the Arctic. Three major smelters, all located north of the Arctic Circle, inject a combined 500,000 tons of sulfur gases, 64,000 tons of dust, 2,460 tons of nickel, 1,600 tons of copper, and 100 tons of cobalt into the Arctic atmosphere.[19]

In the absence of Arctic haze, visibility in the Arctic is quite high. The greatest possible sea level visual range on Earth is 296 km, and Barrow averages 271 km in June. The average value for March is reduced to 143 km, and episodes of Arctic haze drive the range much lower.[20] Arctic haze often reduces visibility to approximately 30 km in the high Arctic.[2] Barrie also notes that suspended ice crystals frequently accompanied the haze, which further reduces visibility to about 10 km. These ice crystals are probably formed by the nucleation of ice onto acidic aerosols at temperatures below -25° C.

Measurements of the optical scattering coefficient (σ_{sp}) taken at Barrow, Alaska[21] indicated a decrease in Arctic haze between 1982 and 1992. NOAA's Climate Monitoring & Diagnostics Laboratory (CMDL) has since reported that while Arctic haze levels continue to be lower than the values observed in the early 1980s, the reported trend has not persisted during the past five years.[20]

J.R. Wilcox, in his Masters thesis,[22] reanalyzed this data and drew different conclusions. He identified, using the mean scattering measurements for average yearly values, or values for February or April instead of for the month of March, a more regular decrease since 1982.

Results from Ny Ålesund, Norway also suggest a decline. The Arctic Monitoring and Assessment Programme (AMAP) reported[4] that wintertime sulfate concentrations at Ny

Ålesund (situated on the Arctic archipelago of Svalbard) had declined roughly 70% between 1980 and 1994. According to AMAP, however, Alert, Canada experienced only a slight decline over the same time period, raising the possibility that the decline might be uneven.

This decline in the severity of Arctic haze has been concurrent with major reductions in pollutant emissions of both sulfate and sulfur dioxide in the source regions, Europe and Russia. The Co-operative Program for Monitoring and Evaluation of the Long-Range Transmission of Air pollutants in Europe (EMEP) reports that Russian emissions of sulfur dioxide west of the Urals have fallen by 61% between 1988 and 1998, while the European Community has seen a concurrent decline of 48%.[23]

Asian Dust

Generally, long-range transport must occur at high altitudes (above 5 km) over an ocean in order to avoid scavenging.[3] Therefore, while the Pacific Ocean usually serves as a barrier to pollution transport, pollution can undergo long-range transport over it if lofted high enough. The transport of desert dust from the Orient is a well-documented phenomenon,[24] and so, increasingly, is the transport of pollution.

One of the first attempts to characterize the origin of Asian dust found that a large haze incident in early May 1976 was caused by desert dust.[25] This conclusion was based on the morphology of the aerosols and their chemical composition, along with consideration of the meteorological situation preceding the appearance of the haze. The dust was almost certainly transported from the Gobi and Taklimakan deserts in Mongolia and northern China. Nearly every spring, high winds loft so much dust that it falls on Japan and Korea like yellow snow. The Japanese refer to the massive dust fall as the "kosa," the Koreans call it the "whangsa." Spring is not only the most active period for dust storms in the Gobi and Taklimakan, but also the period of most active atmospheric transport between the Orient and the Arctic.[24]

Rahn et al.[25] estimated that such a plume could carry an enormous amount of soil into the Arctic; a plume of the intensity observed in 1976 would deliver approximately a half-million tons of soil into the Arctic during a five-day episode, assuming a traveling speed of 80 km/hr. Given that a large plume recently tracked across the Pacific moved at an average velocity of 43 km/hr,[26] Rahn et al.'s estimate may be about double what one would expect.

Since Rahn et al.,[25] the transport of Asian desert dust into the North Pacific atmosphere has been the subject of extensive study.[27,28,29,30,31,32,33,24] These investigations have established that Asian dust events occur in the springtime, usually April, and may reach as far south as Mexico, or as far north as the Arctic. Even Alert, at 82˚N latitude, sees a sharp seasonal elevation of soil dust in April/May.[34]

Cahill[35] found that elemental ratios in dust were similar in Denali National Park and Preserve and Crater Lake National Park, Oregon, during the spring, when both experience peaks in soil aerosol concentrations, indicating that the dust had a common origin. Cahill et al.[36] also showed Asian dust reaching Adak Island, Alaska, and the Poker Flat Research Range, north of Fairbanks, Alaska. These measurements were taken as a part of the Aerosol Characterization Experiment-Asia (ACE-Asia), a multi-national experiment designed to quantify the emissions of dust and other aerosols from the Asian continent into the North Pacific. During this study, the transport of these aerosols across the Pacific and into Alaska and Western United States was observed. Large segments of dust clouds moving east over the Pacific from Asia were observed to peel off and transport northward into the Arctic.[26] Model simulations also predict this phenomenon.[37,38]

Geological evidence suggests that global scale transport of Asian dust has been a long-running natural phenomenon.[27] Chemical analysis of Greenlandic ice cores[39] and Hawaiian soil studies[40,41,42,43] have shown that the chemical and radiological fingerprints of deposited dust were consistent with the composition of the Asian dust sources.

Rahn et al.[25] detected little pollution in the 1976 dust plume, but Chinese sulfur dioxide emissions have since tripled. Unsurprisingly, more recent studies have shown an increase in anthropogenic pollution concurrent with the transport of Asian air during the spring over the Pacific Ocean[44,45,46] and North America.[47] The concentration of sulfate, nitrate, soot, and heavy metal aerosols accompanying these dust plumes will almost certainly increase as China's coal-fired economy rapidly expands over the coming decades.

Aside from the probable increase in obviously anthropogenic pollution, the amount of dust may also be increasing. The dust itself has been implicitly assumed to be an entirely natural phenomenon, but this assumption needs to be examined. The dust storms should be considered at least partially anthropogenic, because human activities are contributing to an expansion of the Gobi desert, which has in turn produced more dust storms.[48] Beijing lies directly in the path of these storms, and therefore the Chinese have anxiously noted the accelerating occurrence of dust storms. Chinese records describe fierce dust storms occurring in Beijing once every seven or eight years in the 1950s. By the 1970s, they occurred every two or three years; and by the early 1990s, they had become an annual problem. By 2000, the problem had become acute; the worst storm in memory continued for many days, blotting out the sun, halting air travel and filling emergency rooms.[48]

The IMPROVE monitoring site in Denali National Park and Preserve actually saw a slight decrease in the severity of dust events reaching Alaska between 1988 and 2000. Perhaps this could be due to changes in transport patterns, but barring a fundamental shift in the seasonal teleconnection between the Gobi and Alaska, the Gobi desert's accelerating expansion ought to eventually cause an increase in the amount of dust entering the Arctic.

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Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.4.a
Alaska Volcano Observatory Events near Simeonoff
Class 1 Area: Examples from 2002-2006

Appendix to
Section III. K: Areawide Pollutant Control Program for
Regional Haze

Public Review Draft

October 7th, 2010

(This page serves as a placeholder for two-sided copying)

Eruptions
(Reports from search tool at http://www.avo.alaska.edu/volcanoes/eruptsearch.php)

Veniaminof 2002, 2004, 2004, 2005

Event Specific Information: Veniaminof - 2002

Eruption Type: Explosive
MaxVEI: 1 * Uncertain

Start: September 28, **2002** Observed
Stop: March 223, **2003** ± 1 Months Observed

Tephra plume
Phreatic

Description: From Neal and others (**2005**): "On the basis of several days of increasingly frequent, emergent seismic events on multiple stations of the new Veniaminof network (Dixon and others, **2002**), AVO announced Level of Concern Color Code YELLOW on September 11, **2002**. Following established protocols, the Anchorage Volcanic Ash Advisory Center (VAAC) issued a one-time volcanic ash advisory [see fig. 4 in original text].

"Over subsequent weeks, seismicity was characterized by periods of above-background activity alternating with quiet intervals. Telephone calls to Perryville and other nearby communities[see fig. 5 in original text] turned up no unequivocal observations of unrest until September 24 when AVO received phone reports and digital photographs from the Perryville Native Council. These images showed small, faint gray clouds rising just above the intracaldera cone that has been the source of all known historical eruptions at Veniaminof (Miller and others, 1998). One observer described 'puffs' of mixed dark and white clouds approximately every 5 minutes. Another observer described the 'puffs' as solid white and emanating from the top of the cone.

"Perryville residents next reported 'plumes of smoke' between 8 and 10 pm on October 1. Others reported 'rumbling' during the evening, however no clearly correlative signals were noted on seismograms. One and one half minutes of video taken on October 2 or 3, about 2 pm, from the vantage of the Sandy River (~45 km [28 mi] west of the active cone) showed several small, dilute, gray-brown clouds rising about 300-600 ft above the intracaldera cone and drifting a short distance to the north. In the 1.5 minutes of tape, two distinct 'puffs', about 1 minute apart, rise from the cone and drift downwind. The cone was not unusually snow free, however, a dark covering of ash was visible on the caldera ice field at the base of the cone and extending generally north. On October 6, Sandy River Lodge [see fig. 5 in original text] reported black ash and 'smoke' rising 400-500 ft above the cone, explosions, and ground shaking.

"Cloud-free satellite images of the Veniaminof caldera revealed nothing unusual until October 2 when AVO acquired a Moderate Resolution Imaging Spectroradiometer (MODIS) image that captured a localized, gray deposit on the caldera ice field [see fig. 6 in original text]. The image shows a faint, fan-shaped deposit extending generally east from the cone to the caldera boundary and perhaps just beyond. When viewed in light of reports from Perryville and the video from Sandy River, the dark fan likely represents ash fall from low-level phreatic activity on October 1. No thermal anomalies were detected in satellite imagery throughout this period and no incandescence was reported. A compilation of reports from residents and other observers through the end of the year is presented in table 3. Seismicity and reports of discolored clouds over the intracaldera cone gradually declined through the fall.

"A re-invigorated hydrothermal system beneath the intracaldera cone may account for these intermittent ejections of diffuse, ash-bearing clouds. It seems unlikely that this was prompted by a new magmatic intrusion at depth based on the lack of volcano-tectonic earthquakes. Increased hydrothermal activity may have been related to what was, according to some long time residents of the area, one of the rainiest autumns in memory. Although precipitation falling at the elevation of the intracaldera cone would have been in the form of snow (C. Searcy, NOAA, oral.commun., **2003**), precipitation in Cold Bay [see fig. 1 in original text] was approximately 80% above normal for the month of October, according to long term climate records maintained by NWS (National Oceanic and Atmospheric Administration: http://www.arh.noaa.gov/climate.php). King.Salmon, the other nearby long-term weather station, recorded approximately 45% and 60% more precipitation than normal in the months of September and October, respectively."

The **2002** activity continued into **2003**. From McGimsey and others (**2005**): "On January 3, **2003**, AVO belatedly received a report from the caretaker of a lodge located northwest of the volcano describing his observations from about mid-December, **2002**, during clear weather, of distinct puffs of steam coming from the intracaldera cone. AVO upgraded the Level of Concern Color Code to YELLOW on Monday, January 6, **2003**. Several weeks of poor weather conditions followed before clear views revealed that intermittent episodes of steam and diffuse ash emissions from the active cone continued [see fig. 15 in original text]. AVO seismologists detected the onset of small, volcano-tectonic earthquakes on Veniaminof seismic stations beginning on the morning of January 29, **2003** and a commensurate decline in amplitudes and numbers of low-frequency events (S. Moran, written communication). Elevated seismicity continued, and on March 11, a 4-hour period of continuous seismic tremor was observed followed by 17 hours of discrete seismic events and 3-4-minute-long tremor bursts. This culminated with another 4-hour period of continuous tremor on March 12, which was followed by a distinct decline in seismicity over the next several days. The last report of emissions from the active cone was from Mark Battaion in Perryville on March 23, **2003** [see fig. 16 in original text].

From Neal and others (**2005**): "In the summer of **2003**, AVO geologists visited the summit caldera of Veniaminof and examined the intracaldera cone for evidence of the **2002** activity (K. Wallace, written.commun., **2003**). Within 50 m (160 ft) of the east side of the cone, the ice surface was dusted with fine wind blown debris derived from the cone. A crevasse at the base of the cone revealed a prominent, 1-cm-thick (0.4 in), black, scoriaceous deposit 1 m (3 ft) beneath the surface [see fig. 7a, b, in original text]. Scoria fragments ranged from fine ash to medium lapilli (with a maximum diameter of 5 mm [0.2 in]). The base of the crevasse was not visible, however no other debris layers were recognized over a thickness of at least 10 m (33 ft) suggesting that this type of depositional event was not common (e.g. wind reworking of cone debris). In hand sample, the tephra consists of abundant black iridescent, glassy scoria; hydrothermally altered scoria (with native sulfur and secondary minerals); and rare individual crystals. Microscopic investigation showed all glass fragments to be devitrified. Wallace and co-workers concluded that this deposit represented recycled cone material ejected during low-level phreatic explosions in October **2002**.

"In response to the **2002** unrest at Veniaminof, AVO staff conducted outreach to communities in the vicinity of the volcano and compiled contact phone lists of observers and others who would be helpful in tracking activity on our behalf. We were in frequent telephone contact with people in Perryville, regional airlines, and our colleagues at U.S. Fish and Wildlife Service (USFWS) and the Alaska State Troopers who were often flying in the area. At least one private lodge near the volcano contacted AVO for information on potential hazards. AVO posted a 'Frequently-Asked-Questions' about Veniaminof on our web site, a first in the history of AVO.

"Interestingly, the change in Level of Concern Color Code to YELLOW for Veniaminof occurred on September 11, **2002**, during a time when the Department of Homeland Security had recently established a Threat Level of ORANGE. It is therefore possible that reaction to our initial information release on September 11 may have been more pronounced than usual, and confusion over the two color designations may explain why some residents of the Peninsula thought AVO had declared an 'imminent' eruption.

"From September 11 to November 18, **2002**, AVO issued three special information release notices on the increased seismicity and its eventual decline at Veniaminof. The volcano was mentioned in weekly updates from September 13 through November 22. AVO reverted to color code GREEN on November 18. During the time of heightened activity, the AVO seismology and remote sensing groups increased the frequency of analysis of Veniaminof seismicity and relevant satellite imagery."

Event Specific Information: Veniaminof - 2004

Eruption Type: Explosive
ColHeight: 3500 m
MaxVEI: 2

Start: February 19, **2004** Observed
Stop: September **2004** Observed

Tephrafall
Tephra plume
Central eruption
Phreatic

Description: From Neal and others (**2005**): "In mid-February, residents of Perryville, located 35 km (22 mi) south of Veniaminof, reported small ash clouds rising several hundred feet above the intracaldera cinder cone of the volcano. At other times, vigorous, ash-free steam plumes were reported. On February 19, AVO received a pilot report of a small black ash cloud rising approximately 300 ft (90 m) above the cone and fresh ash on the snowfield east of the cone [see fig. 13 in original text]. A satellite image from the same day showed a dark deposit within the Veniaminof summit caldera. Seismic activity coincident with these reports was insignificant and AVO considered these small explosions to be typical of background activity at Veniaminof where ground water within the active cone occasionally flashes to steam producing a small explosion. The volcano had last produced such activity over a several month-period in late **2002** and early **2003** (Neal and others, **2005**; McGimsey and others, **2005**). On February 23, AVO described this activity in a special Information Release but remained at Level of Concern Color Code GREEN. AVO received no reports of activity over the next two weeks. Satellite imagery did not indicate increased surface temperatures or further ash deposits and seismicity remained low. AVO ceased special mention of Veniaminof in its weekly updates on March 5.

"In mid-April, seismicity beneath Veniaminof began to increase and several episodes of volcanic tremor and isolated volcano-tectonic earthquakes were recorded. Tremor pulses were several minutes in duration and the largest were recorded on most stations in the network. On April 19, residents of Perryville reported a steam emission from the intracaldera cone that had occurred on April 18, possibly containing a small amount of ash. This burst rose an estimated 2,000 ft (610 m) above the intracaldera cone. Based on this renewed activity and elevated seismicity, AVO elevated the Level of Concern Color Code for Mount Veniaminof to YELLOW. NWS issued a VAA and the FAA issued a temporary flight restriction from the surface to 14,000 ft ASL (4,270 m) within a 10 nautical mile (18.5 km) radius of the center of the volcano.

"Over the next few weeks, Perryville residents reported vigorous steam plumes (often described as mushroom-shaped clouds) over the intracaldera cone. AVO received few reports of small ash emissions until April 25 when, using a newly installed remote video camera, as many as 25 small steam and ash emissions were observed over an 8-hour period, most rising about 2,000 ft (610 m) above the active cone [see fig. 14 in original text].

"Through the remainder of spring and into summer, passing pilots, Perryville residents, personnel at Wildman Lake Lodge, and the AVO internet camera continued to record occasional steam plumes and steam and ash bursts, at times reaching as much as 915 m (3,000 ft) above the intracaldera cone and drifting as far as 16-32 km (10-20 mi). Poor weather obscured views of the volcano on many days, however bursts of tremor recorded on the seismic network likely reflected the continuation of small ash emissions, or �puffs'. On May 5, a pilot spotted ash to 610 m (2,000 ft) above the cone and drifting east-southeast; on May 18, a pilot reported ash up to 3,000 ft (915 m) above the cone and drifting 32 km (20 mi) downwind. On May 26, satellite images of the volcano showed ash deposits on the north and southeast caldera floor.

"Aerial views on June 27 revealed that much of the caldera floor was covered by a thin, dark layer of ash. On July 10, an AVO crew flying inside the caldera on a clear, calm day witnessed one of these ash bursts and captured it on video. As the helicopter approached the cone, only a faint wisp of steam and volcanic gas emerged from the summit of the intracaldera cone that consists of a series of coalescing craters each several 10s to 100 m wide. Suddenly, two closely spaced (20-30 seconds apart) vigorous explosions of gray-tan ash emerged from one of the central craters. The discrete puffs were followed by at least 2.5 minutes of continuous roiling of ash from the crater. Ash rose several hundred m (700-1,000 ft) above the cone and drifted downwind; ballistics and incandescence are not visible in this video clip. On July 22, an AVO field crew within the Veniaminof caldera witnessed another typical ash burst rising a few hundred ms (less than 1,000 ft) above the summit of the cone (fig. 15). Fallout was largely confined to the area around the base of the cone.

"AVO geologists visited the ice field by helicopter in late July and reported a discontinuous, 1- to 2-mm thick ash blanket. They observed no large bombs or ballistics beyond the base of the cone, suggesting that recent ash emissions had not been accompanied by energetic explosions of large rock fragments. Further, they reported no changes in the ice field that would indicate subglacial melting. Additional observations of the cone were made in early August and photographs capture ash-poor puffs rising from one of several summit craters on the cone [see figs. 16, 17 in original text]. On August 7, geologists recorded 6-10 puffs over the course of about 10 minutes of focused observation. They reached about 150 m (500 ft) above the summit of the cone in fairly calm wind conditions.

"Steam and ash emissions and correlative tremor bursts continued sporadically through the summer of **2004** but with decreasing frequency and intensity. Cloudy weather precluded any visual observations for much of September and October, however seismic signals continued to record small tremor bursts similar to those correlated with confirmed ash emissions earlier in the year. At times, only weak steaming was visible above the intracaldera cone. The last ash emission with localized ash fall was noted on the web camera images in early September. The pilot of a small aircraft reported �light to moderate smoke' from Veniaminof on September 13. On October 26, AVO lowered the level of concern color code to GREEN based on a decline in the level of activity and an accompanying decrease in seismicity.

"In response to the **2004** unrest at Veniaminof, AVO staff conducted outreach to communities in the vicinity of the volcano and revised existing contact phone lists of observers and others in the area. To track and document activity, a web-camera system was installed in Perryville in April (with assistance from the Perryville School and Perryville Village Council, gratefully acknowledged.) These images along with other graphical and text information were made available to the public via the AVO web site. AVO issued seven special Information Releases on the activity at Veniaminof."

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"Through the remainder of spring and into summer, passing pilots, Perryville residents, personnel at Wildman Lake Lodge, and the AVO internet camera continued to record occasional steam plumes and steam and ash bursts, at times reaching as much as 915 m (3,000 ft) above the intracaldera cone and drifting as far as 16-32 km (10-20 mi). Poor weather obscured views of the volcano on many days, however bursts of tremor recorded on the seismic network likely reflected the continuation of small ash emissions, or �puffs'. On May 5, a pilot spotted ash to 610 m (2,000 ft) above the cone and drifting east-southeast; on May 18, a pilot reported ash up to 3,000 ft (915 m) above the cone and drifting 32 km (20 mi) downwind. On May 26, satellite images of the volcano showed ash deposits on the north and southeast caldera floor.

"Aerial views on June 27 revealed that much of the caldera floor was covered by a thin, dark layer of ash. On July 10, an AVO crew flying inside the caldera on a clear, calm day witnessed one of these ash bursts and captured it on video. As the helicopter approached the cone, only a faint wisp of steam and volcanic gas emerged from the summit of the intracaldera cone that consists of a series of coalescing craters each several 10s to 100 m wide. Suddenly, two closely spaced (20-30 seconds apart) vigorous explosions of gray-tan ash emerged from one of the central craters. The discrete puffs were followed by at least 2.5 minutes of continuous roiling of ash from the crater. Ash rose several hundred m (700-1,000 ft) above the cone and drifted downwind; ballistics and incandescence are not visible in this video clip. On July 22, an AVO field crew within the Veniaminof caldera witnessed another typical ash burst rising a few hundred ms (less than 1,000 ft) above the summit of the cone (fig. 15). Fallout was largely confined to the area around the base of the cone.

"AVO geologists visited the ice field by helicopter in late July and reported a discontinuous, 1- to 2-mm thick ash blanket. They observed no large bombs or ballistics beyond the base of the cone, suggesting that recent ash emissions had not been accompanied by energetic explosions of large rock fragments. Further, they reported no changes in the ice field that would indicate subglacial melting. Additional observations of the cone were made in early August and photographs capture ash-poor puffs rising from one of several summit craters on the cone [see figs. 16, 17 in original text]. On August 7, geologists recorded 6-10 puffs over the course of about 10 minutes of focused observation. They reached about 150 m (500 ft) above the summit of the cone in fairly calm wind conditions.

"Steam and ash emissions and correlative tremor bursts continued sporadically through the summer of **2004** but with decreasing frequency and intensity. Cloudy weather precluded any visual observations for much of September and October, however seismic signals continued to record small tremor bursts similar to those correlated with confirmed ash emissions earlier in the year. At times, only weak steaming was visible above the intracaldera cone. The last ash emission with localized ash fall was noted on the web camera images in early September. The pilot of a small aircraft reported �light to moderate smoke' from Veniaminof on September 13. On October 26, AVO lowered the level of concern color code to GREEN based on a decline in the level of activity and an accompanying decrease in seismicity.

"In response to the **2004** unrest at Veniaminof, AVO staff conducted outreach to communities in the vicinity of the volcano and revised existing contact phone lists of observers and others in the area. To track and document activity, a web-camera system was installed in Perryville in April (with assistance from the Perryville School and Perryville Village Council, gratefully acknowledged.) These images along with other graphical and text information were made available to the public via the AVO web site. AVO issued seven special Information Releases on the activity at Veniaminof."

Event Specific Information: Veniaminof - 2005

Eruption Type: Explosive
Duration: About 2 months * Intermittent, low-level ash emissions
MaxVEI: 1
ColHeight: 3000 m * Maximum height

Start: September 7, 2005 Observed
Stop: November 4, 2005 Observed

Tephrafall
Tephra plume
Minor explosive eruption

Description: From McGimsey and others (2007): "Veniaminof remained relatively quiet [since February, 2005] until early September when several minor bursts of ash were observed by Perryville residents and visible on the web camera (see fig. 34 in original text). This and an increase in seismicity prompted AVO to elevate the Level of Concern from Green to Yellow on September 7. The minor unrest continued only for a couple of weeks when seismicity once again decreased to background level and there were no observations of emissions. AVO reduced the Level of Concern from Yellow to Green on September 28.

"Then, on November 4, a low-level, minor ash emission visible in the webcam prompted AVO to raise the Level of Concern from Green to Yellow. Slightly elevated seismicity persisted for the next few weeks but poor weather conditions precluded visual observations. By mid-December, seismic levels were again down to background level, and on December 30, the Level of Concern was downgraded from Yellow to Green, the 8th Color Code change of the year for Veniaminof (see table 6 in original text)."

From the Smithsonian Institution (2006, v. 31, n. 3): "On 7 September 2005, the Alaska Volcano Observatory (AVO) noted several minor bursts of ash from the volcano during the afternoon. Ash bursts continued to occur through at least 9 September, with ash rising less than 3 km altitude, and with the ash confined to the caldera. Over the following 2 weeks, minor ash emission continued at a rate of 1-5 events per day based on interpretations of seismic data. AVO reported that it was likely that diffuse ash plumes rose to heights less than ~ 3 km and were confined to the summit caldera. Cloudy weather during 16-23 September prohibited web-camera and satellite observations of Veniaminof, but seismic data indicated diminishing activity. On 28 September seismicity had remained at background levels for over a week, and there was no evidence to suggest that minor ash explosions were continuing.

"On 4 November 2005, a low-level minor ash emission occurred from the intracaldera cone beginning at 0929. Ash rose a few hundred meters above the cone, drifted E, and dissipated rapidly. Minor ashfall was probably confined to the summit caldera. During the previous 2 weeks, occasional steaming from the intracaldera cone was observed. Very weak seismic tremor and a few small discrete seismic events were recorded at the station closest to the active cone. However, AVO reported that there were no indications from seismic data that a significantly larger eruption was imminent."

Shishaldin 2004.

Event Specific Information: Shishaldin - 2004

Eruption Type: Explosive
Duration: Intermittent for 3 months
MaxVEI: 1
ColHeight: 5500 m * 4800-5500 m, reported from Cold Bay on Feb. 26, **2004**.

Start: February 17, **2004** Observed
Stop: May 17, **2004** Observed

Steam
Tephra plume
Central eruption

Description: From Neal and others (**2005**): "Since its last eruption in 1999, the background level of seismic activity at this frequently active volcano has remained relatively high and consists of many small, discrete, volcano-tectonic earthquakes, small explosion signals, and short (2-6 min) periods of tremor-like signals. Typically, this activity is interpreted to reflect either hydrothermal or magmatic processes occurring high in the conduit and deep in the summit crater of Shishaldin (Caplan-Auerbach and Petersen, **2005**). Reports of ash emission or other eruptive phenomena that may have been related to this seismicity were few. However, on February 17, a Peninsula Airlines pilot noted a hazy ash layer above Shishaldin (R. Hazen, written commun., **2004**). On February 20, a pilot report reached AVO describing an ash cloud to 16,000-18,000 ft ASL (4.8-5.5 km) above Shishaldin [note: AVO also received an incorrect pilot observation of ash from Mt. Dutton on February 20; this was later corrected to be Shishaldin.]. AVO seismologists identified no correlative seismicity or anything unusual on associated satellite images. NWS issued a one-time SIGMET based on the pilot report per operational protocols. A similar report from a long-time Cold Bay resident arrived via email on February 26 stating that Shishaldin was emitting steam and ash to 2,000-3,000 ft (600-900 m) above the summit; seismic and satellite data indicated no eruptive activity.

"In late April and early May of **2004**, seismicity at Shishaldin intensified and volcanic tremor similar to that observed during the eruption in 1999 reappeared. A thermal anomaly over the summit was noted on May 3 in MODIS imagery. Airwaves detected by acoustic pressure sensors suggested a shallowing of the source of this tremor over time (Petersen and others, **2004**). In response, AVO raised the Level of Concern Color Code to YELLOW on May 3. On May 16, a pilot reported an ash plume rising 1,000 feet above the summit. Satellite data showed a vigorous steam plume possibly containing a minor amount of ash. Volcanic tremor and small explosions recorded on a pressure sensor continued into the summer and satellite images continued to record an intermittent, weak thermal anomaly into mid-August (S. Smith, written commun., **2005**). On July 24, an AVO field crew approached the volcano by helicopter and observed vigorous steaming from the summit crater and recent (?) ash on the upper slopes of the volcano [See figures 18-20 in original text].

"Low-level volcanic tremor continued at Shishaldin with little variation from late summer through the end of the year. AVO received at least two additional pilot reports of �smoke' and �steam' from Shishaldin, both on September 24. After more than five months at Color Code YELLOW, AVO downgraded Shishaldin to GREEN on October 26 based on the lack of any confirmed ash emission or other eruptive activity. Unlike most other Alaskan volcanoes, Shishaldin appears to have a high level of background seismicity, at least during the period following an eruption sequence (Caplan-Auerbach and Petersen, **2005**; Nye and others **2002**).

"Shishaldin Volcano, located about 1,100 km (~680 mi) southwest of Anchorage, near the center of Unimak Island, is a symmetric stratocone that forms the highest peak in the Aleutian Islands. Largely basaltic in composition, Shishaldin is one of the most active volcanoes in the Aleutian arc with at least 27 eruptions since 1775 (Miller and others, 1998). The most recent eruptive period began in mid-February 1999, and produced a sub-Plinian ash cloud to at least 45,000 ft ASL on April 19, 1999 (Nye and others, **2002**). During subsequent strombolian eruptions, ash plumes as high as 6 km (20,000 ft) ASL extended as far as 800 km (500 mi) from the volcano. The last eruptive activity occurred on May 27, 1999, however continued phreatic activity giving rise to intermittent seismicity and significant steam plumes containing minor amounts of ash persists. Even during non-eruptive periods, nearly constant fumarolic activity within the summit crater produces a steam plume that can occasionally be quite vigorous and typically results in numerous false eruption reports. The nearest community is False Pass, 32 km (20 mi) east-northeast of the volcano."

Augustine 2005

Event Specific Information: Augustine - 2005

Eruption Type: Explosive
Duration: About 3 months * Includes explosive and extrusive phases
Eruption Product: andesite
MaxVEI: 3
ColHeight: 9000 m * higher than

Start: December **2005** Observed
Stop: March 31, 2006 Observed

Lava flow
Tephrafall
Pyroclastic flow, surge, or nuee ardente
Lava dome
Fumarolic or hydrothermal activity
Steam
Tephra plume
Phreatic

Description: From Power and others (2006): The 2006 eruption of Augustine consisted of four phases defined by the character of unrest or eruptive activity, which are described below. These phases are the precursory (May **2005** to 11 January 2006), the explosive (11 to 28 January), the continuous (28 January to 2 February), and the effusive (2 February to late March).

"The precursory phase began as a steady increase in microearthquakes beneath the volcano, ranging from one to two per day in May **2005** to 15 per day in mid-December [see Figure 3 in original text]. In July **2005**, geodetic baselines began to lengthen, indicative of pressurization at sea level centered beneath the edifice (Cervelli et al., 2006). On 2 December **2005**, seismometers began recording signals from small phreatic explosions; the largest signals occurred on 10, 12, and 15 December. An overflight on 12 December revealed vigorous steaming, a new vent on the summit's southeastern side, and a dusting of ash on the volcano's southern flanks. The ash was a mix of weathered and glassy particles; the latter appear to be remobilized 1986 tephra. An explosion on 15 December disabled the telemetery for the two highest seismic stations [see figure 2 in original text].

"Augustine then entered an explosive phase, which lasted from 11-28 January 2006. A strong swarm of volcano-tectonic (VT) earthquakes began at 0030 UTC on 11 January, culminating in explosive eruptions at 1344 and 1412 UTC. These explosions produced ash plumes, reported by the U.S. National Weather Service (NWS) to have reached heights greater than nine kilometers above sea level (asl), which moved slowly to the north and northeast. Ash sampled on 12 January was primarily dense or weathered fragments, suggesting little juvenile magma. Over the next 36 hours, several sequences of small, regularly spaced VT earthquakes, many with identical waveforms, occurred at rates as high as three to four per minute. Similar earthquakes, referred to as clones or drumbeats, have been associated at other volcanoes with the emplacement of lava domes (Dzurisin et al., **2005**).

"Monitoring instruments also recorded six powerful explosions that occurred between 1324 UTC on 13 January and 0914 UTC on 14 January [see figure 3 in original text]. The first explosion destroyed the seismometer and CGPS high on the volcano's northeastern flank [see figure 2 in original text]. Plumes reached altitudes of 14 kilometers asl and deposited traces of ash on southern Kenai Peninsula communities. Ash from these eruptions was more heterogeneous and contained dense particles as well as fresh glass shards, indicating the eruption of new magma. Satellite imagery tracked these plumes as they moved eastward and disrupted commercial airline traffic to and from Alaska.

"A 16 January overflight revealed a small, new lava dome at the summit. An explosive eruption at 1658 UTC on 17 January sent ash to 13 kilometers asl that moved westward. The eruption left a 20- to 30-meter-diameter crater in the new dome and produced ballistic fields on the volcano's western flanks. Data transmission from the west flank CGPS station stopped coincident with this explosion [see figure 2 in original text]. Additionally, the eruptions of 13-17 January generated pumiceous pyroclastic flows, snow avalanches, and lahars that moved down the volcano's flanks [see figure 2 in original text].

"The volcano then entered a period of more continuous eruptive activity that began at 0534 UTC on 28 January and that lasted until 2 February. The phase began with four explosive eruptions that generated ash plumes to heights of nine kilometers asl [see figure 3 in original text]. Ash moved southward and fell in trace amounts on Kodiak Island. These explosions generated substantial pumiceous pyroclastic, block, and ash flows that destroyed seismic and CGPS stations on the west and north flanks of the volcano [see figure 2 on original text]. Destruction of these seismometers compromised AVO's ability to assign reliable hypocentral depths to earthquakes.

"Data from the remaining CGPS stations indicated that the volcano reversed its long inflationary trend (during which accumulating magma caused a swelling of the volcano's surface) and began a sharp deflation that continued until 10 February [see figure 3 in original text]. Modeling suggests the locus of deflation, which results from the removal of magma, was much deeper (~10 kilometers) than the precursory signal. On 29 January, the seismic network began to detect numerous block and ash flows - generated by small failures of the growing lava dome - cascading down the volcanos northern flanks [see figure 2 in original text].

"Augustine then entered an effusive phase, which lasted through late March. From 2 February through 6 March, block and ash flow signals continued to dominate the seismic record. Geodetic data showed inflation from 10 February until 1 March, when the volcano again reversed and entered an 11-day period of deflation [see figure 3 in original text]. On 7 March, seismic activity again shifted to small, mostly identical repetitious earthquakes. These events increased in rate and size, forming a continuous signal early on 8 March that lasted until 14 March. They then began a slow decline and disappeared by 16 March. Lava extrusion at the summit increased markedly in association with these repetitive earthquakes, and two blocky lava flows moved down the north and northeastern flanks [see figures 1 and 2 in original text]. Observations indicate that the effusion of lava stopped in late March. The volcano entered a final period of inflation between 12 and 31 March. The estimated volume of effusively erupted material is currently 30 million cubic meters."

Cleveland 2005

Event Specific Information: Cleveland - 2005

Eruption Type: Explosive
MaxVEI: 2
ColHeight: 4600 m * detached from volcano?

Start: April 27, **2005** Observed
Stop: September 27, **2005** ± 3 Months Observed

Tephrafall
Lahar, debris-flow, or mudflow
Tephra plume
Minor explosive eruption

Description: From McGimsey and others (2007): "After several years of quiescence following an explosive eruption in 2001, AVO remote sensors observed a 3-pixel thermal anomaly at the summit of Cleveland on March 13, **2005** (see fig. 38 in original text). On April 27, **2005**, the FAA alerted AVO of a pilot report of eruptive activity - "ash cloud * * * 15,000 to 18,000 ft high" - in the vicinity of Cleveland (based on coordinates from the pilots). Satellite images showed no evidence of activity. AVO seismologists checked seismic data from the nearest stations (Nikolski, located 75 km [45 mi] east, and at Okmok Volcano, 150 km [93 mi} east of Cleveland), and found nothing unusual. CWSU issued a one-time Urgent Pilot Report, and AAWU issued a one-time SIGMET. Although time-series thermal data did not record any evidence of activity, short-lived minor explosive activity would not be considered unusual for Cleveland and could go undetected if it occurred during periods between acquisitions of satellite images or if concealed within the frequent cloud cover.

"Following the detection of a 1-pixel thermal anomaly at the summit on June 28, evaluation of before and after satellite images suggested the presence of a lahar deposit on the northeast flank, inferring that minor activity persisted at Cleveland. Then, on July 5, the entire upper flanks of the volcano were observed dusted with ash in a satellite image (see fig. 39 in original text). AVO rasied the Level of Concern Color Code from Unassigned (UA) to Yellow in an Information Release on July 7, **2005** (see table 6 in original text). The presence of ash, minor blocky avalanche-like deposits, and thermal anomalies was consistent with low-level Strombolian eruptive activity (D. Schneider, AVO logs).

"Thereafter, although a thermal anomaly was observed on August 11, the activity appeared to wane. AVO reduced the Color Code from Yellow back to UA on August 27. But the volcano remained restless, and a summit thermal anomaly again was observed on August 31. By mid-September, AVO was ready to test a new automated system that detects thermal anomalies and raises an alert. On September 21, this new system successfully detected a thermal anomaly at the summit of Cleveland. For the next few weeks, the volcano remained quiet. Then, on the morning of October 7, AVO detected in satellite images a small drifting ash cloud located about 150 km (90 mi) east-southeast of Dutch Harbor. On the basis of regional seismic data at Nikolski (75 km [45 mi] east of the volcano), and backtracking the ash cloud, AVO concluded that a small eruption had occurred at Cleveland at approximately 01:45 ADT (0945 UTC). AVO and the NWS worked together to determine that the ash cloud was at an altitude of no more than 15,000 ft (4,600 m). No ash fell in Nikolski. AVO immediately raised the Color Code from UA to Orange and NWS issued a SIGMET indicating that the ash cloud was moving east. The next day, October 8, ther was no sign of ash emission or a summit thermal anomaly, and on October 10 the Color Code was downgraded from Orange to Yellow. The last thermal anomaly was seen on November 6, and steam plumes were occasionally visible in satellite data for the next several weeks. Because there was no evidence of ash emissions on November 25, AVO reduced the Color Code for Cleveland from Yellow to UA. As fate would have it, a few days later, evidence for minor eruptive activity was observed; however, the activity did not continue and the volcano remained quiet for the rest of the year. AVO issued five special Information Releases about Cleveland activity between July 7 and November 25, **2005**."

A chronology of this event is available at: http://www.avo.alaska.edu/archives/Cleveland**2005**.php

From the Smithsonian Institution (**2005**): "Mount Cleveland produced significant ash plumes during March 2001 (BGVN 26:04). Volcanic unrest continued through 4 May 2001, and signals consistent with volcanic seismicity were detected by an Alaska Volcano Observatory (AVO) seismic network 230 km E. By the end of May, neither eruptive activity nor thermal anomalies were observed. Until July **2005**, no alert level was assigned, and AVO monitoring produced no reports on Cleveland.

"Cleveland lacks a real-time seismic network. Accordingly, even during times of perceived quiet there is an absence of definitive information that activity level is at background. AVO's policy for volcanoes without seismic networks is to not get assigned a color code of Green.

"Satellite imagery of Cleveland taken during 24 June to 1 July **2005** showed increased heat flow from the volcano and a possible debris flow. AVO stated that although observations were inhibited by cloudy weather, they indicated the possibility of increased volcanic activity. AVO did not assign a Concern Color Code to Cleveland due to the lack of seismic monitoring and limited satellite observations.

"Satellite images during 1-8 July showed increased heat flow, thin ash deposits, and possible debris flows extending ~ 1 km down the flanks from the summit crater. AVO assigned a Concern Color Code of Yellow on 7 July. On 18

July satellite imagery showed steam emanating from Cleveland's summit and evidence of minor ash emissions. Meteorological clouds obscured Cleveland during the third week of July. During 22-29 July satellite images showed minor steaming from the summit, possible fresh localized ash deposits, and a weak thermal anomaly.

"On 4 August satellite images showed a thermal anomaly. On 27 August AVO reduced the Concern Color Code at Cleveland from Yellow to "Not Assigned" because there had been no evidence of activity since a thermal feature was observed on satellite imagery from 11 August. A thermal feature was detected on several satellite images obtained on 31 August, and one on 19 September, but there was no evidence of eruptive activity.

"On 7 October, AVO raised the Concern Color Code to Orange after detecting a small drifting volcanic ash cloud. The cloud was seen in satellite data at a spot ~ 150 km ESE of Dutch Harbor at 1700 UTC. Based on data from a regional seismometer at Nikolski, AVO concluded that the ash came from a small Cleveland eruption at approximately 0145. AVO, in consultation with the National Weather Service, estimated the top of the ash cloud to be no more than 4,600 m altitude. The ash cloud dissipated and was not detected via satellite after 1800 UTC. Three days passed during which there were no new observations of eruptive activity at Cleveland from satellite data, pilots, or ground-based observers. Accordingly, on 10 October the Concern Color Code was reduced to Yellow."

Korovin 2005

Event Specific Information: Korovin - **2005**

This is a questionable event.

Eruption Type: Explosive
MaxVEI: 1
ColHeight: 300 m

Start: February 23, **2005** 19:00:00 Observed
Stop: May 7, **2005** ± 14 Days Observed

Steam:
Tephra plume:
Minor explosive eruption:

Description: From McGimsey and others (2007): "On the morning of February 24, **2005**, AVO received a report from residents of Atka Village that Korovin had erupted the previous evening, producing a large steam and ash cloud. February 23 was a clear day and local residents had noticed minor steaming from Korovin about noon (see fig. 40 in original text). Then, about 7 p.m. HST (8 p.m. AST), they witnessed a dark plume over Korovin, rising several thousand feet high, drifting east, that had ash visibly falling out near the base, presumably confined to the flanks of Korovin (see fig. 41 in original text). Several minutes later, three or four smaller, gray puffs occurred. Although they watched, no further activity ensued during the calm, clear, moonlit night.

"Satellite data from about the time of the reported activity indicated the presence of a 1-2 pixel thermal anomaly and a small steam plume, possibly with localized minor ash. Height of the steam plume was estimated to be about 10,000 ft (~3 km), corroborating the observer account. AVO issued an Information Release on February 24 and raised the Level of Concern Color Code to Yellow. With no further reports of continuing activity, nothing evident in subsequent satellite data, and no unusual seismicity from a seismic station in Atka Village, AVO reduced the Color Code from Yellow to UA in the March 4, **2005**, Weekly Update (see table 6 in original text). Evidence of similar activity has been identified in **2002** and **2004** satellite images and observed by field crews in **2004** (see fig. 42 in original text).

"A PIREP of steam reaching several thousand feet above Korovin on March 19 was the next report of activity, and then in early May observational data indicated that the lake had drained in the south summit crater of Korovin and that incandescence was visible in the about 100-m (~325 ft) - wide pit. The next several months were quiet.

Non-Eruption Events
(Reports from search tool at http://www.avo.alaska.edu/volcanoes/eruptsearch.php)

Event Specific Information: Wrangell - 2003

Eruption Type: Not an eruption.

Start: June 11, 2003   Observed
Stop: September 18, 2003   Observed

Fumarolic or hydrothermal activity
Steam

Description: From McGimsey and others (2005): "Danny Rosenkrans, geologist for the Wrangell-St. Elias National Park and Preserve, contacted AVO on June 13, 2003 with photographs taken by a local resident on June 11, 2003 showing an unusual, towering, cloud over the summit area of Mt. Wrangell (fig. 4). Although the cloud might simply have been a common cumulus cloud fortuitously located at or near the summit, the lack of other cumulus clouds in the area over nearby Mts. Drum and Sanford suggest that instead, calm weather conditions permitted steam emissions from the known summit fumaroles to coalesce and form the plume-like cloud over Wrangell. AVO receives several reports per year from pilots and local residents who observe what they consider to be larger than normal steam clouds situated over the summit."

"On September 18, 2003 the Center Weather Service Unit (CWSU) called at 12:50 pm ADT with a Pilot Weather Report (PIREP) of a '2,000-to 2,300-foot-high steam plume' over Mt. Wrangell. The pilot reported no ash or sulfur smell. AVO scientists checked satellite imagery and seismograms and found nothing unusual."

Event Specific Information: ??

Eruption Type: Not an eruption.

Start: September 9, 2003   Observed
*Not an eruption - fumarolic activity only

Fumarolic or hydrothermal activity
Steam

Description: From McGimsey and others (2005): "AVO received a pilot report through Kenai Flight Service of increased steaming at Augustine volcano about mid-day on September 9, 2003. Concomitant to this report we received an inquiry about Augustine from the Homer Police Department. A check of the seismograms and spectrograms revealed nothing unusual."

Event Specific Information: Hague, Mt - 2003

Eruption Type: Not an eruption.

Start: July 2003   Observed

Fumarolic or hydrothermal activity:

Description: From McGimsey and others (2005): "On July 7, 2003, AVO scientists conducting seismic network maintenance near Mt. Hague on the rim of Emmons Lake Caldera noticed that the crater lake typically present was almost completely gone and all that remained was a few isolated pools surrounded by several vigorously venting fumaroles, and yellow sulfur deposits in the center of the crater. Mud cracks suggested that the lake had drained or evaporated rather recently. A photograph taken a week later, August 16, 2003, shows a full lake. Photographs taken of the crater lake on August 16, 2002 also show the lake filled with water.

"The Hague crater lake apparently has a history of draining and refilling. Sporadic checks of the crater since 1973 have found it empty about as often as full (T. Miller, written communication, 2003). The most recent observations [2003] verify that the lake is capable of reforming within days or weeks."

Event Specific Information: Pavlof - 2003

Eruption Type: Not an eruption.

Start: March 16, 2003   Observed

Fumarolic or hydrothermal activity:
Eruption re-assigned to another volcano:

Description: From McGimsey and others (2005): "A barge operator reported seeing Pavlof volcano erupting about 10 AM AST on March 16, 2003. A check of spectrograms revealed no activity. CWSU staff was informed of the report; they had already reviewed the latest satellite imagery and saw no ash signature (the area was cloudy with a ceiling of around 3,000 ft.). AVO remote sensing specialists corroborated that there was no indication of activity. Strong fumaroles on the flank, and in the crater, of nearby Mt. Hague vent of Emmons Lake Caldera occasionally produce steam clouds that from certain vantage points appear to originate at Pavlof. A similar occurrence [at Hague] was documented in 2001 (McGimsey and others, 2005) and in 2002 (Neal and others, 2005)."

Event Specific Information: Veniaminof - 2006

Eruption Type: Explosive
MaxVEI: 1
ColHeight: 2300 m * Ash and steam plume height was less than 2.3 km

Start: March 3, 2006   Observed
Stop: September 7, 2006   Observed

Tephra plume:
Central eruption:
Phreatic:
Minor explosive eruption:

Description: From the Smithsonian Institution (2006, v. 31, n. 3): "On the morning of 3 March 2006 ash again rose a few hundred meters above the intracaldera cone, drifted E, and dissipated rapidly. Ashfall was expected to be minor and confined to the summit caldera. Seismicity was again low and did not indicate that a significantly larger eruption was imminent. Over the week of 5-10 March, seismicity was low but slightly above background.

"On the morning of 10 March, AVO received a report from a pilot of low-level ash emission from the intracaldera cone. Clear web-camera views on 9 March showed small diffuse plumes of ash extending a short distance from the intracaldera cone. The Anchorage Volcanic Ash Advisory Center (VAAC) reported a steam/ash plume noted on web-cam and satellite on 13 March 2006 at 0500Z (12 March 2006 at 2000 hours local), moving NNW at 9.2 km/hr and falling to the land surface. Web-cam images on 22 March showed a very diffuse steam-and-ash plume that was confined to the summit caldera, and on 24 March showed a steam-and-ash plume drifting from the summit cone at a height of less than 2.3 km. This level of activity was similar to that on 23 March, but higher than activity on 21 and

22 March, when a very diffuse steam-and-ash plume was confined to the summit caldera.

"The flow of seismic data from Veniaminof stopped on the evening of 21 March 2006, and the problem was expected to continue until AVO staff could visit the site to repair the problem. Absent seismic data, the volcano could potentially still be monitored in other ways such as using web-camera and satellite images. Imagery was obscured by cloudy weather after 21 March. On 26 March 2006, a pilot reported a small ash plume rising above the volcano. Low-altitude ash emissions from Veniaminof were visible during 31 March to 7 April. On 6 April, a pilot reported an ash plume at a height of 3 km. AVO stated in its weekly report of 14 April 2006 that the seismicity at Veniaminof remained low but above background. Internet camera and satellite views had been obscured by cloudy weather, and AVO lacked new information about ash clouds or activity."

Continued activity was summarized by the Smithsonian Institution (2006, v. 31, n. 8): "Intermittent, very small-volume steam and ash bursts from the intra-caldera cone have been typical of this volcano intermittently over the past few years, and this pattern continued. The previous report mentions several minor bursts of ash, particularly on 13 June 2006 and 7 September, and minor white plumes through mid-September. This report discusses the interval 8 April through 15 September. Seismicity during this interval was nearly always low, although it often rose above background.

"Clouds obstructed visibility during 7-14 April. For the duration of April and June, activity remained low with few steam plumes containing minor amounts of ash. On 30 May a weak daytime thermal anomaly was recorded, possibly due to solar heating inside the dark intra-caldera cone. Intermittent clear weather on the week ending 9 June indicated weak steam plumes.

"On 13 June an ash emission rose to a height estimated at ~ 600 m above the summit area, as reported by a passing aircraft. Transient plumes were seen on satellite imagery during the week ending 21 July.

"During the week ending 28 July, an AVO field party flew over the summit and observed typical steaming from the intra-caldera cone with no signs of recent ash emissions. Satellite and web camera views during occasional clear periods showed no other signs of activity. Occasional satellite views during clear weather failed to disclose new ash emissions during 28 July through 15 September.

"AVO noted a slight increase in seismicity starting 2 August but in the subsequent weeks it again returned to low levels. Available satellite and camera views continued to reveal occasional small white plumes through 15 September."

Steam plumes without ash emission continue to be observed at Veniaminof, as of this writing (March 21, 2007).

Event Specific Information: Veniaminof - 2006

Eruption Type: Explosive
MaxVEI: 1
ColHeight: 2300 m * Ash and steam plume height was less than 2.3 km

Start: March 3, 2006 Observed
Stop: September 7, 2006 Observed

Tephra plume:
Central eruption:
Phreatic
Minor explosive eruptio

Description: From the Smithsonian Institution (2006, v. 31, n. 3): "On the morning of 3 March 2006 ash again rose a few hundred meters above the intracaldera cone, drifted E, and dissipated rapidly. Ashfall was expected to be minor and confined to the summit caldera. Seismicity was again low and did not indicate that a significantly larger eruption was imminent. Over the week of 5-10 March, seismicity was low but slightly above background.

"On the morning of 10 March, AVO received a report from a pilot of low-level ash emission from the intracaldera cone. Clear web-camera views on 9 March showed small diffuse plumes of ash extending a short distance from the intracaldera cone. The Anchorage Volcanic Ash Advisory Center (VAAC) reported a steam/ash plume noted on web-cam and satellite on 13 March 2006 at 0500Z (12 March 2006 at 2000 hours local), moving NNW at 9.2 km/hr and falling to the land surface. Web-cam images on 22 March showed a very diffuse steam-and-ash plume that was confined to the summit caldera, and on 24 March showed a steam-and-ash plume drifting from the summit cone at a height of less than 2.3 km. This level of activity was similar to that on 23 March, but higher than activity on 21 and 22 March, when a very diffuse steam-and-ash plume was confined to the summit caldera.

"The flow of seismic data from Veniaminof stopped on the evening of 21 March 2006, and the problem was expected to continue until AVO staff could visit the site to repair the problem. Absent seismic data, the volcano could potentially still be monitored in other ways such as using web-camera and satellite images. Imagery was obscured by cloudy weather after 21 March. On 26 March 2006, a pilot reported a small ash plume rising above the volcano. Low-altitude ash emissions from Veniaminof were visible during 31 March to 7 April. On 6 April, a pilot reported an ash plume at a height of 3 km. AVO stated in its weekly report of 14 April 2006 that the seismicity at Veniaminof remained low but above background. Internet camera and satellite views had been obscured by cloudy weather, and AVO lacked new information about ash clouds or activity."

Continued activity was summarized by the Smithsonian Institution (2006, v. 31, n. 8): "Intermittent, very small-volume steam and ash bursts from the intra-caldera cone have been typical of this volcano intermittently over the past few years, and this pattern continued. The previous report mentions several minor bursts of ash, particularly on 13 June 2006 and 7 September, and minor white plumes through mid-September. This report discusses the interval 8 April through 15 September. Seismicity during this interval was nearly always low, although it often rose above background.

"Clouds obstructed visibility during 7-14 April. For the duration of April and June, activity remained low with few steam plumes containing minor amounts of ash. On 30 May a weak daytime thermal anomaly was recorded, possibly due to solar heating inside the dark intra-caldera cone. Intermittent clear weather on the week ending 9 June indicated weak steam plumes.

"On 13 June an ash emission rose to a height estimated at ~ 600 m above the summit area, as reported by a passing aircraft. Transient plumes were seen on satellite imagery during the week ending 21 July.

"During the week ending 28 July, an AVO field party flew over the summit and observed typical steaming from the intra-caldera cone with no signs of recent ash emissions. Satellite and web camera views during occasional clear periods showed no other signs of activity. Occasional satellite views during clear weather failed to disclose new ash emissions during 28 July through 15 September.

"AVO noted a slight increase in seismicity starting 2 August but in the subsequent weeks it again returned to low levels. Available satellite and camera views continued to reveal occasional small white plumes through 15 September."

Steam plumes without ash emission continue to be observed at Veniaminof, as of this writing (March 21, 2007).

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.4.b
Maps of Wildfires affecting Alaska's Class 1 Areas

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

APPENDIX III.K.4.b

Maps of Wildfires affecting Alaska's Class 1 Areas

Maps of Wildfires affecting Alaska's Class 1 Areas

Historical fire information and mapping in the following figures is provided by the Alaska Interagency Coordination Center (AICC) (http://fire.ak.blm.gov/aicc.php). AICC cooperators include the Bureau of Land Management, State of Alaska Department of Natural Resources, USDA Forest Service, National Park Service, Bureau of Indian Affairs, and the Fish and Wildlife Service.

A) Wildfire Impacts on Alaska Class 1 Areas, 2000-2006. Wildland fires are frequent and widespread in Alaska's Interior. Depending on prevailing weather systems, visibility at any of the Class 1 Areas may be affected by fire. IMPROVE monitoring sites are labeled in yellow.

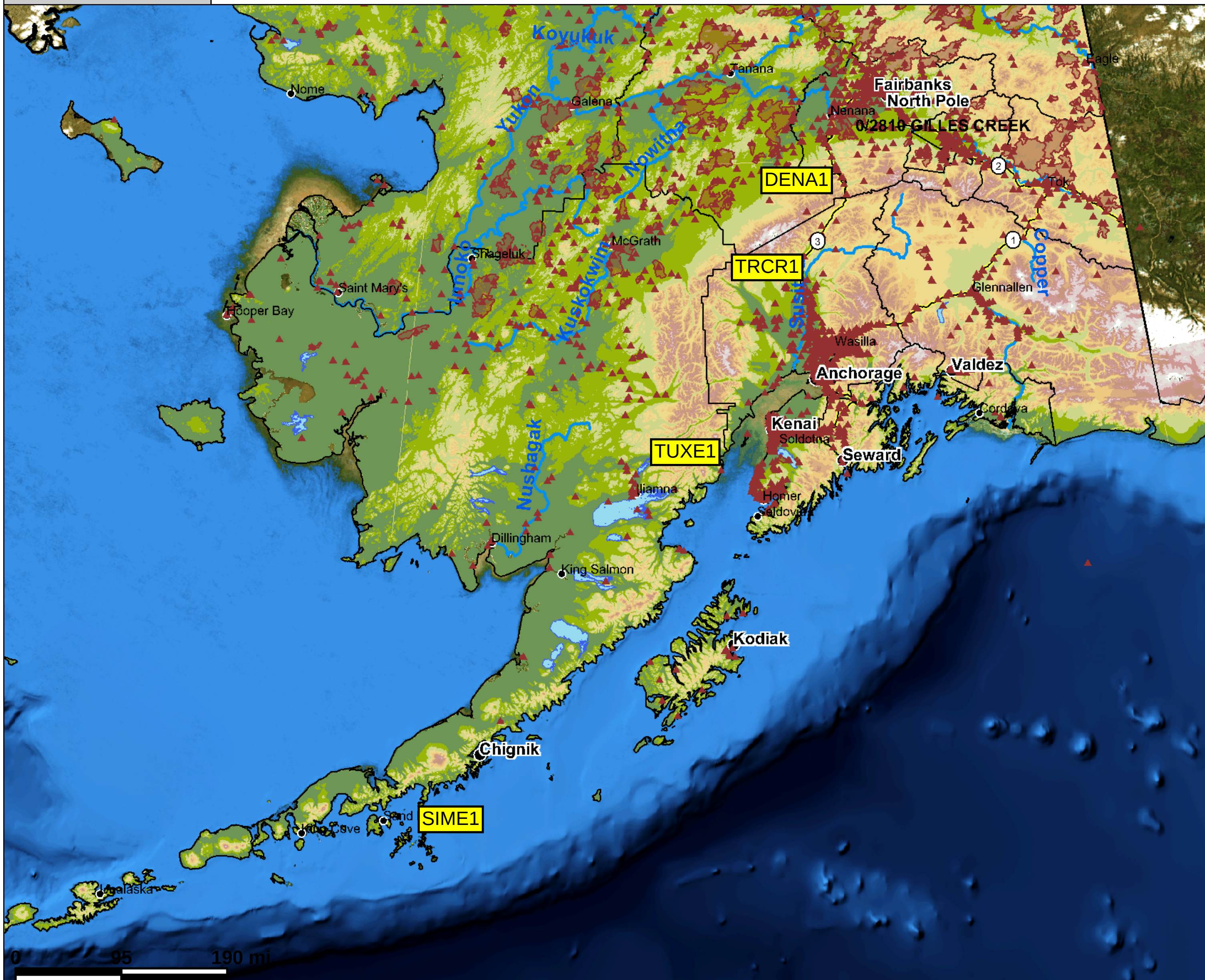
B) A Closer Look at Wildfire Impacts on Denali and Tuxedni Class 1 Areas, 2000-2006. Denali C1A is affected by fires from every direction, but the two Denali IMPROVE sites (DE and TR) are separated by the Alaska Range, and have different fire exposures. Tuxedni (TU) is affected by fewer, more distant fires than Denali.

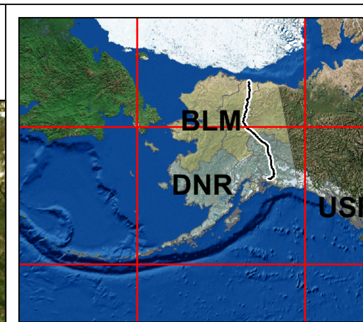
C) Mapped Fires for Individual years, 2000-2006, centered on Denali Class 1 Area. Each year is different with respect to fire locations and sizes.

D) Wildfire Impacts at Denali Class 1 Area over the Longer Term: 1990-2009. Denali visibility is strongly affected by wildfire, with Organic Matter Carbon and Elemental Carbon the dominant aerosols. Aerosols from the mapped fires vary according to fire location, severity, timing, and land cover - the types of vegetation and soil burned. Over decades, land cover of Alaska's Interior changes, affecting future fire regimes and future biogenic emissions of forests, wetlands, and tundra. Land cover change will itself alter visibility of Denali Class 1 Area.

Alaska Interagency Coordination Center

2000-2006 Fires: All Class 1 Areas





Legend

Elevation Meters

- 0-250
- 251-500
- 501-750
- 751-1000
- 1001-1250
- 1251-1500
- 1501-1750
- 1751-2000
- 2001-2500
- 2501-3000
- > 3001
- Background
- Out of range

Temporary Flight Restrictions

Towns

- Municipality
- Home Rule
- First or Second Class City

- Major Rivers
- NHD Lakes GT 150 SQKM
- Freeway System (State)
- Fire Management Zones
- Fire Locations 1
- Fire Perimeters 1

N

Scale: 1:8,749,869

This map is a user generated static output from an Internet mapping site and is for general reference. Data layers that appear on this map are obtained from many sources. This map is not to be used for navigation.

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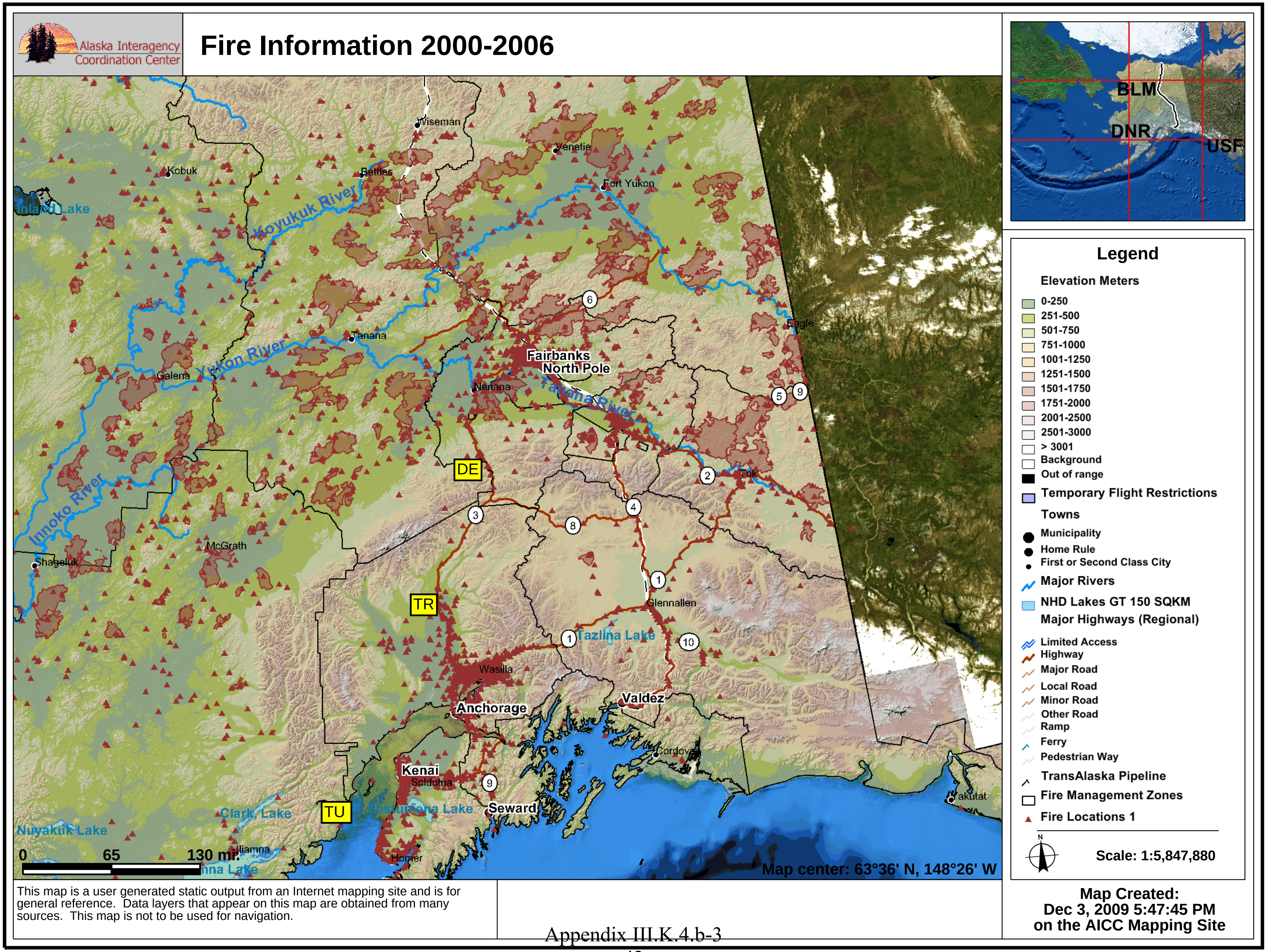
Appendix III.K.4.b-2


Alaska Interagency Coordination Center
Fire Information 2000-2006
BLM
DNR
USF
Legend
Elevation Meters
0-250
251-500
501-750
751-1000
1001-1250
1251-1500
1501-1750
1751-2000
2001-2500
2501-3000
> 3001
Background
Out of range
Temporary Flight Restrictions
Towns
Municipality
Home Rule
First or Second Class City
Major Rivers
NHD Lakes GT 150 SQKM
Major Highways (Regional)
Limited Access
Highway
Major Road
Local Road
Minor Road
Other Road
Ramp
Ferry
Pedestrian Way
TransAlaska Pipeline
Fire Management Zones
Fire Locations 1
Scale: 1:5,847,880
Wiseman
Venetie
Kobuk
Bettles
Fort Yukon
Koyukuk River
Tanana
Fairbanks
North Pole
Galena
Yukon River
Nenana
Tanana River
Eagle
Tok
Innoko River
McGrath
Shageluk
DE
TR
TU
Glennallen
Tazlina Lake
Wasilla
Anchorage
Valdez
Cordova
Kenai
Soldotna
Seward
Clark Lake
Nuyakuk Lake
Iliamna
Homer
Yakutat
0
65
130 mi.
Map center: 63°36' N, 148°26' W
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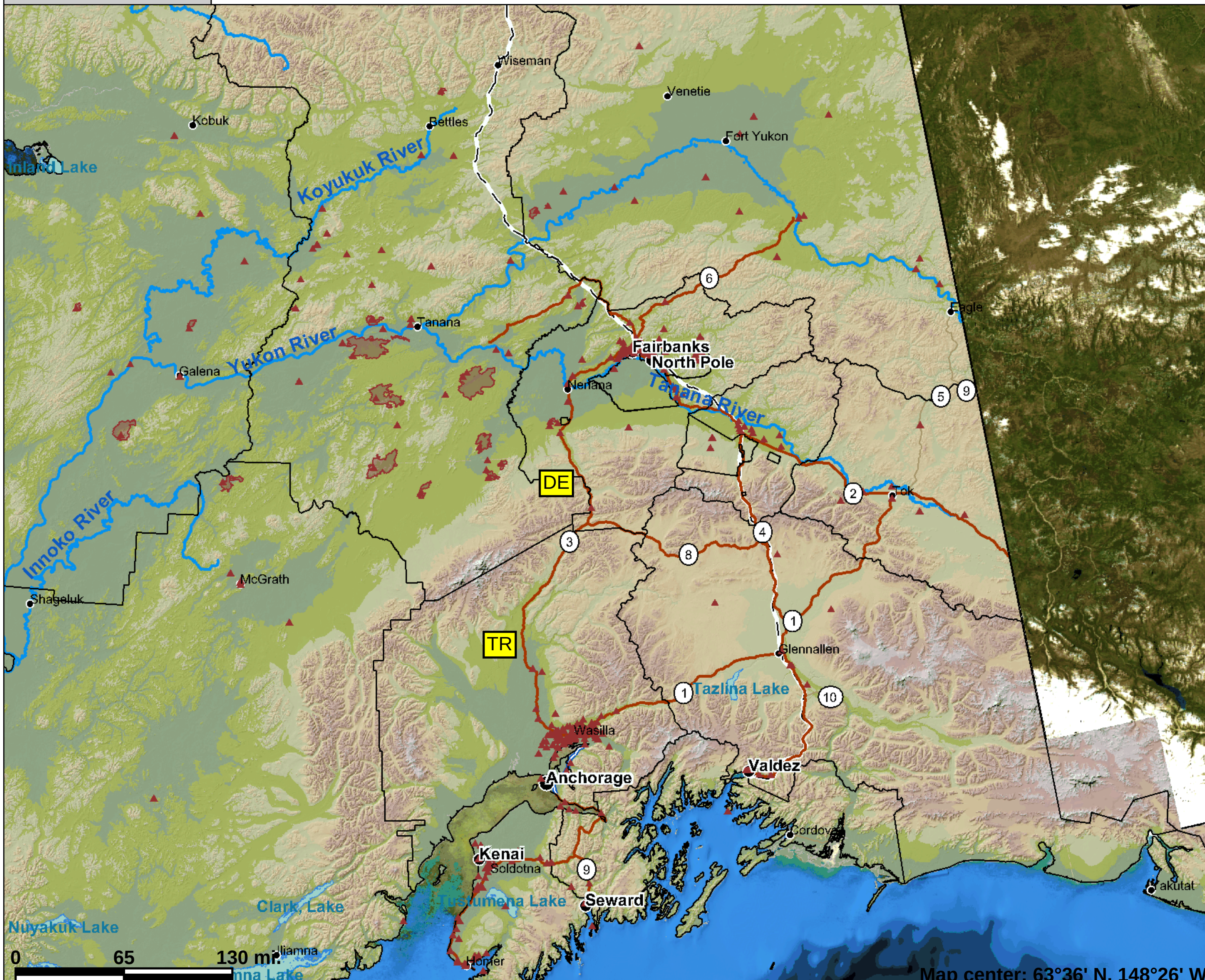
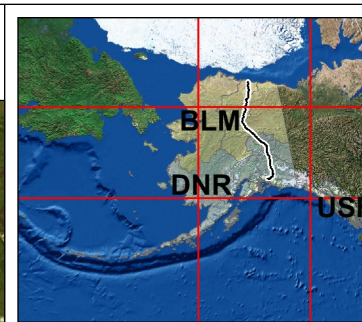
Alaska Interagency Coordination Center

Fire Information 2000





Legend

Elevation Meters

- 0-250
- 251-500
- 501-750
- 751-1000
- 1001-1250
- 1251-1500
- 1501-1750
- 1751-2000
- 2001-2500
- 2501-3000
- > 3001
- Background
- Out of range

Temporary Flight Restrictions

Towns

- Municipality
- Home Rule
- First or Second Class City

Major Rivers

NHD Lakes GT 150 SQKM

Major Highways (Regional)

- Limited Access
- Highway
- Major Road
- Local Road
- Minor Road
- Other Road
- Ramp
- Ferry
- Pedestrian Way

TransAlaska Pipeline

Fire Management Zones

Fire Locations 1

Scale: 1:5,847,880

This map is a user generated static output from an Internet mapping site and is for general reference. Data layers that appear on this map are obtained from many sources. This map is not to be used for navigation.

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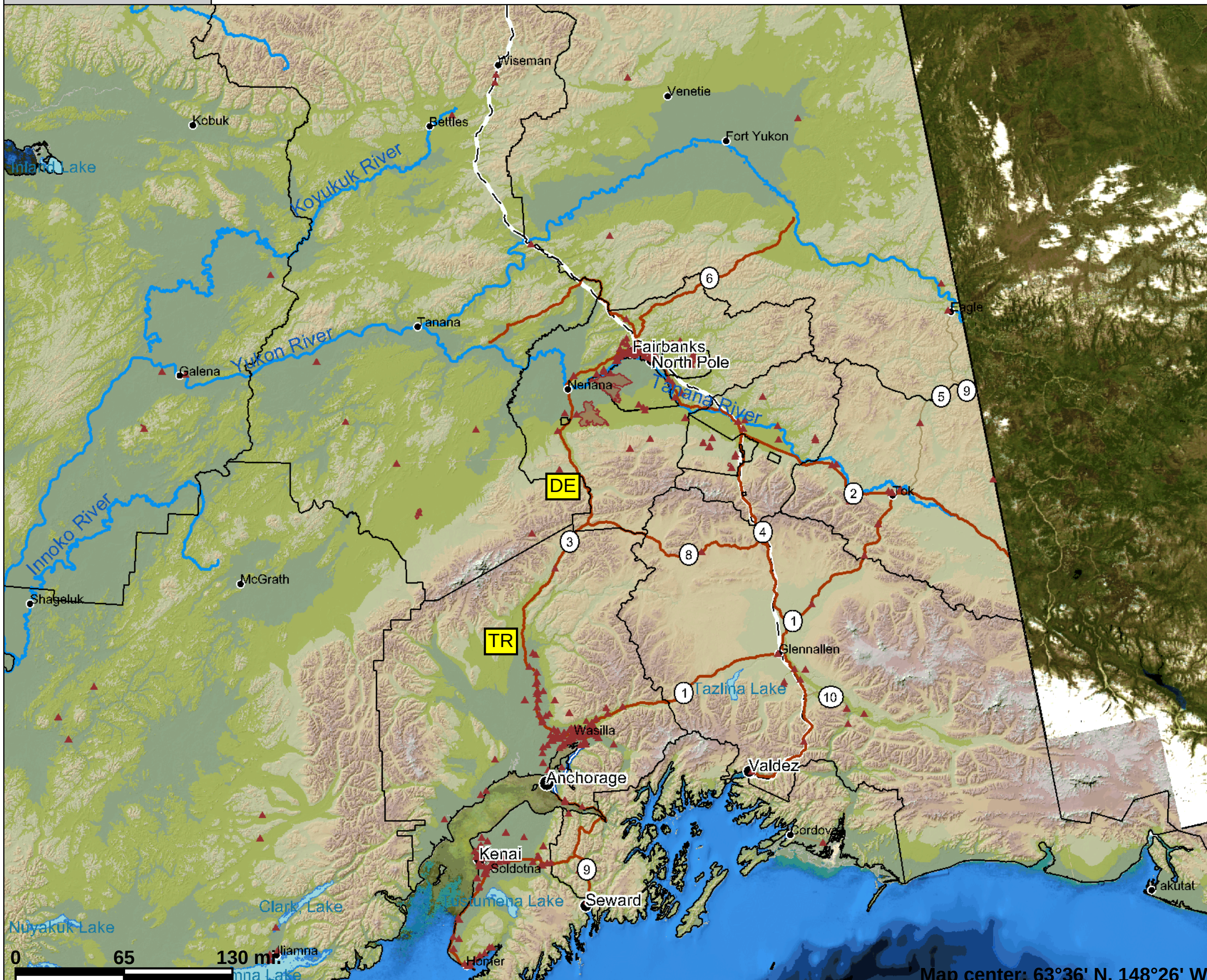
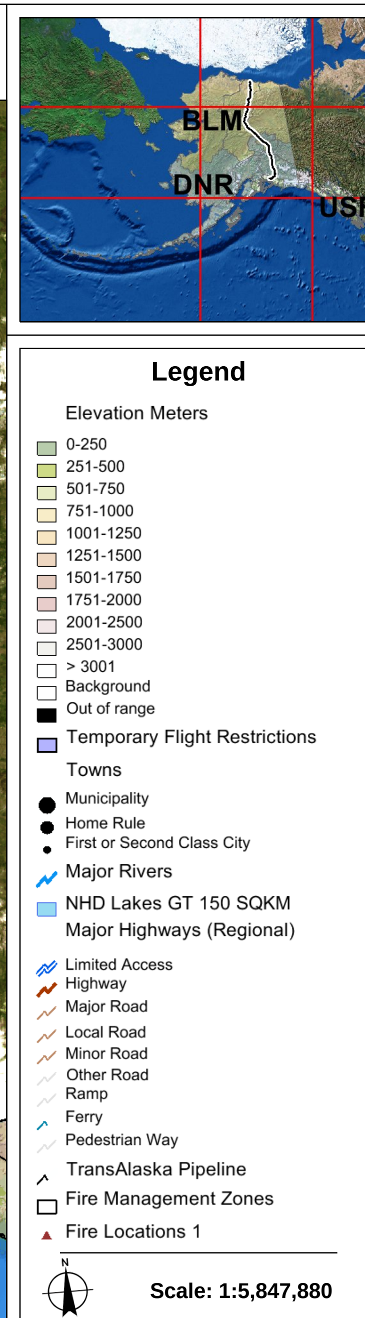
Fire Information 2001

Alaska Interagency Coordination Center





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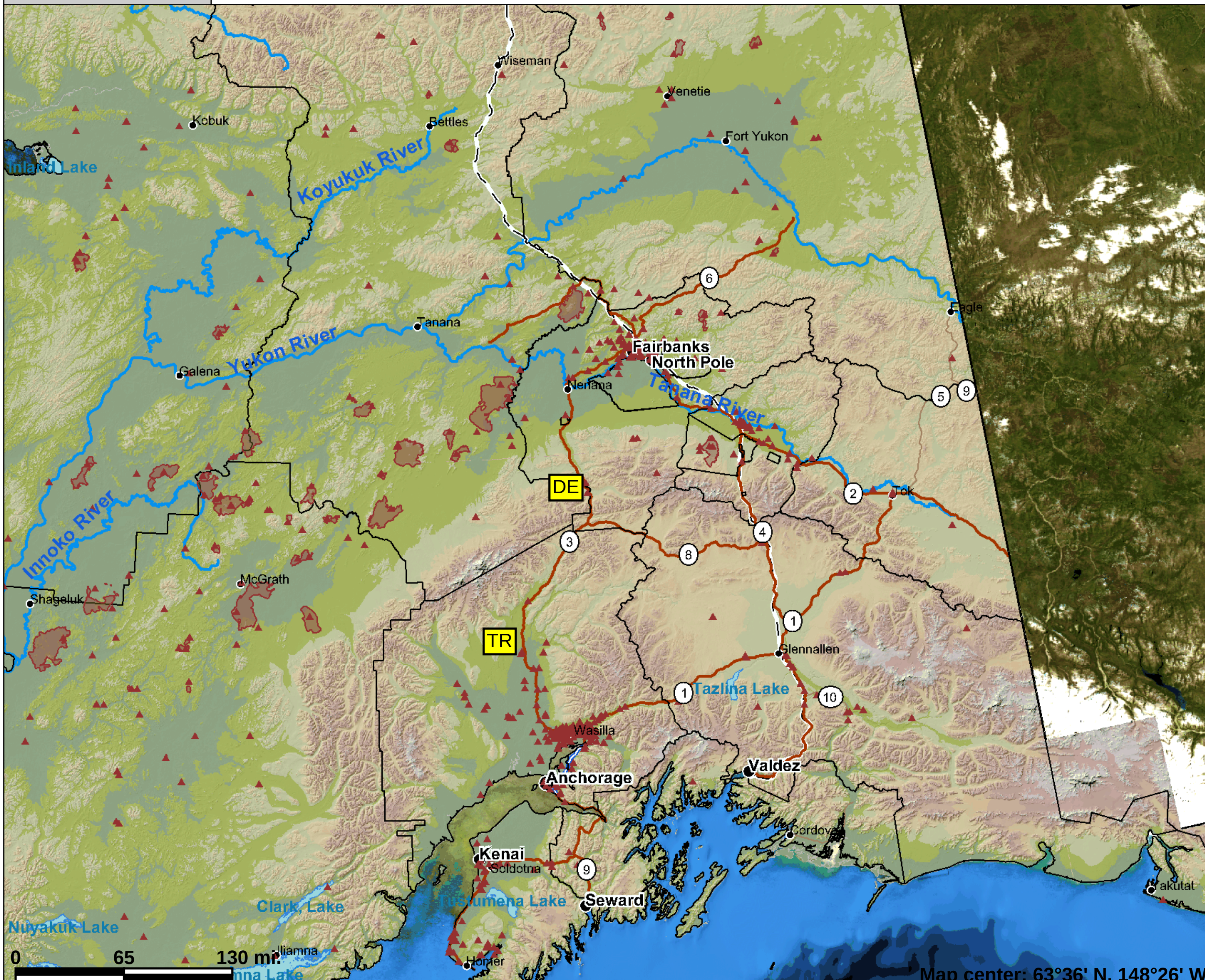
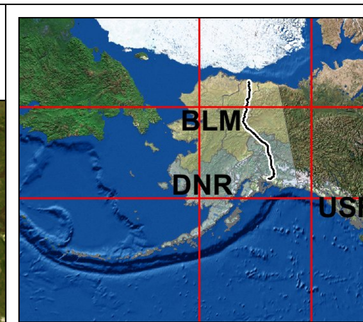
Alaska Interagency Coordination Center

Fire Information 2002





Legend

Elevation Meters
- 0-250
- 251-500
- 501-750
- 751-1000
- 1001-1250
- 1251-1500
- 1501-1750
- 1751-2000
- 2001-2500
- 2501-3000
- > 3001
- Background
- Out of range

Temporary Flight Restrictions

Towns
- Municipality
- Home Rule
- First or Second Class City

Major Rivers

NHD Lakes GT 150 SQKM

Major Highways (Regional)
- Limited Access
- Highway
- Major Road
- Local Road
- Minor Road
- Other Road
- Ramp
- Ferry
- Pedestrian Way

TransAlaska Pipeline

Fire Management Zones

Fire Locations 1

Scale: 1:5,847,880

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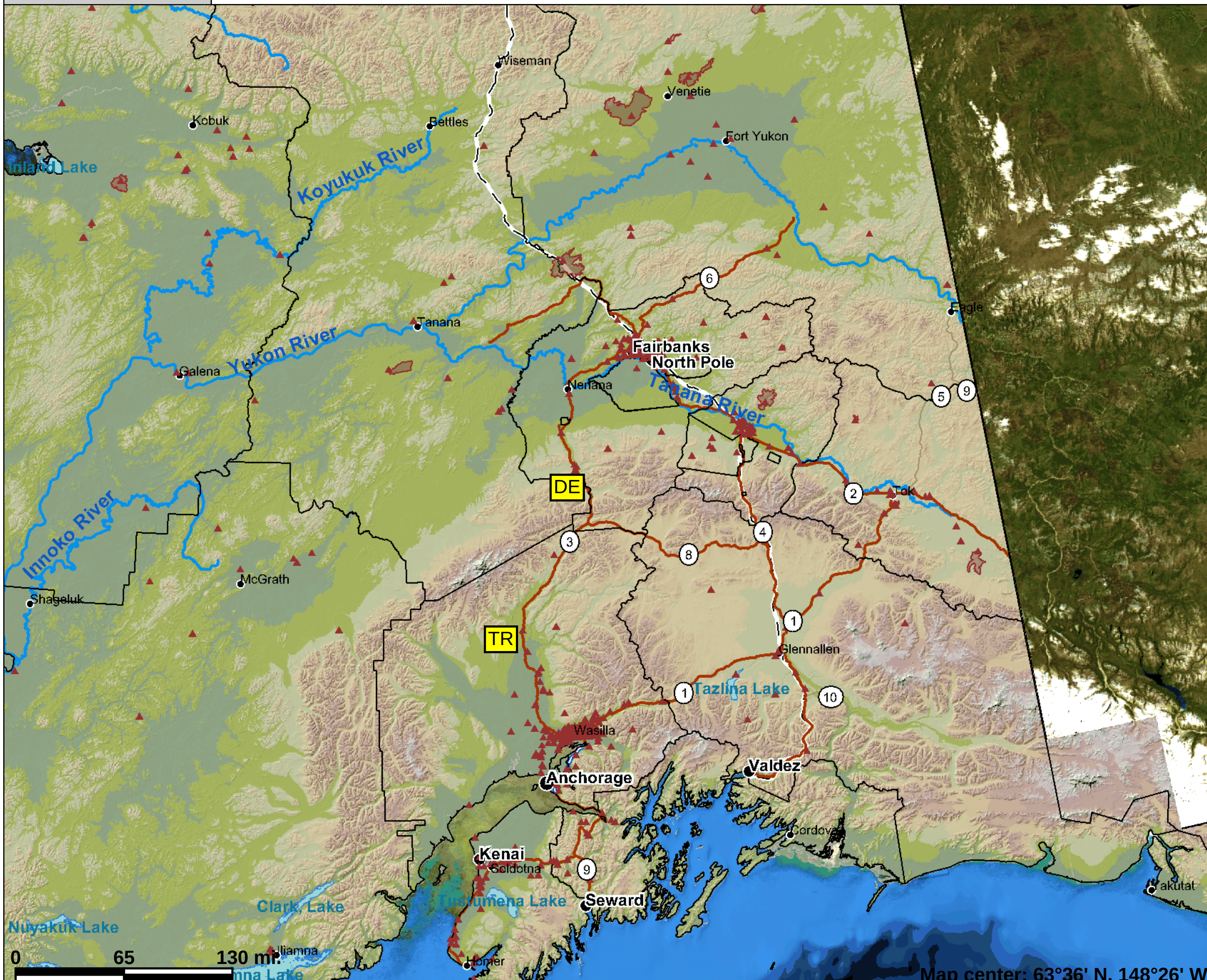
Fire Information 2003

Alaska Interagency Coordination Center



Legend

Elevation Meters

- 0-250
- 251-500
- 501-750
- 751-1000
- 1001-1250
- 1251-1500
- 1501-1750
- 1751-2000
- 2001-2500
- 2501-3000
- > 3001
- Background
- Out of range

Temporary Flight Restrictions

Towns

- Municipality
- Home Rule
- First or Second Class City

Major Rivers

NHD Lakes GT 150 SQKM

Major Highways (Regional)

- Limited Access
- Highway
- Major Road
- Local Road
- Minor Road
- Other Road
- Ramp
- Ferry
- Pedestrian Way

TransAlaska Pipeline

Fire Management Zones

Fire Locations 1

N

Scale: 1:5,847,880

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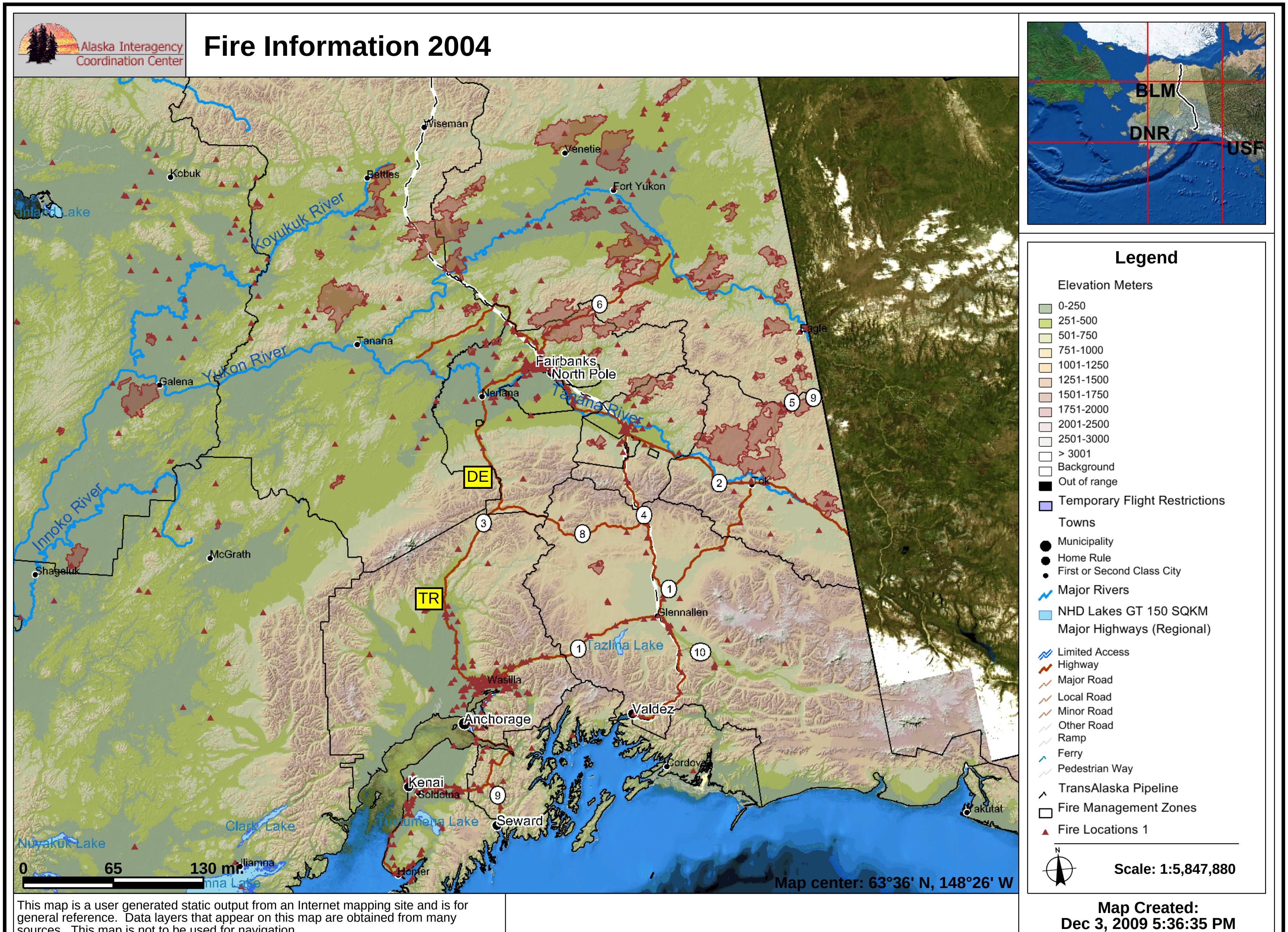

Alaska Interagency Coordination Center
Fire Information 2004
BLM
DNR
USF
Legend
Elevation Meters
0-250
251-500
501-750
751-1000
1001-1250
1251-1500
1501-1750
1751-2000
2001-2500
2501-3000
> 3001
Background
Out of range
Temporary Flight Restrictions
Towns
Municipality
Home Rule
First or Second Class City
Major Rivers
NHD Lakes GT 150 SQKM
Major Highways (Regional)
Limited Access
Highway
Major Road
Local Road
Minor Road
Other Road
Ramp
Ferry
Pedestrian Way
TransAlaska Pipeline
Fire Management Zones
Fire Locations 1
N
Scale: 1:5,847,880
Wiseman
Venetie
Kobuk
Bettles
Fort Yukon
Koyukuk River
Eagle
Tanana
Fairbanks
North Pole
Galena
Yukon River
Nenana
Tanana River
DE
Tok
Innoko River
McGrath
Shageluk
TR
Glennallen
Tazlina Lake
Wasilla
Valdez
Anchorage
Cordova
Kenai
Soldotna
Seward
Tustumena Lake
Clark Lake
Nuyakuk Lake
Yakutat
Homer
Iliamna
0
65
130 mi.
Map center: 63°36' N, 148°26' W
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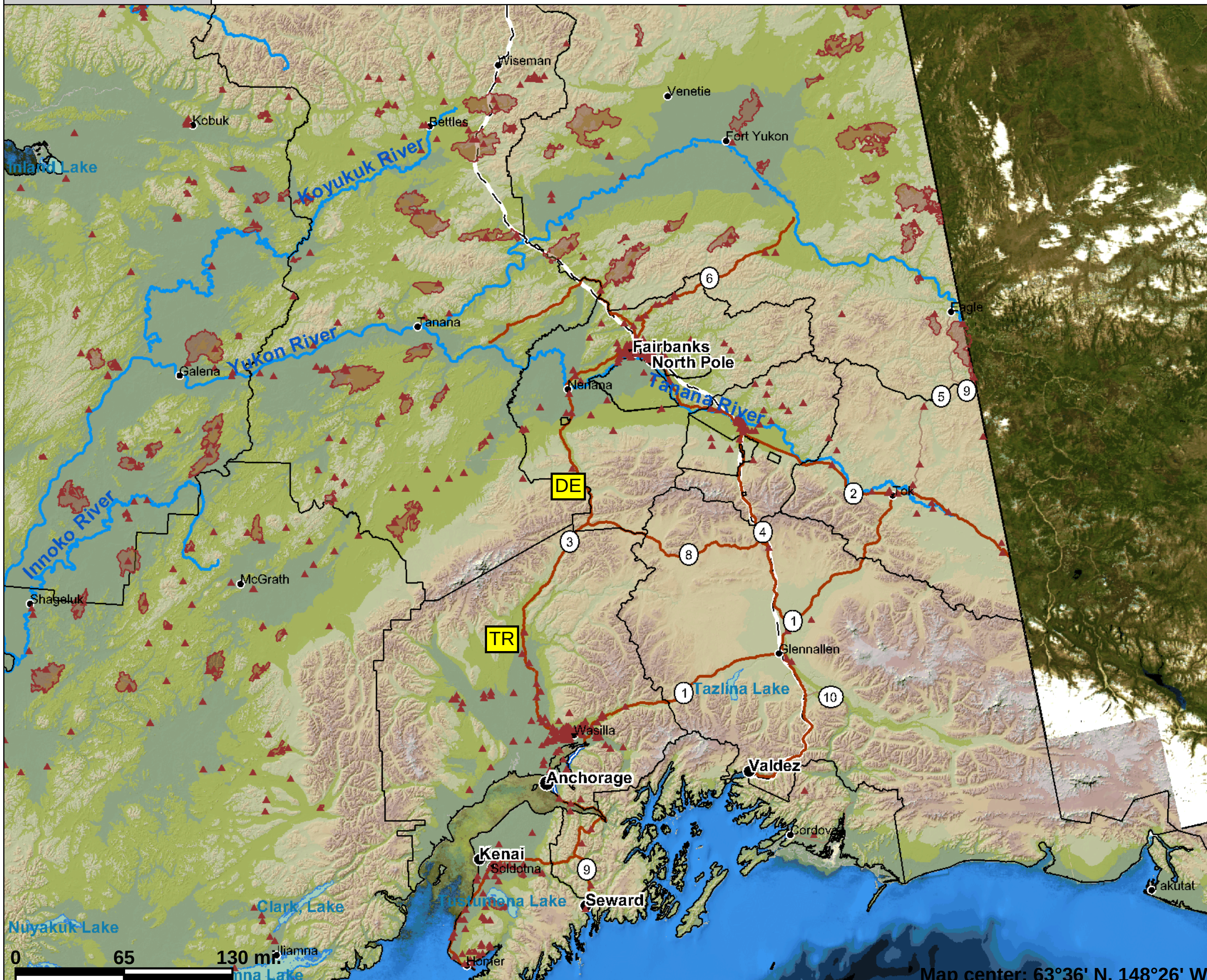
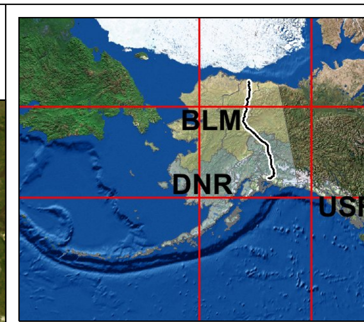
Fire Information 2005

Alaska Interagency Coordination Center





Legend

Elevation Meters
- 0-250
- 251-500
- 501-750
- 751-1000
- 1001-1250
- 1251-1500
- 1501-1750
- 1751-2000
- 2001-2500
- 2501-3000
- > 3001
- Background
- Out of range

Temporary Flight Restrictions

Towns
- Municipality
- Home Rule
- First or Second Class City

Major Rivers

NHD Lakes GT 150 SQKM

Major Highways (Regional)
- Limited Access
- Highway
- Major Road
- Local Road
- Minor Road
- Other Road
- Ramp
- Ferry
- Pedestrian Way

TransAlaska Pipeline

Fire Management Zones

Fire Locations 1

Scale: 1:5,847,880

This map is a user generated static output from an Internet mapping site and is for general reference. Data layers that appear on this map are obtained from many sources. This map is not to be used for navigation.

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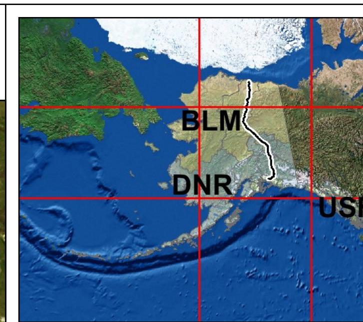
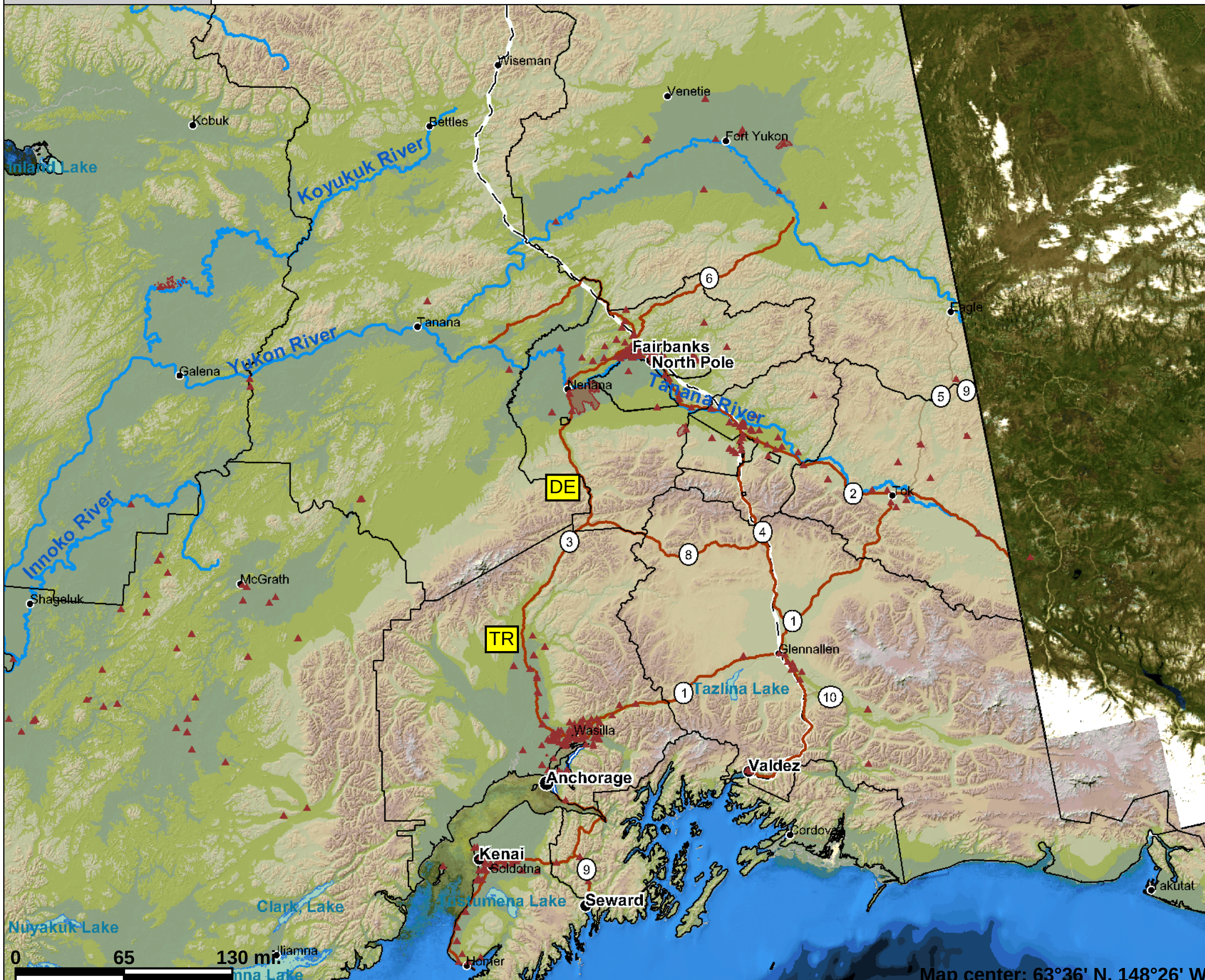
Fire Information 2006

Alaska Interagency Coordination Center





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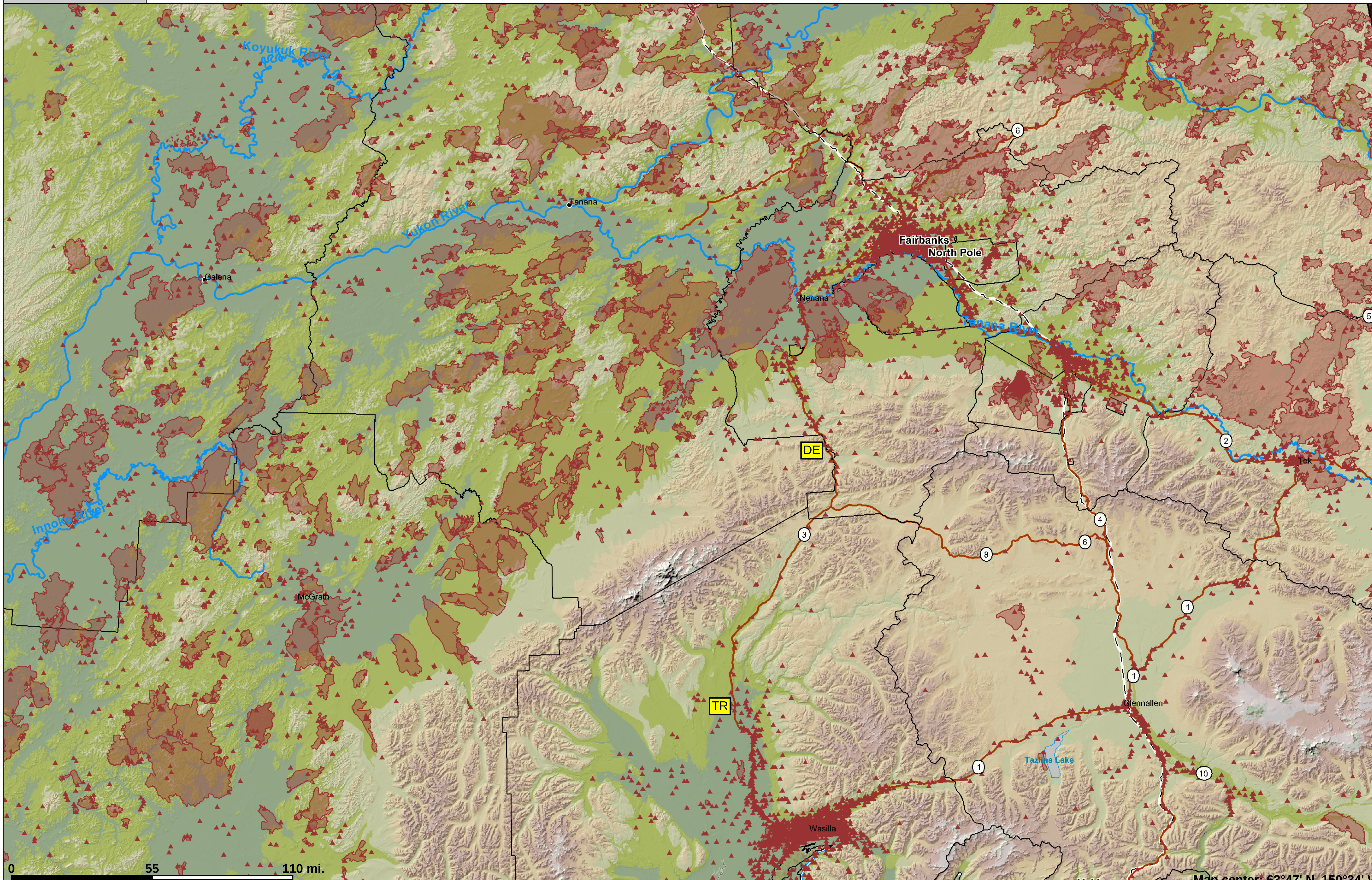
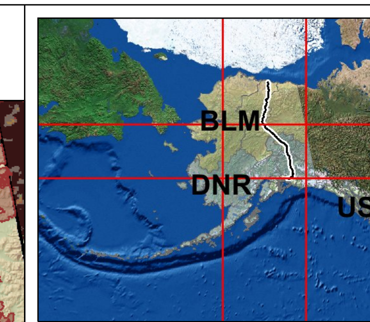
Fire Information 1990-2009

Alaska Interagency Coordination Center





Legend

Elevation Meters
- 0-250
- 251-500
- 501-750
- 751-1000
- 1001-1250
- 1251-1500
- 1501-1750
- 1751-2000
- 2001-2500
- 2501-3000
- > 3001
- Background
- Out of range

Temporary Flight Restrictions

Towns
- Municipality
- Home Rule
- First or Second Class City

Major Rivers

NHD Lakes GT 100 SQKM

Major Highways (Regional)
- Limited Access
- Highway
- Major Road
- Local Road
- Minor Road
- Other Road
- Ramp
- Ferry
- Pedestrian Way

TransAlaska Pipeline

Fire Management Zones

Fire Locations 1

Fire Perimeters 1

Scale: 1:2,465,924

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Map Created:
Dec 3, 2009 6:03:04 PM
on the AICC Mapping Site

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Vol. III: Appendices

Appendices to:
Vol. II: Analysis of Problems, Control Actions
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

The State of Alaska's State Air Quality Control Plan Volume III, Appendix to Volume II of this plan, is amended to include the following documents:

Volume II, Section II. Air Quality Control Program is amended by removing the following regulations:

- 18 AAC 50 Air Quality Control as amended through November 6th, 2010;

and replacing them with the following regulations currently under public review and comment:

- 18 AAC 50 Air Quality Control as amended through {*Adoption Date of Regulations*}.

Appendices to Volume II, Section III. K: Areawide Pollutant Control Program for Regional Haze, adopted into the State Air Quality Control Plan {*Adoption Date of Regulations*}, are added as follows:

- Appendix III.K.1- no appendix;
- Appendix III.K.2 -IMPROVE Algorithms;
- Appendix III.K.3- Overview of Alaska Air Quality;
- Appendix III.K.4.a- Alaska Volcano Observatory Events near Simeonoff Class 1 Area: Examples from 2002-2006;
- Appendix III.K.4.b- Maps of Wildfires affecting Alaska's Class 1 Areas;
- Appendix III.K.5- Emission Inventory;
- Appendix III.K.6- no appendix;
- Appendix III.K.7- Air Quality Modeling of Source Regions;
- Appendix III.K.8- Alaska Enhanced Smoke Management Plan;
- Appendix III.K.9- Reasonable Progress Goals;
- Appendix III.K.10- no appendix;
- Appendix III.K.11.a- Consultation: Regional Planning WRAP Meetings and Conference Calls;
- Appendix III.K.11.b- Consultation: Federal Land Manager Review; and
- Appendix III.K.11.c- Consultation: Public Participation and Review.

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.5
Emission Inventory

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

(This page serves as a placeholder for two-sided copying)

	Aleutians East Borough						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	57	236	754	873	151	79	0
Non-Road	2	32	5	1	0	0	0
On-Road	4	60	2	0	0	0	0
Point	61	198	606	20	0	181	25
Commercial Marine Vessels (CMV)	2	26	36	1	1	9	0
Aviation (Aircraft & GSE)	6	116	2	3	3	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**132**	**669**	**1,404**	**897**	**155**	**270**	**25**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Aleutians East Borough						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	56	233	742	860	148	78	0
Non-Road	2	32	5	1	0	0	0
On-Road	4	59	2	0	0	0	0
Point	103	237	545	29	0	196	25
Commercial Marine Vessels (CMV)	3	37	39	1	1	0	0
Aviation (Aircraft & GSE)	6	115	2	3	3	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**173**	**712**	**1,335**	**893**	**153**	**275**	**25**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Aleutians East Borough						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-
Non-Road	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
On-Road	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Point	+67.8%	+19.4%	-10.1%	+46.9%	-	+7.8%	+0.0%
Commercial Marine Vessels (CMV)	+20.1%	+41.1%	+7.4%	-2.4%	-2.4%	-96.8%	+39.2%
Aviation (Aircraft & GSE)	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**+30.8%**	**+6.3%**	**-5.0%**	**-0.5%**	**-1.5%**	**+1.6%**	**+0.0%**

Inventory Sector	Aleutians West Census Area 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	7,489	4,689	1,154	3,460	1,238	155	0
Non-Road	359	1,743	90	14	13	10	0
On-Road	13	173	5	0	0	0	1
Point	67	353	2,140	52	0	105	2
Commercial Marine Vessels (CMV)	20	192	1,193	44	43	309	0
Aviation (Aircraft & GSE)	8	158	2	4	4	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**7,955**	**7,309**	**4,583**	**3,574**	**1,297**	**580**	**5**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	Aleutians West Census Area 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	7,379	4,621	1,137	3,409	1,220	153	0
Non-Road	354	1,718	89	13	12	10	0
On-Road	13	171	5	0	0	0	1
Point	94	509	3,074	78	0	172	2
Commercial Marine Vessels (CMV)	25	245	1,275	47	10	48	1
Aviation (Aircraft & GSE)	8	155	2	4	4	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**7,872**	**7,418**	**5,582**	**3,552**	**1,245**	**384**	**5**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	Aleutians West Census Area Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-
Non-Road	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
On-Road	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Point	+39.8%	+44.2%	+43.7%	+48.8%	-1.5%	+63.3%	-0.3%
Commercial Marine Vessels (CMV)	+27.3%	+27.6%	+6.9%	+6.8%	-77.4%	-84.3%	+49.8%
Aviation (Aircraft & GSE)	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%	-1.5%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-1.0%**	**+1.5%**	**+21.8%**	**-0.6%**	**-4.0%**	**-33.9%**	**+3.7%**

	Anchorage, Municipality of						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	2,075	1,369	1,188	10,778	2,644	15	0
Non-Road	875	9,278	745	83	80	3	1
On-Road	2,762	29,421	2,487	78	58	124	124
Point	93	1,411	4,813	126	2	28	0
Commercial Marine Vessels (CMV)	8	76	282	25	24	204	0
Aviation (Aircraft & GSE)	585	7,054	2,389	229	220	207	2
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	1	18	0	2	1	0	0
TOTAL - All Sources	**6,400**	**48,627**	**11,905**	**11,321**	**3,030**	**580**	**128**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**99.9%**

	Anchorage, Municipality of						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	2,329	1,524	1,325	12,363	3,016	17	0
Non-Road	852	16,343	461	56	53	1	2
On-Road	939	15,938	1,040	52	28	15	131
Point	106	1,379	4,588	51	0	28	0
Commercial Marine Vessels (CMV)	14	135	426	39	177	40	0
Aviation (Aircraft & GSE)	691	8,328	2,820	270	260	244	2
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	1	18	0	2	1	0	0
TOTAL - All Sources	**4,932**	**43,664**	**10,661**	**12,832**	**3,536**	**346**	**135**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**99.9%**

	Anchorage, Municipality of						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+12.2%	+11.3%	+11.5%	+14.7%	+14.1%	+14.5%	-
Non-Road	-2.7%	+76.1%	-38.1%	-33.2%	-34.0%	-52.7%	+68.4%
On-Road	-66.0%	-45.8%	-58.2%	-33.1%	-52.3%	-87.9%	+5.3%
Point	+13.7%	-2.2%	-4.7%	-59.9%	-86.8%	+1.7%	-
Commercial Marine Vessels (CMV)	+74.2%	+77.3%	+51.2%	+57.4%	+639.3%	-80.3%	+187.6%
Aviation (Aircraft & GSE)	+18.1%	+18.1%	+18.1%	+18.1%	+18.1%	+18.1%	+18.1%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**-22.9%**	**-10.2%**	**-10.4%**	**+13.3%**	**+16.7%**	**-40.3%**	**+6.2%**

	Bethel Census Area 2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	13,877	8,284	865	3,260	1,799	50	0
Non-Road	607	4,324	271	17	15	3	1
On-Road	9	127	4	0	0	0	1
Point	19	27	647	21	0	21	0
Commercial Marine Vessels (CMV)	6	98	14	0	0	2	0
Aviation (Aircraft & GSE)	96	1,510	50	50	48	13	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	575	12,227	262	1,189	1,020	72	55
TOTAL - All Sources	**15,189**	**26,598**	**2,114**	**4,537**	**2,883**	**160**	**57**
Anthropogenic Fraction	**96.2%**	**54.0%**	**87.6%**	**73.8%**	**64.6%**	**55.2%**	**3.9%**

	Bethel Census Area 2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	16,070	9,594	1,001	3,776	2,083	58	0
Non-Road	703	5,008	314	19	18	4	1
On-Road	11	147	5	0	0	0	1
Point	30	41	753	28	0	39	0
Commercial Marine Vessels (CMV)	7	140	16	0	0	0	0
Aviation (Aircraft & GSE)	111	1,749	58	58	56	15	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	575	12,227	262	1,189	1,020	72	55
TOTAL - All Sources	**17,506**	**28,906**	**2,410**	**5,070**	**3,177**	**187**	**58**
Anthropogenic Fraction	**96.7%**	**57.7%**	**89.1%**	**76.5%**	**67.9%**	**61.6%**	**4.5%**

	Bethel Census Area Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%	-
Non-Road	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%
On-Road	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%
Point	+53.4%	+51.1%	+16.4%	+32.0%	+15.8%	+89.9%	+15.8%
Commercial Marine Vessels (CMV)	+20.8%	+43.9%	+12.0%	-4.5%	-4.4%	-96.8%	+43.6%
Aviation (Aircraft & GSE)	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%	+15.8%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**+15.3%**	**+8.7%**	**+14.0%**	**+11.7%**	**+10.2%**	**+16.9%**	**+0.7%**

	Bristol Bay Borough 2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	24	101	322	373	64	34	0
Non-Road	1	14	2	0	0	0	0
On-Road	2	26	1	0	0	0	0
Point	1	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	1	10	8	0	0	2	0
Aviation (Aircraft & GSE)	22	386	10	13	12	3	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**51**	**536**	**342**	**386**	**77**	**38**	**0**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Bristol Bay Borough 2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	24	100	319	369	64	34	0
Non-Road	1	14	2	0	0	0	0
On-Road	2	25	1	0	0	0	0
Point	1	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	1	14	9	0	0	0	0
Aviation (Aircraft & GSE)	22	383	10	13	12	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**50**	**536**	**341**	**383**	**76**	**36**	**0**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Bristol Bay Borough Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-
Non-Road	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%
On-Road	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%
Point	-0.8%	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+20.8%	+43.8%	+15.6%	-2.7%	-2.7%	-96.6%	+43.6%
Aviation (Aircraft & GSE)	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-0.5%**	**-0.0%**	**-0.4%**	**-0.8%**	**-0.8%**	**-5.3%**	**+0.9%**

Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
	Denali Borough						
	2002 Annual Emissions (tons/year)						
Area, Excluding Fires	4,609	3,144	385	2,907	924	15	0
Non-Road	96	360	7	4	3	0	0
On-Road	8	133	4	0	0	0	1
Point	1	130	229	58	0	136	0
Commercial Marine Vessels (CMV)	0	0	0	0	0	0	0
Aviation (Aircraft & GSE)	3	64	3	3	3	0	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	17	355	8	16,330	14,005	2	2
TOTAL - All Sources	**4,734**	**4,187**	**635**	**19,302**	**14,936**	**154**	**3**
Anthropogenic Fraction	**99.6%**	**91.5%**	**98.8%**	**15.4%**	**6.2%**	**98.6%**	**38.4%**

Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
	Denali Borough						
	2018 Annual Emissions (tons/year)						
Area, Excluding Fires	4,157	2,836	347	2,622	833	14	0
Non-Road	87	325	6	3	3	0	0
On-Road	7	120	3	0	0	0	1
Point	1	134	187	3	0	106	0
Commercial Marine Vessels (CMV)	0	0	0	0	0	0	0
Aviation (Aircraft & GSE)	3	58	2	3	3	0	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	17	355	8	16,330	14,005	2	2
TOTAL - All Sources	**4,272**	**3,828**	**554**	**18,962**	**14,845**	**123**	**2**
Anthropogenic Fraction	**99.6%**	**90.7%**	**98.6%**	**13.9%**	**5.7%**	**98.3%**	**36.0%**

Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
	Denali Borough						
	Annual Emissions Percentage Change (2002 to 2018)						
Area, Excluding Fires	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%	-
Non-Road	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%
On-Road	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%
Point	+4.7%	+2.8%	-18.1%	-94.5%	-	-21.9%	-
Commercial Marine Vessels (CMV)	-	-	-	-	-	-	-
Aviation (Aircraft & GSE)	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%	-9.8%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**-9.8%**	**-8.6%**	**-12.7%**	**-1.8%**	**-0.6%**	**-20.4%**	**-3.8%**

	Dillingham Census Area						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	4,619	3,026	1,208	2,698	858	148	0
Non-Road	221	1,088	58	9	8	6	0
On-Road	11	146	4	0	0	0	1
Point	14	73	434	7	0	64	0
Commercial Marine Vessels (CMV)	3	49	27	1	1	6	0
Aviation (Aircraft & GSE)	19	532	5	7	7	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**4,886**	**4,914**	**1,736**	**2,723**	**873**	**225**	**2**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Dillingham Census Area						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	4,818	3,156	1,260	2,815	895	154	0
Non-Road	231	1,135	61	9	8	7	0
On-Road	11	152	4	0	0	0	1
Point	12	73	326	7	0	63	0
Commercial Marine Vessels (CMV)	4	71	31	1	1	0	0
Aviation (Aircraft & GSE)	20	555	6	8	7	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**5,095**	**5,142**	**1,688**	**2,839**	**911**	**226**	**2**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Dillingham Census Area						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%	-
Non-Road	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%
On-Road	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%
Point	-14.8%	+0.0%	-24.9%	-4.1%	+4.3%	-0.1%	+4.3%
Commercial Marine Vessels (CMV)	+20.8%	+44.0%	+16.5%	-2.4%	-2.4%	-96.6%	+43.9%
Aviation (Aircraft & GSE)	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%	+4.3%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**+4.3%**	**+4.6%**	**-2.8%**	**+4.3%**	**+4.3%**	**+0.5%**	**+5.4%**

Inventory Sector	Fairbanks North Star Borough 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	917	1,391	255	12,054	2,376	603	0
Non-Road	1,082	4,336	360	57	54	2	1
On-Road	1,579	18,494	1,732	52	39	81	64
Point	74	4,095	6,375	2,808	33	4,651	22
Commercial Marine Vessels (CMV)	0	4	2	0	0	1	0
Aviation (Aircraft & GSE)	250	1,702	371	87	84	35	1
Fires, Anthropogenic	0	1	0	0	0	0	0
Fires, Natural	4,215	89,564	1,921	8,708	7,469	527	403
TOTAL - All Sources	**8,118**	**119,588**	**11,017**	**23,766**	**10,054**	**5,900**	**490**
Anthropogenic Fraction	**48.1%**	**25.1%**	**82.6%**	**63.4%**	**25.7%**	**91.1%**	**17.8%**

Inventory Sector	Fairbanks North Star Borough 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	1,082	1,635	301	13,854	2,735	712	0
Non-Road	1,006	5,032	171	37	34	1	1
On-Road	565	8,628	582	31	17	8	70
Point	107	2,932	7,370	629	38	5,831	22
Commercial Marine Vessels (CMV)	0	6	3	0	0	0	0
Aviation (Aircraft & GSE)	296	2,015	440	102	99	42	1
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	4,215	89,564	1,921	8,708	7,469	527	403
TOTAL - All Sources	**7,272**	**109,813**	**10,788**	**23,362**	**10,392**	**7,121**	**497**
Anthropogenic Fraction	**42.0%**	**18.4%**	**82.2%**	**62.7%**	**28.1%**	**92.6%**	**18.9%**

Inventory Sector	Fairbanks North Star Borough Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+18.0%	+17.5%	+18.0%	+14.9%	+15.1%	+18.1%	-
Non-Road	-7.1%	+16.0%	-52.4%	-35.0%	-35.7%	-46.4%	+29.8%
On-Road	-64.2%	-53.3%	-66.4%	-41.0%	-57.4%	-89.5%	+9.9%
Point	+44.9%	-28.4%	+15.6%	-77.6%	+15.4%	+25.4%	+0.0%
Commercial Marine Vessels (CMV)	+20.9%	+44.0%	+16.7%	-2.3%	-2.3%	-96.5%	+44.0%
Aviation (Aircraft & GSE)	+18.4%	+18.4%	+18.4%	+18.4%	+18.4%	+18.4%	+18.4%
Fires, Anthropogenic	-40.0%	-40.0%	-40.0%	-40.0%	-40.0%	-40.0%	-40.0%
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**-10.4%**	**-8.2%**	**-2.1%**	**-1.7%**	**+3.4%**	**+20.7%**	**+1.4%**

Inventory Sector	Haines Borough 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	1,900	1,086	45	1,633	415	3	0
Non-Road	25	213	8	3	2	1	0
On-Road	26	226	28	1	0	1	1
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	6	46	285	13	12	104	0
Aviation (Aircraft & GSE)	1	31	0	0	0	0	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**1,959**	**1,603**	**366**	**1,650**	**430**	**109**	**1**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	Haines Borough 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	1,535	878	36	1,320	335	3	0
Non-Road	21	172	7	2	2	1	0
On-Road	21	183	23	1	0	0	1
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	10	67	366	19	18	4	0
Aviation (Aircraft & GSE)	1	25	0	0	0	0	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**1,588**	**1,325**	**431**	**1,342**	**356**	**8**	**1**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	Haines Borough Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%	-
Non-Road	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%
On-Road	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%
Point	-	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+66.4%	+44.7%	+28.2%	+50.3%	+50.3%	-96.1%	+47.2%
Aviation (Aircraft & GSE)	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%	-19.2%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-18.9%**	**-17.4%**	**+17.7%**	**-18.7%**	**-17.2%**	**-92.7%**	**-13.8%**

	Juneau City and Borough						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	417	442	74	2,810	693	6	0
Non-Road	263	2,093	395	38	36	1	1
On-Road	736	9,015	832	22	16	34	27
Point	19	108	334	10	0	50	0
Commercial Marine Vessels (CMV)	54	254	1,631	118	114	840	1
Aviation (Aircraft & GSE)	53	1,363	106	33	31	12	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**1,541**	**13,276**	**3,371**	**3,030**	**891**	**942**	**28**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Juneau City and Borough						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	458	484	81	3,101	765	6	0
Non-Road	167	2,066	48	8	7	0	0
On-Road	418	4,958	276	10	5	3	30
Point	23	136	417	9	0	30	0
Commercial Marine Vessels (CMV)	119	522	3,036	230	49	237	2
Aviation (Aircraft & GSE)	55	1,416	110	34	32	13	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**1,240**	**9,582**	**3,968**	**3,392**	**858**	**289**	**32**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Juneau City and Borough						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+9.7%	+9.5%	+9.7%	+10.3%	+10.4%	+9.8%	-
Non-Road	-36.6%	-1.3%	-87.8%	-79.6%	-80.1%	-74.8%	-61.3%
On-Road	-43.2%	-45.0%	-66.8%	-53.3%	-68.6%	-90.8%	+12.5%
Point	+25.3%	+25.9%	+25.1%	-6.7%	-	-39.5%	-
Commercial Marine Vessels (CMV)	+123.2%	+105.5%	+86.1%	+95.7%	-57.4%	-71.8%	+114.3%
Aviation (Aircraft & GSE)	+3.9%	+3.9%	+3.9%	+3.9%	+3.9%	+3.9%	+3.9%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-19.5%**	**-27.8%**	**+17.7%**	**+11.9%**	**-3.6%**	**-69.3%**	**+13.3%**

Inventory Sector	Kenai Peninsula Borough 2002 Annual Emissions (tons/year)						
	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	3,975	2,506	441	4,957	1,286	82	0
Non-Road	261	1,948	158	19	18	1	0
On-Road	576	6,344	555	13	13	27	25
Point	2,892	4,420	11,917	322	113	108	506
Commercial Marine Vessels (CMV)	25	316	531	19	19	167	0
Aviation (Aircraft & GSE)	46	838	18	28	27	5	0
Fires, Anthropogenic	94	2,007	43	195	167	12	9
Fires, Natural	0	7	0	1	1	0	0
TOTAL - All Sources	**7,869**	**18,385**	**13,662**	**5,555**	**1,644**	**401**	**541**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	Kenai Peninsula Borough 2018 Annual Emissions (tons/year)						
	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	4,466	2,812	486	5,495	1,428	91	0
Non-Road	239	2,902	94	13	12	0	0
On-Road	192	3,142	206	10	6	3	26
Point	3,783	5,074	9,731	247	8	120	966
Commercial Marine Vessels (CMV)	39	523	631	23	58	17	0
Aviation (Aircraft & GSE)	52	945	20	32	31	6	0
Fires, Anthropogenic	50	1,060	23	103	88	6	5
Fires, Natural	0	7	0	1	1	0	0
TOTAL - All Sources	**8,820**	**16,465**	**11,191**	**5,925**	**1,631**	**243**	**998**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	Kenai Peninsula Borough Annual Emissions Percentage Change (2002 to 2018)						
	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+12.4%	+12.2%	+10.3%	+10.8%	+11.0%	+12.1%	-4.5%
Non-Road	-8.5%	+49.0%	-40.6%	-34.7%	-35.0%	-37.9%	-2.8%
On-Road	-66.7%	-50.5%	-62.9%	-22.5%	-56.5%	-89.6%	+2.8%
Point	+30.8%	+14.8%	-18.3%	-23.1%	-92.9%	+10.5%	+91.0%
Commercial Marine Vessels (CMV)	+55.5%	+65.4%	+18.8%	+21.2%	+208.4%	-90.0%	+45.0%
Aviation (Aircraft & GSE)	+12.8%	+12.8%	+12.8%	+12.8%	+12.8%	+12.8%	+12.8%
Fires, Anthropogenic	-47.2%	-47.2%	-47.2%	-47.2%	-47.2%	-47.2%	-47.2%
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**+12.1%**	**-10.4%**	**-18.1%**	**+6.6%**	**-0.8%**	**-39.5%**	**+84.5%**

	Ketchikan Gateway Borough /2						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	196	250	462	1,267	321	49	0
Non-Road	117	935	176	16	16	0	0
On-Road	199	2,424	223	6	5	9	7
Point	6	59	222	7	0	18	0
Commercial Marine Vessels (CMV)	25	139	889	51	49	343	0
Aviation (Aircraft & GSE)	26	441	16	16	15	3	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**568**	**4,247**	**1,988**	**1,364**	**407**	**422**	**7**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Ketchikan Gateway Borough /2						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	175	225	415	1,135	288	43	0
Non-Road	105	838	158	15	15	0	0
On-Road	61	1,178	60	3	2	0	6
Point	6	59	222	7	0	18	0
Commercial Marine Vessels (CMV)	57	305	1,693	100	19	103	1
Aviation (Aircraft & GSE)	23	396	14	15	13	3	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**427**	**3,000**	**2,562**	**1,275**	**337**	**168**	**7**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Ketchikan Gateway Borough /2						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-10.7%	-10.0%	-10.2%	-10.4%	-10.3%	-11.8%	-
Non-Road	-10.3%	-10.3%	-10.3%	-5.8%	-10.3%	-	-
On-Road	-69.3%	-51.4%	-73.3%	-53.2%	-66.1%	-96.6%	-9.6%
Point	+0.0%	+0.0%	-0.0%	+0.0%	-	-0.0%	-
Commercial Marine Vessels (CMV)	+128.7%	+119.5%	+90.6%	+96.9%	-60.7%	-70.0%	+99.5%
Aviation (Aircraft & GSE)	-10.3%	-10.3%	-10.3%	-10.3%	-10.3%	-10.3%	-10.3%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-24.9%**	**-29.4%**	**+28.9%**	**-6.5%**	**-17.1%**	**-60.3%**	**-3.5%**

	Kodiak Island Borough						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	11,409	7,417	2,280	7,126	2,185	245	0
Non-Road	326	1,857	34	15	14	2	0
On-Road	29	394	11	1	0	0	3
Point	4	0	0	0	0	0	1
Commercial Marine Vessels (CMV)	13	126	298	13	13	108	0
Aviation (Aircraft & GSE)	34	353	89	21	20	11	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	43	904	19	88	75	5	4
TOTAL - All Sources	**11,857**	**11,050**	**2,732**	**7,263**	**2,308**	**371**	**8**
Anthropogenic Fraction	**99.6%**	**91.8%**	**99.3%**	**98.8%**	**96.7%**	**98.6%**	**51.5%**

	Kodiak Island Borough						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	11,009	7,156	2,200	6,875	2,109	236	0
Non-Road	314	1,792	33	14	13	2	0
On-Road	28	380	11	1	0	0	3
Point	4	0	0	0	0	0	1
Commercial Marine Vessels (CMV)	20	219	352	15	4	15	0
Aviation (Aircraft & GSE)	33	341	86	20	19	10	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	43	904	19	88	75	5	4
TOTAL - All Sources	**11,449**	**10,791**	**2,700**	**7,013**	**2,221**	**269**	**8**
Anthropogenic Fraction	**99.6%**	**91.6%**	**99.3%**	**98.7%**	**96.6%**	**98.0%**	**51.3%**

	Kodiak Island Borough						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%	-
Non-Road	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%
On-Road	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%
Point	-3.5%	-	-	-	-3.5%	-3.5%	-3.5%
Commercial Marine Vessels (CMV)	+54.5%	+73.6%	+18.0%	+11.9%	-67.3%	-86.0%	+48.8%
Aviation (Aircraft & GSE)	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%	-3.5%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**-3.4%**	**-2.3%**	**-1.1%**	**-3.4%**	**-3.8%**	**-27.4%**	**-0.5%**

	Lake and Peninsula Borough 2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	34	142	454	525	91	48	0
Non-Road	1	20	3	0	0	0	0
On-Road	3	36	1	0	0	0	0
Point	1	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	1	19	16	0	0	4	0
Aviation (Aircraft & GSE)	22	424	7	10	10	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**62**	**640**	**480**	**536**	**101**	**54**	**0**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Lake and Peninsula Borough 2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	32	133	424	491	85	45	0
Non-Road	1	18	3	0	0	0	0
On-Road	2	34	1	0	0	0	0
Point	1	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	2	27	17	0	0	0	0
Aviation (Aircraft & GSE)	21	396	6	10	9	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**58**	**607**	**451**	**501**	**95**	**47**	**0**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Lake and Peninsula Borough Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%	-
Non-Road	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%
On-Road	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%
Point	-6.6%	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+20.6%	+43.1%	+11.6%	-2.5%	-2.4%	-96.7%	+42.2%
Aviation (Aircraft & GSE)	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%	-6.6%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-6.0%**	**-5.1%**	**-6.0%**	**-6.6%**	**-6.6%**	**-12.7%**	**-4.4%**

Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
	Matanuska-Susitna Borough						
	2002 Annual Emissions (tons/year)						
Area, Excluding Fires	977	785	277	4,361	988	109	0
Non-Road	359	2,498	201	26	24	1	0
On-Road	785	8,661	761	19	17	37	34
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	1	12	10	0	0	2	0
Aviation (Aircraft & GSE)	61	1,467	24	32	29	6	1
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	402	8,541	183	830	712	50	38
TOTAL - All Sources	**2,585**	**21,965**	**1,455**	**5,268**	**1,771**	**205**	**74**
Anthropogenic Fraction	**84.5%**	**61.1%**	**87.4%**	**84.2%**	**59.8%**	**75.5%**	**47.8%**

Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
	Matanuska-Susitna Borough						
	2018 Annual Emissions (tons/year)						
Area, Excluding Fires	1,579	1,269	436	6,998	1,584	179	0
Non-Road	477	5,483	162	24	23	1	0
On-Road	381	6,220	410	21	11	6	51
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	1	18	11	0	0	0	0
Aviation (Aircraft & GSE)	101	2,418	39	52	47	9	1
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	402	8,541	183	830	712	50	38
TOTAL - All Sources	**2,941**	**23,949**	**1,242**	**7,925**	**2,377**	**245**	**91**
Anthropogenic Fraction	**86.3%**	**64.3%**	**85.2%**	**89.5%**	**70.0%**	**79.5%**	**58.0%**

Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
	Matanuska-Susitna Borough						
	Annual Emissions Percentage Change (2002 to 2018)						
Area, Excluding Fires	+61.6%	+61.6%	+57.3%	+60.4%	+60.2%	+63.9%	+39.7%
Non-Road	+33.1%	+119.5%	-19.3%	-6.7%	-7.4%	-24.0%	+40.2%
On-Road	-51.5%	-28.2%	-46.1%	+11.7%	-36.7%	-85.0%	+50.3%
Point	-	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+20.9%	+44.0%	+16.7%	-2.3%	-2.3%	-96.5%	+44.0%
Aviation (Aircraft & GSE)	+64.9%	+64.9%	+64.9%	+64.9%	+64.9%	+64.9%	+64.9%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**+13.8%**	**+9.0%**	**-14.7%**	**+50.4%**	**+34.2%**	**+19.5%**	**+24.1%**

	Nome Census Area						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	11,488	6,746	396	5,775	1,917	23	0
Non-Road	329	2,865	176	9	8	2	0
On-Road	22	194	14	0	0	0	1
Point	8	27	411	8	0	65	0
Commercial Marine Vessels (CMV)	1	23	4	0	0	1	0
Aviation (Aircraft & GSE)	33	535	15	19	18	4	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	106	2,259	48	220	188	13	10
TOTAL - All Sources	**11,988**	**12,649**	**1,064**	**6,031**	**2,132**	**108**	**11**
Anthropogenic Fraction	**99.1%**	**82.1%**	**95.4%**	**96.4%**	**91.2%**	**87.7%**	**11.4%**

	Nome Census Area						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	13,178	7,739	454	6,625	2,200	26	0
Non-Road	378	3,286	202	10	9	2	0
On-Road	26	222	16	0	0	0	1
Point	7	51	783	16	0	124	0
Commercial Marine Vessels (CMV)	2	34	5	0	0	0	0
Aviation (Aircraft & GSE)	38	614	17	21	21	5	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	106	2,259	48	220	188	13	10
TOTAL - All Sources	**13,734**	**14,204**	**1,525**	**6,893**	**2,418**	**171**	**12**
Anthropogenic Fraction	**99.2%**	**84.1%**	**96.8%**	**96.8%**	**92.2%**	**92.2%**	**12.9%**

	Nome Census Area						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%	-
Non-Road	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%
On-Road	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%
Point	-16.2%	+90.6%	+90.6%	+90.6%	+14.7%	+90.5%	+14.7%
Commercial Marine Vessels (CMV)	+20.7%	+43.8%	+12.4%	-4.1%	-4.0%	-96.8%	+43.6%
Aviation (Aircraft & GSE)	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%	+14.7%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**+14.6%**	**+12.3%**	**+43.3%**	**+14.3%**	**+13.4%**	**+58.0%**	**+1.7%**

Inventory Sector	North Slope Borough 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	5,034	2,871	109	2,585	836	9	0
Non-Road	635	4,069	359	20	18	4	1
On-Road	14	124	12	0	0	0	0
Point	1,107	16,239	41,409	2,282	943	779	23
Commercial Marine Vessels (CMV)	0	0	0	0	0	0	0
Aviation (Aircraft & GSE)	38	742	18	23	21	4	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**6,828**	**24,045**	**41,908**	**4,910**	**1,818**	**796**	**24**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	North Slope Borough 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	5,529	3,153	120	2,840	919	10	0
Non-Road	698	4,469	395	22	20	4	1
On-Road	15	136	14	0	0	0	0
Point	938	12,838	31,229	330	48	1,045	89
Commercial Marine Vessels (CMV)	0	0	0	0	0	0	0
Aviation (Aircraft & GSE)	42	815	20	25	23	5	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**7,222**	**21,413**	**31,777**	**3,217**	**1,010**	**1,064**	**90**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	North Slope Borough Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%	-
Non-Road	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%
On-Road	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%
Point	-15.3%	-20.9%	-24.6%	-85.5%	-94.9%	+34.1%	+285.1%
Commercial Marine Vessels (CMV)	+19.5%	+41.9%	-12.6%	-14.4%	-14.3%	-97.6%	+38.7%
Aviation (Aircraft & GSE)	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%	+9.8%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**+5.8%**	**-10.9%**	**-24.2%**	**-34.5%**	**-44.5%**	**+33.6%**	**+273.1%**

Inventory Sector	Northwest Arctic Borough 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	5,029	2,873	128	2,583	836	9	0
Non-Road	635	4,077	360	20	18	4	1
On-Road	14	124	12	0	0	0	0
Point	175	387	3,804	156	145	258	0
Commercial Marine Vessels (CMV)	1	6	28	1	1	12	0
Aviation (Aircraft & GSE)	30	560	14	15	14	4	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	92	1,957	42	190	163	12	9
TOTAL - All Sources	**5,976**	**9,984**	**4,388**	**2,966**	**1,179**	**297**	**10**
Anthropogenic Fraction	**98.5%**	**80.4%**	**99.0%**	**93.6%**	**86.1%**	**96.1%**	**9.7%**

Inventory Sector	Northwest Arctic Borough 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	5,866	3,351	150	3,012	975	10	0
Non-Road	741	4,755	420	23	21	4	1
On-Road	16	145	14	0	0	0	0
Point	325	484	4,610	283	262	308	0
Commercial Marine Vessels (CMV)	1	8	29	1	0	2	0
Aviation (Aircraft & GSE)	35	654	16	17	17	4	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	92	1,957	42	190	163	12	9
TOTAL - All Sources	**7,076**	**11,353**	**5,281**	**3,528**	**1,439**	**339**	**10**
Anthropogenic Fraction	**98.7%**	**82.8%**	**99.2%**	**94.6%**	**88.7%**	**96.6%**	**11.1%**

Inventory Sector	Northwest Arctic Borough Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%	-
Non-Road	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%
On-Road	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%
Point	+86.2%	+25.2%	+21.2%	+81.1%	+80.6%	+19.3%	-
Commercial Marine Vessels (CMV)	+35.8%	+31.8%	+4.7%	-0.1%	-76.4%	-87.0%	+42.4%
Aviation (Aircraft & GSE)	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%	+16.6%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**+18.4%**	**+13.7%**	**+20.3%**	**+18.9%**	**+22.1%**	**+14.3%**	**+1.6%**

	Prince of Wales-Outer Ketchikan C.A./2 /3						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	4,554	2,603	107	3,915	994	8	0
Non-Road	305	1,918	99	11	10	3	0
On-Road	63	542	67	2	1	1	3
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	39	392	922	60	58	474	1
Aviation (Aircraft & GSE)	15	281	5	9	8	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**4,976**	**5,737**	**1,200**	**3,996**	**1,071**	**488**	**4**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Prince of Wales-Outer Ketchikan C.A./2 /3						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	3,844	2,198	90	3,305	839	7	0
Non-Road	257	1,619	84	9	8	3	0
On-Road	53	457	56	2	1	1	2
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	75	685	1,414	109	32	106	1
Aviation (Aircraft & GSE)	13	238	4	7	7	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**4,242**	**5,197**	**1,649**	**3,432**	**887**	**118**	**4**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Prince of Wales-Outer Ketchikan C.A./2 /3						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%	-
Non-Road	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%
On-Road	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%
Point	-	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+90.3%	+75.0%	+53.4%	+81.6%	-44.8%	-77.6%	+88.3%
Aviation (Aircraft & GSE)	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%	-15.6%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-14.7%**	**-9.4%**	**+37.5%**	**-14.1%**	**-17.2%**	**-75.8%**	**+1.0%**

	Sitka City and Borough						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	126	160	297	815	207	31	0
Non-Road	76	601	113	10	10	0	0
On-Road	128	1,558	144	4	3	6	4
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	30	151	881	63	61	451	0
Aviation (Aircraft & GSE)	8	143	3	5	4	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**367**	**2,614**	**1,438**	**897**	**286**	**489**	**5**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Sitka City and Borough						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	127	163	301	824	209	31	0
Non-Road	76	608	115	11	11	0	0
On-Road	44	855	43	2	1	0	4
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	31	176	881	63	61	417	0
Aviation (Aircraft & GSE)	8	145	3	5	4	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**287**	**1,947**	**1,343**	**905**	**287**	**449**	**5**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Sitka City and Borough						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+0.8%	+1.6%	+1.4%	+1.1%	+1.2%	-0.4%	-
Non-Road	+1.2%	+1.2%	+1.2%	+6.3%	+1.2%	-	-
On-Road	-65.3%	-45.1%	-69.8%	-47.2%	-61.7%	-96.1%	+2.0%
Point	-	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+3.3%	+16.4%	-0.0%	-0.1%	-0.1%	-7.6%	+8.3%
Aviation (Aircraft & GSE)	+1.2%	+1.2%	+1.2%	+1.2%	+1.2%	+1.2%	+1.2%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-21.9%**	**-25.5%**	**-6.6%**	**+0.9%**	**+0.3%**	**-8.1%**	**+2.5%**

Inventory Sector	Skagway-Hoonah-Angoon C.A. 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	2,613	1,494	61	2,246	570	5	0
Non-Road	163	1,033	53	6	5	2	0
On-Road	36	311	38	1	1	1	2
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	37	205	1,380	79	76	571	0
Aviation (Aircraft & GSE)	14	225	4	7	7	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**2,863**	**3,268**	**1,537**	**2,339**	**660**	**579**	**2**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	Skagway-Hoonah-Angoon C.A. 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	2,025	1,158	48	1,741	442	4	0
Non-Road	126	801	41	5	4	1	0
On-Road	28	241	30	1	1	1	1
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	68	346	2,089	130	126	25	1
Aviation (Aircraft & GSE)	11	175	3	5	5	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**2,259**	**2,720**	**2,211**	**1,882**	**578**	**32**	**2**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Inventory Sector	Skagway-Hoonah-Angoon C.A. Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%	-
Non-Road	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%
On-Road	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%
Point	-	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+83.7%	+68.9%	+51.4%	+65.1%	+65.1%	-95.6%	+71.5%
Aviation (Aircraft & GSE)	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%	-22.5%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-21.1%**	**-16.7%**	**+43.9%**	**-19.5%**	**-12.3%**	**-94.5%**	**-2.6%**

Inventory Sector	Southeast Fairbanks Census Area 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	14,535	10,070	1,836	9,168	2,920	47	0
Non-Road	287	1,077	21	11	10	1	0
On-Road	24	419	11	1	0	0	3
Point	11	52	214	10	0	30	0
Commercial Marine Vessels (CMV)	0	1	1	0	0	0	0
Aviation (Aircraft & GSE)	81	303	70	25	24	7	0
Fires, Anthropogenic	3	40	3	4	4	1	0
Fires, Natural	17,843	379,157	8,134	36,866	31,618	2,230	1,706
TOTAL - All Sources	**32,784**	**391,121**	**10,291**	**46,086**	**34,578**	**2,317**	**1,709**
Anthropogenic Fraction	**45.6%**	**3.1%**	**21.0%**	**20.0%**	**8.6%**	**3.7%**	**0.2%**

Inventory Sector	Southeast Fairbanks Census Area 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	18,581	12,874	2,347	11,720	3,733	60	0
Non-Road	367	1,377	26	15	13	1	0
On-Road	31	536	15	1	0	0	4
Point	12	59	243	12	0	34	0
Commercial Marine Vessels (CMV)	0	1	1	0	0	0	0
Aviation (Aircraft & GSE)	103	388	90	32	31	9	0
Fires, Anthropogenic	3	40	3	4	4	1	0
Fires, Natural	17,843	379,157	8,134	36,866	31,618	2,230	1,706
TOTAL - All Sources	**36,941**	**394,432**	**10,860**	**48,650**	**35,400**	**2,336**	**1,710**
Anthropogenic Fraction	**51.7%**	**3.9%**	**25.1%**	**24.2%**	**10.7%**	**4.5%**	**0.3%**

Inventory Sector	Southeast Fairbanks Census Area Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%	-
Non-Road	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%
On-Road	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%
Point	+13.6%	+13.6%	+13.6%	+13.6%	-	+13.6%	-
Commercial Marine Vessels (CMV)	+20.9%	+44.0%	+16.7%	-2.3%	-2.3%	-96.5%	+44.0%
Aviation (Aircraft & GSE)	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%	+27.8%
Fires, Anthropogenic	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**+12.7%**	**+0.8%**	**+5.5%**	**+5.6%**	**+2.4%**	**+0.8%**	**+0.1%**

	Valdez-Cordova Census Area						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	11,147	6,665	631	6,279	1,974	23	0
Non-Road	30	416	34	3	3	0	0
On-Road	7	106	3	0	0	0	1
Point	1,142	302	811	42	0	310	0
Commercial Marine Vessels (CMV)	66	525	2,286	153	149	1,195	1
Aviation (Aircraft & GSE)	16	330	6	9	8	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**12,406**	**8,345**	**3,772**	**6,486**	**2,134**	**1,530**	**2**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Valdez-Cordova Census Area						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	11,071	6,620	627	6,236	1,960	23	0
Non-Road	29	414	34	3	3	0	0
On-Road	7	106	3	0	0	0	1
Point	1,058	370	1,045	51	1	464	0
Commercial Marine Vessels (CMV)	114	878	3,245	223	606	107	2
Aviation (Aircraft & GSE)	16	328	6	9	8	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**12,294**	**8,715**	**4,959**	**6,522**	**2,578**	**596**	**3**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Valdez-Cordova Census Area						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-
Non-Road	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
On-Road	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
Point	-7.4%	+22.7%	+28.9%	+22.8%	+61.0%	+49.8%	-
Commercial Marine Vessels (CMV)	+73.2%	+67.2%	+41.9%	+45.2%	+307.1%	-91.1%	+54.3%
Aviation (Aircraft & GSE)	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%	-0.7%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-0.9%**	**+4.4%**	**+31.5%**	**+0.6%**	**+20.8%**	**-61.1%**	**+29.2%**

Inventory Sector	Wade Hampton Census Area 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	10,792	6,201	419	5,970	1,859	19	0
Non-Road	205	2,716	199	4	4	2	0
On-Road	22	153	15	0	0	0	0
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	2	38	4	0	0	0	0
Aviation (Aircraft & GSE)	12	209	4	6	5	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	9	187	4	18	16	1	1
TOTAL - All Sources	**11,042**	**9,505**	**645**	**5,998**	**1,884**	**24**	**1**
Anthropogenic Fraction	**99.9%**	**98.0%**	**99.4%**	**99.7%**	**99.2%**	**95.3%**	**42.3%**

Inventory Sector	Wade Hampton Census Area 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	13,073	7,512	508	7,231	2,252	23	0
Non-Road	248	3,290	241	5	5	2	0
On-Road	26	185	18	0	0	0	0
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	3	55	4	0	0	0	0
Aviation (Aircraft & GSE)	14	254	5	7	7	1	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	9	187	4	18	16	1	1
TOTAL - All Sources	**13,373**	**11,483**	**780**	**7,262**	**2,279**	**28**	**2**
Anthropogenic Fraction	**99.9%**	**98.4%**	**99.5%**	**99.7%**	**99.3%**	**96.0%**	**47.3%**

Inventory Sector	Wade Hampton Census Area Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%	-
Non-Road	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%
On-Road	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%
Point	-	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+20.8%	+43.9%	+11.7%	-2.6%	-2.6%	-96.9%	+43.7%
Aviation (Aircraft & GSE)	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%	+21.1%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**+21.1%**	**+20.8%**	**+20.9%**	**+21.1%**	**+21.0%**	**+18.2%**	**+9.4%**

	Wrangell-Petersburg Census Area						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	984	616	201	1,274	323	21	0
Non-Road	93	667	84	8	8	1	0
On-Road	90	1,054	101	3	2	4	3
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	14	147	519	20	19	173	0
Aviation (Aircraft & GSE)	17	271	6	8	8	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**1,197**	**2,755**	**911**	**1,314**	**361**	**200**	**4**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Wrangell-Petersburg Census Area						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	862	540	177	1,117	284	18	0
Non-Road	81	585	74	7	7	0	0
On-Road	34	544	34	1	1	0	3
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	21	207	619	28	27	6	0
Aviation (Aircraft & GSE)	15	238	5	7	7	2	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**1,013**	**2,114**	**909**	**1,161**	**326**	**27**	**3**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Wrangell-Petersburg Census Area						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-12.3%	-12.3%	-12.2%	-12.4%	-12.3%	-13.7%	-
Non-Road	-12.3%	-12.3%	-12.3%	-8.9%	-12.3%	-12.3%	-12.3%
On-Road	-62.0%	-48.4%	-65.7%	-48.3%	-60.7%	-90.9%	-11.8%
Point	-	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+44.2%	+40.1%	+19.3%	+39.2%	+39.2%	-96.3%	+40.5%
Aviation (Aircraft & GSE)	-12.3%	-12.3%	-12.3%	-12.3%	-12.3%	-12.3%	-12.3%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-15.4%**	**-23.3%**	**-0.2%**	**-11.6%**	**-9.8%**	**-86.7%**	**-7.9%**

	Yakutat City and Borough						
	2002 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	579	331	14	498	126	1	0
Non-Road	40	253	13	1	1	0	0
On-Road	8	69	9	0	0	0	0
Point	3	28	106	4	0	8	0
Commercial Marine Vessels (CMV)	1	20	9	0	0	2	0
Aviation (Aircraft & GSE)	4	81	1	2	2	0	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**636**	**782**	**152**	**505**	**130**	**12**	**0**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Yakutat City and Borough						
	2018 Annual Emissions (tons/year)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	510	291	12	438	111	1	0
Non-Road	35	222	12	1	1	0	0
On-Road	7	61	7	0	0	0	0
Point	3	28	106	4	0	8	0
Commercial Marine Vessels (CMV)	1	29	10	0	0	0	0
Aviation (Aircraft & GSE)	3	72	1	2	2	0	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	0	0	0	0	0	0	0
TOTAL - All Sources	**560**	**703**	**148**	**445**	**114**	**9**	**0**
Anthropogenic Fraction	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

	Yakutat City and Borough						
	Annual Emissions Percentage Change (2002 to 2018)						
Inventory Sector	HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%	-
Non-Road	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%
On-Road	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%
Point	-0.0%	+0.0%	+0.0%	-0.0%	-	+0.0%	-
Commercial Marine Vessels (CMV)	+20.4%	+42.6%	+3.5%	-2.4%	-2.4%	-97.0%	+40.9%
Aviation (Aircraft & GSE)	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%	-12.0%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	-	-	-	-	-	-	-
TOTAL - All Sources	**-11.9%**	**-10.1%**	**-2.6%**	**-11.9%**	**-12.0%**	**-20.1%**	**-9.7%**

Inventory Sector	Yukon Koyukuk Census Area 2002 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	8,817	6,478	379	6,793	2,040	37	0
Non-Road	191	1,791	87	12	11	1	0
On-Road	6	66	3	0	0	0	0
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	0	3	2	0	0	0	0
Aviation (Aircraft & GSE)	66	1,319	28	35	34	7	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	251,133	5,336,578	114,487	492,960	422,788	31,392	24,005
TOTAL - All Sources	**260,212**	**5,346,234**	**114,986**	**499,800**	**424,872**	**31,438**	**24,007**
Anthropogenic Fraction	**3.5%**	**0.2%**	**0.4%**	**1.4%**	**0.5%**	**0.1%**	**0.0%**

Inventory Sector	Yukon Koyukuk Census Area 2018 Annual Emissions (tons/year) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	7,862	5,776	338	6,057	1,819	33	0
Non-Road	170	1,597	78	10	10	1	0
On-Road	5	59	2	0	0	0	0
Point	0	0	0	0	0	0	0
Commercial Marine Vessels (CMV)	0	5	2	0	0	0	0
Aviation (Aircraft & GSE)	59	1,176	25	31	30	6	0
Fires, Anthropogenic	0	0	0	0	0	0	0
Fires, Natural	251,133	5,336,578	114,487	492,960	422,788	31,392	24,005
TOTAL - All Sources	**259,229**	**5,345,191**	**114,932**	**499,060**	**424,647**	**31,433**	**24,006**
Anthropogenic Fraction	**3.1%**	**0.2%**	**0.4%**	**1.2%**	**0.4%**	**0.1%**	**0.0%**

Inventory Sector	Yukon Koyukuk Census Area Annual Emissions Percentage Change (2002 to 2018) HC	CO	NOx	PM10	PM2.5	SOx	NH3
Area, Excluding Fires	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%	-
Non-Road	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%
On-Road	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%
Point	-	-	-	-	-	-	-
Commercial Marine Vessels (CMV)	+20.1%	+42.2%	-1.5%	-3.0%	-2.9%	-97.1%	+39.6%
Aviation (Aircraft & GSE)	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%	-10.8%
Fires, Anthropogenic	-	-	-	-	-	-	-
Fires, Natural	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%
TOTAL - All Sources	**-0.4%**	**-0.0%**	**-0.0%**	**-0.1%**	**-0.1%**	**-0.0%**	**-0.0%**

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.6
No Appendix- Placeholder

Public Review Draft

October 7th, 2010

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.7
Air Quality Modeling of Source Regions

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

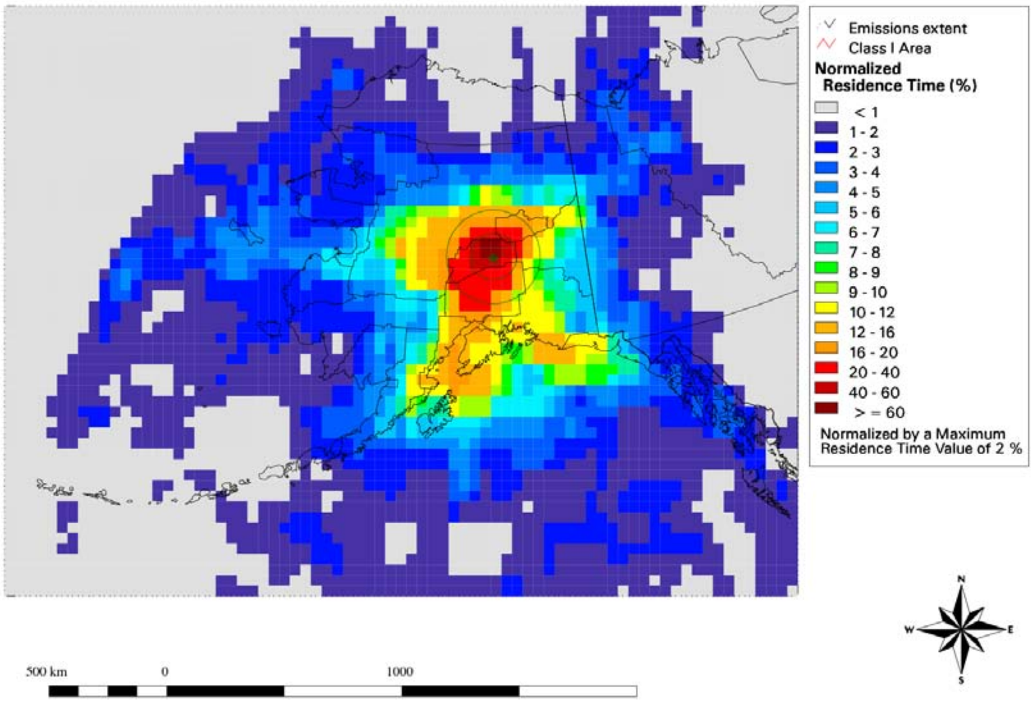
APPENDIX III.K.7

Air Quality Modeling of Source Regions

Denali National Park, AK

Normalized Back-Trajectory Residence Time

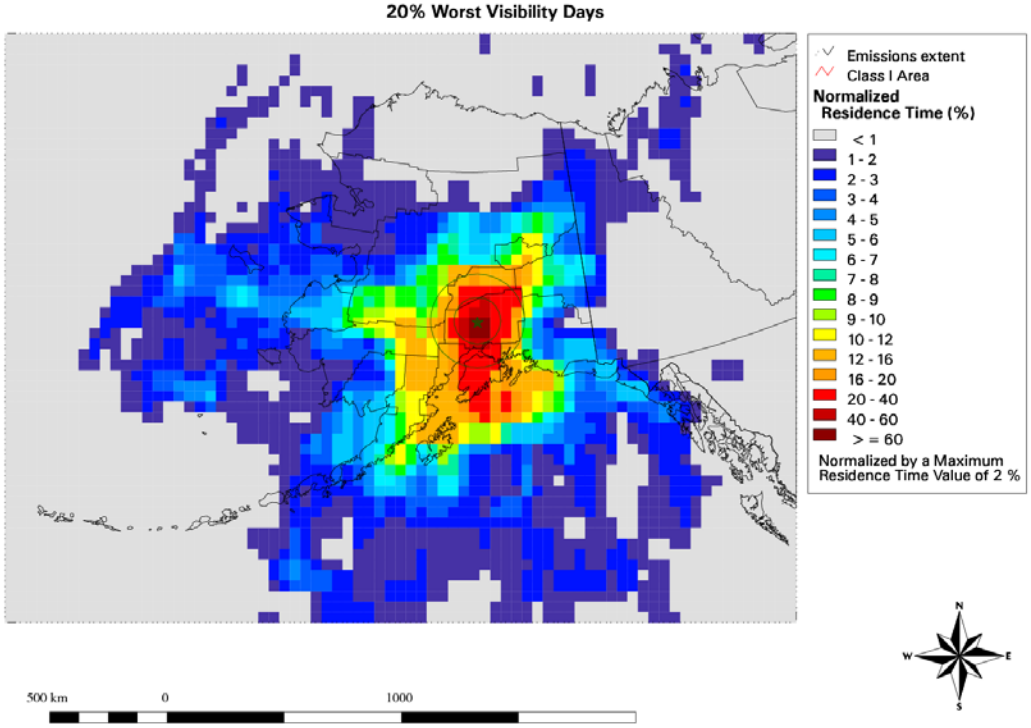
20% Worst Visibility Days



Trapper Creek Wilderness, AK

Normalized Back-Trajectory Residence Time

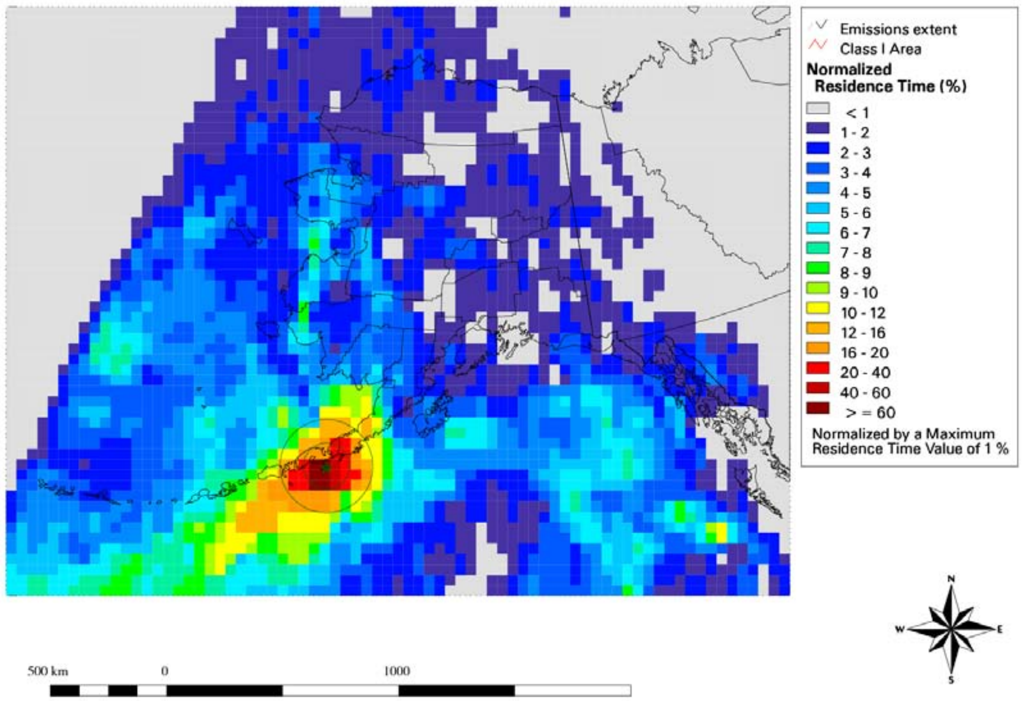
20% Worst Visibility Days



Simeonof Wilderness, AK

Normalized Back-Trajectory Residence Time

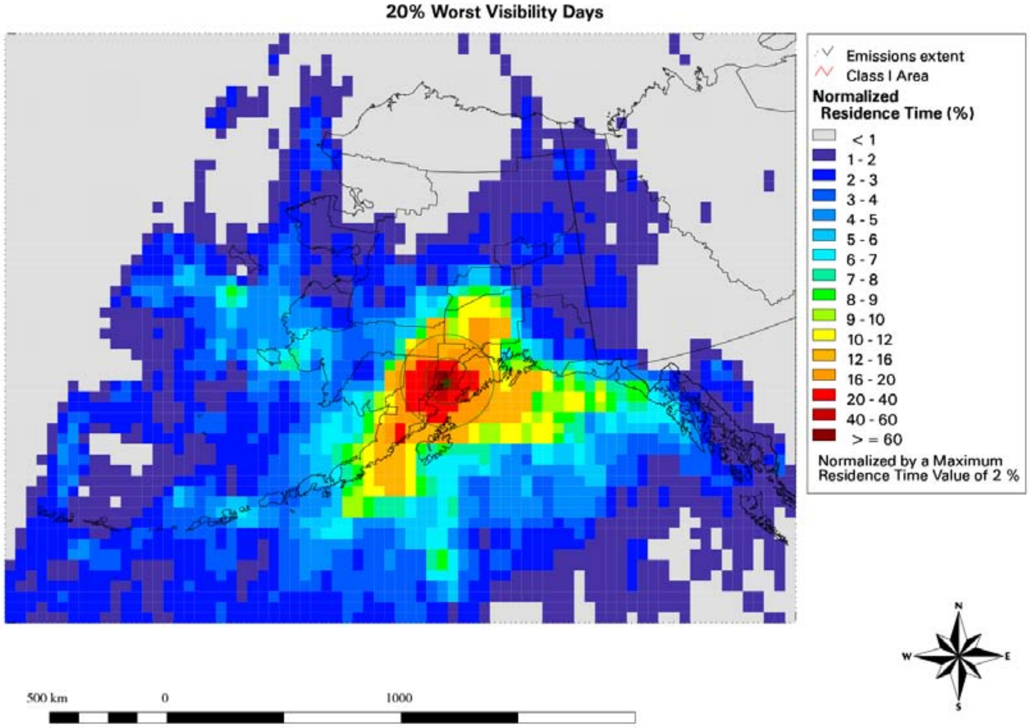
20% Worst Visibility Days



Tuxedni Wilderness, AK

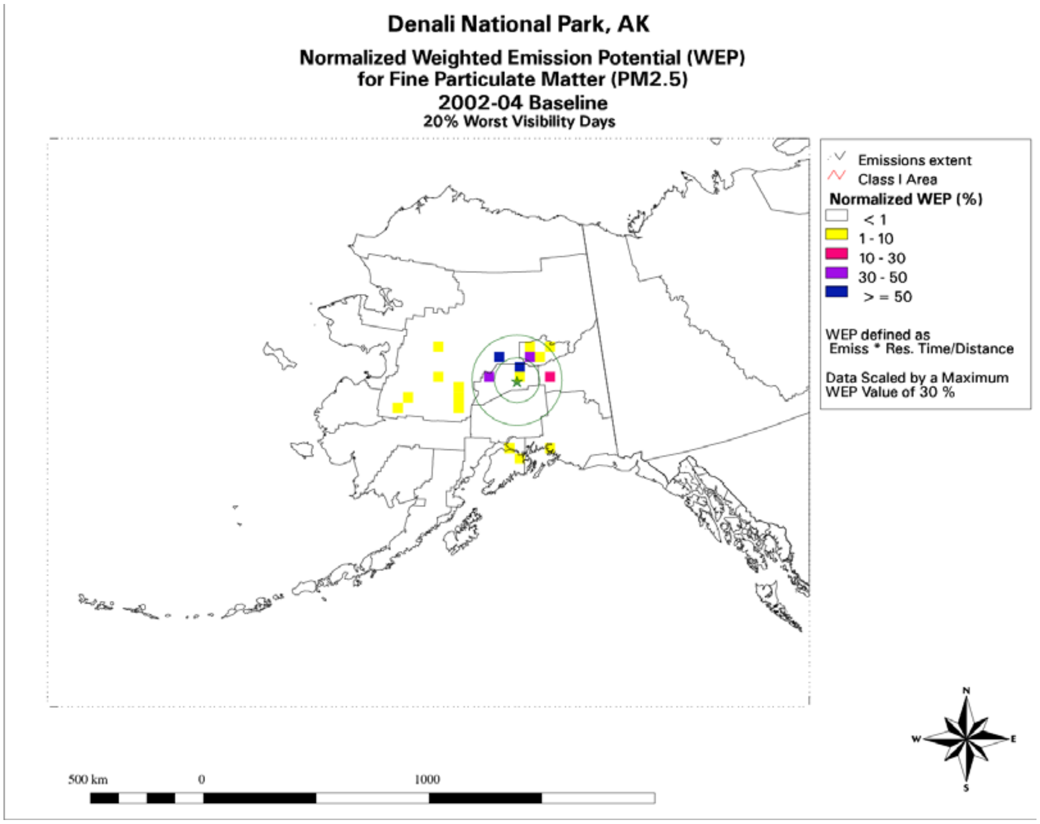
Normalized Back-Trajectory Residence Time

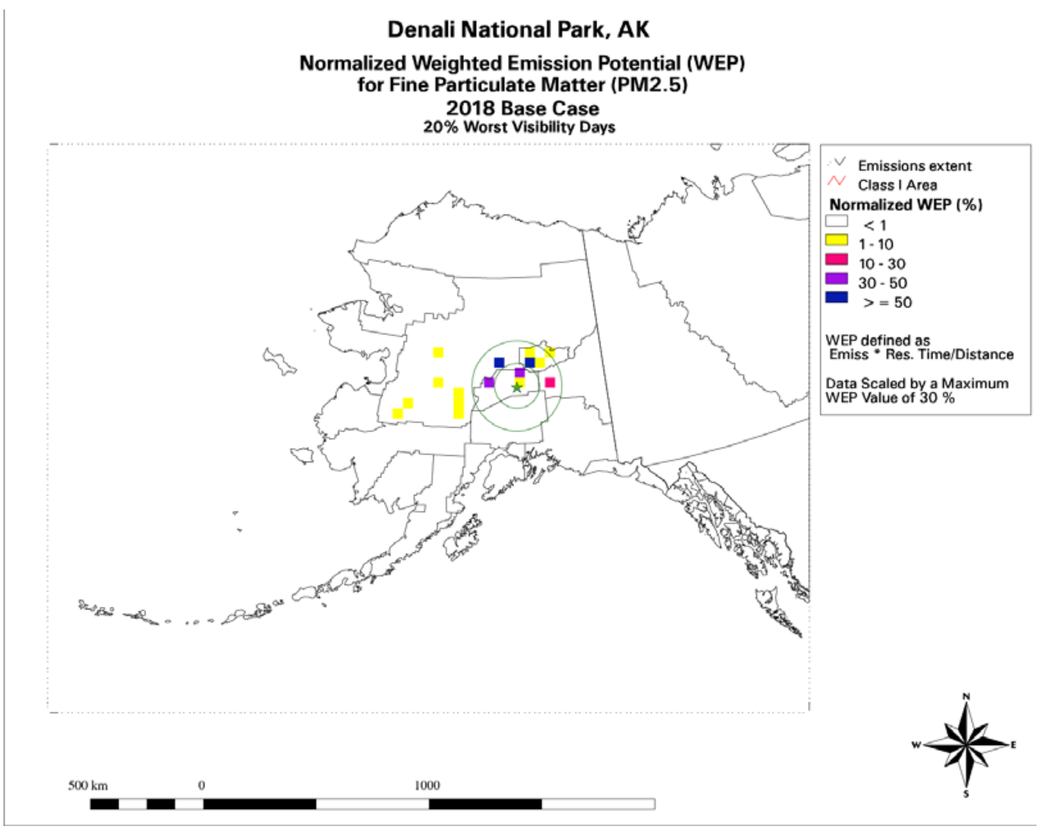
20% Worst Visibility Days

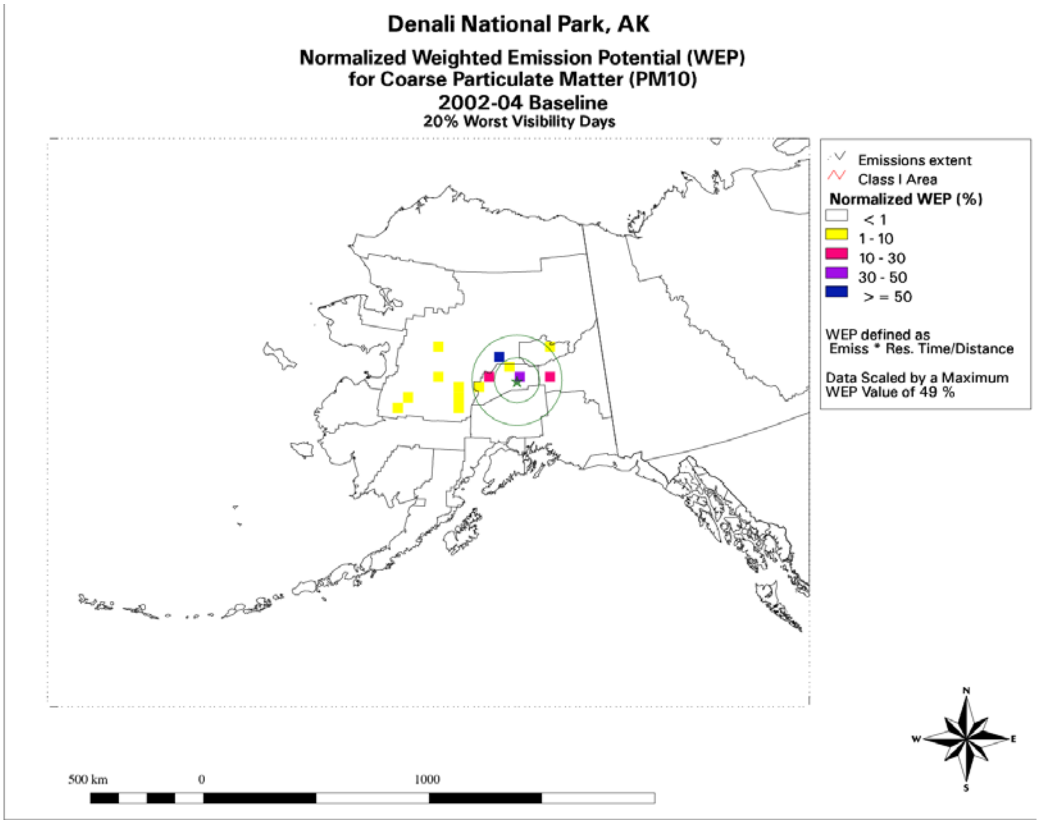


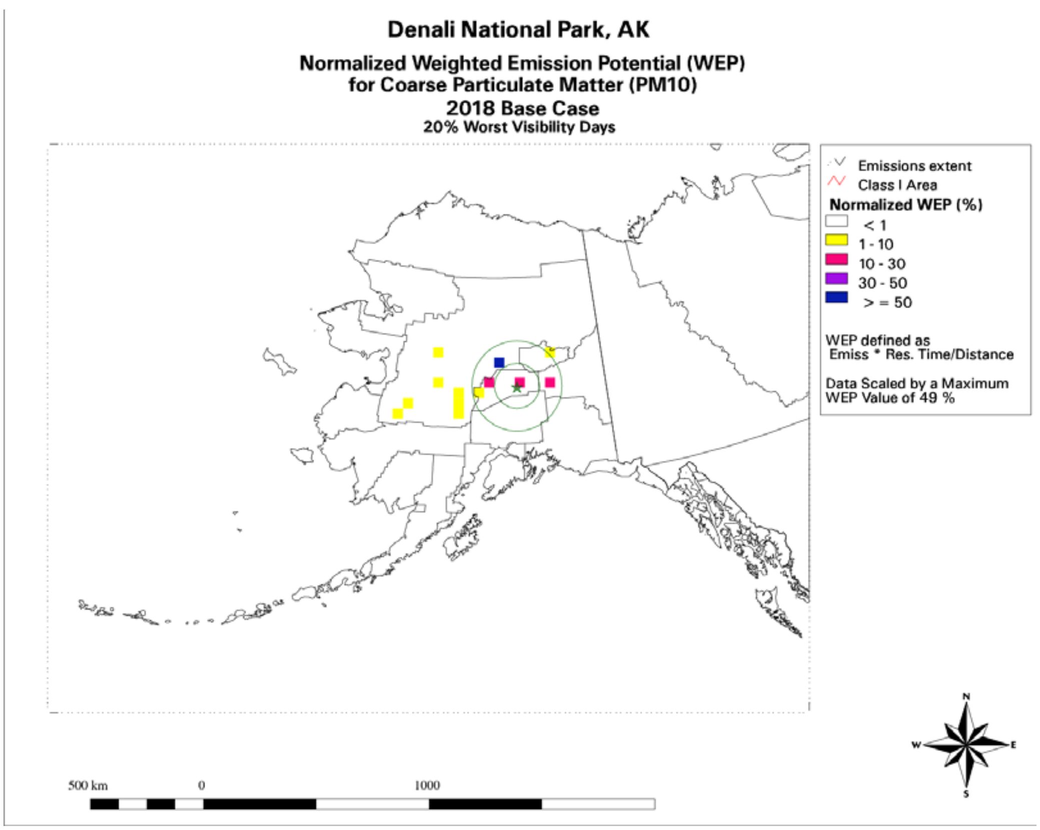
Weighted Emissions Potential Analysis Maps

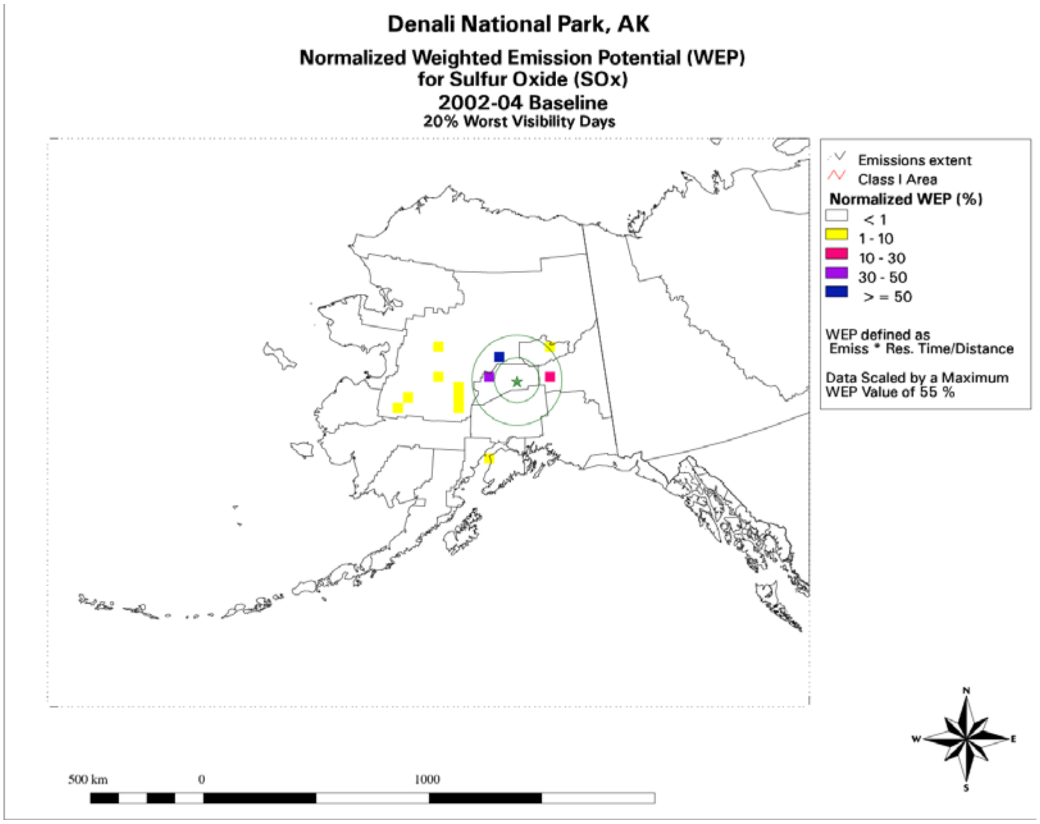
DENALI NATIONAL PARK

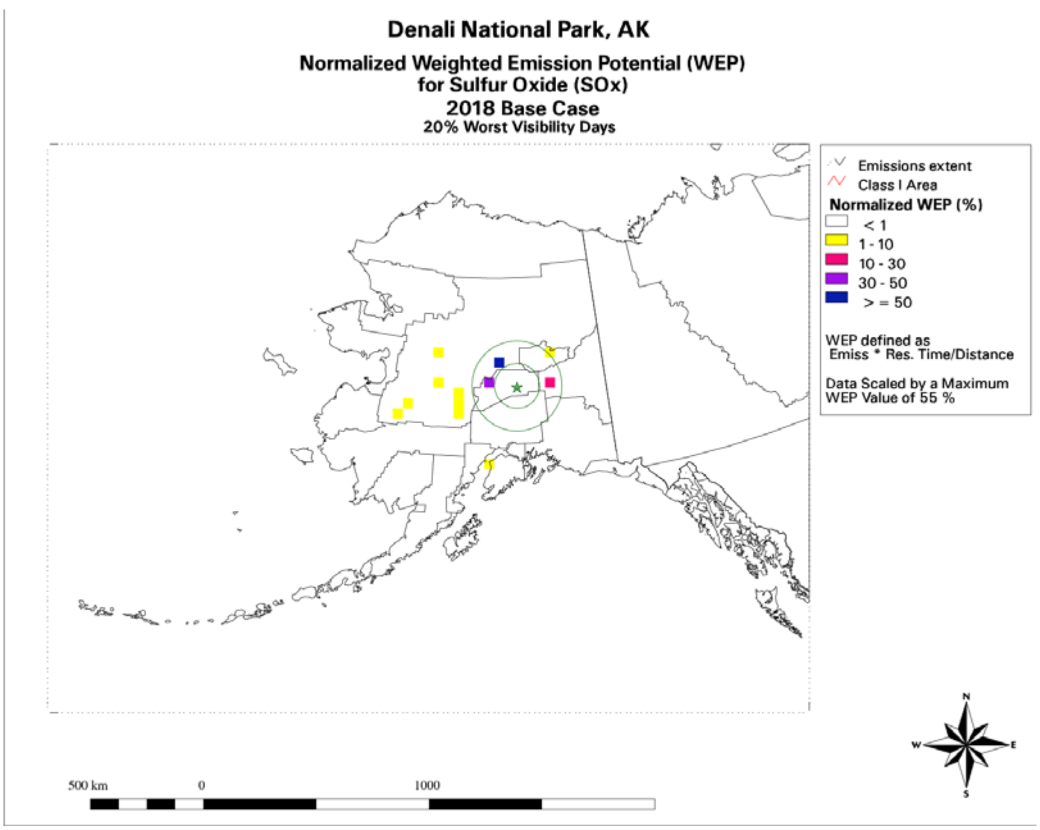

Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Fine Particulate Matter (PM2.5)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 30 %
N
W
E
S
500 km
0
1000

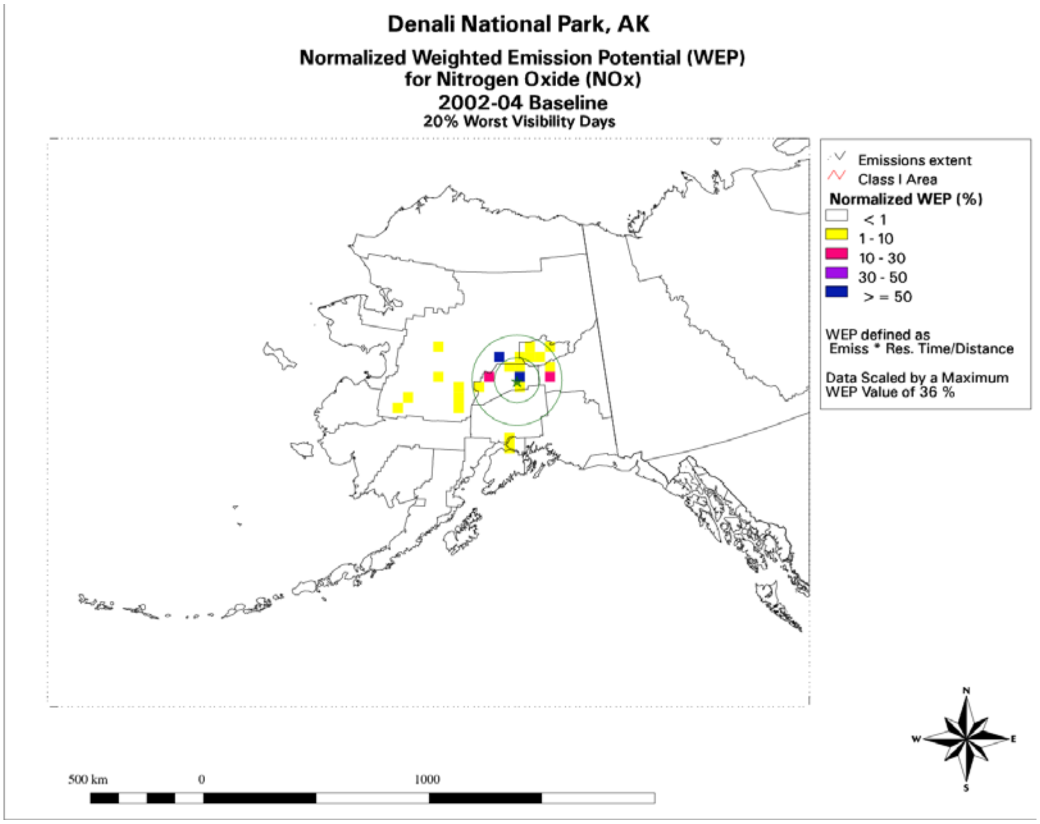

Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Fine Particulate Matter (PM2.5)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 30 %
N
W
E
S
500 km
0
1000


Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Coarse Particulate Matter (PM10)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 49 %
500 km
0
1000
N
W
E
S

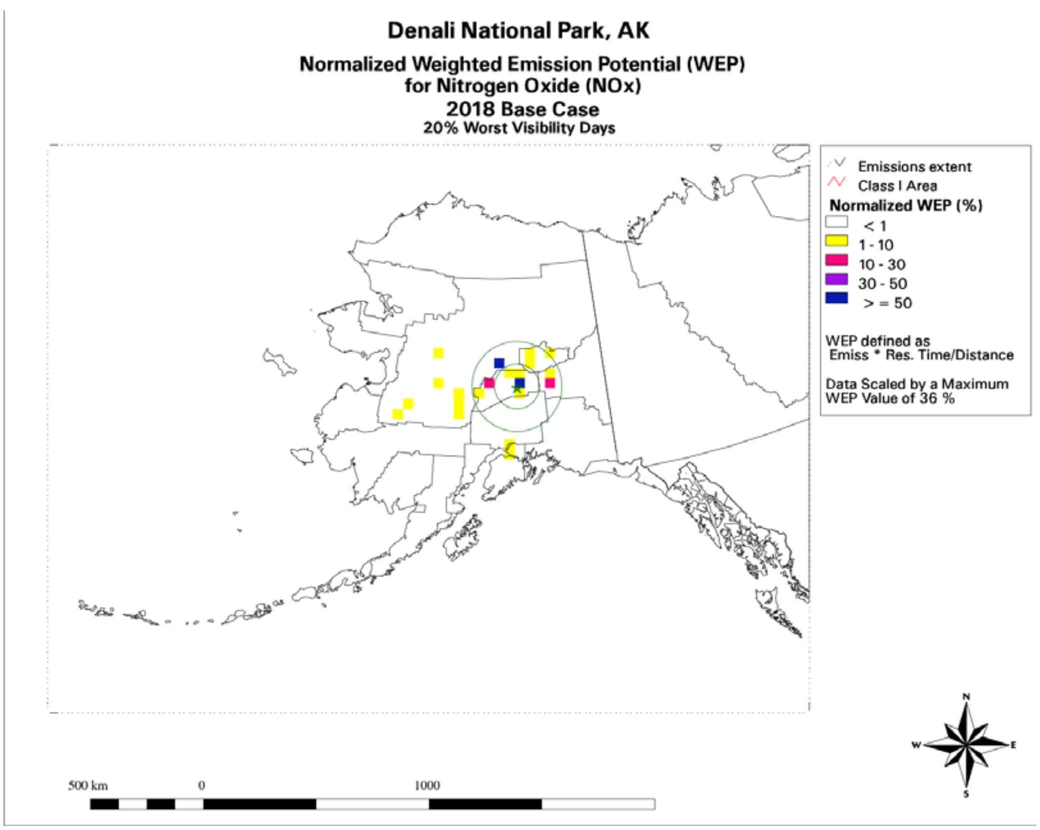

Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Coarse Particulate Matter (PM10)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 49 %
500 km
0
1000
N
W
E
S


Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Sulfur Oxide (SOx)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 55 %
500 km
0
1000
N
W
E
S

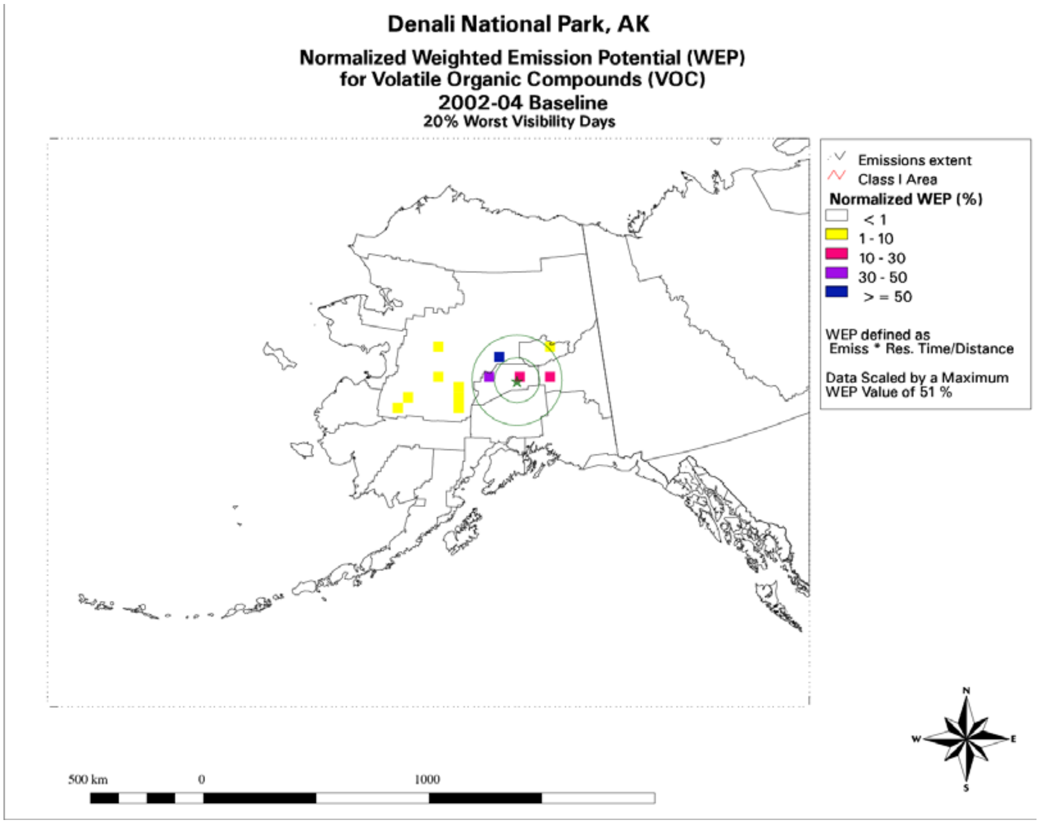

Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Sulfur Oxide (SOx)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 55 %
500 km
0
1000
N
W
E
S

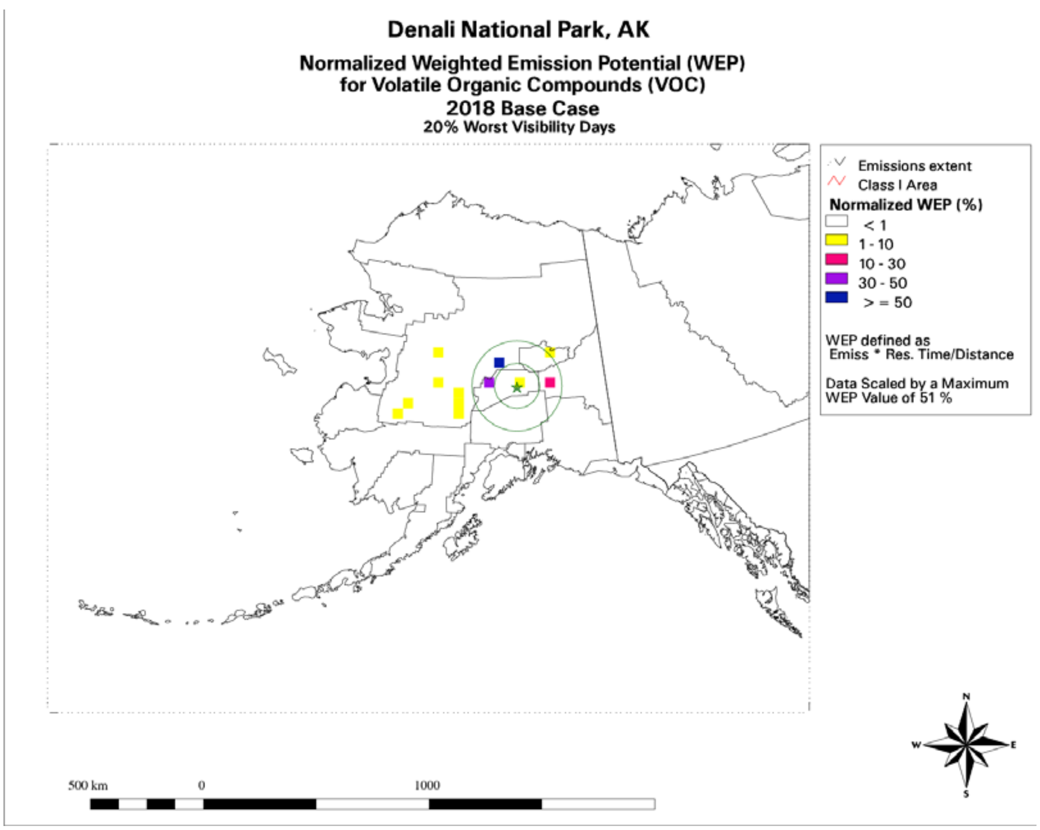


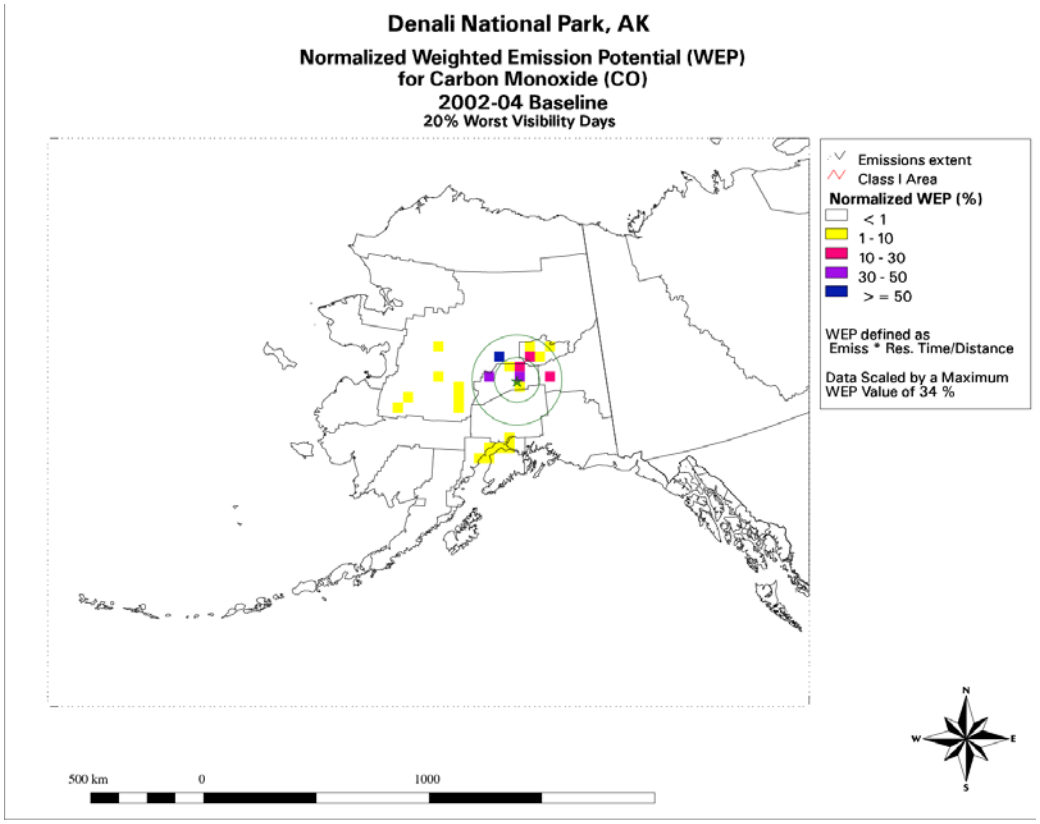
Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Nitrogen Oxide (NOx)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 36 %
N
W
E
S
500 km
0
1000

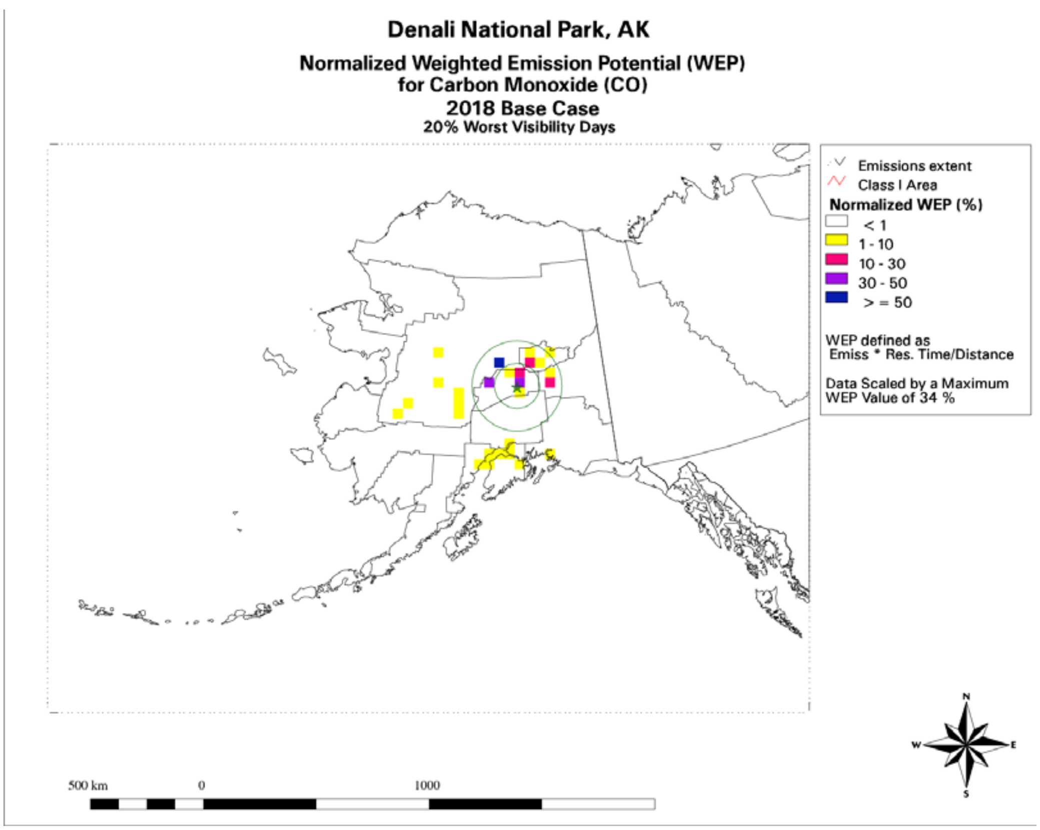


Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Nitrogen Oxide (NOx)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 36 %
N
W
E
S
500 km
0
1000


Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Volatile Organic Compounds (VOC)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 51 %
500 km
0
1000
N
W
E
S


Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Volatile Organic Compounds (VOC)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 51 %
500 km
0
1000
N
W
E
S


Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Carbon Monoxide (CO)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 34 %
500 km
0
1000
N
W
E
S


Denali National Park, AK
Normalized Weighted Emission Potential (WEP)
for Carbon Monoxide (CO)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 34 %
500 km
0
1000
N
W
E
S

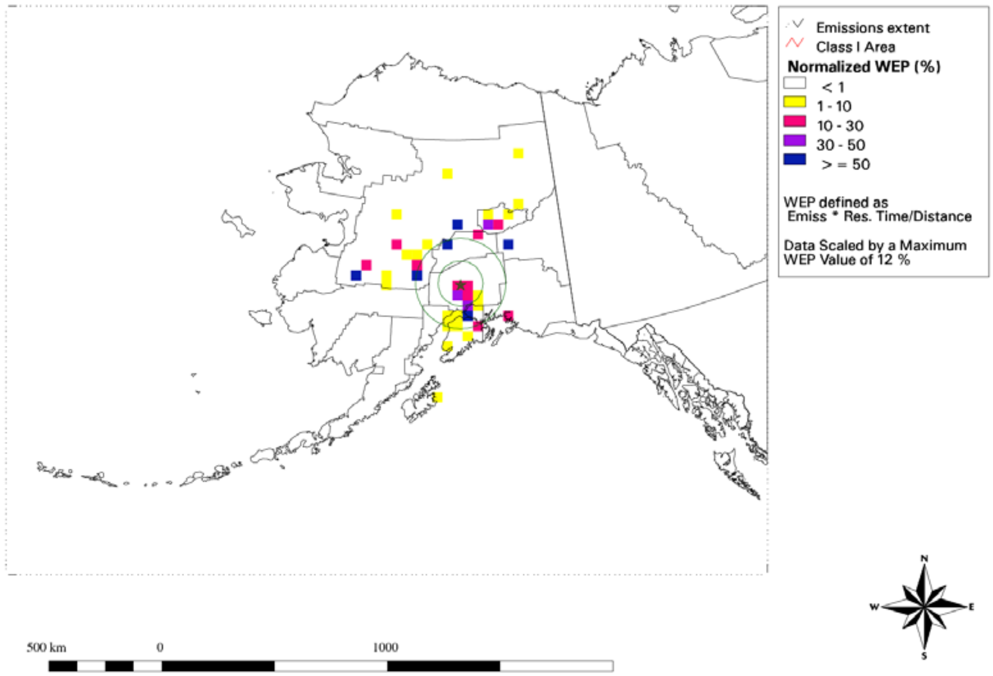
TRAPPER CREEK WILDERNESS

Trapper Creek Wilderness, AK

Normalized Weighted Emission Potential (WEP) for Fine Particulate Matter (PM2.5)

2002-04 Baseline

20% Worst Visibility Days

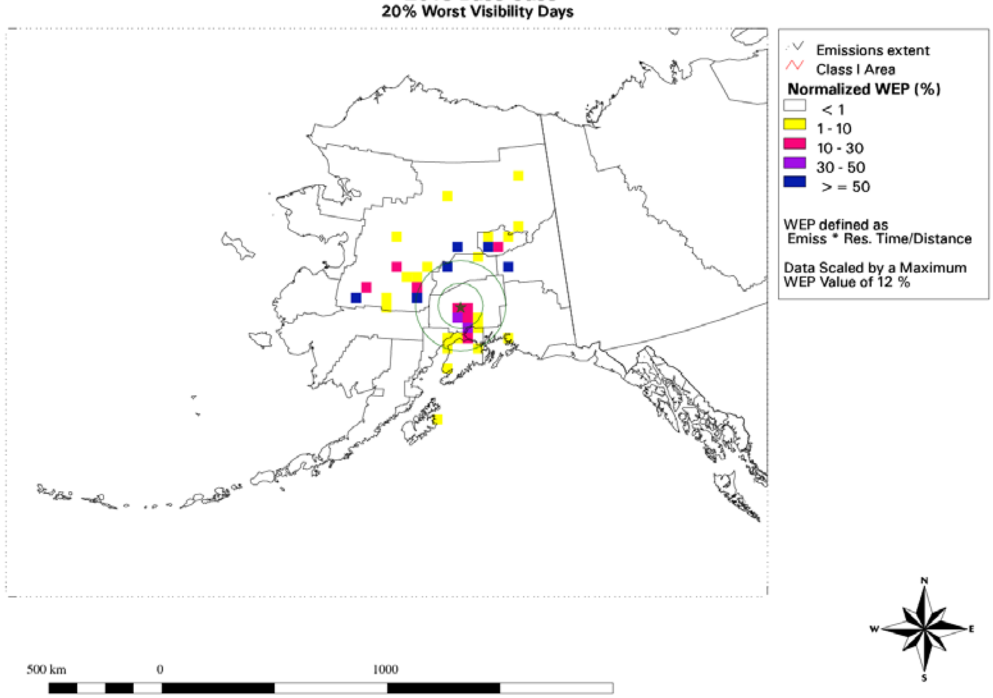


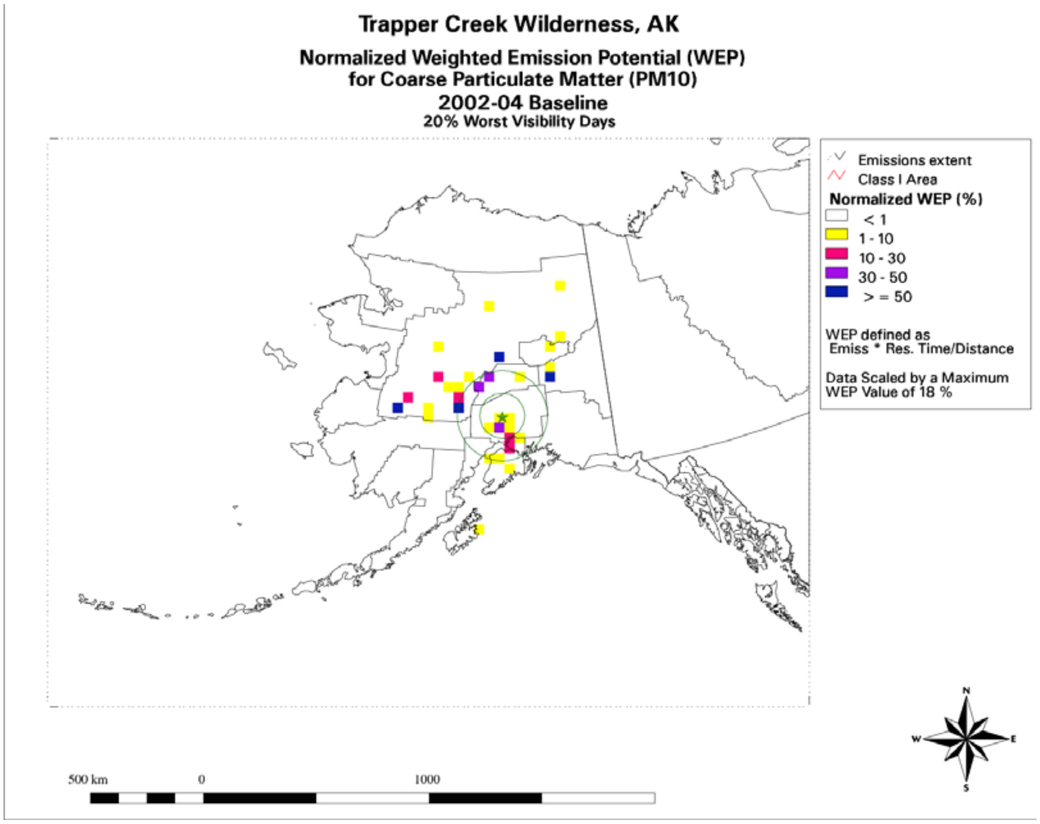
Trapper Creek Wilderness, AK

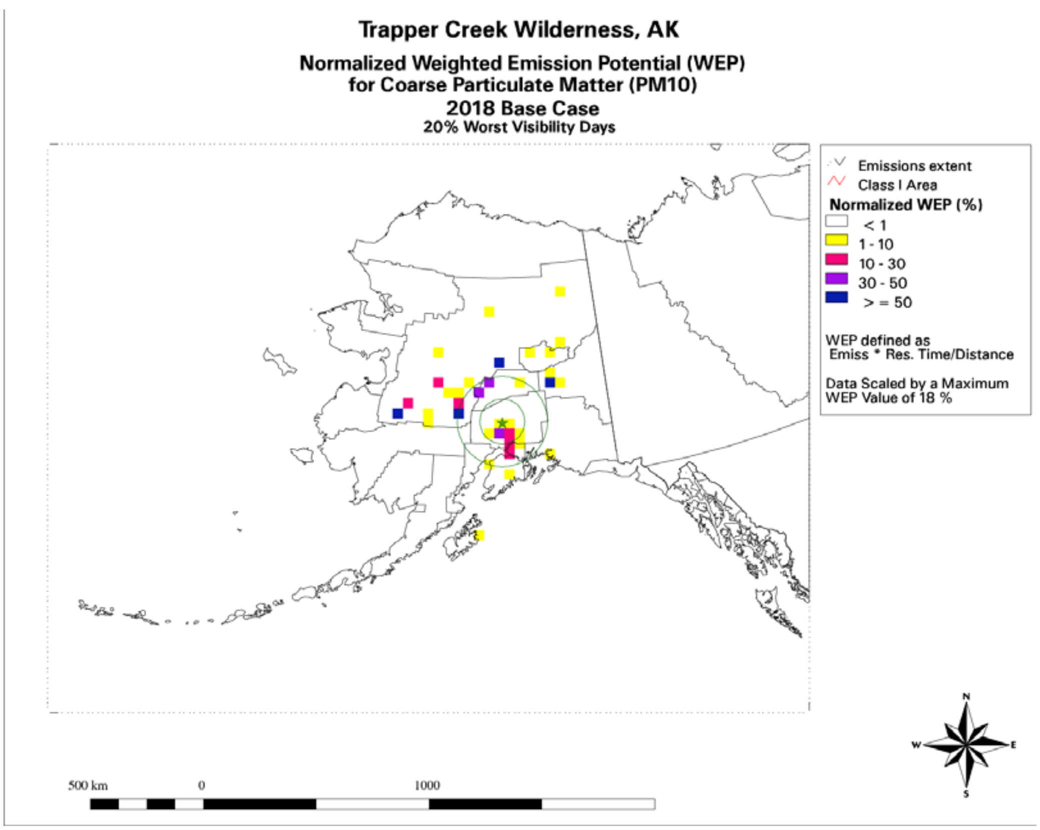
Normalized Weighted Emission Potential (WEP) for Fine Particulate Matter (PM2.5)

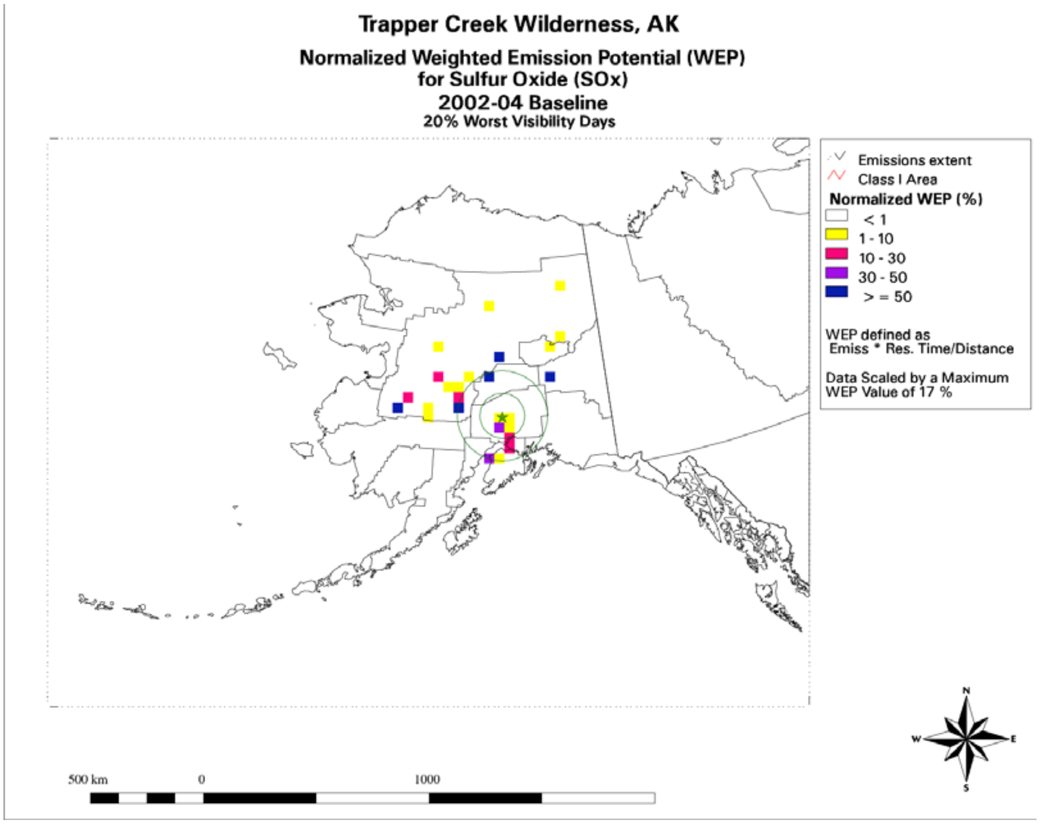
2018 Base Case

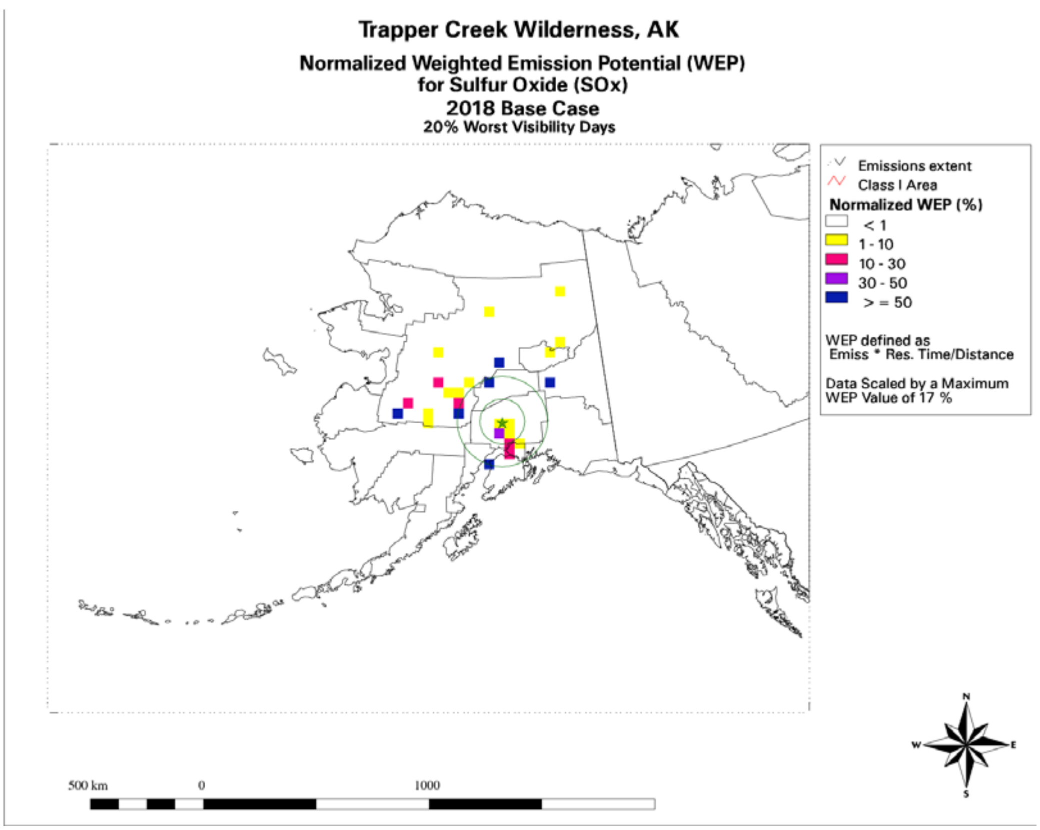
20% Worst Visibility Days

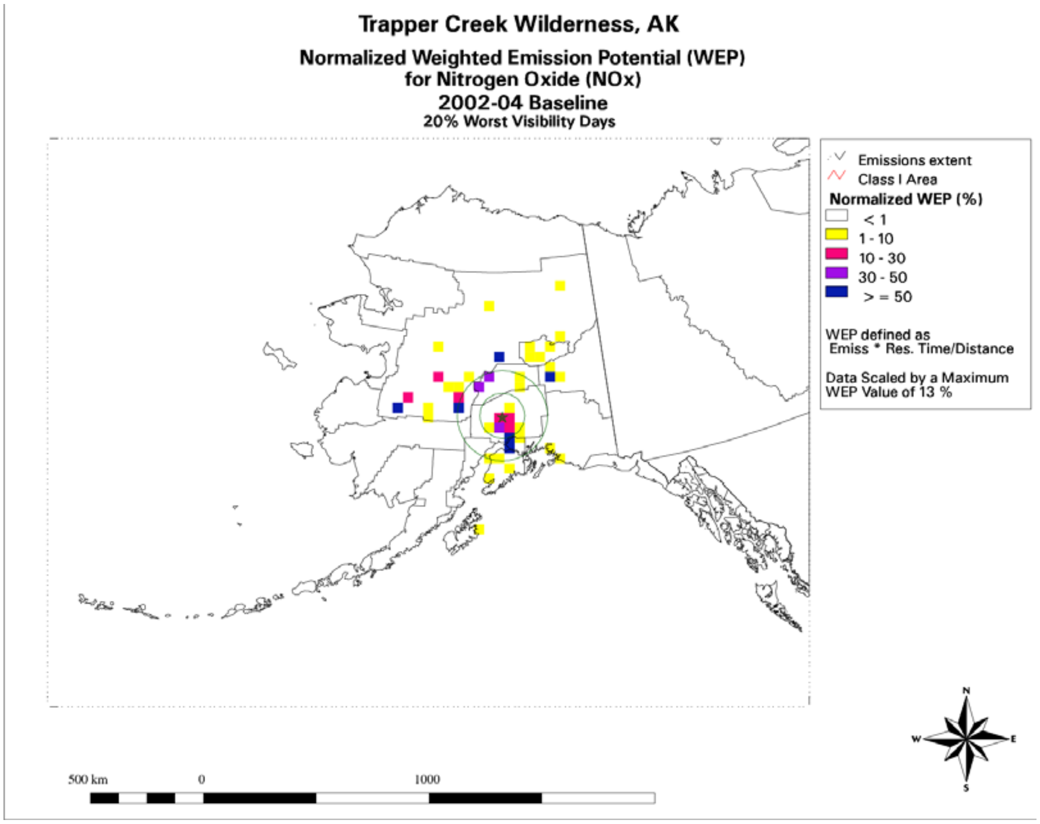


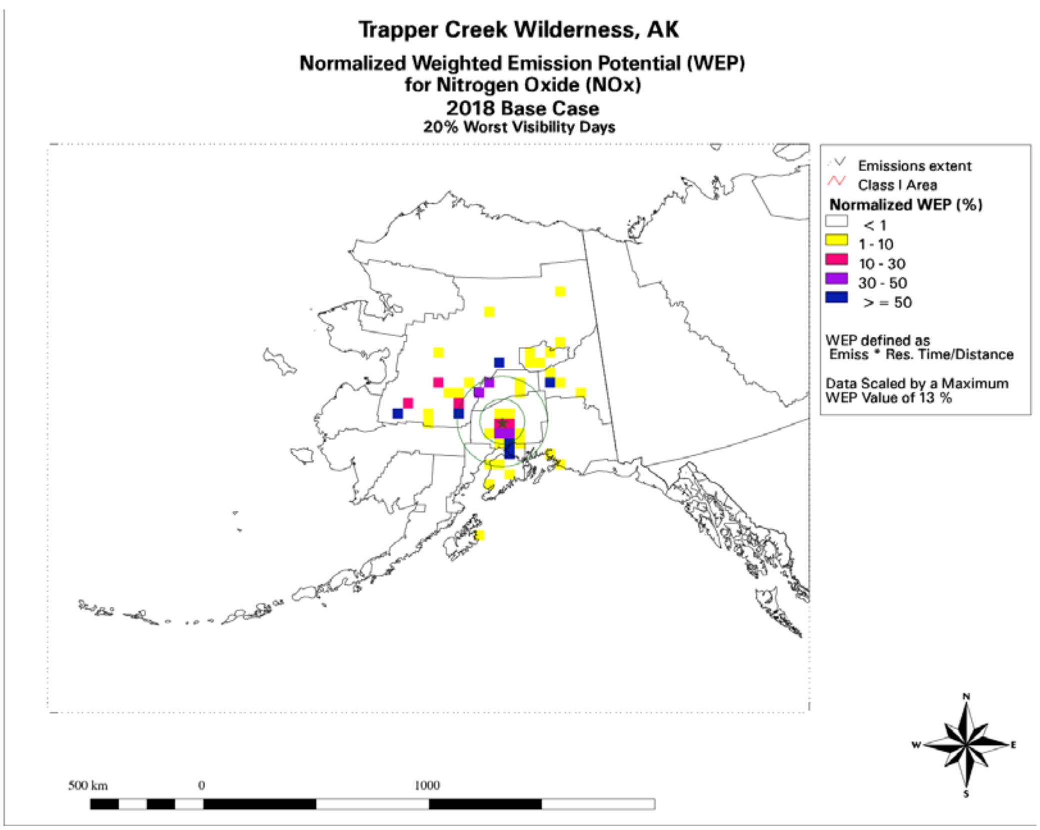

Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Coarse Particulate Matter (PM10)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 18 %
500 km
0
1000
N
W
E
S

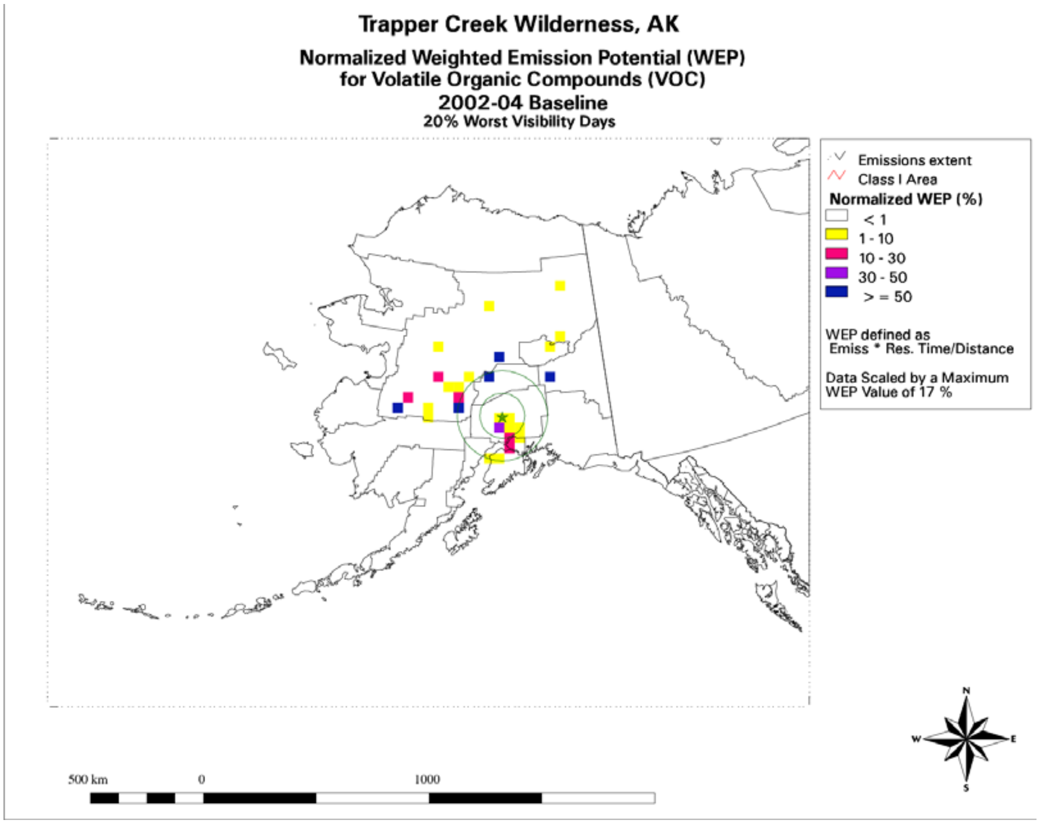

Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Coarse Particulate Matter (PM10)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 18 %
500 km
0
1000
N
W
E
S

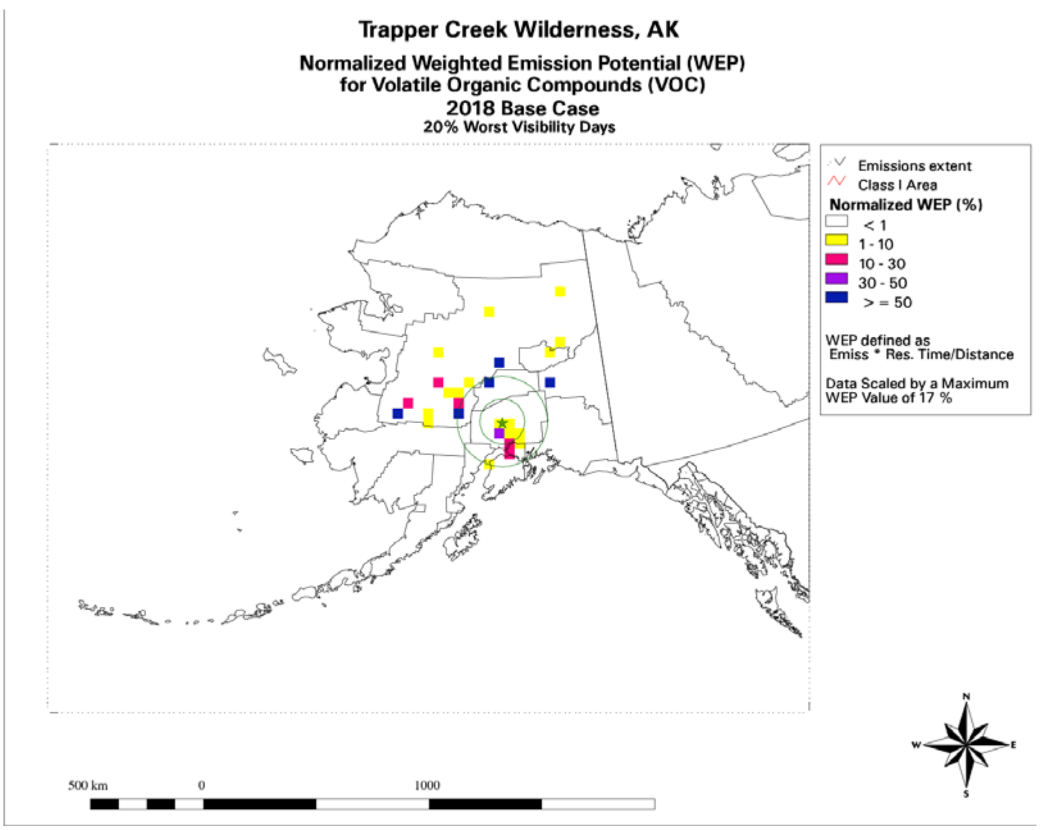

Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Sulfur Oxide (SOx)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
500 km
0
1000

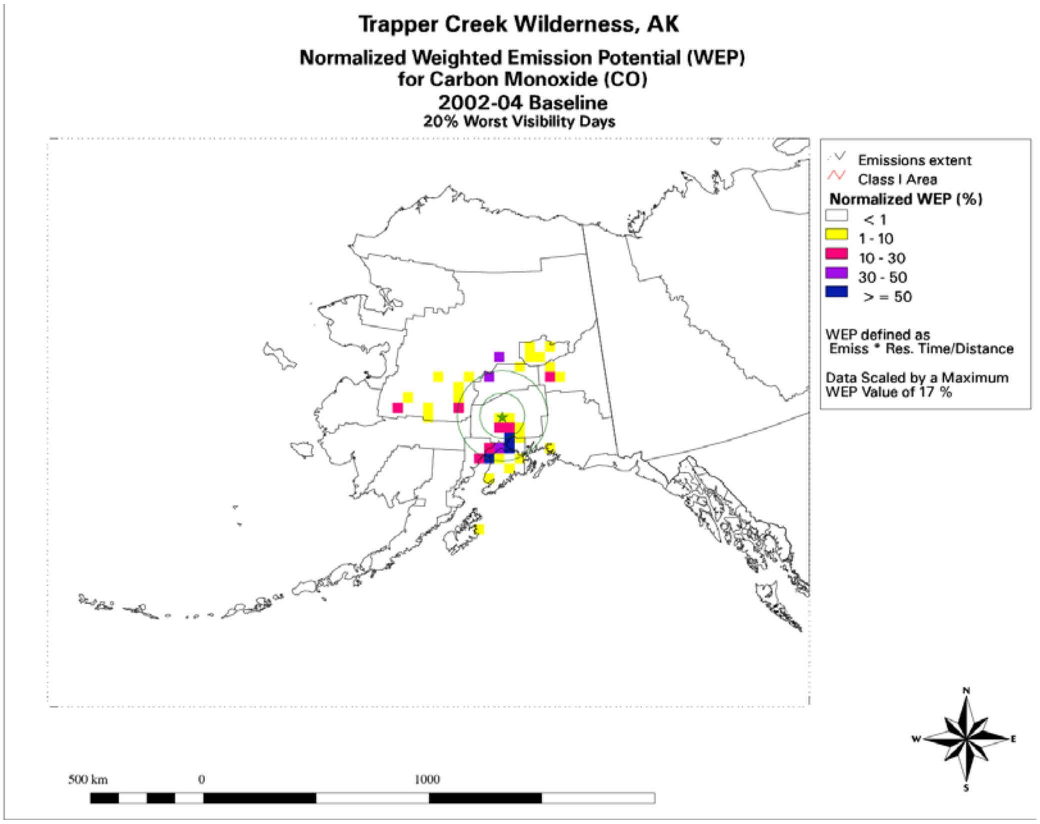

Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Sulfur Oxide (SOx)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
500 km
0
1000

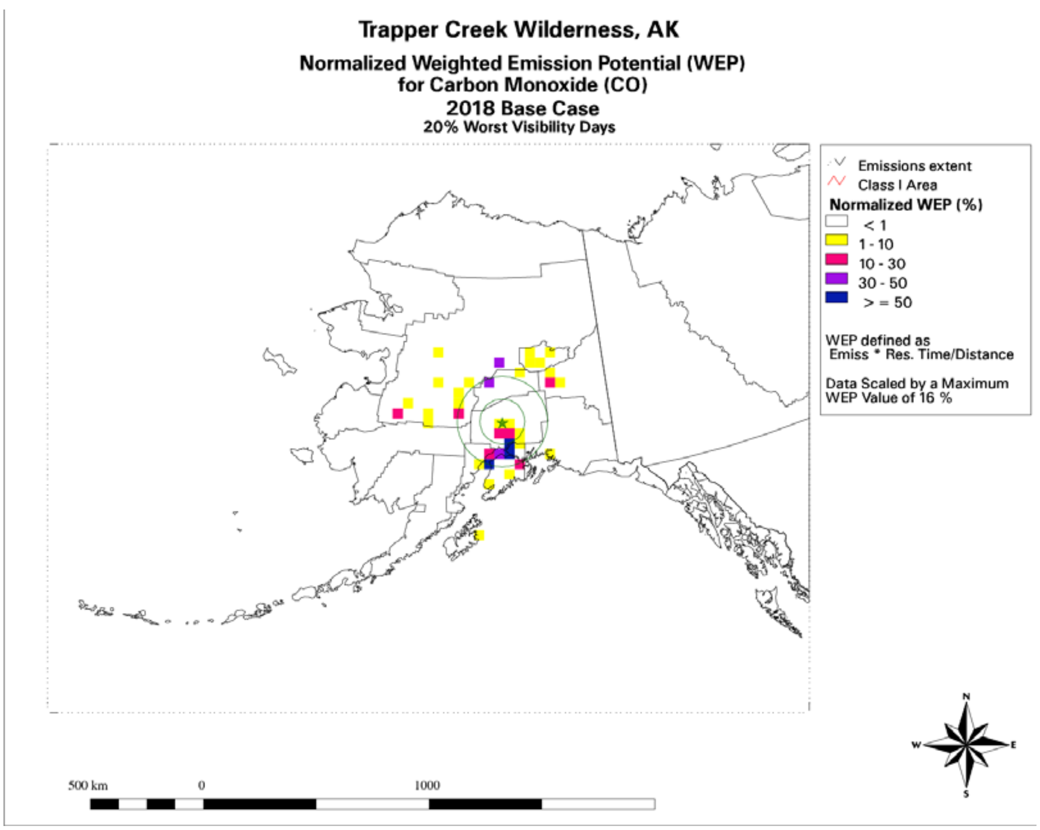

Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Nitrogen Oxide (NOx)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 13 %
500 km
0
1000
N
W
E
S


Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Nitrogen Oxide (NOx)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 13 %
500 km
0
1000
N
W
E
S

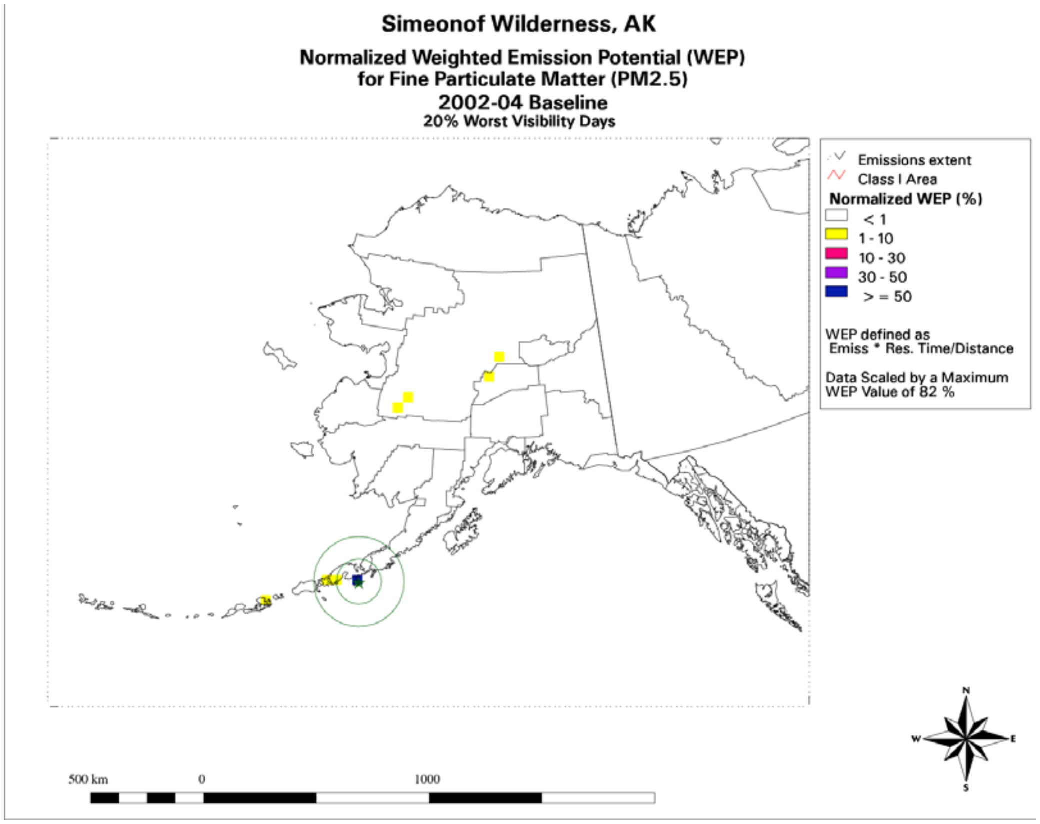

Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Volatile Organic Compounds (VOC)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
500 km
0
1000
N
W
E
S


Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Volatile Organic Compounds (VOC)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
500 km
0
1000
N
W
E
S

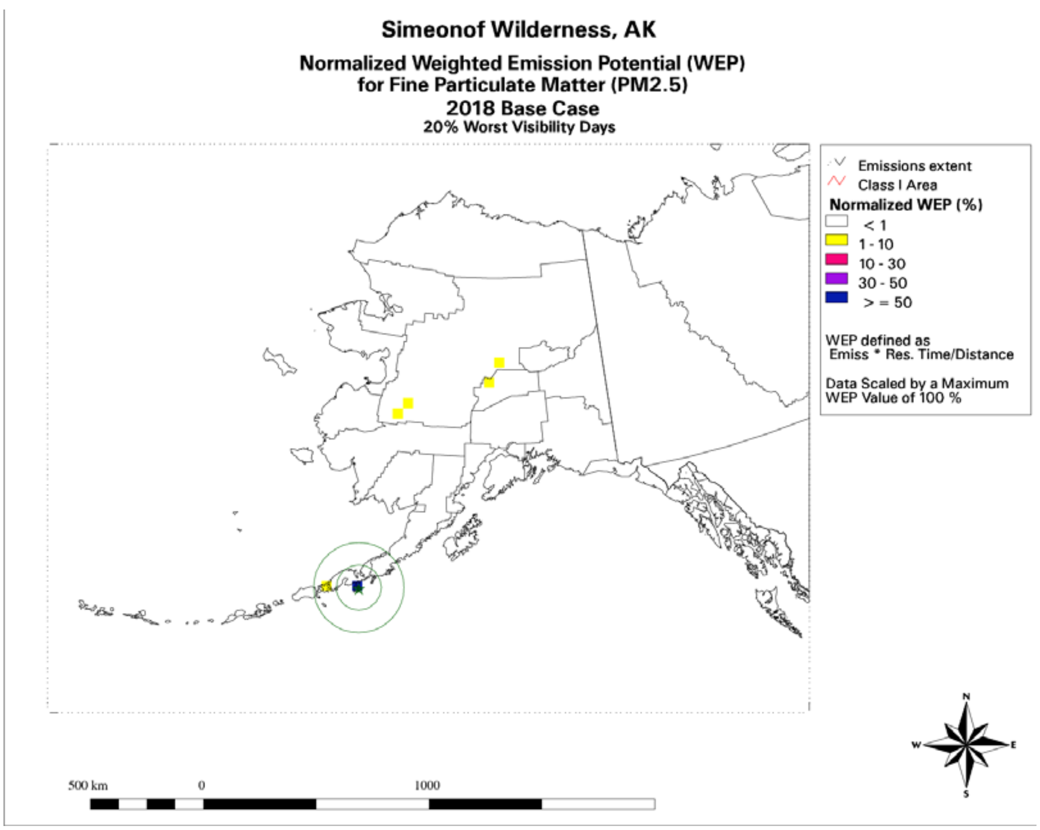

Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Carbon Monoxide (CO)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
N
W
E
S
500 km
0
1000


Trapper Creek Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Carbon Monoxide (CO)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 16 %
N
W
E
S
500 km
0
1000

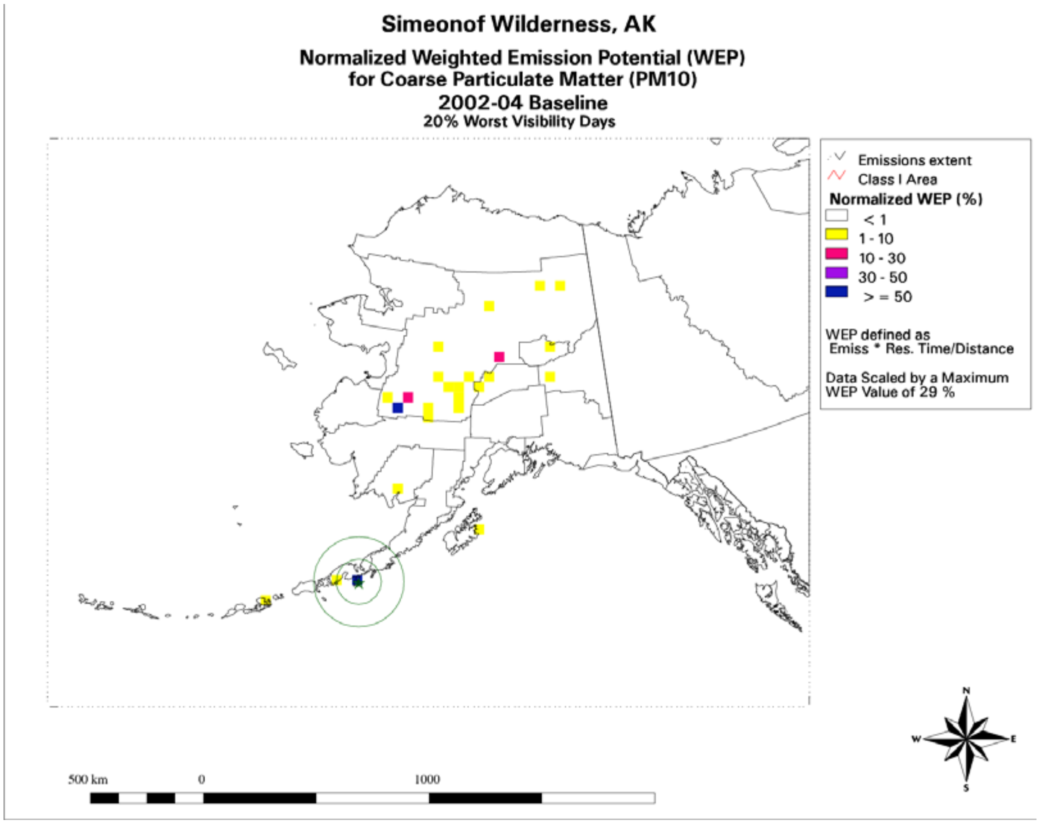
SIMEONOF WILDERNESS



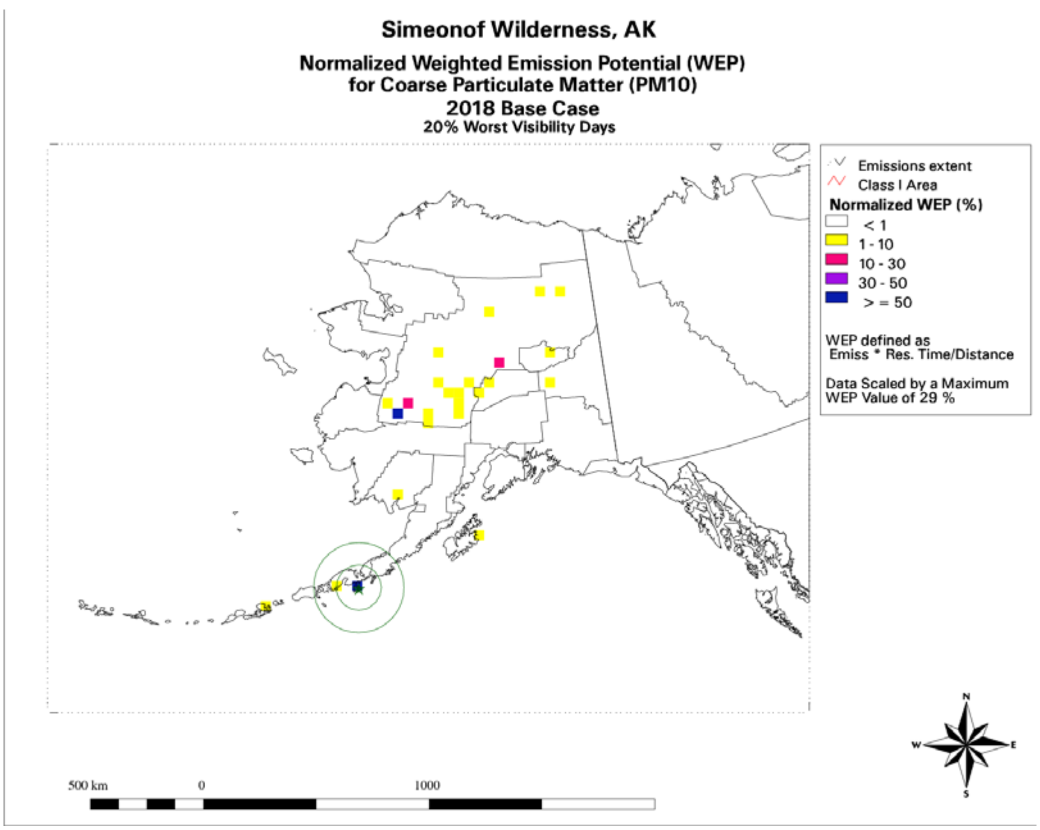
Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Fine Particulate Matter (PM2.5)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 82 %
500 km
0
1000
N
W
E
S



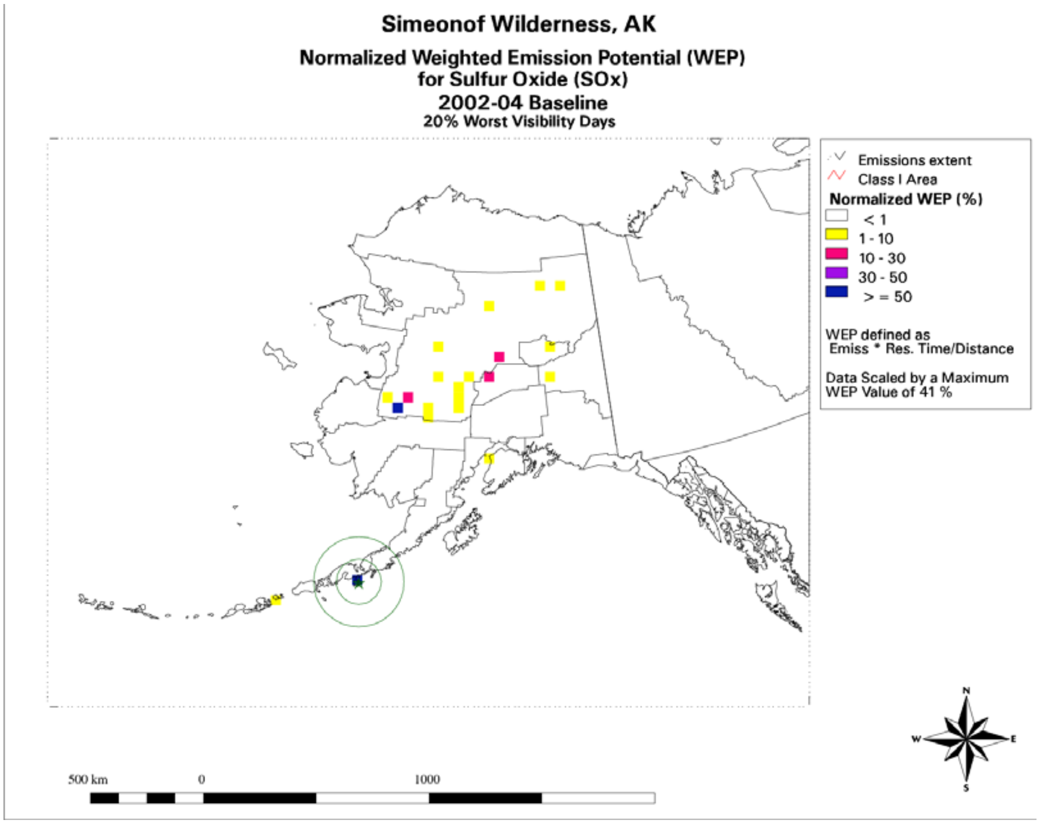
Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Fine Particulate Matter (PM2.5)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 100 %
500 km
0
1000
N
W
E
S

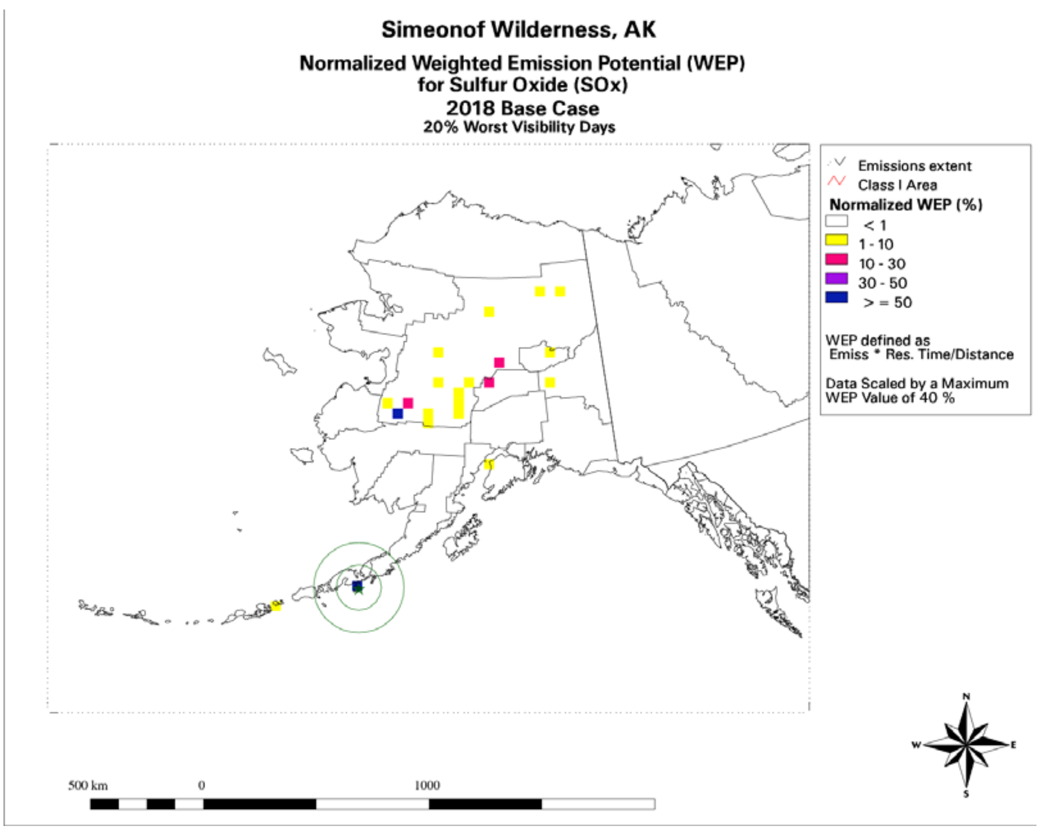


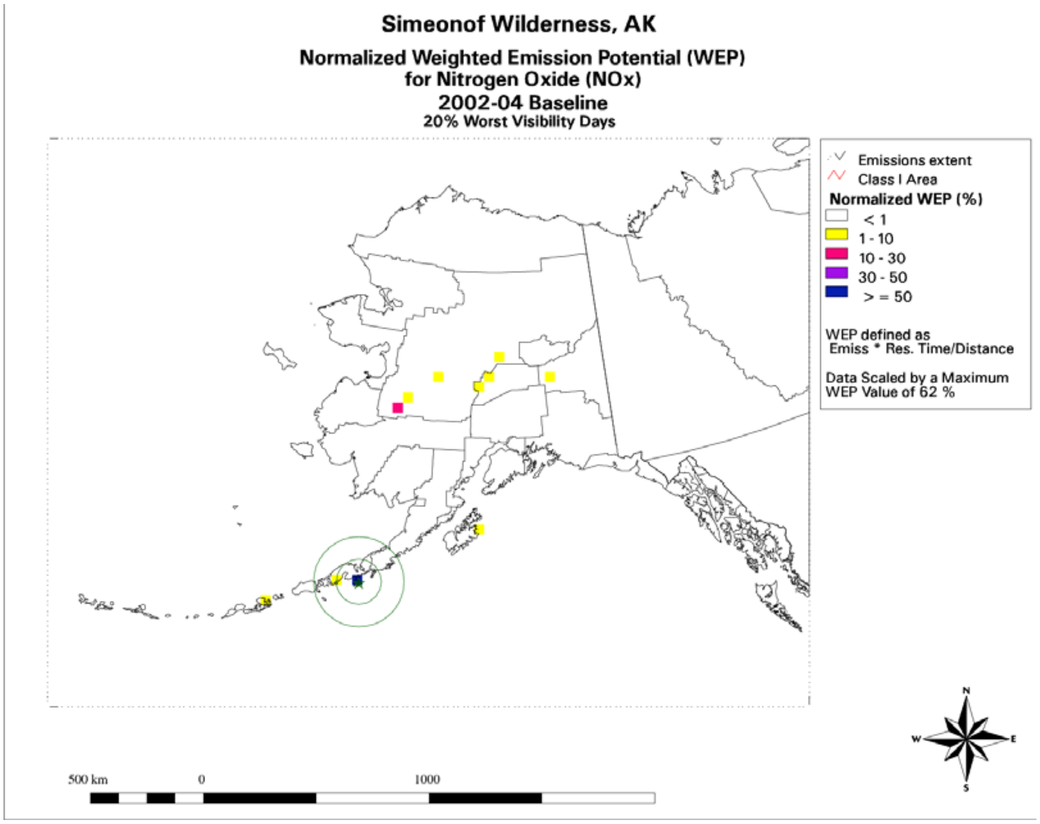
Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Coarse Particulate Matter (PM10)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 29 %
500 km
0
1000
N
W
E
S

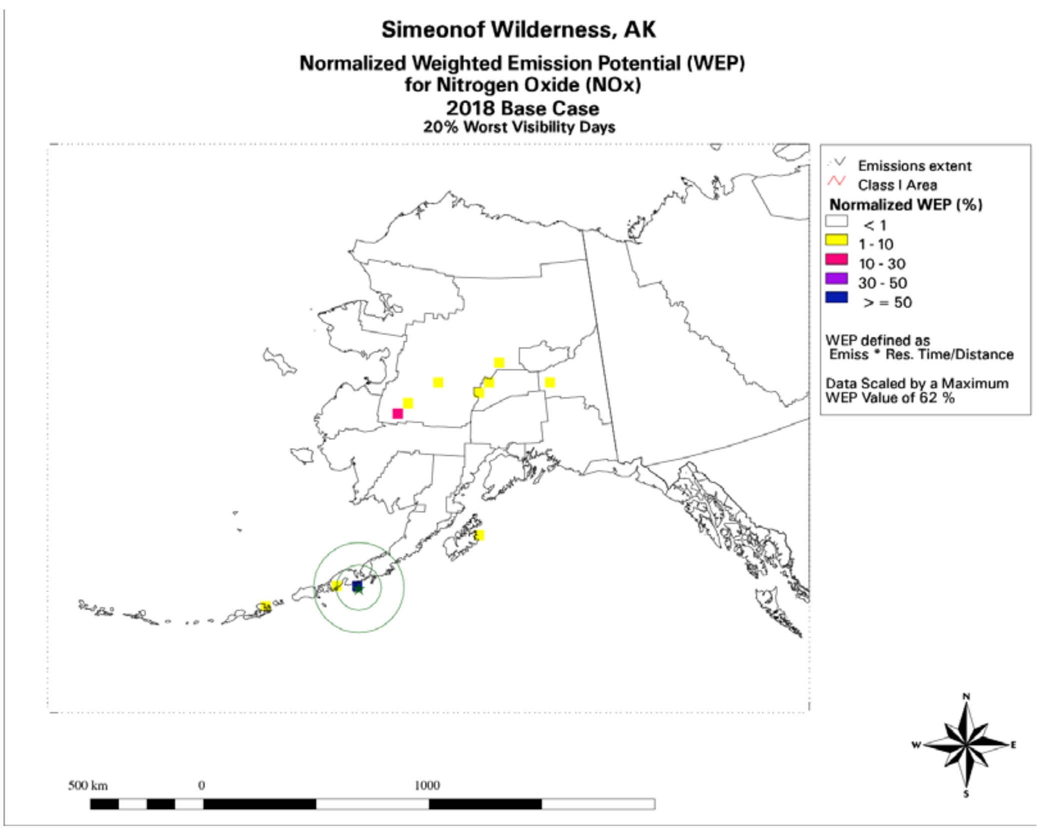


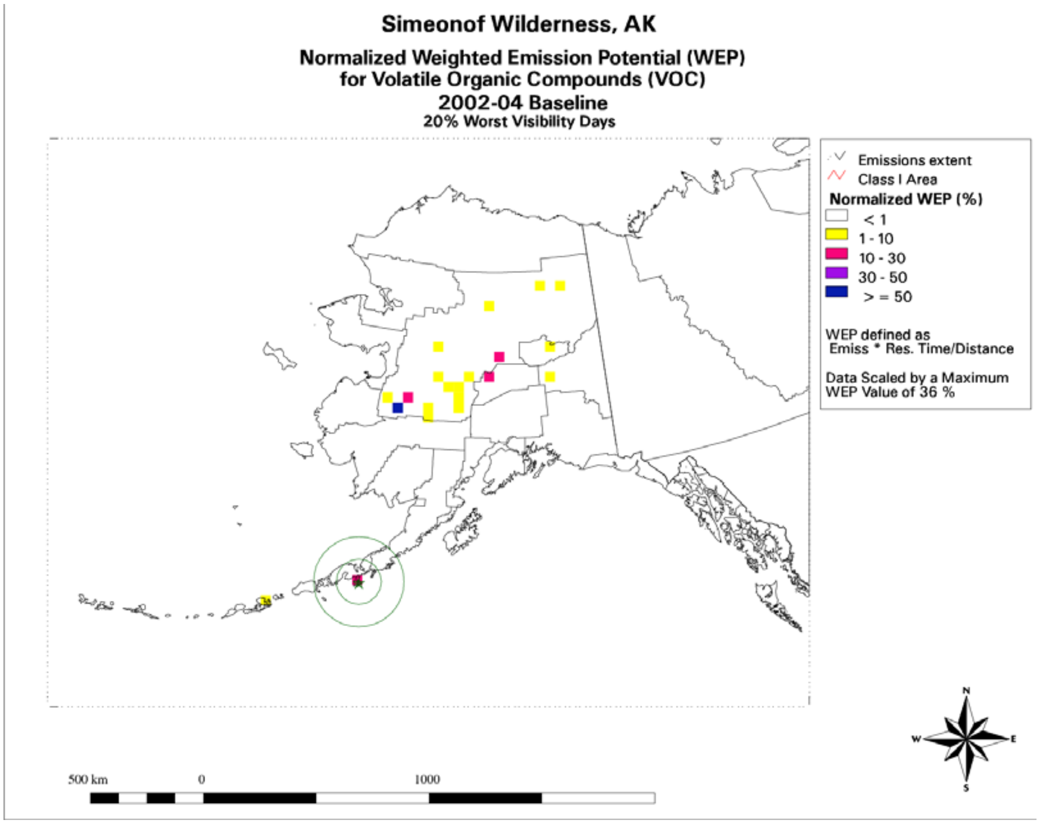
Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Coarse Particulate Matter (PM10)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 29 %
500 km
0
1000
N
W
E
S

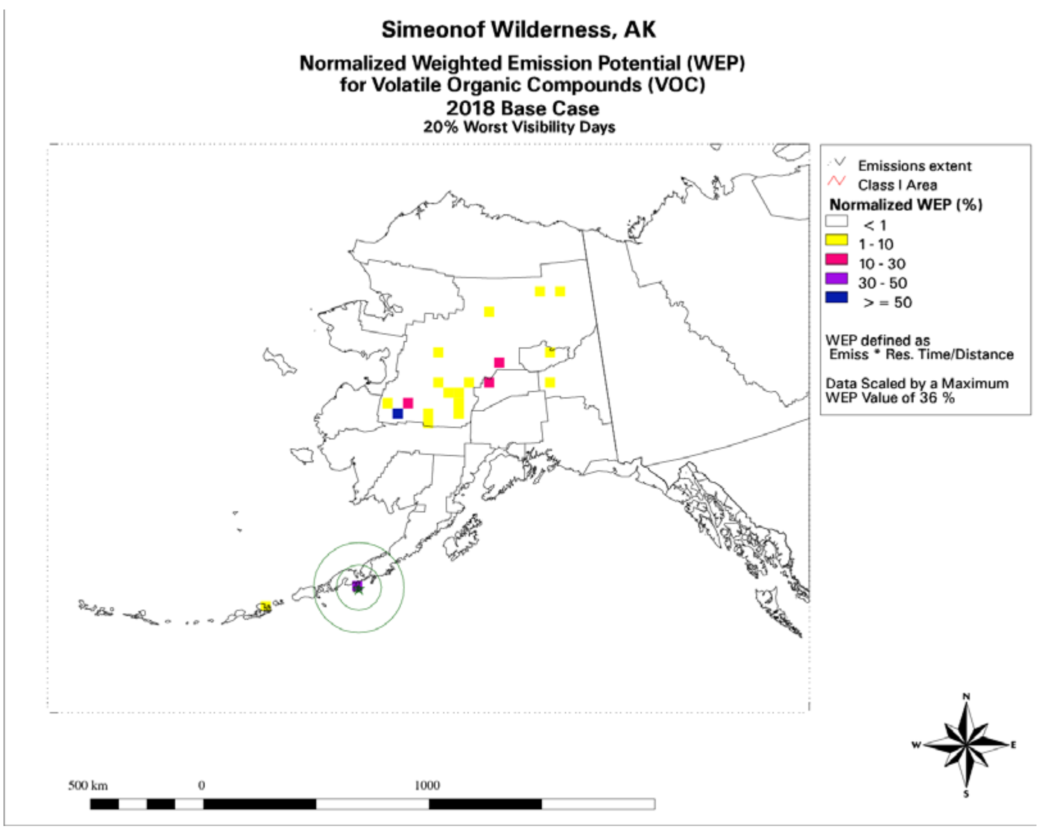

Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Sulfur Oxide (SOx)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 41 %
N
W
E
S
500 km
0
1000

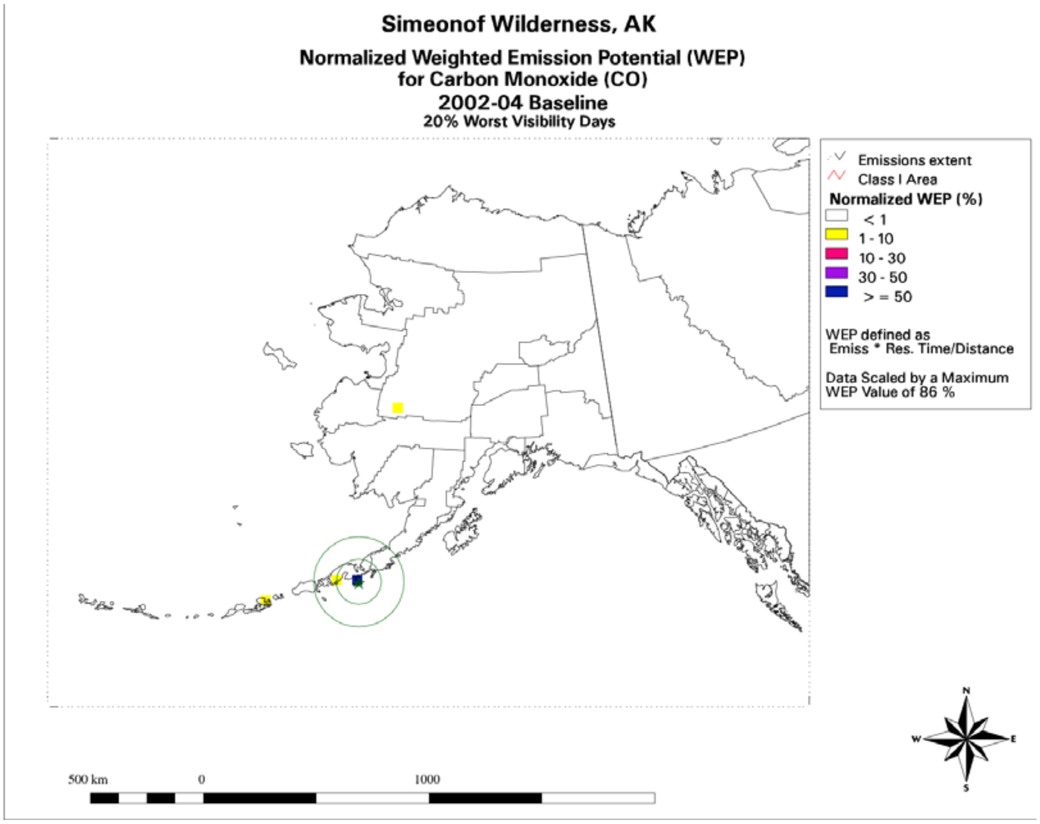

Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Sulfur Oxide (SOx)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 40 %
N
W
E
S
500 km
0
1000


Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Nitrogen Oxide (NOx)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 62 %
500 km
0
1000
N
W
E
S

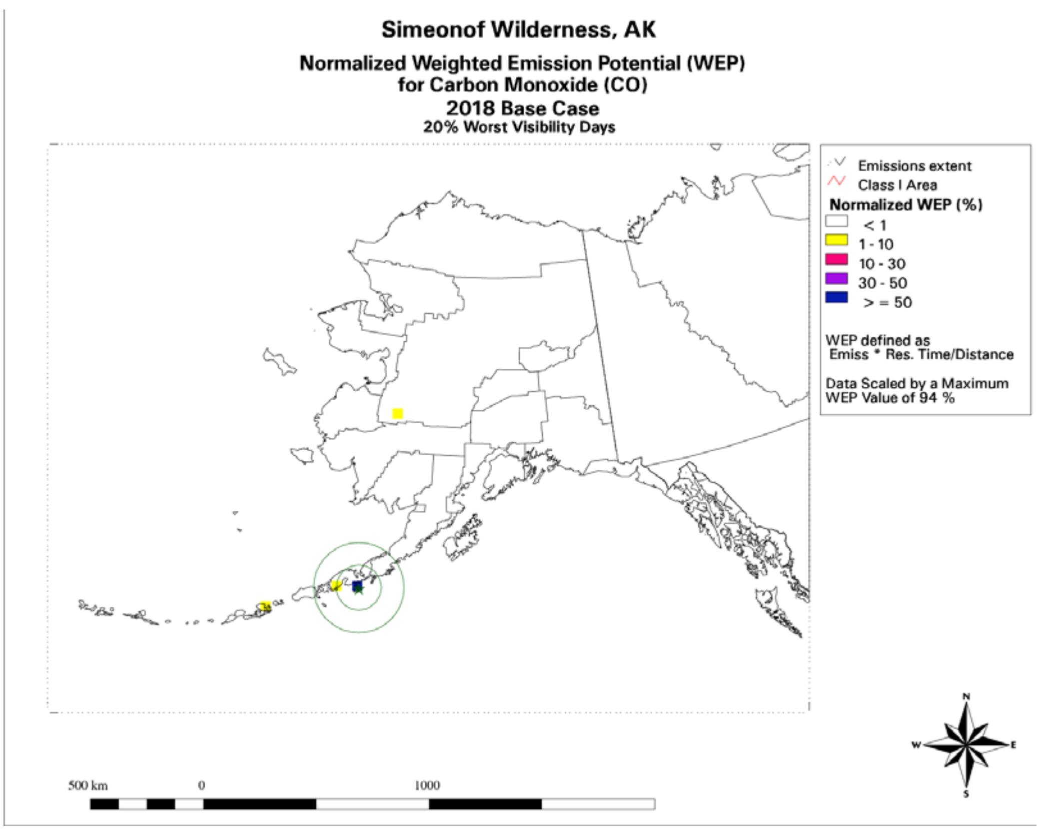

Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Nitrogen Oxide (NOx)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 62 %
500 km
0
1000
N
W
E
S


Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Volatile Organic Compounds (VOC)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 36 %
500 km
0
1000
N
W
E
S


Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Volatile Organic Compounds (VOC)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 36 %
500 km
0
1000
N
W
E
S

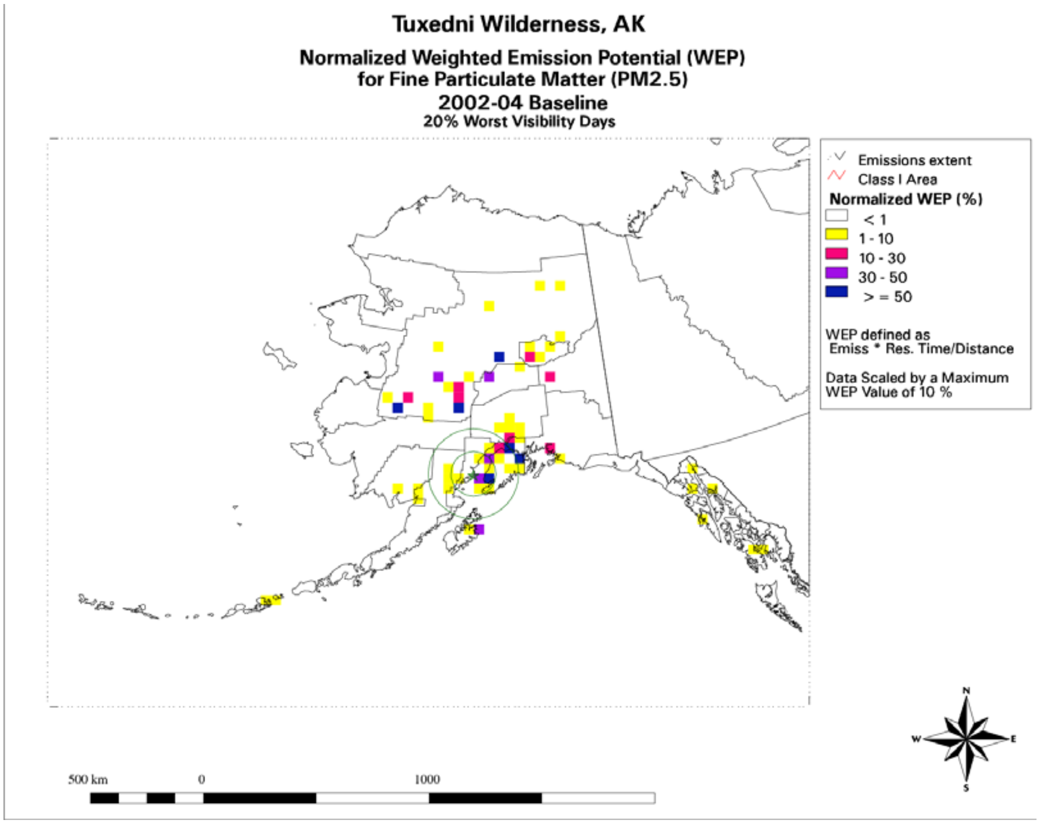


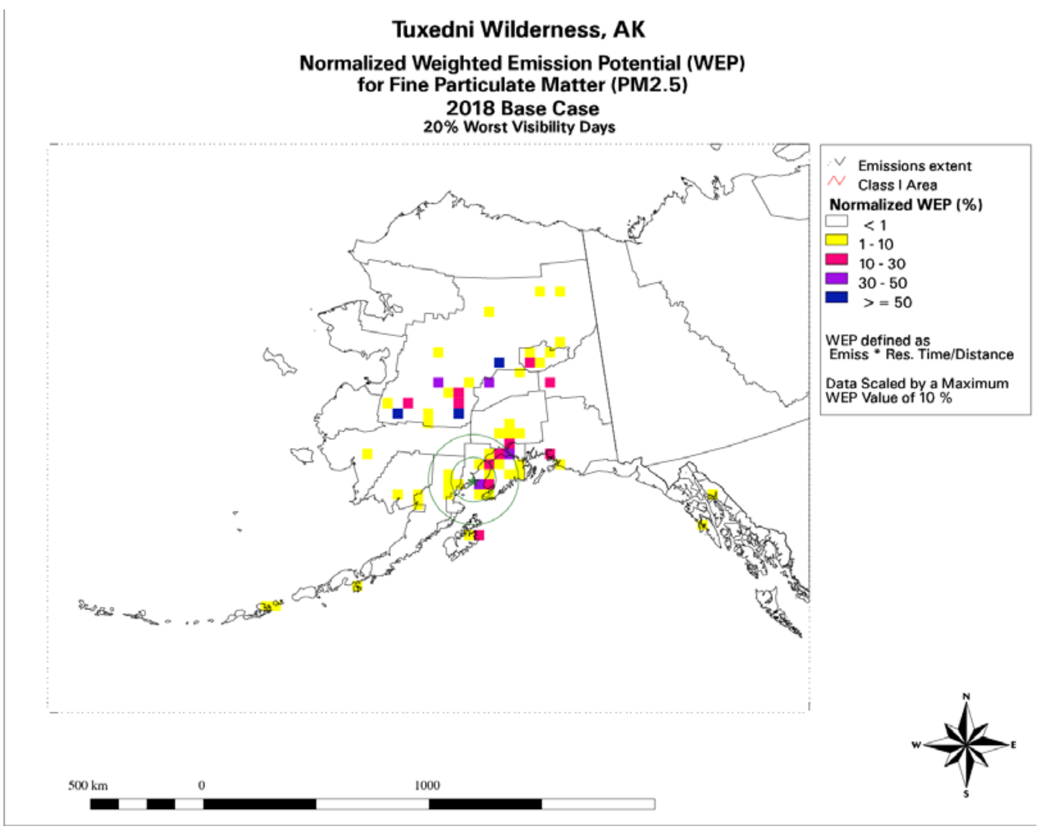
Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Carbon Monoxide (CO)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 86 %
500 km
0
1000
N
W
E
S

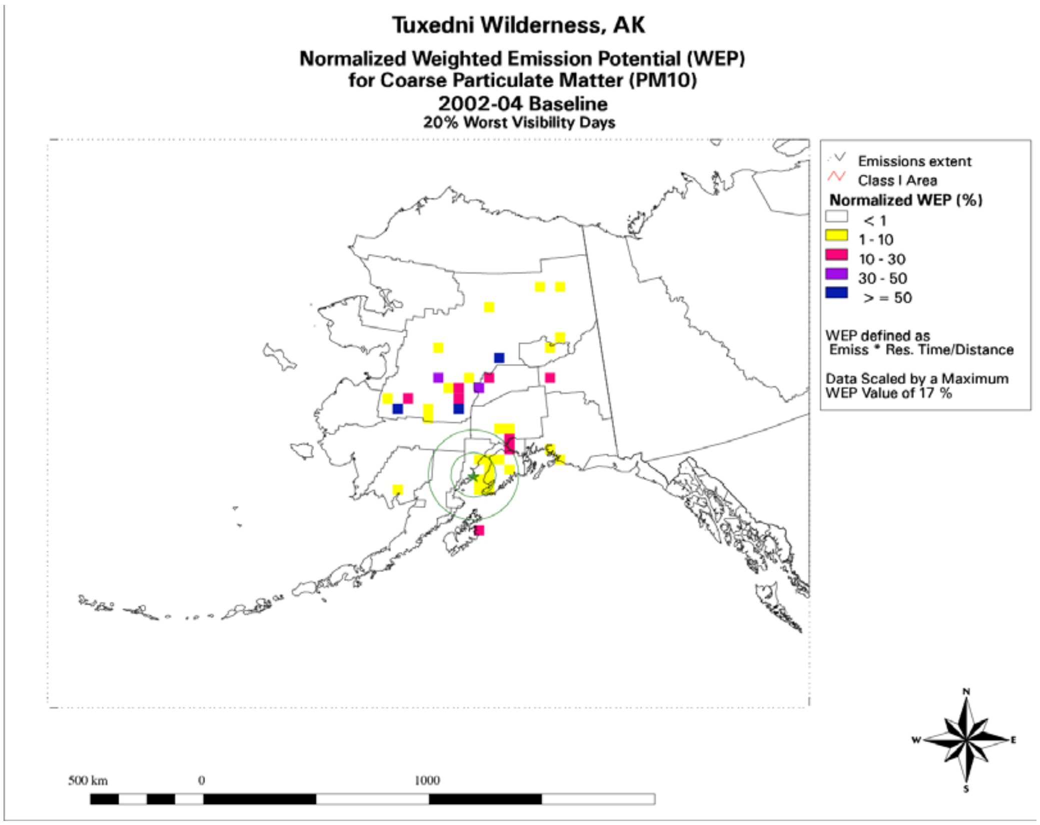


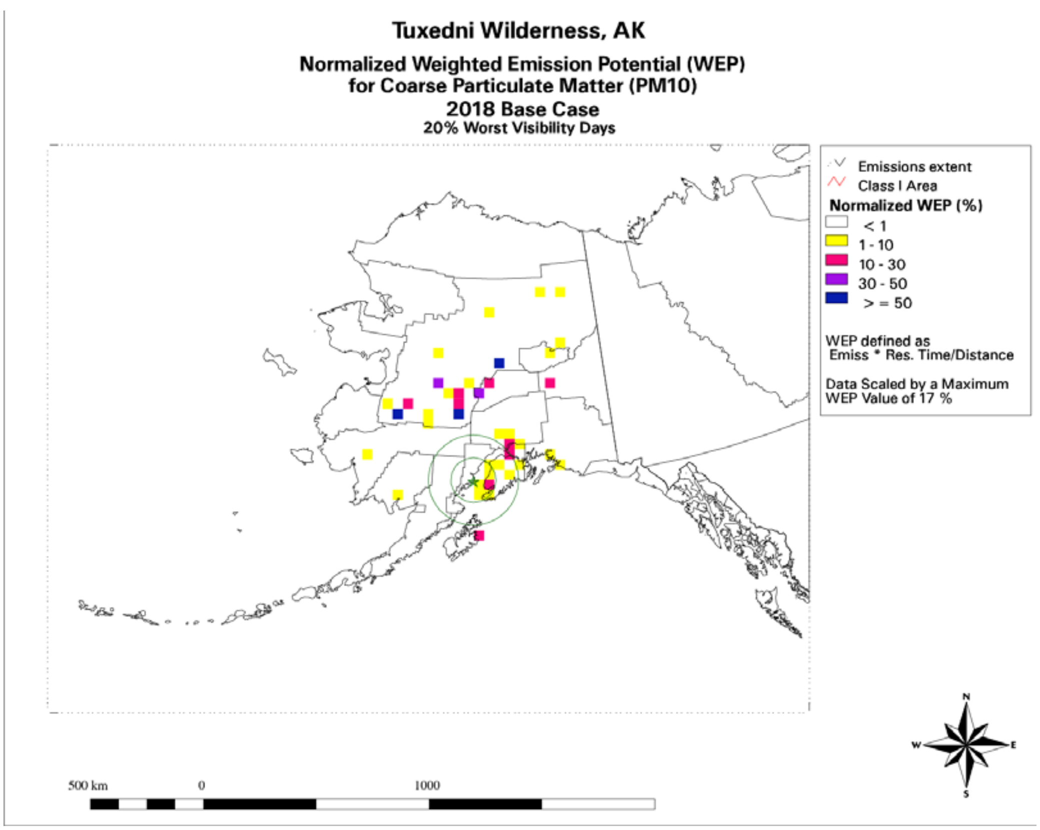
Simeonof Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Carbon Monoxide (CO)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 94 %
500 km
0
1000
N
W
E
S

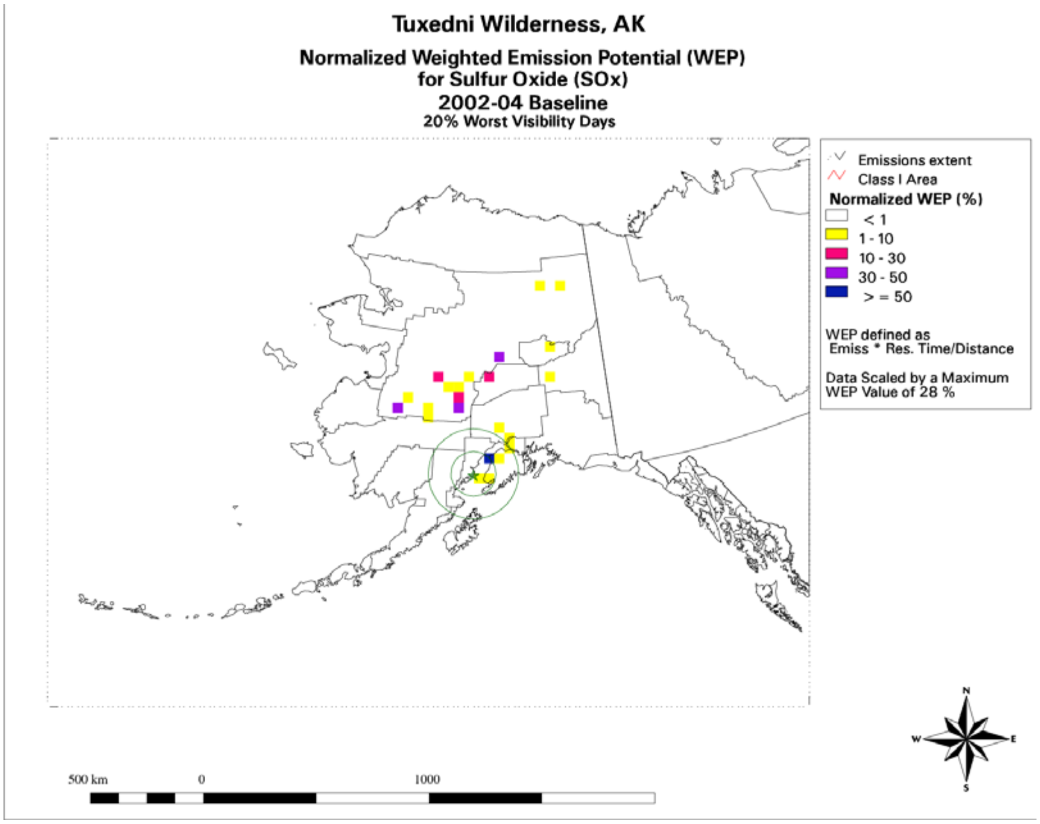
TUXEDNI WILDERNESS

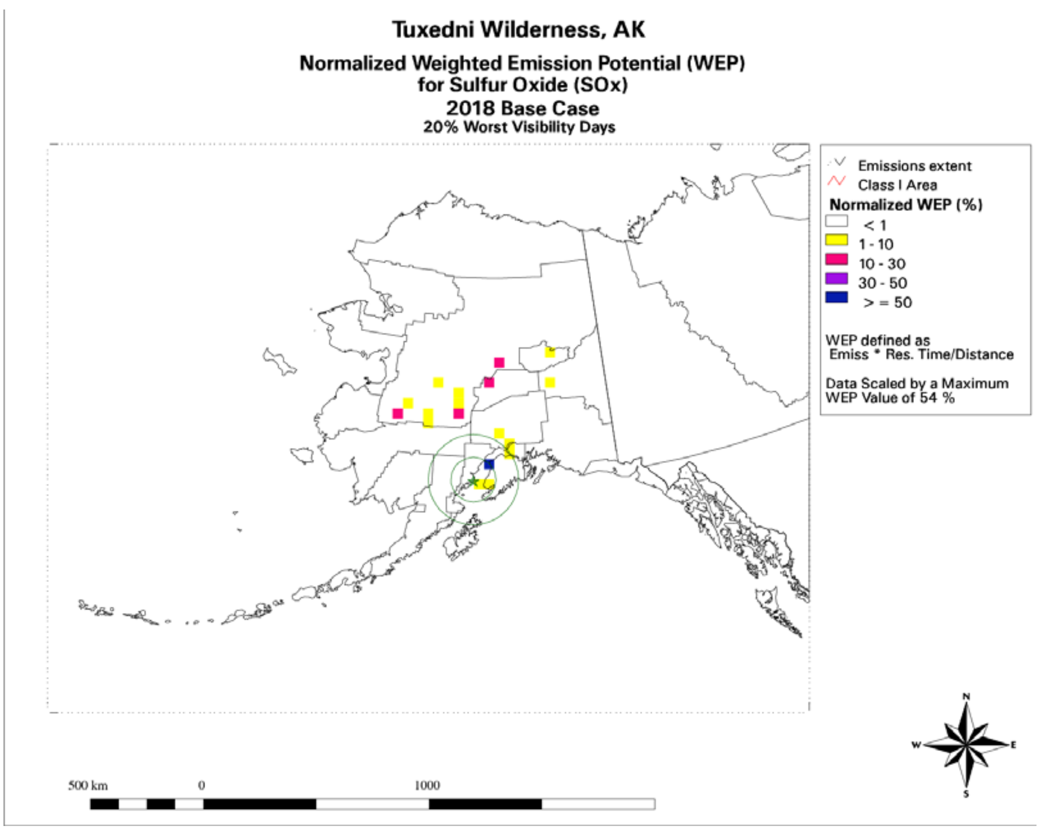

Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Fine Particulate Matter (PM2.5)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 10 %
500 km
0
1000
N
W
E
S

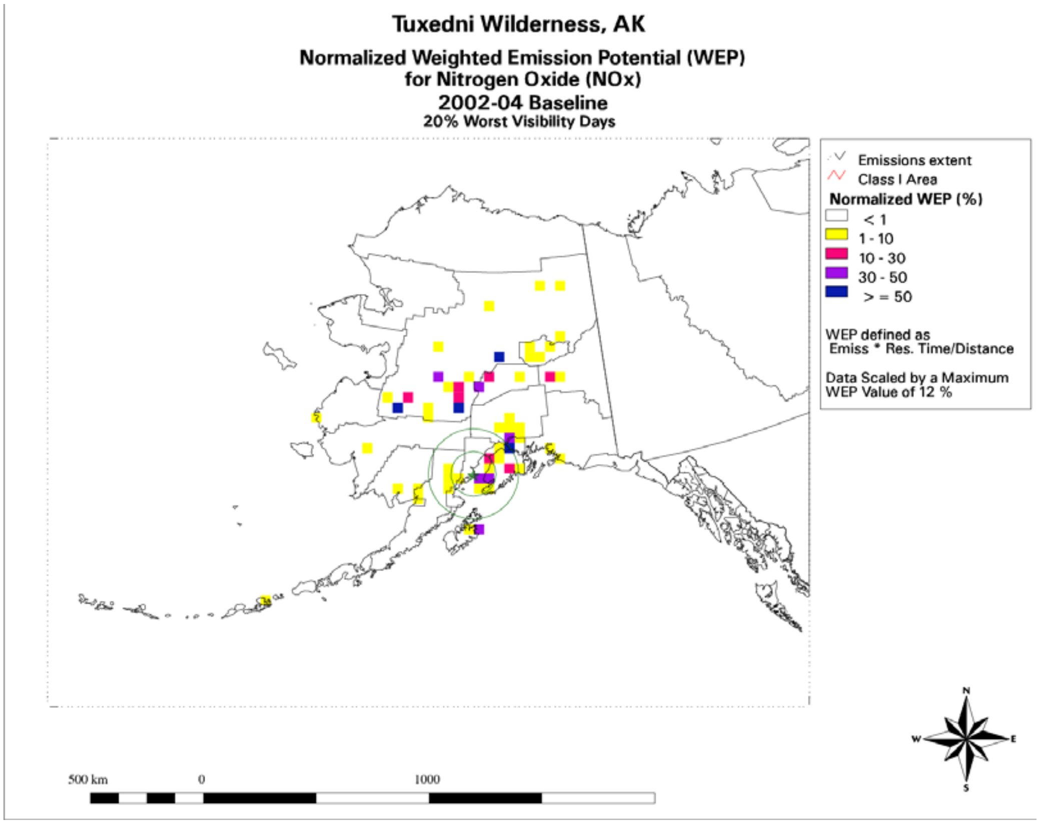

Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Fine Particulate Matter (PM2.5)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 10 %
500 km
0
1000
N
W
E
S

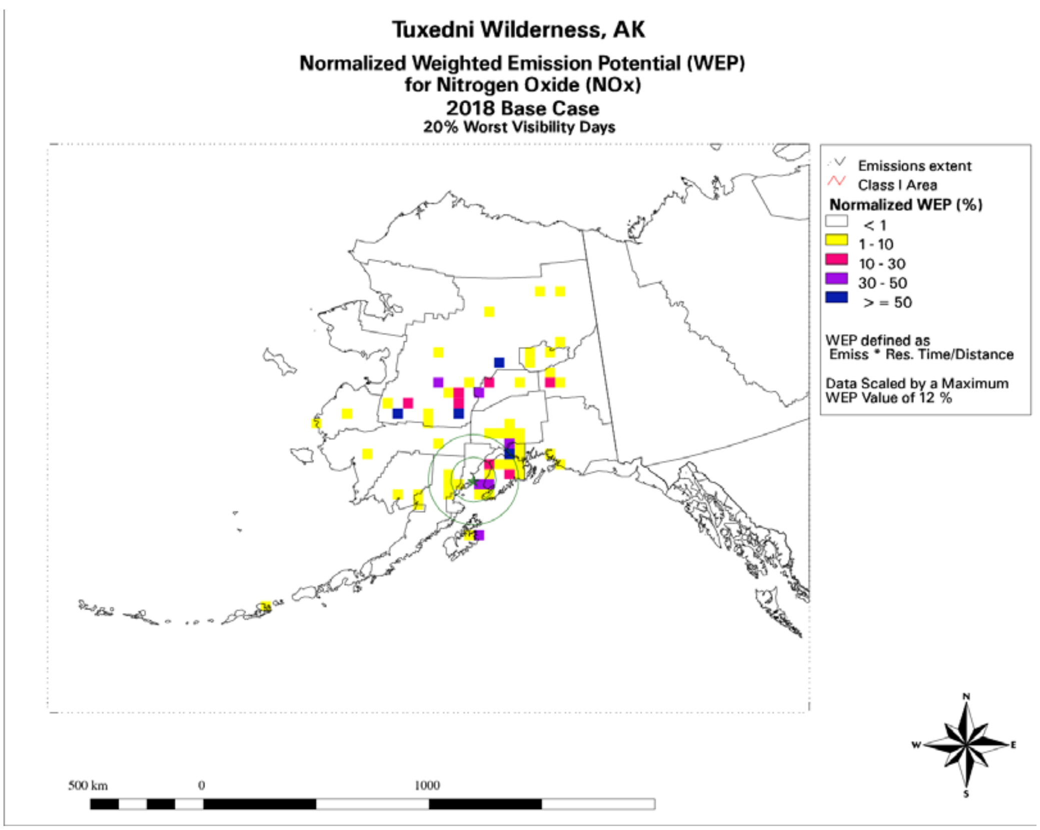

Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Coarse Particulate Matter (PM10)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
500 km
0
1000
N
W
E
S

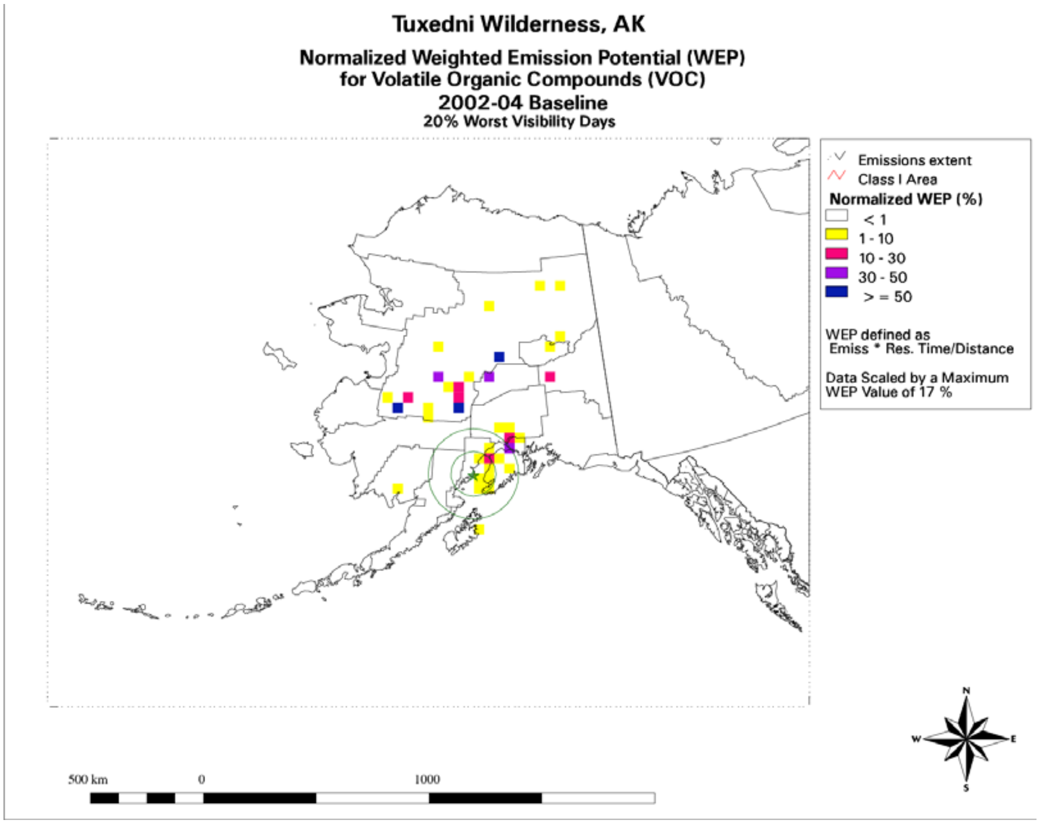

Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Coarse Particulate Matter (PM10)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
500 km
0
1000
N
W
E
S

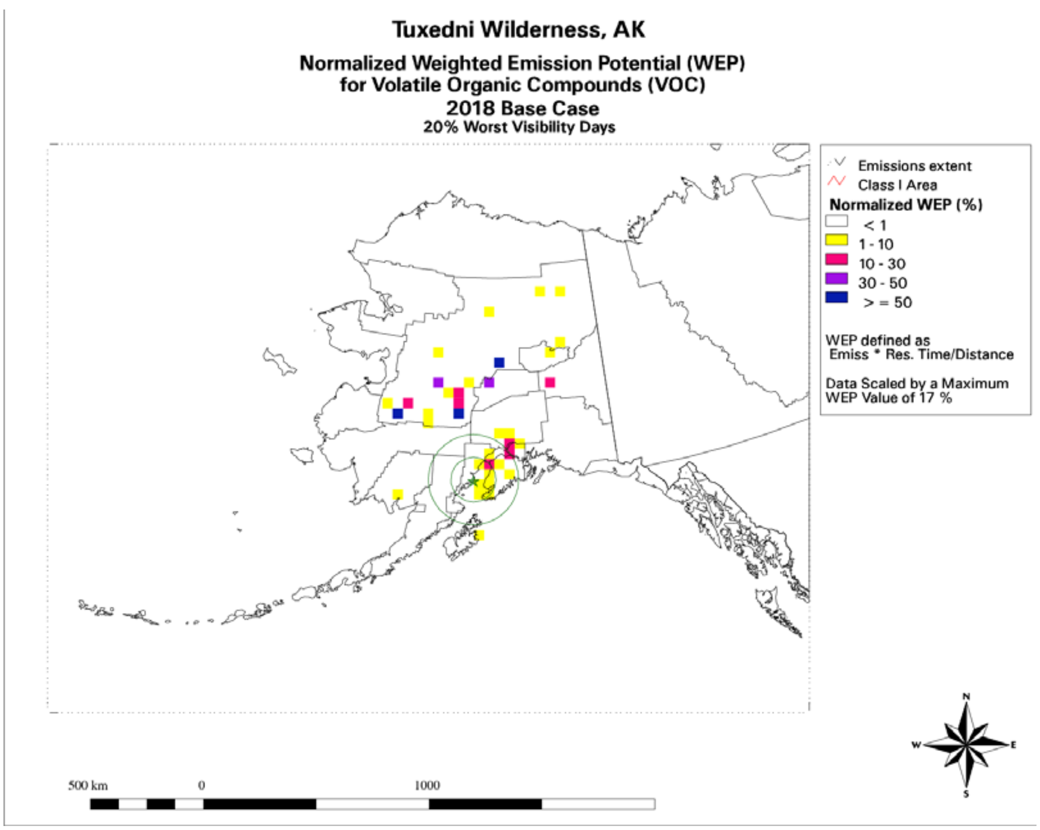

Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Sulfur Oxide (SOx)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 28 %
N
W
E
S
500 km
0
1000

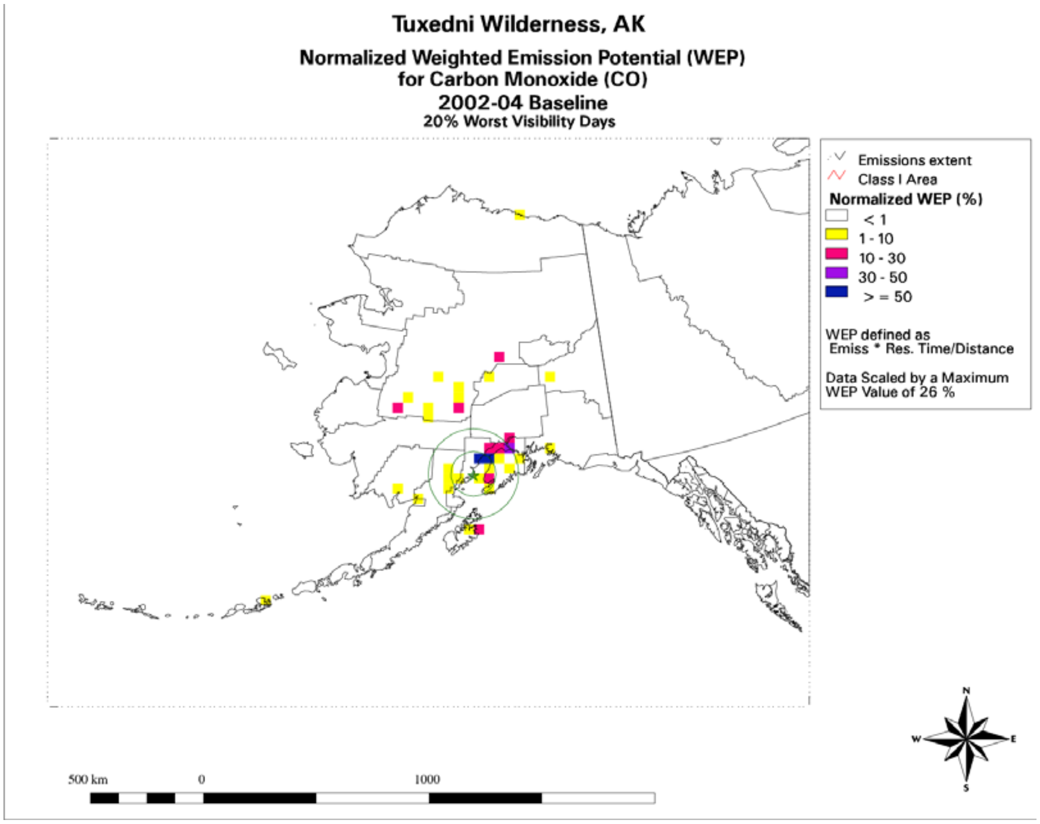

Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Sulfur Oxide (SOx)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 54 %
N
W
E
S
500 km
0
1000

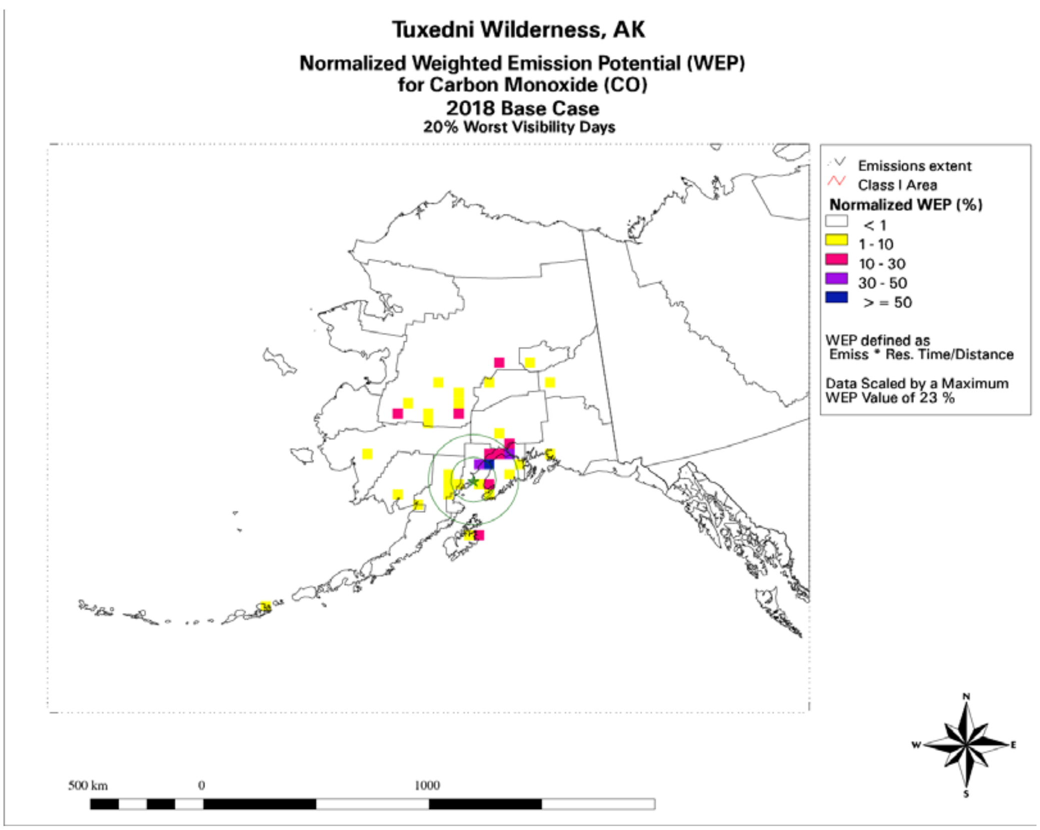

Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Nitrogen Oxide (NOx)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 12 %
N
W
E
S
500 km
0
1000


Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Nitrogen Oxide (NOx)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 12 %
N
W
E
S
500 km
0
1000


Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Volatile Organic Compounds (VOC)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
500 km
0
1000
N
W
E
S


Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Volatile Organic Compounds (VOC)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 17 %
500 km
0
1000
N
W
E
S


Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Carbon Monoxide (CO)
2002-04 Baseline
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 26 %
500 km
0
1000
N
W
E
S


Tuxedni Wilderness, AK
Normalized Weighted Emission Potential (WEP)
for Carbon Monoxide (CO)
2018 Base Case
20% Worst Visibility Days
Emissions extent
Class I Area
Normalized WEP (%)
< 1
1 - 10
10 - 30
30 - 50
> = 50
WEP defined as
Emiss * Res. Time/Distance
Data Scaled by a Maximum
WEP Value of 23 %
500 km
0
1000
N
W
E
S

Weighted Emissions Potential Analysis Spreadsheets

DENALI NATIONAL PARK

DENA **Three Most Highest WEPs for Each Region and Pollutant**

PM2.5	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0	0.0	61.6	0.0	0.0	0.0	0.3	0.0	61.9			
	2018	0.0	0.0	**61.6**	0.0	0.0	0.0	0.3	0.0	61.9			
Southeast Fairbanks	2002	0.0	0.0	28.7	0.0	0.0	0.0	1.1	0.0	29.8			
	2018	0.0	0.0	**28.7**	0.0	0.0	0.0	1.4	0.0	30.1			
Fairbanks North Star	2002	0.0	0.0	2.3	0.0	0.0	0.0	1.3	0.0	3.7			
	2018	0.1	0.0	**2.3**	0.0	0.0	0.0	1.5	0.0	3.9			
	2002 Total	0.1	0.0	92.6	0.0	0.0	0.0	2.7	0.0	95.5	100.0	7.1	100.0
	2018 Total	0.1	0.0	92.6	0.0	0.0	0.0	3.2	0.0	95.9	100.2	7.3	103.4
										0.5	0.2		3.4

VOC	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0	0.0	43.6	0.1	0.0	0.0	1.7	0.0	45.3		1.7	
	2018	0.0	0.0	**43.6**	0.0	0.0	0.0	1.5	0.0	45.2			
Southeast Fairbanks	2002	0.1	0.0	19.3	0.1	0.0	0.0	6.4	0.0	25.9			
	2018	0.1	0.0	**19.3**	0.2	0.0	0.0	8.2	0.0	27.8			
Denali Borough	2002	0.0	0.0	0.0	0.4	0.0	0.0	21.3	0.0	21.8			
	2018	0.0	0.0	0.0	0.4	0.0	0.0	**19.2**	0.0	19.7			
	2002 Total									93.1	100.0	35.3	100.0
	2018 Total									92.6	99.1	34.4	97.6
										-0.5	-0.9		-2.4

NOx	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0	0.0	44.1	0.0	0.1	0.0	0.2	0.0	44.4			
	2018	0.0	0.0	**44.1**	0.0	0.0	0.0	0.1	0.0	44.3			
Southeast Fairbanks	2002	0.1	0.0	19.6	0.0	0.0	1.0	1.5	0.0	22.2			
	2018	0.2	0.0	**19.6**	0.0	0.0	0.8	1.9	0.0	22.5			
Fairbanks North Star	2002	0.6	0.0	1.6	0.5	2.5	**10.8**	0.4	0.0	16.3			
	2018	0.7	0.0	1.6	0.2	0.8	**13.7**	0.4	0.0	17.5			
	2002 Total									82.9	100.0	34.5	100.0
	2018 Total									84.4	99.5	34.0	98.6
										1.4	-0.5		-1.4

SOx	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Fairbanks North Star	2002	0.2	0.0	1.3	0.0	0.3	23.7	2.6	0.0	28.0			
	2018	0.2	0.0	1.3	0.0	0.0	**35.3**	3.0	0.0	39.8			
Yukon-Koyukuk CA	2002	0.0	0.0	35.8	0.0	0.0	0.0	0.1	0.0	35.9			
	2018	0.0	0.0	**35.8**	0.0	0.0	0.0	0.1	0.0	35.9			
Southeast Fairbanks	2002	0.0	0.0	15.9	0.0	0.0	1.3	0.1	0.0	17.4			
	2018	0.0	0.0	**15.9**	0.0	0.0	0.8	0.2	0.0	16.9			
	2002 Total									81.3	100.0	46.9	100.0
	2018 Total									92.6	100.8	47.7	101.8
										11.3	0.8		1.8

NH3	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0	0.0	65.9	0.0	0.0	0.0	0.0	0.0	65.9			
	2018	0.0	0.0	**65.9**	0.0	0.0	0.0	0.0	0.0	65.9			
Southeast Fairbanks	2002	0.0	0.0	29.2	0.0	0.0	0.0	0.0	0.0	29.2			
	2018	0.0	0.0	**29.2**	0.0	0.0	0.0	0.0	0.0	29.2			
Fairbanks North Star	2002	0.0	0.0	2.4	0.0	0.7	0.1	0.0	0.0	3.2			
	2018	0.0	0.0	**2.4**	0.0	0.7	0.1	0.0	0.0	3.3			
	2002 Total									98.3	100.0	2.2	100.0
	2018 Total									98.4	101.1	3.3	148.5
										0.1	1.1		48.5

PM10	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0	0.0	52.9	0.0	0.0	0.0	0.9	0.0	53.8			
	2018	0.0	0.0	**52.9**	0.0	0.0	0.0	0.8	0.0	53.8			
Southeast Fairbanks	2002	0.0	0.0	24.7	0.0	0.0	0.0	2.5	0.0	27.2			
	2018	0.0	0.0	**24.7**	0.0	0.0	0.0	3.2	0.0	27.9			
Fairbanks North Star	2002	0.0	0.0	2.0	0.0	0.0	1.3	4.9	0.0	8.2			
	2018	0.0	0.0	2.0	0.0	0.0	0.3	**5.6**	0.0	7.9			
	2002 Total									89.3	100.0	20.1	100.0
	2018 Total									89.6	99.8	19.9	98.9
										0.3	-0.2		-1.1

TRAPPER CREEK WILDERNESS

TRCR **Three Most Highest WEPs for Each Region and Pollutant**

PM2.5	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0023	0	63.6511	0.001	0.0002	0.0001	0.157	0	63.8117			
	2018	0.0021	0	**63.6511**	0.0008	0.0001	0.0001	0.1433	0	63.7975			
Matanuska-Susitna	2002	0.9549	0.0008	3.9836	0.2725	0.1967	0	10.8874	0	16.2959			
	2018	1.268	0.0008	3.9836	0.2359	0.1159	0.0004	**16.3658**	0	21.9704			
Southeast Fairbanks	2002	0.0089	0	14.7838	0.0028	0	0	0.7811	0.0003	15.5769			
	2018	0.0114	0	**14.7838**	0.0035	0.0001	0	0.9985	0.0003	15.7976			
	2002 Total									95.6845	100.00	15.51	100.0
	2018 Total									101.566	105.96	21.47	138.5
										5.9	6.0		38.5

VOC	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0055	0	43.7091	0.0207	0.0086	0.0001	0.6772	0	44.4212			
	2018	0.0051	0	**43.7091**	0.0189	0.0035	0.0001	0.6055	0	44.3422			
Matanuska-Susitna	2002	1.5123	0.0137	2.5995	4.9566	10.1879	0.2046	8.486	0	27.9606			
	2018	2.1373	0.0146	2.5995	6.1891	4.5769	0.2606	**12.5963**	0	28.3743			
Southeast Fairbanks	2002	0.0362	0	9.6484	0.0876	0.0075	0.0017	4.4983	0.0003	14.28			
	2018	0.0461	0	**9.6484**	0.112	0.0096	0.002	5.7506	0.0003	15.569			
	2002 Total									86.6618	100.00	42.69	100.0
	2018 Total									88.2855	102.16	44.85	105.1
										1.6	2.2		5.1

NOx	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Matanuska-Susitna	2002	5.3577	0.094	1.6826	3.6299	14.3056	8.2052	4.5499	0	37.8249			
	2018	6.5586	0.1049	1.6826	2.5794	6.9418	**9.0053**	6.4113	0	33.2839			
Yukon-Koyukuk CA	2002	0.0029	0.0001	28.295	0.0121	0.0129	0.0035	0.049	0	28.3755			
	2018	0.0027	0.0002	**28.295**	0.0098	0.0047	0.0031	0.0443	0	28.3598			
Kenai Peninsula	2002	0.0108	2.8801	0	0.0999	0.3122	17.9974	0.4369	0	21.7373			
	2018	0.0123	4.6027	0	0.0644	0.1177	**15.724**	0.4823	0	21.0034			
	2002 Total									87.9377	100.00	62.90	100.0
	2018 Total									82.6471	94.87	57.77	91.8
										-5.3	-5.1		-8.2

SOx	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0041	0.0001	44.1092	0.0005	0.0034	0.0012	0.0505	0	44.169			
	2018	0.0041	0	**44.1092**	0.0004	0.0003	0.0014	0.0533	0	44.1687			
Matanuska-Susitna	2002	3.8157	0.0936	2.6213	0.0304	3.8769	0.019	14.5161	0	24.973			
	2018	4.7948	0.0038	2.6213	0.0392	0.5127	0.0152	**23.6884**	0	31.6754			
Fairbanks North Star	2002	0.053	0.0006	0.7672	0.0027	0.1098	6.3078	0.818	0	8.0591			
	2018	0.0627	0	0.7672	0.0014	0.0114	**8.837**	0.9635	0	10.6432			
	2002 Total									77.2011	100.00	42.17	100.0
	2018 Total									86.4873	100.86	43.03	102.0
										9.3	0.9		2.0

NH3	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0004	0	66.5381	0	0.0056	0	0	0	66.5441			
	2018	0.0004	0	**66.5381**	0	0.0065	0	0	0	66.545			
Southeast Fairbanks	2002	0.0008	0	14.6881	0.0009	0.0143	0	0	0.0004	14.7045			
	2018	0.0008	0	**14.6881**	0.0009	0.0177	0	0	0.0004	14.7079			
Matanuska-Susitna	2002	0.0449	0	3.9554	0.03	6.9794	0	0	0	11.0097			
	2018	0.1702	0	3.9554	0.0924	**9.6798**	0	0	0	13.8978			
	2002 Total									92.2583	100.00	12.76	100.0
	2018 Total									95.1507	107.72	20.47	160.5
										2.9	7.7		60.5

PM10	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Matanuska-Susitna	2002	0.6266	0.0005	2.8752	0.1823	0.1493	0.0639	31.0013	0	34.8991			
	2018	0.8398	0.0005	2.8752	0.1526	0.1316	0.0702	**46.9916**	0	51.0615			
Yukon-Koyukuk CA	2002	0.0015	0	45.9413	0.0007	0.0001	0	0.346	0	46.2896			
	2018	0.0014	0	**45.9413**	0.0006	0.0001	0.0001	0.3186	0	46.2621			
Southeast Fairbanks	2002	0.0057	0	10.6705	0.0019	0.0001	0.0099	1.5187	0.0002	12.207			
	2018	0.0072	0	**10.6705**	0.0024	0.0001	0.0113	1.9415	0.0002	12.6332			
	2002 Total									93.3957	100.00	39.01	100.0
	2018 Total									109.957	116.50	55.51	142.3
										16.6	16.5		42.3

SIMEONOF WILDERNESS

SIME **Three Most Highest WEPs for Each Region and Pollutant**

PM2.5	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0053	0	88.0209	0.0013	0.0001	0.001	0.2484	0	88.277			
	2018	0.0046	0	**88.0209**	0.0012	0	0.0016	0.2229	0	88.2512			
Southeast Fairbanks	2002	0.0021	0	2.508	0.0011	0	0	0.3232	0.0005	2.8349			
	2018	0.0026	0	**2.508**	0.0014	0	0	0.4131	0.0005	2.9256			
Fairbanks North Star	2002	0.0055	0	0.7378	0.0034	0.0025	0.0026	0.1506	0	0.9024			
	2018	0.0065	0	**0.7378**	0.0022	0.001	0.003	0.1731	0	0.9236			
	2002 Total									92.0143	100.00	5.25	100.0
	2018 Total									92.1004	100.31	5.56	106.0
										0.1	0.3		6.0

VOC	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.013	0	67.5032	0.0277	0.0045	0.0011	1.1252	0	68.6747			
	2018	0.0119	0	**67.5032**	0.025	0.002	0.0013	1.0041	0	68.5475			
Dillingham CA	2002	0.0622	0.0055	0	0.2223	0.0152	0.0151	4.6563	0	4.9766			
	2018	0.0656	0.0066	0	0.2319	0.0156	0.013	**4.855**	0	5.1877			
Southeast Fairbanks	2002	0.0087	0	1.8209	0.0406	0.0034	0.0018	2.0692	0.0005	3.9451			
	2018	0.011	0	1.8209	0.0519	0.0045	0.0021	**2.6452**	0.0005	4.5361			
	2002 Total									77.5964	100.00	27.61	100.0
	2018 Total									78.2713	102.77	30.38	110.0
										0.7	2.8		10.0

NOx	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0096	0.0004	53.7909	0.0314	0.0078	0.0611	0.1109	0	54.0121			
	2018	0.0087	0.0005	**53.7909**	0.0274	0.0029	0.0546	0.0991	0	53.9841			
North Slope Borough	2002	0.0009	0	0	0.0088	0.0003	9.5703	0.0092	0	9.5895			
	2018	0.0011	0	0	0.0095	0.0003	**7.4473**	0.009	0	7.4672			
Kenai Peninsula	2002	0.0047	0.4423	0	0.0452	0.1466	6.218	0.1521	0	7.0089			
	2018	0.0054	0.6754	0	0.0282	0.0561	**5.2505**	0.1673	0	6.1829			
	2002 Total									70.6105	100.00	42.32	100.0
	2018 Total									67.6342	97.20	39.51	93.4
										-3.0	-2.8		-6.6

SOx	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0122	0.0003	73.9378	0.0009	0.0017	0.0189	0.0677	0	74.0395			
	2018	0.0117	0	**73.9378**	0.0008	0.0002	0.0212	0.0644	0	74.0361			
Fairbanks North Star	2002	0.0275	0.0003	0.5867	0.0014	0.0579	3.168	0.4312	0	4.273			
	2018	0.0325	0	0.5867	0.0007	0.006	**4.4057**	0.5081	0	5.5397			
Dillingham CA	2002	0.0547	0.0826	0	0.0549	0.0009	0.5547	2.0138	0	2.7616			
	2018	0.0581	0.0023	0	0.0576	0.0009	0.5538	**2.0766**	0	2.7493			
	2002 Total									81.0741	100.00	20.71	100.0
	2018 Total									82.3251	97.83	18.54	89.5
										1.3	-2.2		-10.5

NH3	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0007	0	90.9993	0	0.0024	0	0	0	91.0024			
	2018	0.0007	0	**90.9993**	0	0.0028	0	0	0	91.0028			
Kenai Peninsula	2002	0.0004	0.0008	0	0	0.0561	2.0026	0	0	2.0599			
	2018	0.0004	0.0019	0	0	0.0568	**3.8245**	0	0	3.8836			
Southeast Fairbanks	2002	0.0001	0	2.4548	0.0005	0.0058	0	0	0.0006	2.4618			
	2018	0.0001	0	**2.4548**	0.0005	0.0073	0	0	0.0006	2.4633			
	2002 Total									95.5241	100.00	2.41	100.0
	2018 Total									97.3497	101.97	4.39	181.7
										1.8	2.0		81.7

PM10	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0042	0	78.8354	0.0011	0.0001	0.0008	0.6837	0	79.5253			
	2018	0.0037	0	**78.8354**	0.001	0	0.0012	0.615	0	79.4563			
Aleutians East	2002	0.0003	0.0024	0	0.0021	0	0	3.814	0	3.8188			
	2018	0.0003	0.0024	0	0.001	0	0	**3.6957**	0	3.6994			
Bethel CA	2002	0.0195	0	2.1182	0.0054	0.0001	0.0078	1.1334	0	3.2844			
	2018	0.0232	0	**2.1182**	0.0065	0.0001	0.0103	1.3125	0	3.4708			
	2002 Total									86.6285	100.00	15.14	100.0
	2018 Total									86.6265	100.47	15.61	103.1
										0.0	0.5		3.1

TUXEDNI WILDERNESS

TUXE Three Most Highest WEPs for Each Region and Pollutant

PM2.5	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0028	0	71.7426	0.0008	0.0001	0.0003	0.1434	0	71.89			
	2018	0.0025	0	**71.7426**	0.0007	0	0.0005	0.1298	0	71.8761			
Kenai Peninsula	2002	0.0837	0.2353	0	0.3297	0.2366	0.6201	16.2884	0	17.7938			
	2018	0.0943	0.4394	0	0.21	0.0911	0.0447	**17.9233**	0	18.8028			
Matanuska-Susitna	2002	0.2884	0.0004	0.7856	0.0639	0.046	0	2.3663	0	3.5506			
	2018	0.3436	0.0004	0.7856	0.0507	0.0258	0.0002	**3.3121**	0	4.5184			
	2002 Total									93.2344	100.00	22.84	100.0
	2018 Total									95.1973	102.07	24.91	109.1
										1.96	2.07		9.1

VOC	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Kenai Peninsula	2002	0.1002	0.1465	0	5.662	8.9212	16.8876	15.3616	0	47.0791			
	2018	0.1135	0.2494	0	5.037	3.0224	**22.082**	17.2024	0	47.7067			
Yukon-Koyukuk CA	2002	0.0049	0	36.1579	0.0129	0.0041	0.0003	0.4601	0	36.6402			
	2018	0.0044	0	**36.1579**	0.0117	0.0017	0.0003	0.411	0	36.587			
Matanuska-Susitna	2002	0.2927	0.0017	0.3939	0.7422	1.885	0.0692	1.8439	0	5.2286			
	2018	0.3567	0.002	0.3939	0.8786	0.778	0.0881	**2.5739**	0	5.0712			
	2002 Total									88.9479	100.00	61.12	100.0
	2018 Total									89.3649	101.02	62.14	101.7
										0.42	1.02		1.7

NOx	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Kenai Peninsula	2002	0.0388	3.4955	0	1.7908	8.0282	60.9012	2.0805	0	76.335			
	2018	0.0443	5.0448	0	0.8622	2.6574	**48.6917**	2.3156	0	59.616			
Yukon-Koyukuk CA	2002	0.0018	0.0001	13.886	0.0055	0.0036	0.0069	0.021	0	13.9249			
	2018	0.0016	0.0001	**13.886**	0.0046	0.0013	0.0062	0.0188	0	13.9186			
Matanuska-Susitna	2002	0.9816	0.0119	0.1513	0.4156	1.4911	1.6458	0.6153	0	5.3126			
	2018	1.1613	0.0138	0.1513	0.2934	0.7136	**1.8063**	0.8085	0	4.9482			
	2002 Total									95.5725	100.00	85.07	100.0
	2018 Total									78.4828	82.94	68.01	79.9
										-17.09	-17.06		-20.1

SOx	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Yukon-Koyukuk CA	2002	0.0044	0.0001	39.2639	0.0004	0.0017	0.0044	0.033	0	39.3079			
	2018	0.0043	0	**39.2639**	0.0003	0.0002	0.0049	0.0336	0	39.3072			
Kenai Peninsula	2002	0.091	13.724	0	0.0027	3.8967	4.2926	25.6739	0	47.6807			
	2018	0.1018	0.7165	0	0.0027	0.2532	5.0119	**28.8929**	0	34.979			
Matanuska-Susitna	2002	1.1796	0.0272	0.4275	0.0111	0.7552	0.0069	1.3143	0	3.7218			
	2018	1.3966	0.0014	0.4275	0.0108	0.1011	0.0055	**2.1312**	0	4.0741			
	2002 Total									90.7104	100.00	57.79	100.0
	2018 Total									78.3603	87.00	44.78	
										-12.35	-13.00		

NH3	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Kenai Peninsula	2002	0.0075	0.0106	0	0	5.328	37.9118	0	0	43.2579			
	2018	0.0075	0.0258	0	0	5.6692	**72.4002**	0	0	78.1027			
Yukon-Koyukuk CA	2002	0.0003	0	51.5049	0	0.0025	0	0	0	51.5077			
	2018	0.0003	0	**51.5049**	0	0.0029	0	0	0	51.5081			
Matanuska-Susitna	2002	0.0142	0	0.5609	0.0095	1.2423	0	0	0	1.8269			
	2018	0.0159	0	0.5609	0.0233	**1.5793**	0	0	0	2.1794			
	2002 Total									96.5925	100.00	44.62	100.0
	2018 Total									131.79	135.21	79.83	178.9
										35.20	35.21		78.9

PM10	Dataset	Aviation & GSE	CMV	Natural Fires	Non-Road Mobile	On-Road Mobile	Point	Stationary Area	Anthropogenic Fires	Total	Grand Total	Anthropogenic Grand Total	
Peninsula	2002	0.0463	0.1276	0	0.1887	0.1648	1.0261	40.983	0	42.5365			
	2018	0.0527	0.1971	0	0.1259	0.0958	0.7503	**44.9773**	0	46.1991			
Yukon-Koyukuk CA	2002	0.0015	0	44.2336	0.0005	0.0001	0.0002	0.2713	0	44.5072			
	2018	0.0014	0	**44.2336**	0.0004	0	0.0003	0.2472	0	44.4829			
Matanuska-Susitna	2002	0.1566	0.0002	0.4843	0.0355	0.0292	0.024	5.3783	0	6.1081			
	2018	0.1867	0.0002	0.4843	0.0284	0.0252	0.0264	**7.608**	0	8.3592			
	2002 Total									93.1518	100.00	52.42	100.0
	2018 Total									99.0412	105.94	58.36	111.3
										5.89	5.94		11.3

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.8
Alaska Enhanced Smoke Management Plan

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

APPENDIX III.K.8

Alaska Enhanced Smoke Management Plan

Alaska
Enhanced Smoke Management Plan
for Planned Fire

Procedures Manual

June 3, 2009

Contact:

Joan Hardesty
Alaska Department of Environmental Conservation
Division of Air Quality
610 University Avenue
Fairbanks, AK 99709-3643
Phone (907) 451-2167; (fax) 451-2187

ALASKA ENHANCED SMOKE MANAGEMENT PLAN

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Section

1. EXECUTIVE SUMMARY

The Alaska Department of Environmental Conservation (DEC) in coordination with the Alaska Wildland Fire Coordinating Group (AWFCG) has led the development of Alaska's Enhanced Smoke Management Plan (ESMP). The ESMP and accompanying volume of appendices has been adopted by DEC and participating Wildland owners and managers through a Memorandum of Understanding (MOU).

The ESMP helps fulfill Alaska's responsibilities for protection of air quality and human health under federal and state law and reflects the Clean Air Act requirement to improve regional haze in Alaska's Class I areas. The Regional Haze Rule requires that visibility at Class I areas be returned to natural background conditions by 2064. As Alaska develops its State Implementation Plan (SIP) for regional haze, plan updates may be necessary to address additional fire tracking and emission management needs based upon policies and guidelines developed by the Western Regional Air Partnership. The updated ESMP will be incorporated into Alaska's regional haze SIP. DEC welcomes the participation of AWFCG agencies and the public in the process to improve the document.

Under state regulation all agencies, corporations and individuals that burn areas larger than forty acres of land a year, whether slash or *in situ*, require a controlled burn approval application and written approval from DEC. The ESMP outlines the process and identifies issues that need to be addressed by DEC and land management agencies or private landowners / corporations to help ensure that prescribed fire (e.g. controlled burn) activities minimize smoke and air quality problems. Adoption of this document enables the State to certify to the U.S. Environmental Protection Agency (EPA) that we are implementing a smoke management plan which addresses elements of the EPA's Interim Air Quality Policy on Wildland and Prescribed Fire, April 23, 1998 (EPA's Interim Policy). If states do not certify that a basic smoke management plan is being implemented, EPA will not provide special consideration to particulate matter health standard violations attributed to fires managed for resource benefits. According to EPA's policy, a state adopted ESMP enables EPA to use its discretion in deciding to reclassify an area as non-attainment when fires cause or contribute to particulate matter air quality violations. If EPA does reclassify an area, then states need to review the adequacy of their ESMP to make appropriate improvements in cooperation with Wildland owners/managers.

The ESMP provides accurate and reliable guidance and direction to and from not only the fire authorities who use prescribed fire as a resource management tool, but also to the private landowners and/or corporations who conduct land clearing burns. This ESMP describes and clarifies the relationship between fire authorities and DEC. These agencies must work together effectively to combine planned burning, resource management and development with smoke, public health and Class I area visibility goals.

The ESMP Appendices provide additional assistance for interagency sharing of information, the applicability and availability of current smoke management techniques, monitoring protocol, public education strategies, and emission reduction techniques. The ESMP Appendices include up-to-date techniques and tools (e.g. monitoring equipment, modeling, emission factors) available through the Western Regional Air Partnership (WRAP) and member organizations tasked with assisting states, tribes and land managers with smoke management.

Alaska's ESMP will be evaluated annually by the AWFCG and interested parties and revised at least every 5 years in accordance with EPA's Interim Policy on Wildland and Prescribed fires. The ESMP companion appendices will be updated as new information becomes available, but not more often than once a year.

2. GUIDELINES, MEMBERSHIP CRITERIA, AND RESPONSIBILITIES

2-1. Alaska Wildland Fire Coordinating Group (AWFCG)

The AWFCG (Appendix A), formed in 1994 through the consolidation of the Alaska Multi-Agency Coordinating Group and the Alaska Interagency Fire Management Council, provides a forum that fosters cooperation, coordination and communication for Wildland fire and for planning and implementing interagency fire management statewide. The AWFCG membership includes State, Federal and Native land management agencies/owners that have fire management responsibilities for the lands they manage/own.

One of the objectives of the AWFCG is to provide a forum for anticipating smoke intrusions, resolving on-going smoke management issues, and improving smoke management techniques. Another objective is to ensure that prescribed fire, as a tool to reduce risk and/or future smoke emissions, is considered by DEC when promulgating policy, procedures and regulations.

The AWFCG established committees and workgroups to address specific issues. Since smoke management is a critical and continuous issue in statewide fire management, the AWFCG established the Smoke Management / Air Quality Committee. The purpose of the committee is to address the AWFCG smoke management objectives and assist DEC with the development and revision of the Alaska Enhanced Smoke Management Plan (ESMP) for Prescribed Fire and propagation of policies, procedures and regulations related to smoke management. AWFCG members may provide representatives to serve on the Smoke Management / Air Quality Committee. Participation is not mandatory.

The DEC representative serves as Committee Chair. Each agency/organization representative is the point of contact for communicating information between the Smoke Management / Air Quality Committee and their agency/organization. The agency/organization representatives are responsible for assisting agency/organization personnel with pre-season permit applications and post-season reporting. The Smoke Management / Air Quality Committee was established through a charter with the AFWCG.

Committee members will:

- Represent an AWFCG member.
- Have the authority to speak for their agency or organization on fire and smoke management issues.
- Promote good smoke management practices, alternative methods to burning and emission reduction techniques.
- Disseminate smoke management information to agency/organization personnel, thereby keeping employees informed of the requirements and procedures of the ESMP.

- Attend Smoke Management / Air Quality Committee meetings as scheduled and assist with accomplishing committee objectives/assignments.

The responsibilities of the Smoke Management / Air Quality Committee include assisting in development of the ESMP and annually reviewing the effectiveness of the plan. In addition, the Regional Haze Rule requires five year progress reports to EPA describing how well the Enhanced Smoke Management Plan is being implemented as needed to meet reasonable further progress requirements.

The following elements of the ESMP will be reviewed during annual evaluations:

- Implementation
- Burn activity summaries
- Smoke complaint summaries
- Compliance and enforcement
- Progress towards goals including visibility improvement/impact reduction
- Scientific and technological advancements
- Sections needing clarification and improvement
- Recommendation for revisions

Changes to DEC's open burning regulations (DEC 18 AAC 50) may occur if DEC deems it necessary. All changes to state regulations must follow standard procedure, including public comment periods. Regulatory changes that affect prescribed burning in the state will be done in coordination with the AWFCG members and any other affected parties. It will be up to DEC to ensure that stakeholders are informed of any anticipated changes. The current DEC Open Burning Policy and Guidelines is contained in Appendix B. Changes to the ESMP MOU document can only be made after contacting each signatory in writing.

2-2. Responsible Authority for the Burn

The Responsible Authority is the individual who is primarily responsible for a Controlled Burn for Resource Management (prescribed burn) or Controlled Burn for Land Clearing and ensures the conditions of the permit are met. Prescribed and land clearing burns require written DEC approval before starting the burn if the intent is to burn, or clear and burn 40 acres or more during a year. The Responsible Authority submits the finalized Prescribed Burn or Land Clearing application to DEC. This person may also collect, review, and distribute any pre- and post-burn information to DEC. The Responsible Authority should be identified in the prescribed burn or land clearing burn approval application. The Responsible Authority is often the one who conducts public meetings and has the greatest ability to interact with the public and local authorities on prescribed burning activities in their area.

To obtain valid Controlled Burning for Resource Management and Controlled Burning for Land Clearing Approvals from DEC prior to each permitted ignition, the Responsible Authority must submit a controlled burn approval application to DEC containing the 15 elements listed in Section 3 of this document. Controlled burning for Resource Management and Controlled Burning for Land Clearing approval applications must include a section on smoke management contingencies that discuss actions to be taken in the event of smoke intrusions. The controlled burn approval for resource management (prescribed burns) or land clearing burns received from DEC will contain conditions to be met by the Responsible Authority. The Responsible Authority must call and notify the DEC by telephone by noon the business day prior to any planned burn, Monday through Friday between 8:00 a.m. and 4:30 p.m. excluding State holidays. Call the number listed in the Open Burn Approval Letter.

The person calling must provide the following information:

1. Controlled Burn Approval number;
2. Authorized Agency Name;
3. Burn Location;
4. Burn Date(s);
5. Contact Name During Burn;
6. Contact Telephone Number;
7. Description of proposed Test Burn (prescribed and land clearing only);
8. Estimated Duration of Active Firing (ignition) Phase (prescribed burning only);
9. Estimated Duration of the Smoldering Phase (prescribed burning only);
10. Description of Pre-Burn Public Notices - when, in what publications, radio, etc.;
11. Consideration of weather forecast and air quality advisories in area of burn - Did contact person check the weather forecast for stagnant air conditions? Did contact person confirm there are no Air Quality Advisories in area of burn?

DEC staff will verify the burn approval is current and send an email message with the eleven elements to the appropriate DEC controlled burn application personnel and air monitoring personnel.

The final responsibility for ensuring the conditions of the burn approval permit are met rests with the Responsible Authority. On the burn day, the Responsible Authority must check restriction/no restriction information from the DEC Air Quality Air Advisory web site: http://www.dec.state.ak.us/air/am/aq_sr.htm. The Responsible Authority should curtail burning if, in their opinion, they are not getting adequate smoke dispersion or if local weather factors are such that smoke problems could result. The Responsible Authority communicates any potential or existing smoke problems to the DEC Meteorologist at, 907-269-7676 (primary); or call 907-269-6249, (secondary), and handles local coordination, local problem-solving and local communication within the area affected by smoke intrusions. The Responsible Authority may request monitoring assistance, if necessary. DEC will work with the Responsible Authority to provide monitoring assistance, if requested (see “Emergency Monitoring Policy,” Section 5-3).

2-3. DEC Smoke Management Program

The purpose of the Enhanced Smoke Management Plan (ESMP) is to provide a clear and equitable regulatory basis for smoke management in Alaska. DEC is responsible for protecting the health and welfare of Alaskans from the impacts of smoke from fire as well as protecting visibility according to federal Regional Haze Rules. The ESMP assists DEC in meeting these requirements. In order to ensure the ESMP is successful the DEC is responsible for the following:

- Development and implementation of the ESMP;
- Reviewing controlled burn for resource management and controlled burn for land clearing approval applications and issuing controlled burn approvals;

- Ensuring controlled burn approval applications comply with state air quality regulations (18 AAC 50.065) and ESMP guidelines;
- Collecting, reviewing, tracking, and summarizing statewide pre- and post-burn data for annual ESMP emission inventory reports to be distributed to AWFCG, EPA, and the Western Regional Air Partnership (WRAP). This activity will require annual assistance from the Alaska Interagency Coordination Center at the end of the fire season. General information will be compiled from the AICC website at http://fire.ak.blm.gov/**.** Specific information required for compiling an electronic version for the annual emission inventory report can be obtained by calling AICC at (907) 356-5671;
- Ensuring that field oversight and enforcement is conducted and is uniformly applied;
- Coordinating with the Smoke Management Committee members to establish and facilitate support for smoke management techniques and mitigation strategies within the program;
- Ensuring that the ESMP is understood and communicated to all land management agencies and the AWFCG; and
- Facilitating Smoke Management Committee meetings to evaluate the program effectiveness, review policies, discuss new smoke management methods, and help solve agency smoke management issues.

The DEC staff will notify health authorities, news media, the public-at-large, land management agencies and all other appropriate agencies when unacceptable limits of smoke accumulation are approached or exceeded. DEC staff will restrict implementation of controlled burn approval for resource management and controlled burn for land clearing permits in specific areas, request burn suppression actions, or request burn bans/restrictions when meteorological and/or existing air quality conditions so warrant (i.e., if weather forecasters predict undesirable wind conditions and smoke drifting into sensitive areas).

3. OPERATIONS AND AUTHORIZATION TO BURN

3-1. Smoke Management

This section is designed to give guidance on preparing smoke management information for the controlled burn for resource management and controlled burn for land clearing approval applications. Consideration of smoke management is a critical component of every controlled burn approval application. This is important for meeting public health, welfare and Class I area visibility goals as well as coordinating smoke management that may affect other burning in the area. These goals are discussed further in Section 5-1.

Evaluating potential dispersion of smoke emissions from a project is the single most important component of an effective ESMP. Land managers/owners may use a variety of evaluation methods for small projects that will not impact any sensitive features or where potential impacts are easily monitored and mitigated. For large projects, state-of-the-art tools exist to evaluate potential impacts.

DEC evaluates the controlled burn for resource management and controlled burn for land clearing approval applications for the potential of the project to contribute to unacceptable smoke impacts or particulate levels on smoke sensitive features. DEC is responsible for evaluating the cumulative impacts of multiple projects and authorizing only as many projects as the airshed can handle. If during the controlled burn approval process several individual projects request ignition at close time intervals, attempts will be made to ensure the agencies and/or landowners involved coordinate ignition times to minimize smoke impact.

When scheduling a burn and ignition time, the Responsible Authority must consider existing air quality, meteorological, and environmental conditions to evaluate smoke dispersion. The potential effects of multiple burn days, multiple ignitions and residual smoke must be evaluated prior to ignition or any new ignition.

Controlled burns (prescribed burns and land clearing burns) and ignition of controlled burns will only be conducted when favorable dispersion conditions exist. The Responsible Authority should obtain wind forecasts from the National Weather Service (NWS) forecasters for wind speed and direction estimates for the burn, an estimate of mixing heights, and residual smoke behavior on the night following the burn. The NWS forecast for smoke dispersion will generally integrate all pertinent weather information such as the timing of expected weather changes that may affect smoke dispersion. Your prescribed burn approval conditions may require a pre-burn meteorological conference (METCON) between your fire weather team and DEC's meteorologist prior to ignition.

After ignition, if meteorological conditions change and smoke impacts sensitive features, technologically feasible and economically and environmentally reasonable actions must be taken to mitigate impacts.

Smoke Management Techniques.

Below are some examples of smoke management techniques the Responsible Authority should consider to minimize emissions and smoke impacts:

- Use of ventilation factors, up-to-date weather data, weather forecasts
- Appropriate modeling with accurate weather data and emission factors
- Scheduling burns to use weather fronts bringing rain/snow to assist with minimizing air quality impacts when appropriate
- Burning when fuel moistures are low enough to prevent excessive smoldering
- Reference historic (e.g. over the last 10 years) emissions from burns in the area
- Emission projections based on sound data/science
- Identification of smoke sensitive features/receptors, and burning at times when wind direction and dispersion will mitigate impacts to sensitive features
- Visual observations
- Monitoring
- Test burns (small piles or representative areas)

3.2 Elements of Controlled Burn for Resource Management and Controlled Burn for Land Clearing Approval Application

Prior to each planned burn that requires DEC's approval (land management agency or landowner / corporation intends to burn, or clear and burn 40 acres or more during a calendar year), the Responsible Authority will submit their controlled burn approval application for controlled burning for resource management or controlled burning for land clearing (Appendix C) to DEC. Each controlled burn approval (Appendix C) will expire on December 31st of the year it was issued. Each agency or landowner may use its own established format instead of the DEC application, but each controlled burn approval application submittal must contain the following information for each planned ignition/burn unit:

1. **Indicate the location, duration, and inclusive dates considered for the burn:**

   Provide a legal description or latitude and longitude of the location to be burned and the expected duration of both single events and the entire burning project. Minor changes or additional information for the burn plan can be discussed at the time of DEC notification by phone. At a minimum, the applicant is required to call DEC by noon at least one working day prior to ignition. Call the number listed in the Open Burn Approval Letter.

2. **Identify the location of all sensitive features that might be impacted by smoke:**

   The Responsible Authority should identify on a map all Sensitive Features which include population centers such as communities, cities, towns, hospitals, health clinics, nursing homes, schools (in session), camp grounds, numbered Alaska highways and roads, airports, Prevention of Significant Deterioration Class I Areas, where smoke and air pollutants can adversely affect public health, safety, and welfare.

3. **Indicate how the public will be informed prior to, during, and after the burning:**

   The best way to avoid complaints is to make sure everyone around the burn area knows when the burn will occur so they can take steps to avoid the smoke. The Responsible Authority's local contact phone number should be publicized so the public can contact you. The public must be notified at least three days prior to the anticipated burn through the local news media or the local Post Office.

4. **Indicate how you will coordinate with other concerned agencies, including the Responsible Authorities of sensitive features:**

   Indicate how you will notify all concerned agencies, including authorities in control of sensitive features identified in Item 2 (such as the FAA, State Troopers, military, fire department, adjacent land managers, etc.) who are potentially affected by impaired visibility or adverse smoke impacts, prior to ignition. Include a list of telephone numbers or email addresses of agencies that must be contacted prior to ignition.

   The Department of Natural Resources, Division of Forestry (DOF) also issues burn permits; contact DOF to determine what requirements apply.

5. **Indicate the source of the weather forecast and how it will be used to prevent smoke impacts:**

   Identify how the local and spot weather forecast will be obtained (e.g. through the NWS) prior to ignition of the controlled burn. Parameters that should be obtained are the predicted visibility, dispersion conditions, wind direction, and wind speed.

6. **Indicate how weather changes will be monitored and what will be done to reduce or mitigate smoke impacts if unfavorable weather should occur after ignition:**

   Indicate how the weather will be monitored throughout the controlled burn. Identify what you will do if a wind shift or other weather change begins to create an adverse smoke impact on sensitive features identified in Item 2. For example, if an inversion is expected to occur during the night, active ignitions could be ceased.

   If any safety hazard is present as a result of smoke, or if requested by the authority of a sensitive feature, you must take technologically feasible and economically and environmentally reasonable steps to mitigate smoke impacts.

7. **Indicate what will be done to validate predicted smoke dispersion:**

   Indicate how you will predict smoke dispersion. If a recommended method (test fire, small piles or areas etc.) fails to indicate that acceptable smoke dispersion will occur, no fires will be ignited.

8. **Indicate proposed techniques to be used to enhance the active fire phase and reduce the smoldering phase:**

   Consider employing emission reduction techniques (Appendix D) to enhance the active fire phase and reduce smoldering, and indicate what is feasible to accomplish the burn objectives.

9. **Indicate how authorities in control of sensitive features will be contacted if visibility decreases:**

   Provide a contingency plan (Appendix E) for smoke intrusion into populated areas, Class I areas, or other smoke sensitive features as notified in Item 2. Authorities having control over sensitive features identified in Item 2 must be notified if visibility is expected to be decreased to less than three miles for an hour. Indicate how you will notify authorities of sensitive features if this occurs. If any safety hazard is present, or if requested by the authority of a sensitive feature, you must mitigate impacts through steps that are technologically feasible and economically and environmentally reasonable. Contingency or emergency monitoring may be needed to measure and detect smoke intrusions on sensitive features.

10. **Identify alternative disposal options for material being controlled burned:**

    An evaluation of alternatives to controlled burning (Appendix F) must demonstrate that controlled burning is the only technologically feasible and economically and environmentally reasonable alternative. Identify other alternative disposal options for material burned or why burning is the selected alternative (e.g. marketing timber with a lumber company) and why the alternatives were not used; or list any alternatives to burning that have been done to the burn units prior to ignition.

11. Indicate how you will coordinate with air quality authorities having jurisdiction:

At a minimum, notify DEC by telephone by noon one business day prior to ignition. Call the number listed in the Open Burn Approval Letter. Include the 11 items in Section 2.2. If a multiple day burn is planned, the responsible authority need only call before the first ignition day. A call to DEC after a multiple day burn is completed is requested. If the burn is not conducted, please notify DEC within 24 hours to schedule a new burn date.

12. Indicate the type of vegetation to be burned, pre-burn and post-burn fuel loading estimates and ignition technique to be used.

Pre-burn fuel loading represents the amount of fuel present at the burn location (to be consumed) and should be expressed as the weight of fuel per unit area in tons per acre. The post-burn loading estimate represents the fuel remaining after the burn. The ignition technique should describe the method (e.g. hand ignition – drip torch, helitorch) and technique (e.g. strip head fire, backing fire, etc.)

13. **For prescribed fires, indicate whether the fire is considered "anthropogenic" or "natural".** Note: Land clearing burns will be considered "anthropogenic."

The WRAP document, "Policy for Categorizing Fire Emissions" explains what is considered a natural source of fire and what is considered a human-caused source. This document is available at: http://www.wrapair.org/forums/fejf/docs.html

14. Provide the approximate emissions expected for each burn and method used to estimate. Note: Emission estimates for Land Clearing Burns will be calculated by DEC.

Emissions can be estimated by multiplying the amount of fuel consumed (usually expressed in tons), by an emission factor expressed in pounds per ton of fuel. Emission factors can be found on EPA's website at http://www.epa.gov/ttn/chief/ap42/ch13/. Other emission factors or methods may also be used, including, but not limited to: CONSUME, FEPS, FOFEM, PFEP, and SASEM (Appendix D).

15. Air monitoring to be conducted.

Identify how the burn may affect / potentially impact air quality at smoke sensitive features, and how the visibility in Class I areas will be monitored (Appendix G). If the burn will not adversely affect visibility in a Class I area, state that there is low potential of the burn impacting visibility in a Class I area and that monitoring will not be conducted.

Items one through eleven are required in an open burning application under existing DEC regulation (Appendix B); items twelve through fifteen are elements that are necessary for managing smoke and developing and tracking emission inventories for regional haze.

3-3. Post-burn Reporting.

After each burn, the Responsible Authority will submit a post burn report to the DEC within 90 days. The Responsible Authority must maintain a copy of the application and post burn report. A post-burn report must include the following information:

- **Authorized agency and approval number.**
- **Date of burn(s).** Actual dates of the burn (ignition, active burning, and smoldering phases).
- **Burn location.** Latitude and longitude of center of burn area, along with map showing burned area.
- **Area of burn.** The entire burn unit less any unburned inclusions (Estimate in acres).
- **Fuel type(s).** The fuel type optimally represents the predominant fuel or cover type consumed in the fire (e.g. Sitka spruce). Specify CFDR/NFFL and descriptive model.
- **Pre-burn fuel loading information**.
- **Fuel consumption.** The amount of fuel actually consumed expressed in tons/acre (pre-burn fuel loading data is acceptable if actual numbers can not be determined).
- **Predominant configuration of the fuel burned,** e.g., pile, windrow, broadcast, underburn.
- **Emission reduction techniques used.** Describe any burning techniques applied that reduced the actual amount of emissions, for example, changing ignition timing to allow for more efficient combustion.
- **Type of Burn.** "Anthropogenic" or "natural" classification (see glossary/Appendix). All controlled burns for land clearing are considered human-caused or anthropogenic.
- **Verification of weather forecasts and air quality advisory status** for the event date(s).
- **Description of public notifications made.**
- **Public complaints (if any).**

4. BURN RESTRICTIONS DUE TO AIR QUALITY CONCERNS

When DEC issues burning restrictions based on air quality concerns in any part of the state, all AWFCG members will be notified as soon as possible. If there is residual smoke in the area, it is the responsibility of the Responsible Authorities to contact DEC and check the DEC Air Advisory web site (http://www.dec.state.ak.us/air/am/aq_sr.htm) prior to a scheduled burn to determine if a restriction is pending or in effect. Local government agencies and the Division of Forestry also need to be contacted to verify there are no open burning restrictions.

DEC Burn Restrictions can be issued as follows:

- Statewide;
- By airshed(s);
- By proximity to smoke sensitive feature;
- By DEC authority (18 AAC 50.245); or
- Any combination of the above.

Any restrictions will be based on local observations and available monitoring and meteorological data. Generally, restrictions due to poor air quality are in effect for 24 hours, although 3 day and weekend forecasts will be made. DEC encourages Responsible Authorities to restrict conducting prescribed burn projects on holiday weekends near sensitive areas or areas with high recreation use. The Responsible Authority should contact DEC if they wish to burn during holidays so that adequate contingencies are in place to manage any smoke intrusions.

The final responsibility for smoke management in the locality of the prescribed burn rests with the Responsible Authority who is conducting the burning. The Responsible Authorities are expected to mitigate smoke by choosing optimal times and weather conditions that meet the needs of the prescribed burn and also minimizes smoke intrusions if, in their opinion, they are not getting adequate smoke dispersion, or if local weather factors or topographical features are such that smoke problems could result. Conversely, if local weather conditions appear to be more favorable for burning than what was forecast, Responsible Authorities should contact DEC to discuss options.

Prescribed burn ignitions should not occur if:

- An Air Quality Advisory is in place for areas that could be impacted by the burn;

- Air quality is deteriorating and is expected to continue to deteriorate;

- There is a high probability that a significant amount of smoke will intrude into "sensitive features";

- The burn will not comply with the Alaska State Implementation Plan (SIP) or the federal Clean Air Act regarding visibility protection of Class I federal areas (Appendix H);

- Any state or federal air quality standards, regulations, laws, or rules would be violated; or

- Air quality is deteriorating and is expected to continue to deteriorate which may result in an Air Quality Episode (Appendix I) being declared in the next 24-hour period. Additional ignitions will be denied until conditions improve in the area.

5. AIR QUALITY MONITORING.

5-1. Visibility and Regional Haze Goals.

All states must develop programs to make "reasonable progress" toward meeting the visibility goals in designated Class I areas as part of their air quality State Implementation Plans (SIPs). Alaska has four Class I areas: Denali National Park & Preserve, Tuxedni Wilderness Area, Simeonof Wilderness Area, and Bering Sea Wilderness Area (Appendix H). The DEC has the primary responsibility for SIP development and is currently in the process of determining Alaska's rate of progress toward meeting visibility goals.

5-2. Ambient Air Monitoring.

"Ambient air monitoring" within the context of the ESMP refers to air quality monitoring conducted as a consequence of wildfire activity or in support of prescribed fire activities. All monitoring should be performed with DEC approved air monitoring samplers using standard operating procedures for monitor operation, data collection and QA/QC. Samplers should be placed outside of the fire zone in a location which is representative of a smoke sensitive area, such as a hospital or health clinic.

Monitor site placement depends on the meteorology (primarily wind direction), area topography and the relationship of the smoke/airshed to the populated area. Monitoring may require the deployment of several samplers. Example: a land management agency is planning a large prescribed burn in fuels within the management area. The closest community is fifteen miles away. Weather forecasts indicate that the winds could blow toward the town; therefore, a monitor should be placed in or near the community.

In all monitoring site-placement, the focus is protection of public health. The DEC Monitoring and Quality Assurance Program may be requested to work with the Responsible Authority to identify appropriate monitoring sites. Time and materials fee or a reimbursement agreement with DEC will be necessary.

5-3. Smoke Monitoring Policy.

The DEC is willing to work with land managers or land owners to assess smoke impacts and protect public health through ambient air monitoring assistance. While DEC does not have funding to support prescribed fire activity, the air monitoring section does have trained staff who could be mobilized to support a fire event by evaluating smoke impacts or monitoring air quality for prescribed burns. Funding agreements will be necessary for DEC to support monitoring.

Emergency response air monitoring support from DEC has been utilized once before on the Carla Lake Fire. With newer and more portable real-time monitors, the ability to monitor smoke impacts has become easier and more accurate.

6. AIR QUALITY COMPLAINT PROCEDURES.

6-1. General Procedures

There may be occasional intrusions of smoke into smoke sensitive areas. The Responsible Authority and the DEC are responsible for complaint processing and smoke-intrusion reporting. Documentation of such occurrences will improve future prevention measures and properly inform responsible officials and the public.

The nature of the complaint will determine what procedure is to be followed to address the complainant. Every attempt should be made to resolve the complaint at the lowest possible level. Any agency or landowner receiving complaints should handle the initial situation if they are knowledgeable of the ESMP or the specific burn and should learn as much information about the burn as possible in order for proper follow-up to take place.

Complaints can come in several forms. Historically, complaints have been received from the public at large where the basis for the complaint is an objection to seeing smoke, smelling smoke, and health concerns because of smoke. Local explanation of the program and resolution of the caller's concerns will often solve the problem. If an AWFCG member receives the call they should explain the purpose and basis for the ESMP in order to inform the caller that a control program is in place in Alaska.

The following information needs to be collected in order for the organization / landowner to take proper and necessary follow up actions. Information to be collected includes:

- Name and phone number of the caller
- Location of the burn (include best estimate of burn location / direction of smoke)
- Time of day
- Any other comments that will aid in the follow up process (e.g. people see and / or smell smoke, etc.)

The Responsible Authority should forward any complaints received to DEC with their post-burn report or when requested by DEC. If another AWFCG member receives a smoke complaint, it will be forwarded to the appropriate agency representative (usually the Responsible Authority or DEC) as soon as possible. If a smoke complaint on a land clearing burn is received by an AWFCG member, the complaint will be forwarded to DEC as soon as possible. DEC will immediately forward complaints it receives to the Responsible Authority for resolution if the complaint information suggests a prescribed burn is conducted during a restricted period or if smoke dispersion is less than adequate for the burn.

DEC will log all complaints received into the DEC Complaint Automated Tracking System (CATS). For each complaint received by the Responsible Authority and DEC, pertinent data will be recorded along with the final resolution or actions taken to address the complaint. This information may be valuable for contacting community residents prior to future planned burns.

6-2. Public Notification and Exposure Reduction

If smoke impacts develop and it becomes necessary to issue air quality notices (e.g. advisories, alerts, warnings, or emergencies), DEC and the Responsible Authority will cooperatively determine a course of action. According to 18 AAC 50.245, the DEC will, in its discretion, declare an air episode (Appendix I) and prescribe and publicize protective actions when the concentration of an air contaminant in the ambient air has reached, or is likely in the immediate future to reach, any of the concentrations established by the National Ambient Air Quality Standards (NAAQS). The concentrations are 150 $\mu g/m^3$ of particulate, PM_{10} (24-hour average).

Air Episodes for PM_{10}	
Episode Level	**PM_{10} Level**
Advisory	No monitored data available; qualitative based on smoke impact observations and meteorological conditions.
Alert	150 $\mu g/m^3$
Warning	350 $\mu g/m^3$
Emergency	420+ $\mu g/m^3$

Federal standards for $PM_{2.5}$ are in place; however, Alaska has not yet adopted these standards in regulation. The federal 24-hour health standard for $PM_{2.5}$ is 35 $\mu g/m^3$. Prior to Alaska regulations being finalized, the $PM_{2.5}$ levels delineated in the Air Quality Index Chart (below) will be used for public notification and exposure reduction. The chart lists the levels proposed by EPA and cautionary statements for each level. This chart will be updated when Alaska's $PM_{2.5}$ regulations are final.

AQI Index Value	AQI Categories	AQI Cautionary Statements	24 Hour Particulate Level ($\mu g/m^3$)
0 - 50	Good	None	0 - 15.4
51 - 100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.	15.5 - 35.4
101 - 150	Unhealthy for Sensitive Groups	People with respiratory or heart disease, the elderly and children should limit prolonged exertion.	35.5 - 55.4

151 - 200	Unhealthy	People with respiratory or heart disease, the elderly and children should avoid prolonged exertion; everyone else should limit prolonged exertion.	55.5 - 150.4
201 - 300	Very Unhealthy	People with respiratory or heart disease, the elderly and children should avoid any outdoor activity; everyone else should avoid prolonged exertion.	150.5 – 250.4
Over 300	Hazardous	Everyone should avoid any outdoor exertion; people with respiratory or heart disease, the elderly and children should remain indoors.	over 250.5

The DEC will follow the AQI levels and will call air quality advisories when levels reach the AQI category of 'Unhealthy for Sensitive Groups;' ; i.e., when levels exceed or are expected to exceed the NAAQS for $PM_{2.5.}$ If the DEC declares an advisory, the DEC will request voluntary emission restrictions from any permitted activity that might impact the area subject to the advisory, and publicize actions to be taken to protect public health (18 AAC 50.245, Eff. 1/18/96, Register 141).

Air quality general advisories (Appendix I) include broad educational-type statements which advise people about the potential for smoke impacts in the area. The general advisory provides recommendations for persons with respiratory illnesses or heart disease, and suggests ways to limit exposure. "Advisory" status does not involve any required action on the part of the public or the burn agency. Advisories may be issued without monitoring data. When general advisories are issued by DEC, all AWFCG members will be notified.

For PM_{10}, alert, warning, and emergency episode levels each have corresponding 24-hour average particulate concentration levels and have required action statements that suggest ways that the general public and sensitive individuals can limit their exposure. These notices will be based on real-time ambient monitoring, in combination with weather forecasts. Alerts will not be issued based solely on visual estimations of smoke impacts, nor on suspected smoke impacts. The cooperating agencies / land owners will agree on trigger levels, communication strategies and contingency measures before the burn project is ignited.

If smoke intrusions are causing unacceptable area-wide impacts, including nuisance smoke, ignitions of any new controlled burns that could impact the area will be denied by DEC through air advisory postings. Air quality advisories are appropriate for situations where the potential for multiple-day smoke impacts exists. The WESTAR (Western States Air Resources) Council produced a document (the 1995 Wildland Emergency Action Plan Implementation Guideline) that outlined an emergency action plan for implementation in urban areas where significant smoke impact from wildfires affected sensitive population groups.

The Responsible Authority should consult with DEC regarding appropriate short-term fire management response to abate verified impacts to smoke sensitive areas. Management responses should be implemented that will mitigate adverse impacts to public health using technologically feasible and environmentally and economically reasonable actions.

7. PUBLIC EDUCATION

Public education and outreach prior to burn ignition greatly decreases public complaints and often significantly decreases potential public health impacts attributed to smoke intrusion. Every effort should be made by the Responsible Authority to involve the potentially affected community in an early and on-going discourse on the use of prescribed fires in their area.

Public outreach often helps avoid conflicts which might not otherwise be identified, such as igniting burns during scheduled athletic events, or during annual hunting/fishing opening dates, holidays or other special events.

Public education guidance should be cooperatively developed and/or distributed by the AWFCG for use by Responsible Authorities. Such guidance would discuss options available for adequate public education, including public meetings, public service announcements, news articles, and public comment periods. The FireWise campaign (http://www.firewise.org/) and the FireWise Alaska handbook (http://forestry.alaska.gov/pdfs/06Firewise.pdf) have been successful public education processes, and could easily be used as a pattern or as a vehicle to promote public education on prescribed burning objectives at a local/airshed level where appropriate. In addition, the National Wildland Fire Coordinating Group (NWFCG) and the EPA Wildland Fire and Air Quality Workgroup have both developed useful educational packages.

Other Public Education Suggestions:

- Seek out appropriate forums to provide written information about rules and regulations, and answer questions.
- Initiate contacts with local news media to generate feature stories about the prescribed fire program and burn regulations.
- Include appropriate information about prescribed and land clearing burns in displays used at public gatherings, such as fairs.
- Provide press releases and public service announcements when needed.
- Coordinate with other agencies' public affairs offices to combine information about burning when appropriate.
- Develop brochures and other printed materials for distribution to appropriate sources and recipients.

8. FEES AND PROGRAM FUNDING.

Fees for a Controlled Burn for Resource Management and Controlled Burn for Land Clearing Approvals are posted in Alaska Administrative Code 18AAC50.400(l). Open burning regulations are located at 18AAC50.065. The ESMP is a required portion of the SIP, which outlines emission control strategies Alaska must address in accordance with the Clean Air Act and Regional Haze Rules.

9. ENFORCEMENT.

The implementation of the ESMP is usually done through regulation or through a Memorandum of Understanding between stakeholders. As the number, total acreage or complexity of prescribed fires increases, the State of Alaska may find its ESMP needs to be revised to ensure protection of the National Ambient Air Quality Standards and to meet regional haze visibility goals.

Regulations currently exist that prohibit burning in a manner that adversely impacts public health or the environment (18 AAC 50.065. 50.110 and 50.245). Adherence to State of Alaska regulations is mandatory. It is the responsibility of DEC to enforce the regulations. Additional regulations may be promulgated if the State determines that present regulations are inadequate for protecting public health.

Unacceptable smoke impacts that occur because the Responsible Authority was negligent or failed to follow the open burning regulations may result in enforcement action. Should an agency or land owner fail to follow procedures, requirements or restrictions issued under the open burning regulation, it may be considered grounds for revocation of the burn permit.

A mechanism similar to the program used to enforce air quality regulations for industrial sources will be used to enforce Wildland burning regulations or agreements. Such a program will provide:

- A process for notifying land managers of the unacceptable impacts.
- An opportunity for the land managers to respond to allegations of unacceptable impacts.
- The ability for DEC to take regulatory action, including cooperative agreements which may require ESMP revisions.
- An appeal process.

In addition, the ESMP program will be reevaluated if a Responsible Authority follows ESMP guidelines, but resultant smoke still violates the NAAQS or produces significant complaints.

10. LIST OF ACRONYMS, ABBREVIATIONS and DEFINITIONS

$\mu g/m^3$:	micrograms per cubic meter
AAC:	Alaska Administrative Code
AQ:	Air quality
AICC:	Alaska Interagency Coordination Center
AWFCG:	Alaska Wildland Fire Coordinating Group
CAA:	Clean Air Act
CFR:	Code of Federal Regulations
DEC:	Alaska Department of Environmental Conservation
ESMP:	Enhanced Smoke Management Plan (includes Regional Haze requirements)
NAAQS:	National Ambient Air Quality Standards
PM:	Particulate matter
SIP:	State Implementation Plan
WESTAR:	Western States Air Resources Council
WRAP:	Western Regional Air Partnership

Agricultural Burn – also known as Controlled Burning for Land Clearing – open burning of woody debris material by farmers and developers. Approval is required from DEC if the intent is to clear and burn 40 acres or more per year.

Airshed is a geographical area where atmospheric characteristics are similar (e.g. mixing height and transport winds). (i)

Air Quality Advisory refers to a period where an air episode may warrant public notification. Air quality **advisories** are general, educational-type statements which advise the general public about the potential for smoke impacts and suggest ways to limit exposure. "Advisory" status does not involve any required action on the part of the public or the burn agency and often does not have monitoring data associated with it, though it may refer to weather forecasts.

Air quality alert, warning or emergency status refers to a period where an air episode is declared, as stated in 18 AAC 50.245. Valid air quality monitoring data and weather forecasts should be used to document air quality status and duration. Regardless of the source of the emissions, air episodes involve required actions on the part of the public (such as avoiding outdoor exercise) or land managers (such as avoiding additional emissions for the area).

Alternatives (or "burning alternatives") refer to mechanical, biological or chemical treatment methods of fuel reduction that do not include burning, such as chipping, grinding, logging, mechanical/hand thinning with removal, etc.

Ambient air is that portion of the atmosphere, external to buildings, to which the general public has access.

Ambient air monitoring in this document refers to air quality monitoring done in support of prescribed fire activities or in response to Wildland fire activities.

Anthropogenic emissions are produced by human activities. (ii)

Approval or controlled burn approval (or "permit") refers to the DEC written approval that is required if material from land clearing operations for prescribed fire for agricultural, development, hazard fuel reduction, and forest or habitat management if the area burned, or the material collected to be burned, is 40 acres or greater per year. (18 AAC 50.065(g))

AP-42 Handbook is the EPA's Compilation of Air Pollutant Emission Factors for stationary point, area, and mobile sources. An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Emission factors are then used to estimate the magnitude of a source's pollutant emissions.(iii)

Burn plan is a strategic plan for managing a specific fire project to meet specific resource management objects. The plan includes the project objective, fire prescription (including smoke management components), personnel, organization, equipment, etc. It is used to apply for a DEC Controlled Burn Approval. (iv)

Burn restriction (see "Restriction").

Class I Area refers to an area set aside under the Clean Air Act (CAA) Section 162 to receive the most stringent protection from air quality degradation. This classification protects air quality in international parks, national parks greater than 6,000 acres in size, and national wildernesses greater than 5,000 acres in size, that were in existence on August 7, 1977 and any additions to those areas.

Clean Air Act (CAA) means 42 U.S.C. 7401 – 7671q, as amended through November 15, 1990. (18 AAC 50.990(17)).

Controlled Burn Approval application is the permit application required by DEC as part of the controlled burn approval process.

Controlled Burning for Land Clearing – see "Agricultural Burn"

Controlled Burning for Resource Management – see "Prescribed Burn"

Emission Factors are typically based on the EPA's AP-42 Handbook. Emission units are stated as "pounds of emission produced per ton of fuel consumed." An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. Emission factors are not yet available for accurately predicting emissions from burns in fuels such as Sitka spruce forests, tundra or deep duff layers commonly found in Alaska. Efforts are being made by the USDA Forest Service, Pacific Northwest Experiment Station to conduct research that will lead to more accurate estimations of emissions factors for Alaska. (iii)

Enhanced Smoke Management Plan (ESMP) is the agreement and program plan developed and agreed upon by the AWFCG. The purposes of ESMPs are to mitigate the nuisance and public health/safety hazards (e.g., on roadways and at airports, and at smoke sensitive features) posed by smoke intrusions into populated areas, to prevent deterioration of air quality and NAAQS violations; and to address visibility impacts in mandatory Class I Federal areas in accordance with the regional haze rules. (iii)

Fuel includes combustible vegetative matter such as grass, tundra, trees, shrubs, limbs, duff, and stumps.(iii)

Fuel loading is the amount of fuel present expressed quantitatively in terms of weight of fuel per unit area. This may be available fuel (consumable fuel) or total fuel and is usually dry weight. (ii)

Fuel type is an identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause a predictable rate of spread or resistance to control under specified weather conditions. (ii)

Inversion refers to a layer of air in which the temperature increases with height. The effect of various types of inversions is to greatly retard the dispersal of smoke. (vii)

Land manager/owner is the responsible Line Officer for the Federal agencies or designated individual in Federal, State, and private organizations who is authorized to make decisions concerning the management of specified land areas. (vi)

Member representative (or **Representative member** or **AQ Member)** means the individual who represents his or her organizational entity (agency or company) and is responsible for collecting and submitting pertinent agency burn information to the DEC Coordinator and AWFCG from their representative agency or company. They attend the annual meetings of the AWFCG.

Mixing height is measured from the surface upward, the height to which relatively vigorous mixing occurs in the atmosphere due to turbulence and diffusion. (viii)

National Ambient Air Quality Standards (NAAQS) are the standards established by the EPA for maximum acceptable concentrations of pollutants in the ambient air to protect public health with an adequate margin of safety, and to protect public welfare from any known or anticipated adverse effects of such pollutants (e.g. visibility impairment, materials damage, etc.) in the ambient air. (iii)

Natural background condition is an estimate of the visibility conditions at each Federal Class I area that would exist in the absence of human-caused impairment. (ix)

Non-attainment areas are areas that exceed the National Ambient Air Quality Standards (NAAQS) for certain "criteria pollutants" established by EPA or the States. Criteria pollutants have specific standards and exist for ozone, carbon monoxide, oxides of sulfur, oxides of nitrogen, lead, and particulate matter. (i)

Nuisance smoke is the amount of smoke in the ambient air at concentrations below the NAAQS which interfere with a right or privilege common to members of the public, including the use or enjoyment of public or private resources. Nuisance smoke is regulated by Alaska regulation 18 AAC 50.110, "Air Pollution Prohibited: A person may not cause or permit any emission that is injurious to human health or welfare, animal or plant life, or property, or that would unreasonably interfere with the enjoyment of life or property." (iv)

Open burning means the burning of a material that results in the products of combustion being emitted directly into the ambient air without passing through a contaminant outlet. (18 AAC 50.990(59)) Open burning includes prescribed fire (Controlled Burning for Resource Management) and Controlled Burning for Land Clearing (agricultural burning). The terms are used interchangeably in this document.

Particulate matter (PM) refers to any airborne material, except uncombined water, which exists as a solid or liquid at standard conditions (e.g., dust, smoke, mist, fumes or smog). (iii)

PM_{10} refers to particles with an aerodynamic diameter less than or equal to 10 micrometers. Emissions of PM_{10} are significant from fugitive dust, power plants, commercial boilers, metallurgical industries, mineral industries, forest and residential fires, and motor vehicles. (iii)

$PM_{2.5}$ refers to particles with an aerodynamic diameter less than or equal to 2.5 micrometers. A measure of fine particles of particulate matter that comes from fuel combustion, agricultural burning, woodstoves, etc. (iii)

Prescribed fire is any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist. In a federal action National Environmental Policy Act requirements must be met prior to ignition. (vi) Prescribed fire is a type of open burning. The terms are used interchangeably in this document.

Prescription is a written statement defining the objectives to be attained and may include, but is not limited to, temperature, humidity, wind direction, wind speed, fuel moisture, soil moisture, and fire behavior characteristics under which a fire will be allowed to burn. A prescription is generally expressed as acceptable ranges of the prescription elements. The extent of the geographic area to be burned may also be a prescriptive element.

Regional haze is defined in 40 CFR 51.301 and generally refers to concentrations of fine particles in the atmosphere extending up to hundreds of miles across a region and promoting noticeably hazy conditions, wide-spread visibility impairment, especially in mandatory Class I Federal areas where visibility is an important value. (iii)

Responsible Authority (Burn Boss, Fire Management Officer, land manager, etc.) is the individual who collects, reviews, and disseminates pre- and post- burn information to the DEC staff in the form of the Burn Application and Post-burn Report. This person is tasked with the responsibility of ensuring compliance with the approved burn permit, daily operations, coordinating burn information, providing smoke forecasting and air quality restrictions for their burns. This person(s) may also facilitate local area meetings to evaluate program effectiveness, and solve local issues related to their agency's burn plans. The Responsible Authority often has line authority and is the primary person with whom DEC will interact prior to, during, and after a burn. The Responsible Authority should be identified in the Burn Application that is submitted to DEC. (i)

Restriction to burning occurs when an air quality episode is declared which covers the area of concern. Restrictions to burning are generally issued for a twenty-four hour period but may be for a longer period. The alert may be based on an assessment that inadequate air ventilation is available which would inhibit the dispersal of pollutants, such as inversions and low wind speeds. Regardless of the source of the emissions, public notifications will be issued when smoke is impacting the area. Persons with controlled burn approvals must curtail their fire if their portion of the airshed is becoming overloaded or local weather factors would create smoke problems, even though no other restrictions have been imposed, i.e. wind moving directly into sensitive areas, inversions, etc.

Smoke dispersion refers to the processes within the atmosphere which mix and transport smoke away from the source. This depends on three atmospheric characteristics: atmospheric stability, mixing height, and transport winds. (vii)

Smoke intrusion refers to smoke from a prescribed fire entering a designated area at unacceptable levels. (vii)

Smoke sensitive features are population centers, such as towns and villages, camp grounds and trails, hospitals, health clinics, nursing homes, schools (in session), numbered Alaska highways and roads, airports, Federal Class I Areas, etc., where smoke and air pollutants can adversely affect public health, safety and welfare. (iv)

Smolder means to burn and smoke without flame. (18 AAC 50.990(81))

State Implementation Plan (SIP) is a CAA Section 110 required document in which States adopt emission reduction measures necessary to attain and maintain NAAQS and meet other requirements of the Act (such as regional haze). (iii)

Transport winds is a term that refers to the wind speed and direction at the final height of smoke plume rise. (vii)

Violation of the PM NAAQS refers to 40 CFR Part 50, last revised in 2006. The daily PM_{10} standard is violated when the 24-hour concentrations exceeds 150 $\mu g/m^3$ at any monitor within an area more than one time per year. The annual PM_{10} standard has been revoked.

The NAAQS levels for $PM_{2.5}$ are set at a daily concentration less than or equal to 35 $\mu g/m^3$ and an annual mean concentration of less than or equal to 15 $\mu g/m^3$. The daily standard is violated when the 98th percentile of the distribution of the 24-hour concentrations for a period of one year (averaged over three calendar years) exceeds 35 $\mu g/m^3$ at any monitor within an area. The annual standard is violated when the annual arithmetic mean of the 24-hour concentrations from a network of one or more population-oriented monitors (averaged over three calendar years) exceeds 15 $\mu g/m^3$. Compliance with the annual PM2.5 NAAQS is based on population-oriented monitors because the health information, upon which the standard is based, relates area-wide health statistics to area-wide air quality as measured by one or more monitors. (iii)

Visibility protection refers to Section 169A of the federal Clean Air Act (CAA) which establishes a national visibility goal to ". . . prevent any future, and remedy any existing, impairment of visibility in mandatory Class I areas." Alaska has four federal Class I areas that are national parks or wilderness areas (Appendix H). (iii)

Western Regional Air Partnership (WRAP) is a voluntary organization comprised of western governors, tribal leaders and federal agencies, and is charged "to identify regional or common air management issues, develop and implement strategies to address these issues, and formulate and advance western regional policy positions on air quality. (x)

Western States Air Resources Council (WESTAR) is an organization which consists of fifteen states including Alaska. WESTAR was formed to promote the exchange of information between the States, serve as a forum for western regional air quality issues of common concern and share resources for the common benefit of the member states.

Wildland is an area where development is generally limited to roads, railroads, power lines, and widely scattered structures. The land may be neglected altogether or managed for such purposes as wood or forage production, wildlife, recreation, wetlands or protective plant cover. (iv)

Wildland fire is any non-structure fire, other than prescribed fire, that occurs in the Wildland.(xi)

REFERENCES

i EPA Interim Air Quality Policy on Wildland and Prescribed Fires

ii Smoke Management Guide for Prescribed and Wildland Fire, 2001 Edition. National Wildfire Coordinating Group, Fire Use Working Team. 226pp.

iii Idaho/Montana smoke mgmt operating guide/SMP

iv NWFCG Wildland Fire Policy 1998.

v Regional Haze Rules, 40 CFR Part 51, 1999.

vi Alaska Wildland Fire Management Plan 1998.

vii Washington state SMP

viii National Wildfire Coordinating Group. 1996. Glossary of Wildland fire terminology. PMS 205. Boise, ID: National Wildfire Coordinating Group, National Interagency Fire Center. 162 p.

ix Policy for Categorizing Fire Emissions. November, 2001. Natural Background Task Team, Fire Emissions Joint Forum, Western Regional Air Partnership. Available: http://www.wrapair.org/forums/fejf/documents/nbtt/FirePolicy.pdf

x WRAP Charter, Purpose, p.1.

xi USDI and USDA Forest Service. 1998. Wildland and prescribed fire management policy-implementation procedures reference guide. National Interagency Fire Center, Boise, ID. 81pp.

Alaska Enhanced Smoke Management Plan Approval

The Alaska Wildland Fire Coordinating Group approved this version of the Alaska Enhanced Smoke Management Plan at its monthly meeting on June 3, 2009.

Steve Heppner, Chair AWFCG
Fire Program Manager
U.S. Department of Interior
Bureau of Indian Affairs – Alaska Region Office

Alice Edwards, Chair AWFCG Air Quality & Smoke Management Committee
Acting Director
Alaska Department of Environmental Conservation
Division of Air Quality

Alaska
Enhanced Smoke Management Plan
for Planned Fire

Appendices

June 3, 2009

Contact:

Joan Hardesty
Alaska Department of Environmental Conservation
Division of Air Quality
610 University Avenue
Fairbanks, AK 99709-3643
Phone (907) 451-2167; (fax) 451-2187

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Appendices

ALASKA ENHANCED SMOKE MANAGEMENT PLAN

LIST OF APPENDICES

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APPENDIX A

Alaska Wildland Fire Coordination Group (AWFCG)
Contact List

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ALASKA WILDLAND FIRE COORDINATING GROUP MEMBERSHIP
As of February 19, 2009

Agency Representative	Agency Alternate
Steve Heppner, Chair Fire Program Manager **US Department of the Interior** **Bureau of Indian Affairs** Alaska Region Office PO Box 25520 Juneau, Alaska 99802-5520 Phone: (907) 586-7404 Fax: (907) 586-7120 Cell: (907) 350-9280 steve.heppner.bia.ak.@gmail.com	None Specified
Dean Brown, ADNR Deputy Director **State of Alaska** **Department of Natural Resources** **Division of Forestry** 550 W. 7th Avenue, Suite 1450 Anchorage, Alaska 99501-3566 Phone: (907) 269-8476 Fax: (907) 269-8931 Cell (907) 440-4052 dean.brown@alaska.gov	**Lynn Wilcock (State Fire Representative)** Chief of Fire & Aviation **State of Alaska** **Department of Natural Resources** **Division of Forestry** 3700 Airport Way Fairbanks, Alaska 99709 Phone: (907) 451-2675 Fax: (907) 451-2690 Cell (907) 590-3686 lynn.wilcock@alaska.gov
Ron Knowles Incident Business Adminstrator **US Department of Agriculture** **Forest Service - Region 10** 3301 C Street, Suite 202 Anchorage, Alaska 99503-3956 Phone: (907) 743-9462 Fax: (907) 743-9479 Cell: (907) 230-4945 rknowles@fs.fed.us	Gary Lehnhausen Safety and Training **US Department of Agriculture** **Forest Service-Region 10** 3301 C Street, Suite 202 Anchorage, Alaska 99503-3956 Phone: (907) 743-9458 Fax: (907) 743-9479 Cell: (907) 230-4106 glehnhausen@fs.fed.us
Clinton Northway Fire Management Specialist **Tanana Chiefs Conference** 122 First Avenue, Suite 600 Fairbanks, Alaska 99701 Phone: (907) 452-8251 ext 3379 Fax: (907) 459-3852 Cell: (907) 322-7688 clinton.northway@tananachiefs.org	None Specified

ALASKA WILDLAND FIRE COORDINATING GROUP MEMBERSHIP
As of February 19, 2009

Agency Representative	Agency Alternate
Mike Burley Forest Specialist **Association of Village Council Presidents** PO Box 219 Bethel, Alaska 99559 Phone: (907) 543-7364 Fax: (907) 543-5732 Cell (907) 350-1113 mburley@avcp.org	None Specified
Dan Warthin Regional Fire Management Officer **US Department of the Interior** **National Park Service** Alaska Regional Office 240 West 5th Ave Anchorage, Alaska 99501 Phone: (907) 644-3409 Cell: (907) 347-7988 Dan_Warthin@nps.gov	**Mark Musitano, Alternate** Fire Management Officer **US Department of the Interior** **National Park Service** 4175 Geist Road Fairbanks, Alaska 99709-3420 Phone: (907) 455-0650 Fax: (907) 455-0601 Cell: (907) 978-4468 Mark_Musitano@nps.gov
John Gould Manager US Department of the Interior **Bureau of Land Management** **Alaska Fire Service** PO Box 35005 Ft Wainwright, Alaska 99703-0005 Phone: (907) 356-5506 Fax: (907) 356-5517 Cell: (907) 378-4615 John_Gould@ak.blm.gov	**Kent Slaughter** Associate Manager US Department of the Interior **Bureau of Land Management** **Alaska Fire Service** PO Box 35005 Ft Wainwright, Alaska 99703-0005 Phone: (907) 356-5505 Fax: (907) 356-5517 Cell: (907) 388-9924 Kent_Slaughter@ak.blm.gov
Alice Edwards Program Manager **State of Alaska** **Department of Environmental Conservation** Air Non-Point & Mobile Sources 410 Willoughby Avenue, Suite 303 Juneau, Alaska 99801-1795 Phone: (907) 465-5109 Fax: (907) 465-5129 Cell: alice.edwards@alaska.gov	**Cindy Heil** Acting Program Manager **State of Alaska** **Department of Environmental Conservation** Air Non-Point & Mobile Source Program 619 E. Ship Creek Ave, Suite 249 Anchorage, Alaska 99501 Phone: (907) 269-7579 Fax: (907) 269-7508 cindy.heil@alaska.gov

ALASKA WILDLAND FIRE COORDINATING GROUP MEMBERSHIP
As of February 19, 2009

Agency Representative	Agency Alternate
Dale Haggstrom Fire & Habitat Mgmt Coordinator **State of Alaska** **Department of Fish & Game** Division of Wildlife Conservation 1300 College Road Fairbanks, Alaska 99701 **Phone: (907) 459-7259** **Fax: (907) 459-7332 or 7337** Cell: (907) 460-1359 dale.haggstrom@alaska.gov	**Tom Paragi** Intensive Management Coordinator **State of Alaska** **Department of Fish & Game** Division of Wildlife Conservation 1300 College Road Fairbanks, Alaska 99701 Phone: (907) 459-7327 **Fax: (907) 459-7332 or 7337** Cell: (907) 590-3263 tom.paragi@alaska.gov
Jan Passek Fire Planner **US Fish & Wildlife R7** 1011 E. Tudor Road, MS238 Anchorage, Alaska 99503 Phone: (907) 786-3654 Fax: (907) 786-9605 Cell: (907) 947-9556 jan_passek@fws.gov	**Karen Murphy** Regional Fire Ecologist **National Wildlife Refuge System** 1011 E. Tudor Road, MS238 Anchorage, Alaska 99503 Phone: (907) 786-3501 Fax: (907) 786-9605 Cell: (907) karen_a_murphy@fws.gov
Charlie Sink Enterprise Division Manager **Chugachmiut** 1840 Bragaw Street, Suite 110 Anchorage, Alaska 99508-3439 Phone: (907) 562-4155 Fax: (907) 563-2891 Cell: (907) 529-7910 charlie@chugachmiut.org	
John T. Huxley Battalion Chief Anchorage Fire Department 4501 Campbell Airstrip Rd PO Box 196650 Anchorage, Alaska 99519-6650 Phone: (907) 267-5049 Fax: (907) 333-4926 huxleyjt@muni.org	**Sue Rodman** Forester Anchorage Fire Department PO Box 196650 Anchorage, Alaska 99519 Phone: (907) 267-4902 Fax: (907) 243-1654 Cell: (907) 317-7236 rodmansu@muni.org
AWFCG Recorder **RaDonna Turner** SOA, DNR, Division of Forestry 101 Airport Road Palmer, Alaska 99645 Phone: (907) 761-6210 Fax: (907) 761-6213 radonna.turner@alaska.gov	

ALASKA WILDLAND FIRE COORDINATING GROUP MEMBERSHIP
As of February 19, 2009

Agency Representative	Agency Alternate
	NMAC Liaison Brian McManus Chief, Branch of Fire Management **US Fish & Wildlife Service** **National Interagency Fire Center** 3833 South Development Avenue Boise, Idaho 83705 Phone: (208) 387-5583 Fax: (208) 387-5668 Cell: (208) 859-8525 brian_mcmanus@fws.gov

NOTE: Primary & Alternate AWFCG Group members will received all agenda/meeting/information

APPENDIX B

DEC Open Burning Policy and Guidelines

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OPEN BURNING
POLICY & GUIDELINES

State of Alaska
Department of Environmental Conservation
Division of Air Quality
Air Permits Program

January 2006

"A successful burn is one in which no complaints are received by the Department."

For Open Burning Questions Contact:

Interior Alaska:	**Robin Wagner, (907) 451-2114**
South Central Alaska:	**Chris Kent, (907) 269-6847**
Southeast Alaska & Aleutians:	**Chris Kent, (907) 269-6847**

POLICY AND GUIDELINES

The State of Alaska has two basic concerns with open burning: 1) that it does not spread and become a wildfire, and 2) that it does not cause air pollution that creates a health hazard or a public nuisance. The Department of Natural Resources (DNR) is responsible for regulations and permits to address the first concern (fire safety). The Department of Environmental Conservation (DEC) is responsible for regulations and permits to address the second concern (environmental protection).

It is the policy of the DEC to eliminate, minimize, or control open burning and to encourage other methods of disposal where possible. When open burning is permitted by the DEC, the permittee must provide for the most efficient combustion possible for the material to be burned. The DEC supports the maximum recycling and utilization of wood and forest products to reduce the volume of material requiring burning.

All open burning in the state, whether requiring written approval from DEC or not, must be done in a way that maintains maximum combustion efficiency throughout the burning period.

18 AAC 50.110. AIR POLLUTION PROHIBITED.

A person may not cause or permit any emission that is injurious to human health or welfare, animal or plant life, or property, or that would unreasonably interfere with the enjoyment of life or property.

18 AAC 50.065. OPEN BURNING.

(a) Except when conducting open burning under (g), (h), or (i) of this section, a person conducting open burning shall comply with the limitations of (b) - (f) of this section and shall ensure that

(1) the material is dried or kept covered to the greatest extent possible prior to burning;

(2) before igniting the burn, noncombustibles are separated;

(3) natural or artificially induced draft is present;

(4) to the greatest extent practicable, combustibles are separated from grass or peat layer;

(5) combustibles are not allowed to smolder (burn and smoke without flame).

(b) **Black Smoke Prohibited**. Except for firefighter training conducted under (h) or (i) of this section, open burning of asphalt products, rubber products, plastics, tars, oils, oily wastes, contaminated oil cleanup materials, or other materials in a way that gives off black smoke is prohibited without written DEC approval. DEC approval of open burning as an oil spill response countermeasure is subject to the DEC's *In Situ Burning Guidelines for Alaska*, adopted by reference in 18 AAC 50.035. Open burning approved under this section is subject to the following limitations:

(1) opening burning of liquid hydrocarbons produced during oil or gas well flow tests may occur only when there are no practical means available to recycle, reuse, or dispose of the fluids in a more environmentally acceptable manner;

(2) the person who conducts open burning shall establish reasonable procedures to minimize adverse environmental effects and limit the amount of smoke generated; and

(3) the DEC will, in its discretion, as a condition of approval issued under this subsection, require public notice as described in (j) of this section.

(c) **Toxic and Acid Gases and Particulate Matter Prohibited.** Open burning or incineration of pesticides, halogenated organic compounds, cyanic compounds, or polyurethane products in a way that gives off toxic or acidic gases or particulate matter is prohibited.

(d) **Adverse Effects Prohibited**. Open burning of putrescible garbage, animal carcasses, or petroleum-based materials, including materials contaminated with petroleum or petroleum derivatives, is prohibited if it causes odor or black smoke that has an adverse effect on nearby persons or property.

(e) **Air Quality Advisory**. Open burning is prohibited in an area if the DEC declares an air quality advisory under 18 AAC 50.245, stating that burning is not permitted in that area for that day. This advisory will be based on a determination that there is or is likely to be inadequate air ventilation to maintain the standards set by 18 AAC 50.010. The DEC will make reasonable efforts to ensure that the advisory is broadcast on local radio or television.

(f) **Wood Smoke Control Areas**. Open burning is prohibited between November 1 and March 31 in a wood smoke control area identified in 18 AAC 50.025(b).

(g) **Controlled Burning**. Controlled burning to manage forest land, vegetative cover, fisheries, or wildlife habitat, other than burning to combat a natural wildfire, requires written DEC approval if the area to be burned exceeds 40 acres yearly. The DEC will, in its discretion, require public notice as described in (j) of this section.

(h) **Firefighter Training: Structures**. A fire service may open burn structures for firefighter training without ensuring maximum combustion efficiency under the following circumstances:

(1) before igniting the structure, the fire service shall

(A) obtain DEC approval for the location of the proposed firefighter training; approval will be based on whether the proposed open burning is likely to adversely affect public health in the neighborhood of the structure;

(B) visually identify materials in the structure that might contain asbestos, test those materials for asbestos, and remove all materials that contain asbestos;

(C) ensure that the structure does not contain

(i) putrescible garbage;

(ii) electrical batteries;

(iii) stored chemicals such as fertilizers, pesticides, paints, glues, sealers, tars, solvents, household cleaners, or photographic reagents;

(iv) stored linoleum, plastics, rubber, tires, or insulated wire;

(v) hazardous waste;

(vi) lead piping;

(vii) plastic piping with an outside diameter of four inches or more; or

(viii) urethane or another plastic foam insulation;

(D) provide public notice consistent with (j) of this section; and

(E) ensure that a fire-service representative is on-site before igniting the structure;

(2) the fire service shall ignite and conduct training on only one main structure and any number of associated smaller structures at a time; examples of associated smaller structures are garages, sheds, and other outbuildings; and

(3) the fire service shall respond to complaints in accordance with (k) of this section.

(i) **Firefighter Training: Fuel Burning**Error! Bookmark not defined.**.** Unless a greater quantity is approved by the DEC, a fire service may open burn up to 250 gallons of uncontaminated fuel daily and up to 600 gallons yearly for firefighter training without ensuring maximum combustion efficiency. To conduct this training without prior written DEC approval, the fire service shall

(1) provide public notice consistent with (j) of this section before burning more than 20 gallons of uncontaminated fuel, unless waived in writing by the DEC; and

(2) respond to complaints in accordance with (k) of this section.

(j) **Public Notice**. A person required to provide public notice of open burning shall issue the notice through local news media or by other appropriate means if the area of the open burning does not have local news media. The public notice must be issued as directed by the DEC and must

(1) state the name of the person conducting the burn;

(2) provide a list of material to be burned;

(3) provide a telephone number to contact the person conducting the burn before and during the burn;

(4) for a surprise fire drill, state

(A) the address or location of the training; and

(B) the beginning and ending dates of the period during which a surprise fire drill may be conducted may not exceed 30 days; and

(5) for open burning other than a surprise fire drill, the notice must also state the expected time, date, and location of the open burning.

(k) **Complaints**. A person required to provide public notice of open burning shall:

(1) make a reasonable effort to respond to complaints received about the burn;

(2) keep a record for at least 30 days of all complaints received about the burn, including:

(A) the name, address, and telephone number of each person who complained;

(B) a short summary of each complaint; and

(C) any action the person conducting the open burning took to respond to each complaint; and

(3) upon request, provide the DEC with a copy of the records kept under (2) of this subsection. (Eff. 1/18/97, Register 141)

Authority: AS 46.03.020, AS 46.03.710, AS 46.14.010, AS 46.14.020, AS 46.14.030, Sec. 30, ch. 74, SLA 1993

AS 46.14.990 DEFINITION.

(2) “ambient air” has the meaning given in 40 CFR 50.1, which means that portion of the atmosphere, external to buildings, to which the general public has access.

18 AAC 50.990 DEFINITIONS.

(14) "black smoke” means smoke having the color of emissions produced by the incomplete combustion of toluene in the double wall combustion chamber of a smoke generator.

(40) "fire service" means a fire Department registered with the state fire Marshall under 13 AAC 52.030, an organized fire brigade established under 8 AAC 61.010, Subchapter 01.1302(a)(1), and a wildland fire suppression organization within the Alaska Department of Natural Resources, Division of Forestry, the United States Forest Service, or the United States Bureau of Land Management/Alaska Fire Service.

(47) "impairment of visibility" means a humanly perceptible change in visibility such as visual range, contrast, or coloration, from that which would exist under natural conditions.

(62) "open burning" means the burning of a material that results in the products of combustion being emitted directly into the ambient air without passing through a contaminant outlet.

(64) "organic vapors" means any organic compound or mixture of compounds evaporated from volatile liquid or any organic compound or mixture of compounds in aerosols formed from volatile liquid.

(74) "practical means available" means, when approving the open burning of liquid hydrocarbons produced during oil or gas well testing, that all alternative disposal methods will have been analyzed and, where an environmentally acceptable procedure exists, it will be required.

(75) "putrescible garbage" means material capable of being decomposed with sufficient rapidity to cause nuisance or obnoxious odors.

(78) "reduction in visibility" means the obscuring of an observer's vision.

(81) ”responsible official” means:

(A) for a corporation, a president, secretary, treasurer, or vice-president of the corporation in charge of the principal business function, or any other person who performs similar policy or decision making functions for the corporation, or a duly authorized representative of that person if the representative is responsible for the overall operation of one or more manufacturing, production, or operation facilities applying for or subject to a permit under AS 46.14 or this chapter, and

(i) the facilities employ more than 250 persons or have gross annual sales or expenditures exceeding $35 million in second quarter 1980 dollars; or

(ii) the delegation of authority to the representative is approved in advance by DEC;

(B) for a partnership or sole proprietorship, a general partner or the proprietor, respectively; and

(C) for a public agency, a principal executive officer or ranking elected official; for the purposes of this chapter, a principal executive officer of a federal agency includes the chief executive officer with responsibility for the overall operations of a principal geographic unit in this state.

(85) "smolder" means to burn and smoke without flame.

(96) "uncontaminated fuel" means a hydrocarbon fuel, excluding propane, that does not contain used oil, crude oil, or a hazardous waste.

18 AAC 50.245. AIR EPISODES AND ADVISORIES.

(a) The DEC will, in its discretion, declare an air episode and prescribe and publicize curtailment action when the concentration of an air contaminant in the ambient air has reached, or is likely in the immediate future to reach, any of the concentrations established in Table 5 in this subsection.

(b) The DEC will declare an air quality advisory when, in its judgment, air quality or atmospheric dispersion conditions exist that might threaten public health.

(c) If the DEC declares an air quality advisory under (b) of this section, the DEC will

(1) request voluntary emission curtailments from any person issued a permit under this chapter whose facility's emissions might impact the area subject to the advisory; and

(2) publicize actions to be taken to protect public health. (Eff. 1/18/97, Register 141)

Table 5 - Concentrations Triggering an Air EpisodeError! Bookmark not defined.

Episode Type	Air Contaminant	Concentration (micrograms per cubic meter)
Air alert	Sulfur dioxide	365 (24-hour average)
	PM-10	150 (24-hour average)
	PM-10 from wood burning (wood smoke control areas)	92 (24-hour average)
	Carbon monoxide	10,000 (8-hour average)
Air warning	Sulfur dioxide	800 (24-hour average)
	PM-10	350 (24-hour average)
	Carbon monoxide	17,000 (8-hour average)
Air emergency	Sulfur dioxide	1,600 (24-hour average)
	PM-10	420 (24-hour average)
	PM-10 from wood burning (wood smoke control areas)	During an air alert, a concentration measured or predicted to exceed 92 (24-hour average), and to continue to increase beyond the concentration that triggered the air alert
	Carbon monoxide	34,000 (8-hour average)

Authority: AS 46.03.020, AS 46.14.010, AS 46.14.020, AS 46.14.030, Sec. 30, ch. 74, SLA 1993

ARTICLE 4. USER FEES.
18 AAC 50.400. PERMIT ADMINISTRATION FEES.

(l) Except as provided in (m)(10) of this section, the fee for DEC approval of open burning under 18 AAC 50.065 is $200.

(m) Unless the designated regulator service is subject to a fixed fee set out in (a) – (l) of this section, or to the terms of a negotiated service agreement under AS 37.10.052(b) and 18 AAC 50.405, the permittee, owner, or operator shall pay an hourly permit administration fee for a designated regulatory service. The DEC will calculate the total amount due under this subsection by multiplying the number of hours the DEC spent to provide the designated regulatory service by the hourly rate of salary and benefits of the DEC employees who provided the designated regulatory service, and by adding to the resulting amount any other direct costs. Designated regulatory services subject to this subsection include regulator services for:

(10) DEC approval of open burning under 18 AAC 50.065, if the DEC determines that smoke incursion into a public place, into an airport, into a Class I area, into a nonattainment area for CO or PM-10, or into a maintenance area for CO or PM-10 is likely.

(Eff. 1/18/97, Register 141; am 6/21/98, Register 146; am 10/1/04, Register 171; am 12/1/04, Register 172)

Authority: AS 44.46.025, AS 46.14.140, AS 46.14.240, AS 46.03.020, AS 37.10.050, AS 37.10.052, AS 37.10.058

AREA-WIDE POLLUTANT CONTROL EFFORTS FOR OPEN BURNING

Control of open burning incidences for air pollution is the responsibility of the DEC. Open burning is defined as, "the burning of a material that results in the products of combustion being emitted directly into the ambient air without passing through a contaminant outlet." All open burning in the state, whether requiring written approval from the DEC or not, must be done in a way that maintains maximum combustion efficiency throughout the burning period.

Open burning at landfills is also controlled by solid waste disposal regulations, 18 AAC 60.355. Open burning is prohibited at Class I and II landfills.

MATERIALS THAT CANNOT BE OPEN BURNED:

- Spill absorbents and contaminated soils that are RCRA hazardous waste.
- Pesticides, halogenated organic compounds, cyanic compounds or polyurethane products burned in a way that gives off toxic or acidic gases or particulates.
- Putrescible garbage, animal carcasses, or petroleum-based materials burned in a way that causes odor or black smoke that may have an adverse effect on nearby persons or residences.
- Electrical batteries, all types and sizes.
- All liquid-form paints (e.g. in cans).
- Lead-based painted wood debris, if classified as RCRA hazardous waste. For more guidance concerning wood with lead-based paint, please contact EPA RCRA office, Diane Richardson, at 907-271-6329.
- All solvents, except those composed of water and soap/detergent solutions.
- All aerosol cans, except that those do not use chloro- or fluoro- carbon propellants.
- Asbestos or any metals or alloys containing beryllium, chromium, cobalt, arsenic, selenium, cadmium, mercury, lead, or any radioactive wastes.
- Any electrical or electronic lamps or components that contain any of the above metals/alloys (including fluorescent, high-pressure sodium, mercury vapor and metal halide lamps).
- Any plastics or other materials containing chlorine as an essential component (such as Polyvinyl Chloride - PVC pipe). However, empty containers containing salt residue may be burned (salt is any metal chloride used for thawing or ion exchange).
- Tires.

- Treated wood containing compounds such as creosote, napthlate, or tar.

WHO NEEDS WRITTEN APPROVAL?

Certain types of open burning require written approval from the DEC prior to the incident. These include:

1. Controlled Burning For Land Clearing:

Open burning of woody debris material by farmers and developers requires written DEC approval if the intent is to clear and burn 40 acres or more per year. DEC will, in its discretion, require public notice. Open burning should be done, as rapidly and safely as other considerations permit, to develop maximum heat energy per unit time and vent the smoke to the highest elevation possible. The burn material should be as dry as possible to create a high heat energy, less smoke, and a more efficient burn.

2. Controlled Burning For Resource Management (Prescribed Burning):

Prescribed burning, intentionally set fires to burn off ground and forest cover is usually, but not always, done by land management agencies. Prescribed burning is subject to obtaining written DEC approval if the intent is to clear 40 acres or more in a year. DEC will, in its discretion, require public notice.

Since prescribed burning is the burning of ground cover, the normal requirements of "maximum combustion efficiency" do not completely apply. Land Management Agencies, when conducting prescribed burning, shall follow the Alaska Smoke Management Plan.

3. Fire Fighter Training:

Fire fighter training using structures or fuels must be conducted pursuant to 18 AAC 50.065(b), (h), and (i) and requires written DEC approval. Public notification is required unless DEC issues a written waiver for burns conducted in remote areas, where the news media is not generally available, or where no public will be affected.

A fire service may ignite and conduct training on only one main structure and its associated smaller structures at a time; examples of associated smaller structures are garages, sheds, and other outbuildings within close proximity to the main structure. Structures must be inspected for hazardous wastes and other nonburnables prior to ignition. Materials listed on the "**MATERIALS THAT CANNOT BE OPEN BURNED**" list (page 9 of this Guidance) are to be removed from the structure prior to ignition.

A fire service may open burn up to 250 gallons of uncontaminated fuel daily and up to 600 gallons yearly for fire fighter training without prior DEC approval, provided that the fire service give public notice of the event before burning more than 20 gallons of fuel and responds to complaints in accord with 18 AAC 50.365(j) and (k) respectively.

Fire fighter training shall be conducted pursuant to 18 AAC 50.065(b) and (h) and is subject to written DEC approval. Public notification is required according to 18 AAC 50.065(j).

4. Burning Materials that Produce Black Smoke:

Open burning of petroleum-based materials, asphalt, rubber products, or other materials in a way that give off black smoke is subject to obtaining written DEC approval. In addition, DEC will, in its discretion, require public notice.

Open burning should be done using reasonable procedures to minimize adverse environmental effects and limit the amount of smoke generated.

Open burning of oil or gas well flow tests must conform to 18 AAC 50.065(b)(1) and the guidance contained in the *In situ Burning Guidelines for Alaska*. DEC intends to eliminate open burning of liquid hydrocarbons because alternative measures are generally available. If alternatives become unusable because of equipment breakdown or inclement weather, such events do not constitute the non-availability of alternatives.

OPEN BURNING PROHIBITION:

Open burning can be prohibited on an area-by-area basis if DEC issues an air quality advisory covering the area of concern. This advisory can be for a maximum of twenty-four hours but may be renewed daily. The advisory will be based on an assessment that inadequate air ventilation is available which would inhibit the dispersal of pollutants, such as inversions and low wind speeds.

BURN PLAN APPROVAL GUIDELINES

APPROVAL ISSUANCE:

Volume II, Section III-F of the Alaska Air Quality Control Plan incorporated by reference under 18 AAC 50.030 lists the requirements for obtaining approval to open burn. DEC has up to 30 days to issue an approval. Written approval is not automatic but must be evaluated for conformance with the following guidelines.

A contingency plan should be prepared in case of unforeseen changes in weather or other uncontrollable parameters that would affect your burn and the resultant smoke. Persons with approval must curtail their fire if air in the area is becoming overloaded or local weather factors would create smoke problems, even though no other restrictions have been imposed (i.e. wind moving directly into sensitive areas, inversions, etc.).

If any safety hazard is present, you must extinguish the fire as soon as possible. You will be held legally responsible for any accident or adverse health effects that occur because of your open burn.

The guidelines of a burn plan should include the following:

1. Indicate the location, duration, and inclusive dates considered for the burn:

Indicate the type and quantity of material, the condition, and the expected duration of both single events and the entire burning project. Changes or additional information for the burn plan can be discussed at the time of DEC notification by phone.

2. **Identify the location of all sensitive features that might be impacted by smoke:**

   The applicant should list all population centers, including airports, medical facilities, schools (in session), and numbered Alaska highways, that are within an appropriate radius of the project. The "appropriate radius" should include an adequate margin of safety to include all potentially impacted sensitive populations and activities.

3. **Indicate how the public will be informed prior to, during, and after the burning:**

   A successful burn is one in which no complaints are received. The best way to do this is to make sure everyone around you knows when the burn will occur so that they can take steps to either avoid the smoke or tolerate it. Your direct contact phone number should be publicized so that public can contact you if need be. In the case of fire training, notify the public through news media.

4. **Indicate how you will coordinate with other concerned agencies, including authorities of sensitive features:**

   Indicate how you will notify all concerned agencies, including authorities in control of sensitive features identified in Item 2 (such as the FAA, State Troopers, military, fire department, adjacent land managers, etc.) who are potentially affected by visibility or adverse smoke impacts prior to ignition. Indicate if you obtained a permit and notified the Forestry Division of the Department of Natural Resources.

5. **Indicate where the weather forecasts will be obtained and how it will be used to prevent smoke impacts:**

   Identify how the weather forecast will be obtained during the open burn. Parameters that should be obtained are the predicted visibility, wind direction, and wind speed.

6. **Indicate how weather changes will be monitored and what will be done to reduce or mitigate smoke impacts if unfavorable weather should occur after ignition:**

   Indicate how the weather forecast will be monitored throughout the open burn. Identify what you do if a wind shift or other weather change begins to create an adverse smoke impact on sensitive feature identified in Item 2. For example, if you expect an inversion to occur during the night, you would put the fire out at the end of the day. If any safety hazard is present or if requested by the authority of a sensitive feature, you must extinguish the fire as soon as possible.

7. **Indicate what will be done to predicted smoke dispersion:**

   Indicate how you will predict smoke dispersion. If a recommended method (smoke bomb, test fire, etc.) fails to indicate that acceptable smoke dispersion will occur, no fires will be ignited. "Unacceptable smoke dispersion" is defined as an unacceptable decrease in air quality for any sensitive feature identified in Item 2.

8. **Indicate what will be done to enhance the active fire phase and reduce the smoldering phase:**

   Indicate what will be done to enhance the active fire phase and reduce smoldering. For example, material should be stacked in order to enhance oxygen flow to the flames.

For land clearing, indicate if you will conform to the following: berm piles should contain less than five percent of non-combustibles (soil, ice or snow); be readily extinguishable by the applicant within two hours; be loosely stacked to allow for natural draft; be cured for at least one year prior to ignition; and be no longer than 1000 feet without a firebreak.

9. Indicate how sensitive features will be contacted if visibility decreases:

Authorities having control over sensitive features identified in Item 2 will be notified if visibility is expected to be decreased to less than three miles for greater than 30 consecutive minutes and/or 180 minutes during a 24-hour period. Indicate how you will notify authorities of sensitive features if this occurs. If any safety hazard is present or if requested by the authority of a sensitive feature, you must extinguish the fire as soon as possible.

10. Identify alternative disposal options for material being open burned:

For fires other than fire fighter training, evaluate alternatives to open burning must demonstrate that open burning is the only feasible alternative. Identify if you looked into other options of disposal, such as marketing timber with a lumber company.

11. Indicate how you will coordinate with air quality authorities having jurisdiction:

Indicate that you will notify DEC by telephone at least 24 hours prior to ignition Monday thru Friday between 8:00 AM and 4:30 PM excluding State holidays: (907) 269 7577 (Anchorage Administrative Clerk), (907) 451-5173 (Fairbanks Administrative Clerk), or (907) 456-5100 (Juneau Administrative Clerk). Identify your name, location of burn, contact phone number, what your test burn was like, how long you expect the active fire phase and the smoldering phase to last, and what kind of notification procedures you have done.

HOW TO OBTAIN OPEN BURNING APPROVAL:

The applicant shall submit an application for the proposed open burning, which addresses each of the eleven concerns specified above. Application forms are available from DEC, or at http://www.state.ak.us/dec/air/ap/applic.htm.

Please note that there are fees for open burning approvals. With each open burn application, the applicant shall submit a $200 retainer payable to the State of Alaska, DEC. The cost of the approval will be $200 unless DEC determines that there may be smoke incursion into a public place, into an airport, into a Class I area, into a non-attainment area for CO or PM-10, or into a maintenance area for CO or PM-10. If DEC determines there may be smoke incursion, then DEC will notify the applicant that DEC will charge an hourly administrative fee and direct costs for approval processing and administration. DEC will prepare and send a monthly invoice itemizing fees and direct costs to the applicant.

Open burning in compliance with these guidelines or with the approval conditions does not exempt any person from any civil or criminal liability for consequences or damages resulting from such burning, nor does it exempt any person from complying with any other applicable law, ordinance, regulation, rule, permit, order, or decrees of this or any other governmental entity having jurisdiction.

For Open Burning Questions Contact:

Interior Alaska:	Robin Wagner (907) 451-2114
South Central Alaska:	Chris Kent, (907) 269-6847
Southeast Alaska & Aleutians:	Chris Kent, (907) 269-6847

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APPENDIX C

Example DEC Controlled Burning for Resource Management (Prescribed Burning) Approval Application

Example DEC Controlled Burning for Land Clearing Approval Application

Example DEC Controlled Burn Approval Letter

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF AIR QUALITY, AIR PERMITS PROGRAM
Anchorage Title V Permit Supervisor
619 Ship Creek Avenue, Suite 249
Anchorage, AK 99501

OPEN-BURNING APPROVAL APPLICATION

Controlled Burning for Resource Management

Prescribed burning, intentionally setting fires to burn off ground and forest cover, is usually, but not always, done by land management agencies. Prescribed burning requires written DEC approval before starting the burn if the intent is to burn, or clear and burn 40 acres or more during a year.

When conducting prescribed burning, Land Management Agencies shall follow the Enhanced Smoke Management Plan (ESMP). The ESMP is an agreement and program plan developed and agreed upon by the Alaska Wildland Fire Coordinating Group. The purposes of the ESMP is to mitigate the nuisance, health and safety hazards to transportation, such as, roadway and airport visibility impairment, smoke sensitive features (such as hospitals, schools, and clinics) posed by smoke intrusions into populated areas; to prevent deterioration of air quality and Alaskan Ambient Air Quality Standard violations; and to reduce visibility impacts in mandatory Class I Federal Areas in accordance with Regional Haze Rules.

Note: Please type or cut/paste your responses into the appropriate cells; the cells will expand as required.

Person(s) Responsible:

Project Contact:		Phone Number:	

Land Owner:		Fire Manager:		Applicant:	
Mailing Address:		Mailing Address:		Mailing Address:	
Phone Number:		Phone Number:		Phone Number:	

Emergency contact number(s) in case of smoke intrusion:

Name:		Name:		Name:	
Title / Agency		Title / Agency:		Title / Agency:	
Primary contact Phone #:		Primary contact Phone #:		Primary contact Phone #:	
Cell or other contact #:		Cell or other contact #:		Cell or other contact #:	

1. LOCATION AND DATES OF PROPOSED BURN	
Indicate the location, duration, and inclusive dates considered for the burn:	
Legal Description of Burn Site(s):	
Physical Location of Burn Site(s):	
Anticipated Burn Date(s):	Anticipated Duration of Each Event:

2. BURN SUMMARY

Location of Burn (please check):

	KP = Kenai Peninsula		DJ = Delta Junction
	SE = Southeast		AL = Aleutian (inc. Kodiak, Iliamna)
	MS = Mat-Su Borough		FBX = areas north of Talkeetna

	One time event? (yes or no)			Multiple Events? (yes or no)
Total acreage to be burned and/or cleared and burned:				
Acreage to be burned per event (if applicable):				
Permit Approval Requested Length:		1 Year		Multi-Year

If a multi-year permit approval is requested, indicate which portions of the projects will be burned during each of the following years: Attach a map as necessary to further indicate where/when burning will occur.

Indicate the type of vegetation to be burned (please check):

	1 = Broadcast, forested, not piled, heavy		4 = Machine piled slash
	2 = Range/tundra		5 = Hand piled slash
	3 = Wildlife habitat improvement		6 = Understory burns

Pre-burn and post-burn fuel loading estimates:

Size class (inches diameter):	Tons/acre (estimated):
0.00 to 0.25	
0.25 to 1.00	
1.00 to 3.00	
3.00 to 9.00	
Live Crown Mass	
Above Ground Mass	
Duff Layer (DMC, DC)	
Total:	

Ignition techniques to be used (please describe):

Provide the approximate PM, CO, VOC and NOx emissions expected for each burn and method used to estimate. *Emissions can be estimated by multiplying the approximate level of activity, which is the amount of fuel consumed, usually expressed in tons, by an emission factor which is expressed in pounds per ton of material burned. Applicants may use wild-fire emission factors, AP-42 factors, or other factors or methods if they are more specific to Alaskan fuels and conditions. AP-42 emission factors can be found on EPA's website:* http://www.epa.gov/ttn/chief/ap42/ch13/.

Burn Area:	Expected Emissions:	Method Used to Estimate Emissions:
	Ton per year PM	
	Ton per year CO	

	Ton per year VOC	
	Ton per year NOx	

3. SMOKE MANAGEMENT			
Have you developed a Smoke Management Plan for this burn (please check)?			
	Yes (Please attach and show ratings below)		No [Complete Attachment 1 (Smoke Complexity) and provide ratings below]

The Smoke Management Complexity ratings for this open burn are (check appropriate category):

Risk:		Low (1 point)		Moderate (2 points)		High (3 points)
Potential Consequences:		Low (1 point)		Moderate (2 points		High (3 points)
Technical Difficulty:		Low (1 point)		Moderate (2 points		High (3 points)

Complete Attachment 2 (Public Health Impact Complexity) included with this application. Summarize the Smoke Management Public Health Impact Complexity below (check appropriate category):

Risk:		Low (1 point)		Moderate (2 points)		High (3 points)
Potential Consequences:		Low (1 point)		Moderate (2 points		High (3 points)
Technical Difficulty:		Low (1 point)		Moderate (2 points		High (3 points)

Indicate the overall Smoke Management / Public Health Impact Complexity Rating Score for this burn (i.e., the total score of the above six ratings points): *Overall rating may be reduced through smoke mitigation efforts outlined in the complexity rating descriptions.*						
Revised overall smoke /health complexity rating with mitigation applied:		Low (6-8 points)		Moderate (8-12 points)		High (>12 points)

Indicate whether the fire is considered "anthropogenic" or "natural."	

anthropogenic: *a categorization that designates which fire emissions contribute to visibility impairment in a Federal Class I area. "Anthropogenic" emissions must be controlled to achieve progress toward the 2064 natural conditions goal for each Federal Class I area in Alaska. This classification includes natural and human-caused ignitions. Most fire emission sources are classified as "anthropogenic." Prescribed fire is an "anthropogenic" source, except where it is utilized to maintain an ecosystem that is currently in an ecologically functional and fire resilient condition (in which case it is classified as a "natural" source.)*

natural: *a categorization that designates which fire emissions can result in a natural reduction of visibility for each Federal Class I area in Alaska. This classification includes natural and human-caused ignitions. Wildfire that is suppressed by management action is a "natural" source. Wildfire, when suppression is limited for safety, economic, or resource limitations, remains a "natural" source. Wildfires managed for resource objectives are classified the same as prescribed fires. Native American cultural burning for traditional, religious, and ceremonial purposes is a "natural" source.*

Further clarification regarding the differences between "anthropogenic" and "natural" are explained in the WRAP document "Policy for Categorizing Fire Emissions". This document is available at http://www.wrapair.org/forums/fejf/docs.html

4. SENSITIVE FEATURES

Sensitive Features *include population centers such as communities, cities, towns, hospitals, health clinics, nursing homes, schools (in session), camp grounds, numbered Alaska highways and roads, airports, Prevention of Significant Deterioration Class I Areas, where smoke and air pollutants can adversely affect public health, safety, and welfare.*

Include a map of the proposed burn area.

a. Indicate multiple burn sites (if any) within the proposed burn area;
b. List sensitive features as described below that may be adversely affected by low level smoke and distance of those areas from proposed burn area(s);
c. List sensitive features that may be adversely affected long range transport of smoke and distance of those areas from proposed burn area(s).

How many maps are attached?	

5. MITIGATION:

If any safety hazard is present, or if requested by the authority of a Sensitive Feature, you must mitigate impacts through steps that are technologically feasible and economically and environmentally reasonable. Contingency or emergency monitoring may be needed to measure and detect smoke intrusions on Sensitive Features. Failure to have an effective mitigation measure may, in some cases, result in the application not being approved.

Indicate how authorities in control of Sensitive Features will be contacted if air quality degrades (visibility may be used as an indicator of air quality). Provide a contingency plan for smoke intrusion into Sensitive Feature areas. Indicate how you will notify Authorities having control over Sensitive Features identified above if visibility is expected to be decreased to less than three miles for an hour.

Is the burn expected to generate low level smoke, transported locally?		Yes		No
If yes, could people coming into the proposed burn locality be adversely affected by smoke?		Yes		No

If yes, what mitigation practices / contingency plans are proposed to help keep the smoke from affecting Sensitive Features near to the burn site?

Is the burn expected to be large enough (>1000 acres) or hot enough to create a smoke plume that is transported to upper level air currents?		Yes		No

If yes, what mitigation practices / contingency plans are proposed to help keep the smoke from affecting Sensitive Features far from the burn site?

6. PUBLIC NOTICE

The Responsible Authority's / Fire Manager's local contact phone number should be publicized. The public must be notified at least three days prior to the anticipated open burn through the local news media or the local Post Office.

Indicate how the public will be informed prior to, during, and after the burning. How will you notify persons in control of the sensitive features identified on your map of your anticipated burn?

Indicate how you will coordinate with other concerned agencies, including the Responsible Authorities of sensitive features identified above *(such as the FAA, State Troopers, military, fire department, adjacent land managers, etc.)* Include a list of telephone numbers or email addresses of agencies you will contact prior to ignition.

Indicate how you will coordinate with DEC Air Quality. *At a minimum, the DEC Meteorologist must be notified two (2) weeks prior to anticipated project ignition (907-269-3070). If your application is approved, a conference should be scheduled for 24 - 96 hours prior to the actual burn for a burn-weather call*

Attach a copy of your approval for the DNR - Forestry Division Open Burn Permit for your planned activity, or explain below why a DNR Burn Permit is not required.

7. METEOROLOGICAL / WEATHER FORECASTING

The Division's meteorologist is responsible for ensuring, from the Department's standpoint, that smoke from a prescribed burn does not adversely impact the public. To allow their participation in the burn decision making process, please ensure that this application is completed and submitted at least 2 weeks prior to a scheduled burn so they can participate in pre-burn planning events 1-2 days prior to ignition.

Indicate how weather forecasts will be obtained and used to prevent smoke impacts. Identify how the local and spot weather forecast will be obtained prior to ignition of the open burn. *Parameters that should be obtained are the predicted visibility, dispersion conditions, transport and local area wind direction, and wind speed.*

Indicate how weather changes will be monitored.

Explain what will be done to reduce or mitigate smoke impacts if unfavorable weather should occur after ignition. *If any safety hazard is present, or if requested by the Authority of a Sensitive Feature, you must take technologically feasible and economically and environmentally reasonable steps to mitigate smoke impacts.*

Identify what you will do if a wind shift or other weather change begins to create an adverse smoke impact on Sensitive Features previously.

Indicate what will be done to validate predicted smoke dispersion. Note: If a test fire, small piles or areas fire, etc. fails to indicate that acceptable smoke dispersion will occur, no fires are to be ignited.

Indicate proposed techniques to be used to enhance the active fire phase and reduce the smoldering phase. Consider employing emission reduction techniques before, during and after the fire. Indicate what is feasible to address the management objective.

Will air monitoring be conducted during the burn (check applicable boxes)?	
	No, monitoring will not be conducted during the burn. Explain why air quality monitoring for particulates should not be necessary for this burn.
	Yes, monitoring will be conducted. Describe the numbers and placement of monitors to be used, how often the data will be collected / stored, how the results will affect the burn operations, and where the monitoring data can be accessed by DEC staff.
Identify how the effect of the fire on air quality at Sensitive Features, and visibility in Class I areas will be monitored.	

The applicant will supply monitoring equipment and personnel *(Check Yes or No)*	YES	
	NO	
The applicant requests DEC supply monitoring equipment and personnel, and acknowledges that time and materials will be charged for DEC services *(Check Yes or No)*	YES	
	NO	

8. OTHER DISPOSAL OPTIONS

Identify alternative disposal options for material being open burned. *An evaluation of alternatives to open burning must demonstrate that open burning is the only technologically feasible and economically and environmentally reasonable alternative.*

Identify other alternative disposal options for material burned or explain why burning is the selected alternative and why the alternatives were not used.

List any alternatives to burning that have been done to the burn units prior to ignition.

Certification: (If signing as an Authorized Agent, please submit a copy of your authority to do so.)

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate, and complete.

Landowner Signature Date	Fire Manager Signature Date	Applicant Signature Date
Printed Name of Landowner	Printed Name of Fire Manager	Printed Name of Applicant

With each open burn application, submit a $200 retainer payable to the State of Alaska, DEC. The cost of the approval will be $200 unless DEC determines there may be smoke incursion into a public place, into an airport, into a Class I area, or into a non-attainment area or maintenance area for CO or PM-10. If DEC determines there may be smoke incursion, DEC will notify the applicant that an hourly administrative fee and direct costs for approval processing and administration will be charged. DEC will prepare and send a monthly invoice itemizing fees and direct costs to the applicant.

Send each open burn application and check to:

ADEC Air Permits Program
Anchorage TV Permit Supervisor
Open Burn Request
619 Ship Creek Avenue, Suite 249
Anchorage, AK 99501

Your approval may be issued within 30 days. If approved, notification and burn summary requirements will be outlined in your letter of approval.

A copy of the open burning guidelines may be obtained through our website:
http://www.dec.state.ak.us/air/ap/docs/obrguide.pdf

Attachment 1
Prescribed Fire Complexity Rating System Guide

Smoke Management – Risk		
	Low	Smoke concerns are generally few or easily mitigated. The project will produce smoke for only a short period of time or is barely visible to the public. Smoke exposure or amounts are not expected to cause health or safety concerns to project personnel or the public. Members of the public have expressed few or no concerns about smoke.
	Moderate	Smoke concerns are moderate and some concerns require special mitigation. The project will produce smoke visible to the public over several days. Smoke exposures or amounts may cause some health or safety concerns over a short period of time. Members of the public have expressed some concerns about smoke.
	High	Smoke concerns are high and require special and sometimes difficult mitigation. Smoke will be readily visible to the public and last several days to weeks. Smoke exposures or amounts are likely to cause some health and safety concerns that will require special mitigation. Large segments of the public are concerned about smoke.

Smoke Management - Potential Consequences		
	Low	No impacts OR minor impacts to isolated residences, remote roads or other facilities are expected. Firefighter exposure to smoke is expected to be minimal and not cause health and safety concerns.
	Moderate	Vistas, roads, and some residences may experience short-term decreases in visibility. A few health related complaints may occur. Minor smoke intrusions may occur into smoke sensitive areas, but below levels that trigger regulatory concern. Project personnel may be exposed to dense smoke for short periods of time.
	High	Vistas, roads, and residences may experience longer-term decreases in visibility OR significant decreases in visibility over the short-term. Major smoke intrusions may occur into smoke sensitive areas, such as Class I airsheds, non-attainment areas, hospitals, and / or major airports, at levels that trigger regulatory concern. Project personnel may be exposed to dense smoke for prolonged periods of time.

Smoke Management - Technical Difficulty		
	Low	No special operational procedures are required. Limitations on wind direction, season, etc. may be present in the plan. No mitigation efforts are deemed necessary
	Moderate	Some considerations are needed in the prescription OR ignition portions of the plan. Burn window / opportunities are reduced by the required weather / dispersion conditions. Normal coordination with air quality officials is required. Some mitigation measures or additional smoke modeling may be needed to address potential concerns with smoke impacts. Specific smoke monitoring may be required to determine smoke plume heights and directions. Rotating project personnel out of dense smoke is necessary but easy to accomplish. Some mitigation efforts can be used and will be placed into effect as necessary.
	High	Special considerations are needed in the prescribed fire plan. Special smoke management techniques will be used. Burn window / opportunities are limited by the required weather / dispersion conditions. Special coordination with air quality officials is required. Accelerated mop up may be planned to reduce smoke impacts. Some mitigation measures or additional smoke modeling are required to address potential concerns with smoke impacts. Specific smoke monitoring is required to determine smoke plume heights and directions. Rotating project personnel out of dense smoke is necessary but may be difficult to accomplish. Mitigation efforts can be used, but are difficult or will not be applied.

Attachment 2
DEC Smoke Management Public Health Impact Complexity Rating System Guide

Smoke Management Public Health Impact – Risk		
	Low	Smoke will not extend into local communities or travel aloft to distant communities. Health risk minimal.
	Moderate	Smoke will be in and around the public with some potential impact to sensitive individuals.
	High	Smoke would impact communities in the vicinity of the fire or in the distance which will probably require healthy and sensitive individuals to take precautionary actions.

Smoke Management Public Health Impact - Potential Consequences		
	Low	Little impact on public health. No one expected to require hospitalization.
	Moderate	Some impact anticipated. Sensitive individuals may need to take action to protect themselves.
	High	The public will be impacted by smoke from this fire. Sensitive people and some healthy individuals will most probably be impacted and require medical attention or be required to take direct precautionary action such as staying indoor, using an air filtration system or taking medicine.

Smoke Management Public Health Impact - Technical Difficulty		
	Low	No special operational precautions or advisories require to protect public health.
	Moderate	Further consideration of operational actions will need to be undertaken to ensure protection of potentially impacted public. Monitoring will need to be planned and samplers deployed for potential use in protecting the public.
	High	Action will be required to protect public health. Monitoring will be necessary. Samplers will be set up and operated and advisories issued if smoke levels exceed EPA air quality thresholds.

Example DEC Controlled Burning for Land Clearing Approval Application:

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF AIR QUALITY, AIR PERMITS PROGRAM
Anchorage Title V Permit Supervisor
619 E. Ship Creek, Suite 249
Anchorage, AK 99501

OPEN-BURNING APPROVAL APPLICATION

Controlled Burning for Land Clearing

Open burning of woody debris material by farmers and developers requires written DEC approval before lighting if the intent is to burn, or clear and burn, 40 acres or more during a year.

When conducting land clearing or agricultural burning, landowners and/or developers are encouraged to follow the Enhanced Smoke Management Plan (ESMP). The ESMP is an agreement and program plan developed and agreed upon by the Alaska Wildland Fire Coordinating Group. The purposes of the ESMP are to mitigate the nuisance, health and safety hazards to transportation and smoke sensitive features posed by smoke intrusions into populated areas; to prevent deterioration of air quality and Alaskan Ambient Air Quality Standard violations; and to reduce visibility impacts in mandatory Class I Federal Areas in accordance with Regional Haze Rules. Transportation concerns include roadway and airport visibility impairment; smoke sensitive features include hospitals, schools, clinics and etc.

Note: Please type or cut/paste your responses into the appropriate cells; the cells will expand as required.

Person(s) Responsible:

Project Contact:		Phone Number:	

Land Owner:	
Mailing Address:	
Physical Address:	
Phone Number:	

If the fire is being actively managed by someone other than the land owner, please provide their name and phone numbers:

Name:			
Phone Number:		Cell phone number:	

Emergency contact number(s) in case of smoke intrusion:

Name:	
Title / Agency	
Primary contact Phone #:	
Cell or other contact #:	

1. LOCATION AND DATES OF PROPOSED BURN	
Indicate the location, duration, and inclusive dates considered for the burn:	
Legal Description of Burn Site(s):	
Physical Location of Burn Site(s):	
Anticipated Burn Date(s):	Anticipated Duration of Each Event:

2. BURN SUMMARY			
Location of Burn (please check below). Please include a general map of the area showing where the burn is in relation to the nearest community or communities.			
	KP = Kenai Peninsula		DJ = Delta Junction
	SE = Southeast		AL = Aleutian (inc. Kodiak, Iliamna)
	MS = Mat-Su Borough		FBX = areas north of Talkeetna
	OL = Other Location, please specify:		

	One time event? (yes or no)		Multiple Events? (yes or no)

Total acreage to be burned and/or cleared and burned:	
Acreage to be burned per event (if applicable):	
Estimated number of piles/berms:	
Estimated composition of piles/berms:	
Estimated pile/berm size:	
Do piles/berms contain less than 5% non-combustibles (such as soil, snow, or ice)?	
Are piles/berms longer than 1000 feet without a fire break?	
Are piles/berms loosely stacked to allow for natural draft?	
Have the piles/berms been cured for one year prior to ignition?	
How do you propose to extinguish the piles/berms if necessary? (ie, excessive smoke)	
Can this be accomplished within two hours?	

Permit Approval Requested Length:		One Event		Multiple Events

If a multi-year permit approval is requested, indicate which portions of the projects will be burned during each of the following years. Multi-Year permits will require a renewal application each year and are subject to the same fee. Attach a map as necessary to further indicate where/when burning will occur.

Indicate the type of vegetation to be burned (please check):			
	1 = Broadcast, forested, not piled, black spruce, shrub		5 = Hand piled slash
	2 = Broadcast, forested, not piled, white spruce		6 = Grassland / crop field
	3 = Range/tundra		7 = Other (explain below)
	4 = Machine piled slash		
Describe ignition techniques to be used:			
Note: DEC will calculate the emissions from this burn from the information included in the application.			

3. OTHER DISPOSAL OPTIONS

Identify alternative disposal options for material burned (such as marketing timber) and explain why they were not used. *An evaluation of alternatives to open burning must demonstrate that open burning is technologically, economically, and environmentally the best alternative.*

List any alternatives to burning that have been done to the burn units prior to ignition.

4. SENSITIVE FEATURES

Sensitive Features *include population centers such as communities, cities, towns, hospitals, health clinics, nursing homes, schools (in session), camp grounds, numbered Alaska highways and roads, airports, and Class I Areas, where smoke and air pollutants can adversely affect public health, safety, and welfare.*

Include a map of the proposed burn area showing all sensitive features within a five mile radius. Additional maps are encouraged.

a. Indicate multiple burn sites (if any) within the proposed burn area;
b. List sensitive features as described above that may be adversely affected by low level smoke and distance of those areas from proposed burn area(s);
c. List sensitive features that may be adversely affected by long range transport of smoke and distance of those areas from proposed burn area(s).

How many maps are attached?	

5. SMOKE MANAGEMENT

DEC's primary goal is to manage smoke to mitigate impacts on public health and visibility. Depending upon the potential for smoke incursions, special mitigation procedures may be required. The State of Alaska uses the following chart from Montana to relate visibility, as impacted by smoke, with air quality concentrations: http://www.deq.state.mt.us/FireUpdates/VisibilityRanges.asp. **If you have questions while completing the Smoke Management portion of the application, please contact DEC for assistance.**

Out of each group of 3 or 4 statements relating to smoke management issues, please check the one that most accurately describes your land clearing open burn:

☐ The project will only produce smoke for less than 1 day. No smoke related impacts to remote residences, roads, or other facilities.

☐ The project will produce smoke for 1 - 3 days or the smoke will be barely visible to the public. Minor or no smoke related impacts to isolated residences, remote roads or other facilities.

☐ The project will produce smoke visible to the public over 4 - 7 days. Vistas, roads, and some residences may experience short-term decreases in visibility.

☐ The smoke will be readily visible to the public and last more than 7 days. Vistas, roads, and some residences may experience longer-term decreases in visibility or significant decreases in visibility over the short-term. Smoke may affect smoke sensitive areas.

- -

☐ Smoke will not extend into local communities or travel aloft to distant communities. Little impact expected on public health from smoke.

☐ Smoke will be around the public with potential impact to sensitive individuals who may need to take action to protect themselves.

☐ Smoke will impact communities in the vicinity of the fire or in the distance - the public will be impacted by smoke from this fire. Sensitive people and some healthy individuals may be required to take precautionary actions or need medical attention.

- -

☐ No special operational precautions required to protect public health.

☐ Consideration of operational actions will need to be undertaken to ensure protection of potentially impacted public.

☐ Action will be required to protect public health; air quality monitoring will be necessary.

- -

☐ No operational difficulties (wind direction, weather) are expected.

☐ Burn window(s) may be reduced by weather / dispersion conditions.

☐ Burn window opportunities are limited by weather / dispersion conditions. Accelerated mop up may be planned to reduce smoke impacts.

☐ I do not know what smoke impacts my fire will cause, please provide assistance.

Note: All land clearing / agricultural burns will be considered "anthropogenic" (human caused ignition).

6. MITIGATION:

If any safety hazard is present, or if requested by the authority of a Sensitive Feature, you must mitigate impacts through steps that are technologically feasible and economically and environmentally reasonable. Failure to have an effective mitigation measure may, in some cases, result in the application not being approved.

Indicate how authorities in control of Sensitive Features will be contacted if air quality degrades (visibility may be used as an indicator of air quality). Provide a contingency plan for smoke intrusion into Sensitive Feature areas. Indicate how you will notify Authorities having control over Sensitive Features identified above if visibility is expected to be decreased to less than three miles for an hour.

What mitigation practices / contingency plans are proposed to help keep the smoke from affecting Sensitive Features near to the burn site?

Is the burn expected to be large enough (>1000 acres) or hot enough to create a smoke plume that is transported to upper level air currents?		Yes		No

If yes, what mitigation practices / contingency plans are proposed to help keep the smoke from affecting Sensitive Features far from the burn site?

7. PUBLIC NOTICE

The Responsible Individual's local contact phone number should be publicized. The public must be notified at least three days prior to the anticipated open burn through the local news media, the local Post Office, or by individual communication (written documentation is best).

Indicate how the public will be informed prior to, during, and after the burning. How will you notify persons in control of the sensitive features identified on your map of your anticipated burn?

If burning is to occur within a non-urban area, list neighbors within a one-mile radius of the burn area. Use additional sheets if necessary.

Name:		Name:	
Address:		Address:	
Telephone:		Telephone:	
Name:		Name:	
Address:		Address:	
Telephone:		Telephone:	

Indicate how you will coordinate with other concerned agencies, including the Responsible Authorities of sensitive features identified above *(such as the FAA, State Troopers, military, fire department, adjacent land managers, etc.)* Include a list of telephone numbers or email addresses of agencies you will contact prior to ignition.

Indicate how you will coordinate with DEC Air Quality. *At a minimum, the DEC Meteorologist must be notified one week prior to anticipated project ignition (907-269-7676). If your application is approved, a weather conference call should be scheduled for 24 - 96 hours prior to the actual burn.*

Attach a copy of your approval for the DNR - Forestry Division Open Burn Permit for your planned activity, or explain below why a DNR Burn Permit is not required.

8. METEOROLOGICAL / WEATHER FORECASTING

The Division's meteorologist is responsible for ensuring, from the Department's standpoint, that smoke from a land clearing / agricultural burn does not adversely impact the public. To allow their participation in the burn decision making process, please ensure that this application is completed and submitted at least 3 weeks prior to a scheduled burn so they can participate in pre-burn planning events several days prior to ignition.

Indicate how weather forecasts will be obtained and used to prevent smoke impacts. Identify how the local and spot weather forecast will be obtained prior to ignition of the open burn (for example, contacting the National Weather Service). *Parameters that should be obtained are the predicted visibility, dispersion conditions, transport and local area wind direction, and wind speed.*

Indicate how weather changes will be monitored.

Explain what you will do if a wind shift or other weather change begins to create an adverse smoke impact on Sensitive Features previously identified.

Indicate what will be done to ensure smoke disperses as forecast. Note: If a test fire fails to indicate that acceptable smoke dispersion will occur, no more fires are to be ignited.

Indicate proposed techniques to be used to enhance the active fire phase and reduce the smoldering phase. Consider employing emission reduction techniques before, during and after the fire. Indicate what techniques are feasible for you to accomplish.

DEC may require monitoring for certain burns. Such burns are typically large-scale or very close to sensitive features. The monitoring requirements, if any, will be addressed within the approval process. If monitoring is required, DEC may supply monitoring equipment and personnel. The applicant acknowledges that time and materials will be charged for DEC services. ________ Yes
If applicable, identify how the effect of the fire on air quality at Sensitive Features will be monitored.

If any safety hazard is present, or if requested by the persons in control of a sensitive area, you must mitigate the smoke impact of the fire as quickly as possible. You will be held legally responsible for any accidents or adverse health effects that occur because of your open burn.

Certification: (If signing as an Authorized Agent, please submit a copy of your authority to do so.)

Based on information and belief formed after reasonable inquiry, I certify that the statements and information in and attached to this document are true, accurate, and complete.

Landowner Signature Date

Fire Manager Signature (if applicable) Date

Printed Name of Landowner

Printed Name of Fire Manager (if applicable)

With each open burn application, submit a $200 retainer payable to the State of Alaska, DEC. The cost of the approval will be $200 unless DEC determines there may be smoke incursion into a public place, into an airport, into a Class I area, or into a non-attainment area or maintenance area for CO or PM-10. If DEC determines there may be smoke incursion, DEC will notify the applicant that an hourly administrative fee and direct costs for approval processing and administration will be charged. DEC will prepare and send a monthly invoice itemizing fees and direct costs to the applicant.

Send each open burn application and check to:

ADEC Air Permits Program
Anchorage TV Permit Supervisor
Open Burn Request
619 E. Ship Creek, Suite 249
Anchorage, AK 99501

Your approval may be issued within 30 days. If approved, notification and burn summary requirements will be outlined in your letter of approval.

A copy of the open burning guidelines may be obtained through our website:
http://www.dec.state.ak.us/air/ap/docs/obrguide.pdf

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Example: DEC Controlled Burn Approval Letter

Alaska Department of Environmental Conservation
Air Quality Program
Open Burn Approval
Controlled Burning for Resource Management

Approval Number: AQ1048OBR36 **Expiration Date**: April 1, 2009

Applicant: Alaska Fire Service
P.O. Box 35005
1541 Gaffney Road
Fort Wainwright, AK 99703

Contact: Jason Dollard / Tami DeFries
(907) 356-5877
(907)356-5875)

Location: Manchu Range Burn, Total of 435 acres.

Description of Burn Unit: The Manchu Range Burn, located in the Yukon Training Area (Township 2 South, Range 4 East, Sections 31 & 30 / Lat and Long: 64 degrees 42.25' X 147 degrees 01.01'), has an anticipated one to eight days to burn in April through August 2008. Because the range is a live fire training area for small munitions and ordnances, the presence of unexploded ordnance exists. To the north and east, the Manchu unit is surrounded by an old dozer trail that has transformed into wet grassy marshes. On the south, there is a well established 20 ft. wide trail and to the west a 25 ft. gravel road. The goal of the prescribed burn is to reduce fuel loads and prevent serious fires from occurring as a result of small arms training activities. Aerial ignition is the planned method due to size, terrain, and the possibility of unexploded munitions on the ground. Fuels within the unit are predominantly black spruce, shrubs, and sphagnum mix. The sensitive sites nearby are Eielson AFB which hosts a major military airfield and residential areas, are located 2.5 miles SSW of the unit. The Moose Creek Trailer Park is located 3.5 miles to the west. The Two Rivers School is 12 miles north of the unit. The Richardson highway parallels the unit to the west, and is 3 miles away at its closest point. The community of North Pole is located approximately 10 miles WNW of the unit and the Trans-Alaska Pipeline 2 miles to the southwest.

The State of Alaska Department of Environmental Conservation (DEC), under the authority of AS 46.03, AS 46.14 and 18 AAC 50, issues this written approval to the Alaska Fire Service for controlled burning to manage forest land, vegetative cover, fisheries, or wildlife habitat (18 AAC 50.065(g)).

This approval is subject to the following conditions:

1. Provide a copy of this burn approval to the Burn Boss and keep a copy at the burn unit staging area during active burn activities.

2. Air Meteorologist Notification: Contact the DEC meteorologist at (907) 269-7676 or (907) 269-3070, at least one week prior to a scheduled burn and arrange with the meteorologist to participate in the pre-burn meteorological conference scheduled with your fire weather team prior to ignition. DEC Air Quality Division's meteorologist will review prescribed burn plans to check whether smoke from a prescribed burn could adversely impact the public. Our meteorologist will provide an independent evaluation of the predicted fire weather forecast to assist in the burn decision making process. If the anticipated active fire phase and/or the smoldering fire phase lengths are different than those in the approved application, contact DEC personnel. If the burn is not conducted, please notify the DEC Meteorologist within 24 hours of canceling the scheduled burn. Provide a new anticipated burn date if possible.

3. Air Permits Notification: Notify DEC by noon the business day prior to any planned burn, telephone: (907) 269-7577 (Anchorage Administrative Clerk), (907) 451-5173 (Fairbanks Administrative Clerk), or (907) 456-5100 (Juneau Administrative Clerk). Notification shall include:

   a) Open Burn Approval number;
   b) Authorized Agency Name;
   c) Burn Location;
   d) Burn Date(s);
   e) Contact Name During Burn;
   f) Contact Telephone Number;
   g) Description of Test Burn (prescribed and land clearing only);
   h) Estimated Duration of Active Firing (ignition) Phase (prescribed burning only);
   i) Estimated Duration of the Smoldering Phase (prescribed burning only);
   j) Description of Pre-Burn Public Notices; and
   k) Consideration of weather forecast and air quality advisories in area of burn.

4. Notify the public through the local news media (if available in the nearest community to the burn site) or at the local Post Office at least three days prior to the burn (18 AAC 50.065 (j)). The public notice shall contain:

   a) Contact name;
   b) Contact's telephone number;
   c) Location of the burn;
   d) Burn dates; and
   e) Brief description of activity (such as what is to be burned and why).

5. Notify the local fire departments, the Federal Aviation Administration Office and/or the Airport Control Tower before each burn event.

6. Record complaints received concerning excess smoke (if any), including name, phone number of complainant and any corrective action taken (18 AAC 50.065(k)). Maintain records of complaints during the life of this approval and provide copies of the records to the department upon request.

7. Do not conduct burning during stagnant air conditions (fogs or inversions) or when air quality alerts have been posted for that air shed. If weather conditions change after ignition such that any "sensitive feature" (as listed in the Open Burning Policy & Guidelines) is adversely impacted, extinguish the burn as soon as possible. Air Quality Advisory information for the state may be found at http://www.dec.state.ak.us/air/am/aq_sr.htm, or telephone (907) 269-7676 or (907) 269-3070. Please also check with the Fairbanks North Star Borough for any local air quality advisories.

   a) When conducting this burn, if winds are from the east or southeast, low-level smoke may move into smoke sensitive areas (Eielson airfield and residential areas, Moose Creek Trailer Park, and the Richardson Highway). It is advised to avoid burning under this wind flow; in any event, be sure to monitor smoke movement to prevent impacting these sensitive areas.

8. Use test burns to evaluate smoke dispersion.

9. Follow the Enhanced Smoke Management Plan adopted by the Alaska Air Quality Committee in October 2003.

10. As required by Appendix D of the Enhanced Smoke Management Plan, Post-burn Data Reporting, submit a summary to the DEC Air Permits Program, 610 University Avenue, Fairbanks, AK 99709-3643, AND 410 Willoughby Avenue, Suite 303, PO Box 111800, Juneau, AK 99811-1800, attn: Alice Edwards, within 30 days of completion of each burn. The summaries shall include the following information:

    a) Authorized agency and approval number;
    b) Date of burn(s);
    c) Burn location(s);
    d) Area of burn(s);
    e) Fuel type(s);
    f) Pre-burn fuel loading information; Land Managers who are unfamiliar with estimating pre-burn fuel loading should ask DEC to supply them with information, guidance documents, and models that are currently used to compile this information. Estimates of fuel loading are all that are necessary, and only for Size Class C burns (greater than 10 acres).

g) Fuel consumption: The amount of fuel actually consumed expressed in tons/acres. Pre-burn numbers are acceptable if actual numbers cannot be determined.
h) Predominant configuration of the fuel burned: piled, windrows, broadcast, or under burn.
i) Type of burn: "anthropogenic" or "natural" classification;
"Anthropogenic" is defined as a fire that is produced by human activities.
"Natural" is defined as a fire that was ignited by lightning or other natural causes.
j) Emission reduction techniques used: Describe any burning techniques applied that reduced the actual amount of emissions. For example, changing ignition timing to allow for more efficient combustion.
k) Description of public notifications made;
l) Verification of weather forecasts and area air quality advisory status for the event date(s); and
m) List of complaints received concerning excess odors or smoke (if any), including name, phone number of complainant and any corrective action taken.

This approval does not constitute a permit or approval from any agencies other than DEC; other agency permits or approvals may be necessary.

Signed: James Baumgartner

Date: April 7, 2008

James Baumgartner, Title V Permits Section Manager

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APPENDIX D

Estimating Emissions for Prescribed Fire

Emission Calculations

Emission Reduction Techniques

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Estimating Emissions for Prescribed Fire

Policy and Guidance Documents

This appendix will address the national policy goals for how to use fire as a management tool while still accomplishing visibility/smoke management goals.

Several documents are currently being written by the Western Regional Air Partnership/Fire Emission Joint Forum that should be helpful in assisting land managers use fire as a management tool. Should you need one of these documents please contact Joan Hardesty (907-451-2167) or the WRAP website at http://www.wrapair.org/forums/fejf/docs.html.

- Integrated Assessment Update and 2018 Emissions Inventory for Prescribed Fire, Wildfire, and Agricultural Burning. Western Governors Association / Western Regional Air Partnership / Fire Emissions Joint Forum.
- 1996 Fire Emission Inventory – Draft Final Report. WGA/WRAP
- Non-burning Alternatives for Vegetation and Fuel Management, November 2002
- WRAP Policy Annual Emission Goals for Fire, DRAFT Prepared by the Annual Emission Goals Task Team for the Fire Emissions Joint Forum of the Western Regional Air Partnership, December 16, 2002
- Policy for Categorizing Fire Emissions, WRAP/FEJF 2001.
- Wildland and Prescribed Fire Public Outreach Materials. EPA 1999.
- Assessing Status of Incorporating Smoke Effects into Fire Planning and Operations. WGA/WRAP. 2002.
- Development of Emissions Inventory Methods for Wildland Fire. EPA 2002.

Other documents available:

- Smoke Management Guide for Prescribed and Wildland Fire. National Wildfire Coordination Group. 2001.
- National Assessment of Smoke Management Practices & Techniques. NWCG Workshop Synthesis. 1999.
- EPA's Interim Air Quality Policy on Wildland and Prescribed Fires
- Effects of Fire on Air. USDA Forest Service, 2002.
- Visibility/Regional Haze Requirements/Rules. CFR Title 40, Part 51 §308

List of Websites

- ♦ ADEC "Open Burning Policy & Guidelines": http://www.state.ak.us/dec/air/ap/permit.htm
- ♦ Alaska Dept Natural Resources: www.dnr.state.ak.us/
- ♦ Alaska Interagency Wildland Fire Mgmt Plan, October 1998: www.dnr.state.ak.us/forestry/pdfs/98AIFMP.pdf
- ♦ Alaska Zone forecasts: http://www.noaa.gov/wx.html
- ♦ Alaska Webcams: http //www.a mining.com/webcams.htm
- ♦ Alaska Fire Service: http://fire.ak.blm.gov/
- ♦ EPA Air Monitoring data/reports: http://www.epa.gov/air/data/reports.html

- EPA Development of Emissions Inventory Methods for Wildland Fire: http://www.epa.gov/ttn/chief/ap42/ch13/related/c13s01.html
- Fire Emissions Joint Forum (WRAP): http://www.wrapair.org/forums/fejf/index.html
- "Forest Health and Safety Project" (Dec 18, 1997): http://clerk.ci.homer.ak.us/fhsproj.htm report containing information about the spruce bark beetle and related forestry topics, developed by the City of Homer and the US Forest Service.
- "Interim Air Quality Policy on Wildland and Prescribed Fires" (May 1998). US EPA www.epa.gov
- "National Assessment of Smoke Management Practices & Techniques" (Dec 1999). NWFCG Fire Use Working Team, c/o US Fish and Wildlife Service, NIFC, 3833 South Development Avenue, Boise ID 83705. (John Core at jcore@ibm.net)
- NOAA significant events, satellite photos: www.osei.noaa.gov/
- RAWS data (archived, all states) www.wrcc.dri.edu/wraws/
- Regional Haze Rules www.epa.gov
- Smoke Management Guide for Prescribed and Wildland fire, 2001 Edition. 226 pp. NWCG web site, an excellent resource: http://www.nwcg.gov/pms/pubs/large.html#SmokeManagement
- US EPA air contacts: http://www.epa.gov/air/data/contacts.html
- US Federal Wildland Fire Policy (Dec 1995) NIFC/NWFCG: www.wilderness.net/nwps/policy/fire_policy.cfm
- Visibility Info Exchange (multiagency): http://vista.cira.colostate.edu/views/
- Western Regional Air Partnership (WRAP): www.wrapair.org/

Models

A number of models are available at www.frames.gov/tools. Some of the models may not be applicable for Alaska. A copy of FOFEM (First Order Fire Effects Model) is available on a CD from DEC. It is very easy to use, but it does not contain emission factors for Alaska ecosystems. However, it does predict fuel consumption and smoke production over time, which will give you an idea of what to expect. When used in combination with reliable weather data and predictions, you can estimate emission production over time and what direction the smoke will move, how much it will accumulate, at what time during the process, estimates of accumulation, etc.

Emission Calculations

EPA's AP-42 (http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s01.pdf) provides emission factors for calculating approximate emissions from prescribed fires. Below is an example of an emission calculation.

Example problem for carbon monoxide (CO) emissions:

Equation: Emissions (tpy) = Area Burned **x** Fuel Loading **x** Emission Factor
Area Burned (fuel consumed) **=** 2700 acres (1093 hectares)
Fuel Loading = 11 tons/acre (25 Mg/kg) (AP-42 Table 13.1-1 Interior Alaska)
Emission factor = 126 g/kg (AP-42 table 13.1-3, CO, conifer, long needle/fire phase)

Emissions **=** 2700 acres **x** 11 tons/acre **x** 126 g/kg (to convert from g/kg to lb/ton divide by .5 so, 126 g/kg = 252 lbs/ton)

2700 acres **x** 11 tons/acre **x** 252 lb/ton = 7,484,400 lbs (divide by 2000 to get tons)
= 3742.2 tons per year of CO emitted from this 2700 acre fire

Emission Reduction Techniques

The DEC encourages land managers to use techniques that increase combustion efficiency and reduce the smoldering stage of burning, such as fans (when burning slash), mass ignition, accelerated mop-up, and other methods.

To maximize the effective use of fire within the emission levels allowed, it is necessary to employ improved burning techniques. The science of predicting the amount of emissions has improved within the last few years thanks to research done by the USFS Pacific Northwest Research Station, but more work needs to be done for Alaska-specific conditions.

Computer models allow land managers to analyze proposed burns and prepare burning prescriptions that will produce minimum emissions on each acre to be treated. Various site factors and burning technique scenarios can be tested in the models, and estimates of emissions that each scenario would produce can be calculated. This capability will allow land managers to treat maximum acreage with minimum emission production.

The following smoke management and emission reduction techniques are considered best management practices:

1. Reducing the biomass by use of techniques such as yarding or consolidation of unmerchandisable material, multi-product timber sales or public firewood access, when economically feasible. When allowing public firewood access, the public must also be informed of the adverse impact of using green or wet wood as fuel;
2. Burning in seasons characterized by meteorological conditions that allow for good smoke dispersion;
3. Using mass ignition techniques such as aerial ignition by helicopter to produce high intensity fires with short duration impacts;
4. Igniting burns under good-to-excellent ventilation conditions and suspending operations under poor smoke dispersion conditions;
5. Considering smoke impacts on activities conducted by local communities and land users;
6. Burning only those fuels essential to meet resource management objectives;
7. Minimizing duff consumption and smoldering through fuel moisture considerations;
8. Burning piles when other burns are not feasible, such as when snow or rain is present;
9. Implementing maintenance burning in a periodic rotation mimicking natural fire cycles to reduce excessive fuel accumulations and subsequent excessive smoke production through smoldering or wildfire; and
10. Managing smoke impacts as follows:
    a. Limiting smoke impacts to roads, highways, and airports to the amounts, frequencies, and durations consistent with any guidance provided by highway and airport personnel;
    b. Using appropriate signing if smoke will impact any point of public access, i.e. highways, dirt roads, trails, campgrounds, etc.
    c. Notifying potential impacted sensitive receptors; and
    d. Determining nighttime impacts and taking appropriate precautions.

APPENDIX E

Smoke Management Contingency Plan

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Smoke Management Contingency Plan

Each Burn Plan submitted to DEC for written approval should contain a contingency plan for actions to be taken if smoke impacts sensitive features in the area. The format is entirely up to the Responsible Authority, but appropriate short-term (less than 24-hour) contingency actions should, among other things, include:

1. identification and location of smoke sensitive features;
2. smoke sensitive features distance from burn area, potential for problems;
3. notifying the affected public of elevated pollutant concentrations;
4. list of emergency contact numbers in case of smoke intrusions;
5. suggesting actions to be taken by sensitive persons to minimize their exposure (e.g., remain indoors, avoid vigorous activity);
6. providing clean-air facilities for sensitive persons or means of evacuation if needed;
7. halting ignitions of any new open burning that could impact the same area;
8. identification of fuel loading, consumption, and potential rates of emission production over time (so that you can anticipate when the highest emission production will occur).

Example text follows (for guidance purposes, these are not necessarily required items):

> "Smoke sensitive areas are primarily the communities of Tok, Chicken and Northway. Potential smoke related problems include effects on individuals with respiratory problems and reduced visibility for aircraft at air strips. The potential for smoke related problems are considered minimal due to the distances between these communities and the burn (from 25 to 50 miles away)."
>
> The following measures will be taken to reduce the potential for smoke related problems:
>
> 1. firing will not be conducted when fog or inversion potential exists; and
> 2. notification will be given to DEC, Alaska State Troopers in Tok, the FAA Flight Services in Northway, the Boundary and Alaskan Ports of Entry, and media contacts.

Table of Fuel loading and consumption information.

Size class (inches dia)	surface fuel tons/acre	% consumption	duff fuel tons/acre	consumption tons/acre
0-0.25	0.2	40.0		0.08
0.25-1.0	0.3	12.5		0.04
1.00-3.0	0.5	7.5		0.04
>3	3.0	2.5		0.07
duff loading	(estimate)	30.0	10	3.0
TOTAL				3.23

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APPENDIX F

Alternatives to Burning

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Alternatives to Burning

The term "alternatives" refers to mechanical, biological or chemical treatment methods of fuel reduction that do not include burning, such as chipping, grinding, logging, and mechanical/hand thinning with removal. The need for using prescribed fire falls into three broad categories: reduction of hazardous fuels, ecological effects and ecological restoration. In order to be considered a "non-burning alternative" the treatment must mimic at least some effect of a prescribed fire.

Land managers should consider the availability and feasibility of alternatives to burning in lieu of burning. This is particularly true where there is likelihood that burning in or near residential areas may cause an exceedance of the NAAQS, and/or when alternatives are available, feasible, economical, and when the use of the alternative will not cause other unacceptable environmental or human health effects. When alternatives to burning are used, land managers should report this to DEC so that the effort can be tracked as an emission reduction technique.

Examples of alternative measures include:

1. **Mechanical removal.** This category includes logging, onsite chipping, offsite use of brush or firewood, or treatment of unmerchantable material such that slash burning is not needed.

2. **Chemical treatments.**

3. **Land use change.** According to the NWFCG Smoke Management Guide (ii), changing Wildland to another land use category may result in elimination of the need to burn in a prescriptive manner. Conversion of a Wildland site to an urbanized use is the example that they gave (view website at: http://www.nwcg.gov/pms/pubs/large.html#SmokeManagement)

4. **Reduction of fuel consumed in a prescribed burn.** This is achieved when fuels are at or above the moisture of extinction, and therefore unavailable for combustion. This may not result in a real reduction in emissions, and may significantly increase smoldering. But if it is the intention of the land manager to leave the unburned fuels for biological decomposition (or for other reasons), then this method does qualify as an "alternative." (ii, p. 147).

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APPENDIX G

Air Quality Monitors

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Air Quality Monitors

There are several types of air monitors that can be used to assess ambient levels of particulate. Ambient monitoring determines when the public is being impacted by smoke and is a tool to help the burn agency and DEC take necessary steps to protect the public.

- **FRM** or "Federal Reference Method" is a monitor that has been set up and operated in accordance with the procedures set out in the Code of Federal Regulations (CFR). Site placement is very important in determining whether it is a FRM monitor or not. These monitors are usually manually operated samplers with "paper" filters and a vacuum air flow which requires electrical power. While these monitors do provide official data, it often takes several days to process the filter. This type of monitor setup also includes various types, Hi-Vol (PM10), and R&P $PM_{2.5}$ Partisol.

- **FEM** or "Federal Equivalent Method" monitors are comprised of monitors and procedures which were approved after the FRM procedure was promulgated. Some of these monitors are filter-based, manual samplers and some are continuous samplers, like the "real-time" monitors. The real-time monitors are more costly than the filter-based systems, but they do have continuous read-outs which give concentrations in "real time." Many of these monitors are portable, some are hand-held and operate on battery packs so they do not require electrical sources. This type of monitor includes betagauges, TEOMS, etc.

- **SLAMS** or "State and Local Air Monitoring Site" A fixed monitoring site which is part of the federal monitoring network. Normally used to determine compliance with the national particulate standard. An example would be one of the monitors in Anchorage.

- **SPM** or "Special Purpose Monitors" may or may not be FRMs. By virtue of their being SPMs, the data could be used to assist, track and evaluate a burn without "counting against" the land manager. Land managers should be encouraged to use SPMs to collect data. SPMs are usually used to assess pollutant levels and to determine whether a more long-term monitor is needed. They are usually set-up temporarily. Most monitors have been tested against a FRM unit. The assumption is that the data provide a good approximation of what the ambient particulate levels are. An example of each type of sampler would be the Anderson Hi-Vol manual PM10 sampler (FRM) and R&P PM2.5 Partisol (FRM), the Graseby Beta Gauge and R&P TEOMS (two FEM continuous PM10/2.5 monitors), and the nephelometer (a continuous, special purpose, fine-particulate monitor).

- **IMPROVE** or "Interagency Monitoring of Protected Visual Environments." Refers to the monitoring network used to assess air quality in Class I and Class II areas. These units monitor particulates, total carbon, and other components. IMPROVE consists of air quality data from Class I areas that include national parks and wilderness areas where visibility is deemed an important attribute. This monitoring program is an interagency effort with the U.S. Environmental Protection Agency (USEPA) and the U.S. Department of the Interior (USDOI), including the U.S. Forest Service, U.S. Fish and Wildlife

Service, and the Bureau of Land Management. The National Park Service (NPS) provides monitoring and maintains the database to determine spatial and temporal trends in visibility in the NPS parks and wilderness areas and determine causes for visibility degradation. The IMPROVE fine particle network collects $PM_{2.5}$ and PM_{10} samples over a twenty four hour period every Monday and Friday using IMPROVE samplers. The network consists of over 110 monitoring sites, located in Class I ("Clean Air") areas, and has been in operation since 3/88. The PM samples are analyzed for $PM_{2.5}$ mass and its elemental constituents, organics, ions, light absorption and PM10 mass. The data set contains the concentrations, minimum detection limit, error, and data quality flags.

- **Visual:** refers to the evaluation of smoke concentration based on visibility. Experienced personnel would be stationed along roadways, in communities, etc. to evaluate visibility impacts due to smoke. For example, visibility of ¾ mile or less can be indicative of very unhealthy air quality due to hazardous PM2.5 concentrations. Whereas, visibility of 3 to 5 miles can be unhealthy for sensitive individuals only. This procedure, when done properly, could give somewhat valid information on smoke concentrations in an airshed. A good "rule of thumb" tabulation on this method is located in the Smoke Management Guide for Prescribed and Wildland Fire, 2001 edition, p.31. (www.nwcg.gov)

- **Smoke impacts at various receptors:** a certain number of valid complaints from community residents may be evaluated and considered for taking mitigation action on a prescribed burn. Valid complaints from local safety, government, fire department or other authority will be given priority consideration.

APPENDIX H

Map of Fire Weather Monitoring Stations

Map of Class I Areas, Non-Attainment and Maintenance areas

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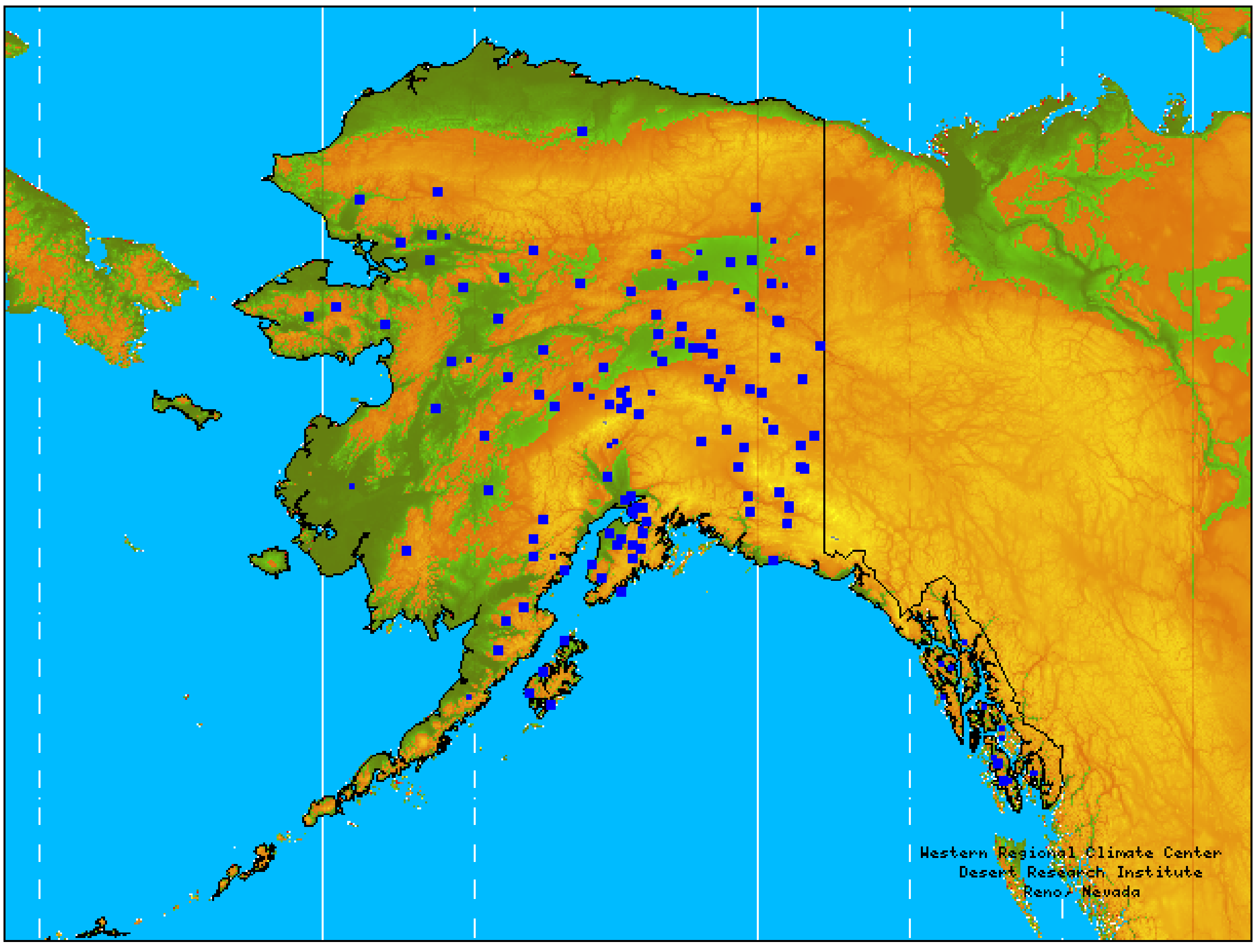
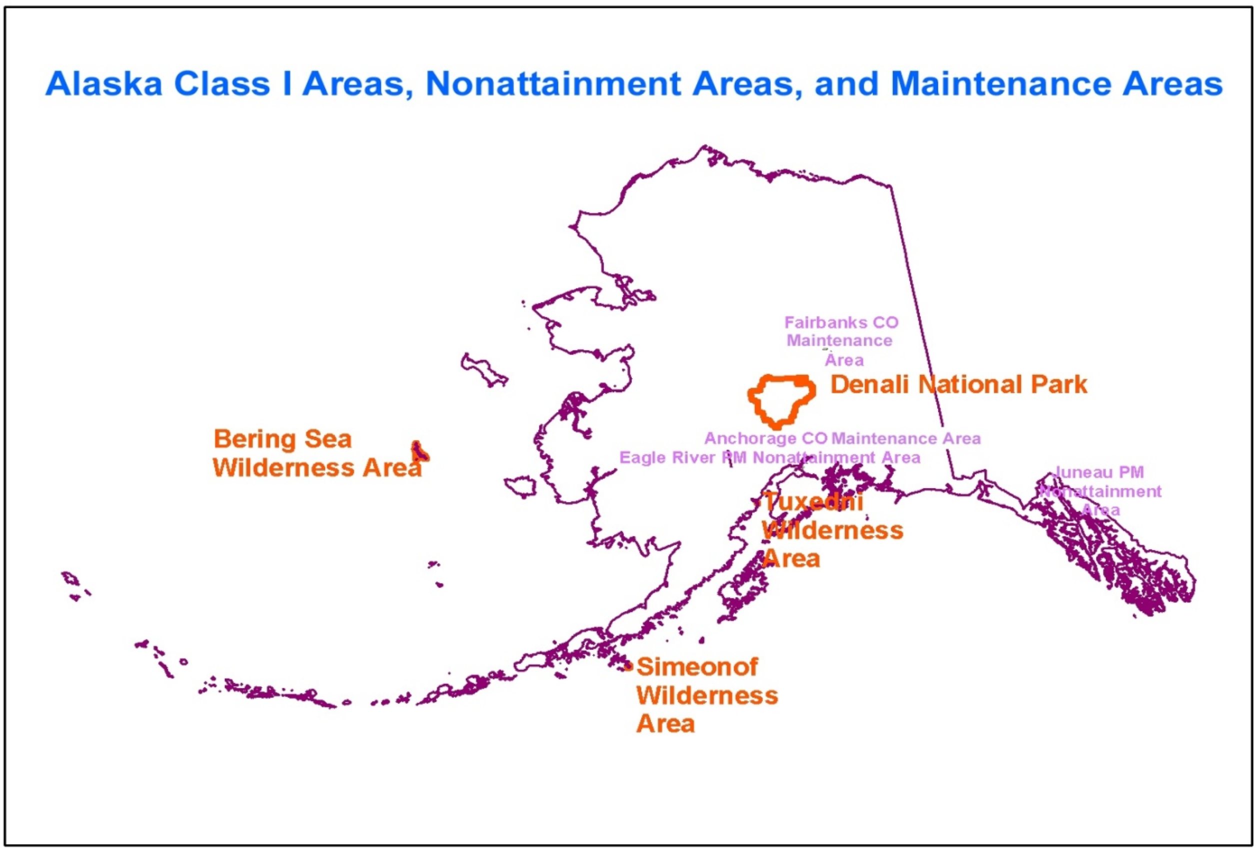
Map of Fire Weather Monitoring Stations

Archived Remote Automated Weather Station (RAWS) data available at
http://www.wrcc.dri.edu/wraws/



Map last generated on 11/23/08

Map of Class I Areas, Non-Attainment and Maintenance areas



APPENDIX I

Example Air Quality Advisory Situation Report

Example Alert Fax List

Criteria Necessary to Issue Air Quality Episode or Alert

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ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Air Quality
SITUATION REPORT

AIR QUALITY ADVISORY
East and Central Interior

LOCATION(S) IMPACTED: Eastern and Central Interior Alaska

TIME/DATE OF UPDATE: Wednesday, August 31, 10:00 AM.

VALID TIME: Valid August 31 until September 6 at 10:00 AM.

TIME/DATE OF THE NEXT REPORT: Tuesday, September 6, 10:00 AM.

ADVISORY: Air quality in the Interior is predominantly **good**, and will continue to be **good** through the next week. The exceptions are the Yukon Flats, the Upper Tanana River Valley, and the Upper Koyukuk, where some smoke is still being given off by active fires. In these locales, air quality may be **very unhealthy** at times. Approximately 10% of the Eastern and Central Interior is currently impacted by smoke.

Due to the proximity of fire to the Taylor Highway, travelers should review the latest road travel advisories prior to going to this area. Though conditions continue to improve, air quality may still be **very unhealthy**.

High pressure is expected to build over the Interior for the weekend, bringing partly cloudy skies and a few scattered showers. Temperatures will remain mild, and fire activity will remain low.

Keep in mind that areas immediately downwind of fires may still experience **hazardous** levels of smoke. Also, worse conditions will generally occur during the nighttime to early morning hours, as the atmosphere cools and brings smoke to the surface. During the day, surface heating will mix the smoke and carry it upwards, temporarily improving air quality conditions.

SMOKE AND PUBLIC IMPACT: This is an area forecast, and as such gives a general forecast for a large area. At this time, 10% of the area is experiencing a smoke problem which could impact public health. Therefore, it is advised that travelers check local weather as smoke conditions may vary considerably from one locality to the next. The most recent weather observations may be found on National Weather Service's homepage at **http://pafc.arh.noaa.gov/obs.php.**

CURRENT BURN RESTRICTIONS: None.

DEC advises everyone with respiratory illness or heart disease, the elderly and children, to avoid exposure to smoke. All others are cautioned to avoid outdoor activities or physical exertion when conditions reach unhealthy levels, as specified below.

The following table is the Air Quality Index for Particle Pollution.

Index Values	Levels of Health Concern	Cautionary Statements
0-50	Good	None
51-100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
101-150	Unhealthy for Sensitive Groups	People with heart or lung disease, older adults and children should reduce prolonged or heavy exertion.
151-200	Unhealthy	People with heart or lung disease, older adults and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
201-300	Very Unhealthy	People with heart or lung disease, older adults and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.
301-500	Hazardous	People with heart or lung disease, older adults and children should remain indoors and keep activity levels low. Everyone else should avoid all physical activity outdoors.

When air quality data is unavailable, the following **Air Quality Smoke Reference Guide** may be used to estimate air quality levels and potential health impacts:

Visibility	Air Quality
10+ miles	Good
6 - 9 miles	Moderate
3 - 5 miles	Unhealthy for sensitive groups
1.5 - 2.5 miles	Unhealthy
0.9 - 1.4 miles	Very Unhealthy
0.8 miles or less	Hazardous

FOR MORE INFORMATION:

For information on Wildfire Smoke from the Department of Health and Social Services, visit their website at **http://www.epi.hss.state.ak.us/wildfire/default.htm.**

For information on Wildfire Smoke from the Department of Environmental Conservation, Air Quality Division, visit the website at **http://www.dec.state.ak.us/air/smokemain.htm.**

For information on air quality conditions around Fairbanks, visit the Fairbanks North Star Borough web site at **http://co.fairbanks.ak.us/HotTopics/Fire2005/default.htm**.

For information on road conditions around Alaska, visit the Road Traveler Information System at **http://511.alaska.gov/.**

For information on this advisory, contact Heidi Strader, Division of Air Quality, **907-269-7676**.

Example Alert Fax List

(Example list of people who might receive a notice of an air quality alert for the Mat-Su Valley)

AIR QUALITY ALERT		**FAX#**
1. Valley School District Office	(907)	745-6119
2. KMBQ, Wasilla Radio	(907)	376-1575
3. Channel 11		273-3188
4. KFQD Radio, Anchorage		344-0742
5. Channel 2		563-3318
6. Channel 13		561-8934
7. Anchorage Daily News		257-4342
8. SOA Public Health, Mat-Su	(907)	376-3096
9. EPA, Anchorage		271-3424

Notify internal DEC contacts, DEC receptionist, program managers, and other local authorities as needed.

Criteria Necessary to Issue Air Quality Episode or Alert

Ambient Air Concentrations Triggering an Air Episode

Episode Type	Air Pollutant	Concentration in micrograms per cubic meter {and in ppm where applicable}
Air alert	Sulfur dioxide	365 (24-hour average) {0.14 ppm}
	* $PM_{2.5}$	40 (24-hr average)
	PM_{10}	150 (24-hour average)
	PM_{10} from wood burning (wood smoke control areas)	92 (24-hour average)
	Carbon monoxide	10,000 (8-hour average) {8.7 ppm}
Air warning	Sulfur dioxide	800 (24-hour average) {0.31 ppm}
	* $PM_{2.5}$	150 (24-hr average)
	PM_{10}	350 (24-hour average)
	Carbon monoxide	17,000 (8-hour average) {15 ppm}
Air emergency	Sulfur dioxide	1,600 (24-hour average) {0.61 ppm}
	* $PM_{2.5}$	250 (24-hr average)
	PM_{10}	420 (24-hour average)
	PM_{10} from wood burning (wood smoke control areas)	During an air alert, a concentration measured or predicted to exceed 92 (24-hour average), and to continue to increase beyond the concentration that triggered the air alert
	Carbon monoxide	34,000 (8-hour average) {30 ppm}

*Note: $PM_{2.5}$ levels are not yet included in state regulation but are being used under EPA's Air Quality Index system.

18 AAC 50.245. Air episodes and advisories. (a) The department may declare an air episode and prescribe and publicize curtailment action if the concentration of an air pollutant in the ambient air has reached, or is likely in the immediate future to reach, any of the concentrations established in Table 6 in this subsection.

(b) The department will declare an air quality advisory if, in its judgment, air quality or atmospheric dispersion conditions exist that might threaten public health.

(c) If the department declares an air quality advisory under (b) of this section, the department will

(1) request voluntary emission curtailments from any person issued a permit under this chapter whose stationary source's emissions might impact the area subject to the advisory; and

(2) publicize actions to be taken to protect public health. (Eff. 1/18/97, Register 141; am 10/1/2004, Register 171)

Authority: AS 46.03.020 AS 46.14.020 Sec. 30, ch. 74, SLA 1993 AS 46.14.010 AS 46.14.030

APPENDIX J

References

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References

i Idaho/Montana smoke management operating guide/SMP

ii EPA Interim Air Quality Policy on Wildland and Prescribed Fires

iii Washington state SMP

iv Regional Haze Rules, 40 CFR Part 51, 1999.

v "Elements of a smoke management program," Colleen Campbell. Dec 31, 1997.

vi NWFCG Wildland Fire Policy 1998.

vii Alaska Wildland Fire Management Plan 1998.

viii Policy for categorizing fire emissions. [online]. 2001. Natural Background Task Team, Fire Emissions Joint Forum, Western Regional Air Partnership. Available: URL [2001, Nov.].

ix National Wildfire Coordinating Group. 1996. Glossary of Wildland fire terminology. PMS 205. Boise, ID: National Wildfire Coordinating Group, National Interagency Fire Center. 162pp.

x USDI and USDA Forest Service. 1998. Wildland and prescribed fire management policy-implementation procedures reference guide. National Interagency Fire Center, Boise, ID. 81pp.

xi WRAP Charter, Purpose, p.1.

xii Smoke Management Guide for Prescribed and Wildland Fire, 2001 Edition. National Wildfire Coordinating Group, Fire Use Working Team. 226pp.

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.9
Reasonable Progress Goals

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

APPENDIX III.K.9

Reasonable Progress Goals

Glidepath Uncertainty Calculations for Denali

Baseline	9.9	**Hist Std Dev**	0.5	dv
Natural Condition	7.3	**WEP Trend**	0.2%	% to 2018
Reduction for 2018	0.0			

	History dv's	**History dv's**		**URP dv's**		**Baseline dv's**	**WEP Trend dv's**
2000	10.6	10.6				9.9	
2001	9.1	9.1				9.9	
2002	10.2	10.2				9.9	
2003	9.9	9.9				9.9	
2004	9.4	9.4	8.8	9.9	11.0	9.9	9.9
2005	10.4	10.4	8.8	9.9	10.9		9.9
2006	9.8	9.8	8.8	9.8	10.9		9.9
2007			8.7	9.8	10.8		9.9
2008			8.7	9.7	10.8		9.9
2009			8.6	9.7	10.7		9.9
2010			8.6	9.6	10.7		9.9
2011			8.5	9.6	10.6		9.9
2012			8.5	9.6	10.6		9.9
2013			8.5	9.5	10.6		9.9
2014			8.4	9.5	10.5		9.9
2015			8.4	9.4	10.5		9.9
2016			8.3	9.4	10.4		9.9
2017			8.3	9.3	10.4		9.9
2018			8.2	9.3	10.3		9.9

Glidepath Uncertainty Calculations for Trapper Creek

Baseline	11.6	**Hist Std Dev**	0.8	dv
Natural Condition	8.4	**WEP Trend**	-2.0%	% to 2018
Reduction for 2018	0.2			

	History dv's	**History dv's**		**URP dv's**		**Baseline dv's**	**WEP Trend dv's**
2000						11.6	
2001						11.6	
2002	11.6	11.6				11.6	
2003	11.1	11.1				11.6	
2004	12.2	12.2	10.1	11.6	13.1	11.6	11.6
2005	13.1	13.1	10.0	11.6	13.1		11.6
2006	11.6	11.6	10.0	11.5	13.0		11.6
2007			9.9	11.4	13.0		11.6
2008			9.9	11.4	12.9		11.5
2009			9.8	11.3	12.9		11.5
2010			9.8	11.3	12.8		11.5
2011			9.7	11.2	12.8		11.5
2012			9.7	11.2	12.7		11.5
2013			9.6	11.1	12.7		11.5
2014			9.5	11.1	12.6		11.4
2015			9.5	11.0	12.6		11.4
2016			9.4	11.0	12.5		11.4
2017			9.4	10.9	12.4		11.4
2018			9.3	10.9	12.4		11.4

Glidepath Uncertainty Calculations for Simeonof

Baseline	18.6	**Hist Std Dev**	0.6	dv
Natural Condition	15.6	**WEP Trend**	-2.5%	% to 2018
Reduction for 2018	0.4			

	History dv's	History dv's		URP dv's		Baseline dv's	WEP Trend dv's
2000						18.6	
2001						18.6	
2002	18.8	18.8				18.6	
2003	18.2	18.2				18.6	
2004	18.6	18.6	17.5	18.6	19.7	18.6	18.6
2005	17.5	17.5	17.5	18.6	19.6		18.6
2006	18.7	18.7	17.4	18.5	19.6		18.6
2007			17.4	18.5	19.5		18.5
2008			17.3	18.4	19.5		18.5
2009			17.3	18.4	19.4		18.5
2010			17.2	18.3	19.4		18.4
2011			17.2	18.3	19.3		18.4
2012			17.1	18.2	19.3		18.4
2013			17.1	18.2	19.2		18.3
2014			17.0	18.1	19.2		18.3
2015			17.0	18.1	19.1		18.3
2016			16.9	18.0	19.1		18.2
2017			16.9	18.0	19.0		18.2
2018			16.8	17.9	19.0		18.2

Glidepath Uncertainty Calculations for Tuxedni

Baseline	14.1	**Hist Std Dev**	1.0	dv
			-	% to
Natural Condition	11.3	**WEP Trend**	15.0%	2018
Reduction for 2018	2.1			

	History dv's	**History dv's**		**URP dv's**		**Baseline dv's**	**WEP Trend dv's**
2000						14.1	
2001						14.1	
2002	15.5	15.5				14.1	
2003	12.6	12.6				14.1	
2004	14.2	14.2	12.1	14.1	16.1	14.1	14.1
2005	14.4	14.4	12.1	14.1	16.0		13.9
2006	13.9	13.9	12.0	14.0	16.0		13.8
2007			12.0	14.0	16.0		13.6
2008			11.9	13.9	15.9		13.5
2009			11.9	13.9	15.9		13.3
2010			11.8	13.8	15.8		13.2
2011			11.8	13.8	15.8		13.0
2012			11.7	13.7	15.7		12.9
2013			11.7	13.7	15.7		12.7
2014			11.6	13.6	15.6		12.6
2015			11.6	13.6	15.6		12.4
2016			11.5	13.5	15.5		12.3
2017			11.5	13.5	15.5		12.1
2018			11.5	13.4	15.4		12.0

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Vol. III: Appendices

Appendices to:
Vol. II: Analysis of Problems, Control Actions
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

The State of Alaska's State Air Quality Control Plan Volume III, Appendix to Volume II of this plan, is amended to include the following documents:

Volume II, Section II. Air Quality Control Program is amended by removing the following regulations:

- 18 AAC 50 Air Quality Control as amended through November 6th, 2010;

and replacing them with the following regulations currently under public review and comment:

- 18 AAC 50 Air Quality Control as amended through {*Adoption Date of Regulations*}.

Appendices to Volume II, Section III. K: Areawide Pollutant Control Program for Regional Haze, adopted into the State Air Quality Control Plan {*Adoption Date of Regulations*}, are added as follows:

- Appendix III.K.1- no appendix;
- Appendix III.K.2 -IMPROVE Algorithms;
- Appendix III.K.3- Overview of Alaska Air Quality;
- Appendix III.K.4.a- Alaska Volcano Observatory Events near Simeonoff Class 1 Area: Examples from 2002-2006;
- Appendix III.K.4.b- Maps of Wildfires affecting Alaska's Class 1 Areas;
- Appendix III.K.5- Emission Inventory;
- Appendix III.K.6- no appendix;
- Appendix III.K.7- Air Quality Modeling of Source Regions;
- Appendix III.K.8- Alaska Enhanced Smoke Management Plan;
- Appendix III.K.9- Reasonable Progress Goals;
- Appendix III.K.10- no appendix;
- Appendix III.K.11.a- Consultation: Regional Planning WRAP Meetings and Conference Calls;
- Appendix III.K.11.b- Consultation: Federal Land Manager Review; and
- Appendix III.K.11.c- Consultation: Public Participation and Review.

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.10
No Appendix- Placeholder

Public Review Draft

October 7th, 2010

Alaska Department of Environmental
Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.11.a
Consultation: Regional Planning WRAP Meetings & Conference Calls

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

Appendix III.K.11.a

Consultation: Regional Planning
WRAP Meetings and Conference Calls

INTRODUCTION and BACKGROUND

Section 308 of 40CFR Part 51, the regional haze rule, calls for consultations among states where there are cross-state impacts of haze producing emissions to ensure states are aware of and agree to each other's reasonable progress goals and long-term strategies. The rule also provides for consultations with federal land management agencies that have jurisdiction over federal mandatory Class areas, specifically calling out for: Notification of FLMs 60 days prior to public hearings; Addressing comments from FLMs in each SIP, Ongoing consultation as SIPs are implemented, reviewed and revised. The rule encourages states and tribes to utilize regional planning processes to facilitate the consultation requirement.

The WRAP participants have, over the years used the WRAP process to maximize the opportunity for consultation among states, between states and tribes, land management agencies and stakeholders. The regional haze rule provides for specific points of consultation and outlines general procedures for meeting the requirement, to achieve appropriate consistencies and allow opportunities for formal comment and response.

The purpose of this document is to gather in one place a consolidated list of each forum, committee and workgroup, its purpose, membership, significant work products and meetings recorded and posted on the WRAP webpage. Although there have been many more meetings and conference calls than are documented here, this list demonstrates the extent of consultation among the WRAP partners and stakeholders for the last eight years. All of the material contained here is taken from the WRAP website at: www.wrapair.org . The electronic version of this document contains hyperlinks to various pages on the WRAP website.

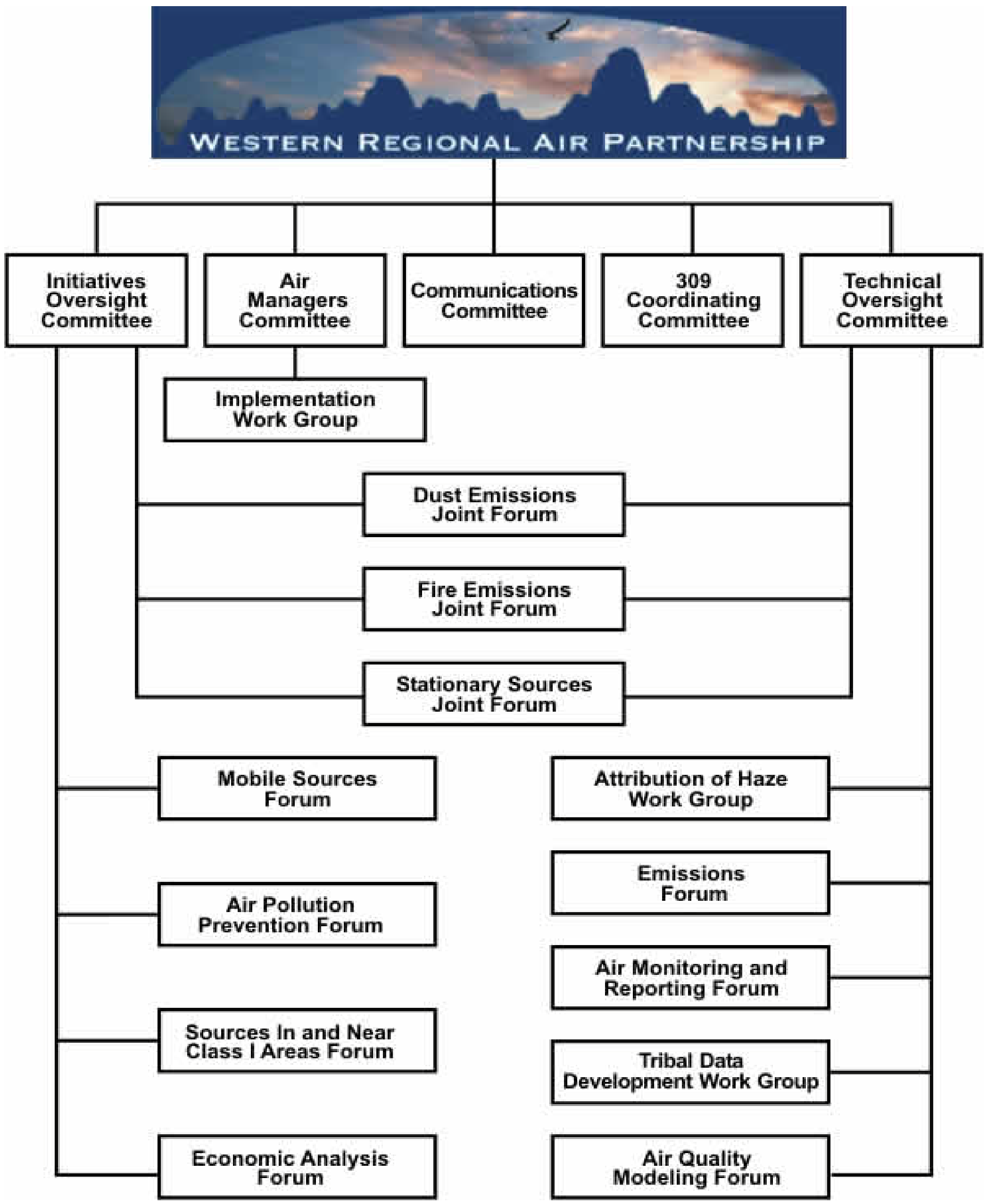
WRAP Membership and Organizational Description:
Members

The Western Regional Partnership (WRAP) was formed in 1997 as a regional planning organization to support states and tribes in preparing and implementing regional haze plans. The WRAP is a partnership among states, tribes, FLMs and EPA, with participation of stakeholders.

The WRAP membership, reflected in the Board of Directors is organized to maximize decision making through consensus and consultation.

Co-chaired by a state and tribal governor, with a designated representative from each state, and an equal number of tribes, EPA and each federal land management agency having at least one federal Class I area as board members. Stakeholder input is achieved through participation on forums that focus on technical and policy issues related to requirements of the Regional Haze Rule. Lists of selected work products are provided for each forum and committee below.

WRAP Organizational Chart



WRAP Committees, Forums, Workgroups

309 Coordinating Committee

Purpose:
To facilitate ongoing communications among the 309 jurisdictions and to facilitate implementation of the plans, including but not limited to the tracking of renewable energy and energy efficiency use and programs and the tracking of emissions for the SO2 backstop program, clean air corridors, and fires.

Membership:
Members
Technical and planning staff from the four states of AZ, NM, UT, WY and Bernalillo County, NM that submitted regional haze SIPs in 2003

Significant Work Products:

Major Projects

- Western Backstop SO2 Trading Program Model Rule (08/13/03) PDF
- Western Backstop SO2 Trading Program Model Rule Supplement (08/13/03) PDF
- Model SIP/TIP for the Western Backstop SO2 Trading Program (08/13/03) DOC
- Final Draft 309 SIP Template, not including the Western Backstop SO2 Trading Program (07/10/03) DOC
- Technical Support Document PDF (6.9 mb)
- More Complete list of SIP- related documents 309 Material
- (Insert more recent SO2 milestones, supporting the 2007 re-submittals of 309 plans)

Meetings:

2008 Events

03/13/08 §309 SO2 Program Stakeholders Call 11:00 AM Mountain

2007 Events
12/19/2007 §309 SO2Program Stakeholders Call
08/07/2007 §309 Program Stakeholders Call
07/10/2007 §309 Program Stakeholders Call
07/09/2007 2005 Milestone Program Audit Call

2006 Events

2005 Events

2004 Events
05/24/04 Call to Coordinate Pre-Trigger SO2 Reporting and Milestone Comparisons PDF or DOC
02/05/04 309 Conference Call Notes PDF or DOC

Air Managers Committee

Purpose:
To provide air managers with a forum for discussing WRAP related matters of concern to them. These matters may cover a spectrum of air quality issues. The Committee also provides a mechanism for communication and guidance to the technical and policy forums as to what air managers believe is needed to support their regional planning efforts.

***Membership*:**
Members
Air program directors of all WRAP states and tribes, federal land management agencies, EPA

Major Projects:

- Implementation Work Group
- 309 STIP-II Work Group
- RA BART Guidelines
- RA BART Case Studies
- 308 SIP Templates

Meetings:

2009 Events
12/21/09 AMC Conference Call
12/17/09 IWG Conference Call
11/16/09 IWG Conference Call
11/11/09 Ozone & NOx in the West Meeting
10/19/09 AMC Conference Call
09/24/09 IWG Conference Call
09/21/09 AMC Conference Call
08/17/09 AMC Conference Call
08/13/09 IWG Conference Call
07/14/09 PRP18b & PRP18cmv Regional Emissions/Modeling Results Call
06/23/09 IWG Conference Call
06/10/09 AMC Conference Call
04/16/09 IWG Conference Call
03/10/09 Implementation Work Group Meeting
03/03/09 IWG Conference Call
02/19/09 IWG Conference Call
02/17/09 AMC Conference Call
01/15/09 IWG Conference Call

2008 Events
12/15/08 AMC Conference Call
10/16/08 IWG Conference Call
09/30/08 Workshop on Regional Support for Air Quality Planning in the West
09/12/08 AMC Conference Call

08/26/08 AMC Conference Call
08/21/08 IWG Conference Call
06/19/08 IWG Conference Call
06/16/08 AMC Call
04/17/08 IWG Conference Call
03/05/08 AMC Call
02/21/08 IWG Conference Call

2007 Events
12/19/07 IWG Conference Call
11/15/07 IWG Conference Call
09/20/07 IWG Conference Call
08/29/07 IWG Meeting, Denver, CO
08/28/07 AMC Meeting, Denver, CO

2006 Events
05/08/06 AMC Conference Call Notes PDF or DOC

2005 Events
02/18/05 Air Managers Committee Conference Call

- Call Notes PDF or DOC
- Proposed AMC 2006 Workplan Narrative PDF or DOC

2004 Events
07/06/04 AMC State Caucus Call
04/14/04 AMC Call
01/12/04 AMC Call

2003 Events
11/19/03 308 Planning Group Meeting, Phoenix, AZ

- Agenda PDF or DOC

06/25/03 AMC Call (Notes: PDF)
03/19/03 WRAP Forums and Planning Team Meeting, Santa Fe, NM

- AMC Meeting Notes DOC
- AMC Meeting Agenda PDF

2002 Events
11/26/02 AMC Call Notes DOC
09/04/02 Air Managers Committee Meeting, Santa Fe, NM
05/23/02 Air Managers Committee Meeting, Salt Lake City, UT
04/15/02 Air Managers Committee/WESTAR Meeting Minutes, Incline Village, NV PDF

2001 Events
09/27/01 Northern Air Managers Committee Meeting Minutes, Portland, OR PDF
07/10/01 Northern Air Managers Conference Call Document DOC

2000 Events
05/09/00 Northern Air Managers Committee Meeting Presentation, Phoenix, AZ PDF
05/03/00 Northern Air Managers Conference Call Minutes
02/14/00 Northern Air Managers Conference Call Minutes

Implementation Work Group

Purpose:
Formed under direction of the Air Managers Committee in 2004, to help states and tribes prepare their haze implementation plans on a regional scale to meet the requirements of 40 CFR 51.308 and 401 CFR 51.309(g); To ensure common agreements and consensus among states and tribes on planning approaches, use of regional data and analysis tools developed by the WRAP, and otherwise meet the consultation requirements of the Regional Haze Rule

Membership:
Members
Technical planning staffs of states and tribes, plan review staff of federal land management agencies, EPA.

Significant Work Products (partial list-for complete list go to):
http://www.wrapair.org/forums/iwg/docs.html

- WRAP Technical Status Report PDF or DOC (6/8/07)
- EPA Checklist for Regional Haze SIPs (08/04/06) DOC or PDF
- State/Tribal Timelines, periodic updates (See webpage)
- Class I Area Profiles - Draft Profile Template (July 2006) DOC
- Draft 308 Regional Haze SIP Template (06/02/06) DOC
- WRAP BART Clearinghouse (Updated 08/31/07) XLS
- WRAP RFP: "Analysis of Regional Haze State and Federal Implementation Plans for Tribal Implications/Issues" (09/15/06) PDF
- FLM Recommendations on SIP Contents and Consultations (08/01/06) PDF
- WRAP Comments on Draft EPA Guidance (08/07/06) DOC or PDF
- Sample Contribution Matrix for Supporting the Consultation Process (06/15/06) PPT
- Western Regional Haze State Implementation Plans, State & Federal Protocol PDF or DOC
- Draft EPA Guidance on Consultation (06/20/06) DOC
- Clearview Newsletters (Regional Haze/WRAP Activity Update – See webpage above)

Meetings:

2009 Events
12/21/09 AMC Conference Call
12/17/09 IWG Conference Call
11/16/09 IWG Conference Call

11/11/09 Ozone & NOx in the West Meeting
10/19/09 AMC Conference Call
09/24/09 IWG Conference Call
09/21/09 AMC Conference Call
08/17/09 AMC Conference Call
08/13/09 IWG Conference Call
07/14/09 PRP18b & PRP18cmv Regional Emissions/Modeling Results Call
06/23/09 IWG Conference Call
06/10/09 AMC Conference Call
04/16/09 IWG Conference Call
03/10/09 Implementation Work Group Meeting
03/03/09 IWG Conference Call
02/19/09 IWG Conference Call
02/17/09 AMC Conference Call
01/15/09 IWG Conference Call

2008 Events
12/15/08 AMC Conference Call
10/16/08 IWG Conference Call
09/30/08 Workshop on Regional Support for Air Quality Planning in the West
09/12/08 AMC Conference Call
08/26/08 AMC Conference Call
08/21/08 IWG Conference Call
06/19/08 IWG Conference Call
06/16/08 AMC Call
04/17/08 IWG Conference Call
03/05/08 AMC Call
02/21/08 IWG Conference Call

2007 Events
12/19/07 IWG Conference Call
11/15/07 IWG Conference Call
09/20/07 IWG Conference Call
08/29/07 IWG Meeting, Denver, CO
08/28/07 AMC Meeting, Denver, CO
08/16/07 IWG Conference Call
07/19/07 IWG Conference Call
06/21/07 IWG Conference Call
05/15/07 IWG Conference Call
04/17/07 IWG Meeting, San Diego, CA
04/13/07 TSS Demonstrating Reasonable Progress Training Call
03/15/07 IWG Conference Call
02/15/07 IWG Conference Call, Notes PDF or DOC
02/15/07 TSS Training for SIP Planners Call
01/25/07 IWG Conference Call

2006 Events
12/21/06 IWG Conference Call Notes PDF or DOC
12/06/06 IWG Meeting, Santa Fe, NM
11/16/06 IWG Conference Call
10/26/06 IWG Conference Call
09/21/06 IWG Conference Call
08/29/06 IWG Meeting, Portland, OR
08/21/06 IWG Conference Call
08/02/06 IWG Special Conference Call
07/20/06 IWG Conference Call
06/15/06 IWG Conference Call
05/24/06 IWG Meeting, Sacramento CA
05/18/06 IWG Conference Call
04/20/06 IWG Conference Call
03/16/06 IWG Conference Call
Draft IWG 5/24-25 Agenda PDF or DOC

- Call Notes PDF or DOC

02/16/06 IWG Conference Call
01/19/06 IWG Conference Call

2005 Events
12/15/05 IWG Conference Call
10/13/05 IWG Conference Call
09/29/05 IWG Conference Call

- Agenda: PDF or DOC

08/29/05 IWG Meeting, Portland, OR

- Agenda: PDF or DOC
- Meeting Notes: PDF or DOC

08/18/05 IWG Conference Call
07/21/05 IWG Conference Call
06/16/05 IWG Conference Call
05/19/05 IWG Conference Call

- Agenda: PDF or DOC
- Call Notes: PDF or DOC

04/21/05 IWG Conference Call
03/17/05 IWG Conference Call

- Agenda PDF or DOC
- Meeting Notes PDF or DOC

03/08/05 IWG Meeting, San Francisco, CA

- Agenda PDF or DOC
- Meeting Notes PDF or DOC
  - Presentation of Draft Phase I Attribution of Haze Report PDF or PPT
  - Update on the CO SIP Process and Outcomes PDF or PPT
  - Process Timeline PDF or DOC
  - Attribution of Haze: What Are the Pieces and How Do They Fit? PDF or PPT
  - Nevada Attribution of Haze Case Study PDF or PPT *Use of Attribution of Haze Report for preliminary analysis of Jarbidge Wilderness Area in Nevada*

    - Presentation: Glacier NP Attribution of Haze Case Study PDF or PPT *Use of Attribution of Haze Report for preliminary analysis of Glacier National Park in Montana*
    - 308 Template Table of Contents PDF or DOC *Working draft Table of Contents for prototype 308 SIP/TIP-Writers of first drafts identified*

02/17/05 IWG Conference Call

- Call Notes PDF or DOC

01/20/05 IWG Conference Call

2004 Events

12/14/04 IWG Meeting, Tempe, AZ

- Agenda PDF or DOC
    - DRAFT 308 Regional Haze SIP/TIP Relationship Table Work Products to Road Map, Sorted by Road Map PDF or DOC
    - DRAFT 308 Regional Haze SIP/TIP Relationship Table Work Products to Road Map, Alpha Sorted by Work Product Code PDF or DOC
    - 308 SIP Development – A Resource Matrix for SIP Preparers PDF or DOC
    - DRAFT Road Map (as of 4/22/04) Regional Haze State Implementation Plan Under Section 309(g) of the Regional Haze Rule PDF or DOC
    - DRAFT Master Key for Road Map, Relationship Table, and Matrix PDF or DOC
    - DRAFT 308 Regional Haze SIP/TIP Development Road Map PDF or PPT
    - Roadmap/Resource Matrix Guide PDF or PPT

10/28/04 IWG Conference Call

09/16/04 IWG Conference Call

- Call Notes PDF or DOC
    - 2005 Workplan SIP Schedule PDF or XLS
    - 2004 Closeout and 2005 Deliverables Table PDF or DOC
    - 308 Regional Haze SIP Development Road Map (Draft) PDF or PPT

07/07/04 IWG Conference Call

05/27/04 IWG Conference Call (Notes: PDF or DOC)

04/29/04 IWG Conference Call (Notes: PDF or DOC)

03/23/04 308/309(g) IWG Meeting, Santa Fe, NM

Communications Committee

Purpose:

facilitate the exchange of information between the standing committees and forums of the WRAP, and is also charged with developing materials that help the general public understand the WRAP process and take part in its decision making. Some of the products of the Communications Committee have included outreach materials to encourage direct participation, the development of internal and external communications plans and the construction of this Web site.

Membership:
Members
Representatives from states, tribes, FLMs and EPA who are specialists in public information and communication

Major Projects:

- Communications Manual PDF or DOC
- Fact Sheets & Handouts
    - WRAP Fact Sheet HTML, PDF or DOC
    - NTEC/WRAP Fact Sheet PDF or WPD
    - Committees and Forums Fact Sheet (April 2004) HTML, PDF or DOC
    - WRAP Participation: Commitments and Benefits PDF or DOC
    - Interest/Sign-up Form PDF or DOC
    - Air Pollution Prevention Forum: Energy Efficiency Flier PDF
    - Fire Emissions Joint Forum Flyer: Smoke Impacts on Regional Haze (June 2003) PDF
    - Tribal Data Development Work Group Fact Sheet PDF or DOC
- Kid's Corner
- Presentation Resources
- Web Site Resources

Meetings:

2006 Events
06/30/06 Committee Call Minutes PDF or DOC
04/03/06 Committee Meeting, Salt Lake City, UT

- Agenda PDF or DOC
- Website Statistics Update PDF or DOC
- Green Tag Presentation PDF or DOC

2005 Events
09/27/05 Committee Meeting, Missoula, MT

- Meeting Notes PDF or DOC
- Agenda PDF or DOC
    - Draft Strategic Plan PDF or DOC
    - WRAP Web Site Statistics Update (09/15/05) PDF or DOC

05/16/05 Committee Meeting, Phoenix, AZ

- Meeting Notes PDF or DOC
- Agenda PDF or DOC
    - Attendees PDF or DOC
    - 2003-05 WRAP Web Statistics PDF or DOC

2004 Events
12/06/04 Committee Meeting, San Francisco, CA
04/07/04 Committee Meeting, Tempe, AZ

- Agenda PDF or DOC
- Meeting Notes PDF or DOC

2003 Events
10/13/03 Committee Meeting, Salt Lake City, UT

- Agenda PDF or DOC
- Meeting Notes PDF or DOC

04/01/03 Committee Meeting, Portland, OR PDF or DOC

2002 Events
12/12/02 Committee Meeting, San Francisco, CA
07/22/02 Committee Meeting, Denver, CO
07/05/02 Subcommittee on Outreach Call Minutes PDF
04/04/02 Committee Conference Call Minutes DOC

2001 Events
11/13/01 Committee Meeting, DOC Salt Lake City, UT
07/24/01 TOC Team Call Minutes DOC
06/22/01 TOC Team Call Minutes DOC
05/22/01 Committee Meeting Minutes, DOC Albuquerque, NM
02/06/01 Committee Conference Call Minutes

2000 Events
09/26/00 Committee Meeting Minutes, Sacramento, CA
09/14/00 Speaker's Bureau Conference Call Minutes
09/07/00 Committee Conference Call Minutes
08/10/00 Committee Meeting Minutes, Seattle Washington
07/26/00 Committee Conference Call Minutes
07/18/00 Committee Conference Call Minutes
06/14/00 Committee Conference Call Minutes
06/06/00 Committee Conference Call Minutes
05/30/00 Committee Conference Call Minutes
05/24/00 Committee Conference Call Minutes
05/17/00 Committee Conference Call Minutes
05/08/00 Committee Meeting Minutes, Tempe, AZ
01/06/00 Committee Conference Call Minutes

1999 Events
09/17/99 Committee Meeting Minutes, Salt Lake City, UT
08/12/99 Committee Conference Call Minutes
06/17/99 Committee Meeting Minutes, Seattle, WA
05/06/99 Committee Meeting Minutes, Denver, CO

Planning Team

Purpose:
As needed to address long-term planning and administrative issues, such as annual WRAP work plans and the WRAP strategic plan. Some of the functions performed by the Planning Team were previous performed by the Coordinating Group, which no longer

exists. A record of Coordinating Group activities can be found on the Meetings & Calls page of the Planning Team portion of this website

Membership:
Members
Co-chairs of all WRAP forums, the co-chairs of the Air Managers Committee, the co-chairs of the Communications Committee, and all members of the Initiatives Oversight and Technical Oversight Committees.

Significant Work Products:
- WRAP Work Plan Update for 2005-2007 (05/05/05) PDF or DOC
- WRAP 2005 Work Plan (12/07/04) PDF or DOC
- WRAP 2004 Work Plan (10/14/03) PDF or DOC
- WRAP Strategic Plan 2003-2008 (09/29/03) PDF or DOC
- WRAP 2003 Work Plan (11/12/02) PDF or DOC

Other Major Projects
- Strategic Planning Work Group

Meetings:

2008 Events
01/25/08 Planning Team Call

2007 Events

2006 Events
02/22/06 Planning Team Meeting, Salt Lake City, UT

2005 Events
03/09/05 Planning Team Meeting, San Francisco, CA

2004 Events
07/20/04 Planning Team Meeting, Denver, CO
- Agenda PDF or DOC
  - Individual Work Plans Available as of July 13 PDF or DOC
  - 2004 Financial Status and 2005 Proposed Projects XLS or PDF
  - 2004 Work Plan PDF
  - Strategic Plan PDF

2003 Events
08/13/03 Planning Team Meeting, Denver, CO
03/18/03 WRAP Forums and Planning Team Meeting, Santa Fe, NM

2002 Events
10/07/02 Planning Team Meeting, Tempe, AZ
07/25/02 Planning Team Meeting, Denver, CO

2001 Events
09/05/01 Planning Team Meeting, Seattle, WA

2000 Events
07/17/00 Coordinating Group Meeting Minutes, Denver, CO
06/05/00 Group Conference Call Minutes
03/29/00 Coordinating Group Meeting Minutes, Salt Lake City, UT

1999 Events
11/01/99 Coordinating Group Meeting Minutes, Salt Lake City, UT
10/27/99 Group Conference Call Minutes
10/20/99 Group Conference Call Minutes
10/07/99 Group Conference Call Minutes
09/29/99 Group Conference Call Minutes
09/22/99 Group Conference Call Minutes
09/16/99 Coordinating Group Meeting Minutes, Salt Lake City, UT
09/08/99 Group Conference Call Minutes
09/01/99 Group Conference Call Minutes
07/20/99 Coordinating Group Meeting Minutes, Salt Lake City, UT
06/16/99 Coordinating Group Meeting Minutes, Seattle, WA
05/14/99 Coordinating Group Meeting Minutes, Phoenix, AZ
04/22/99 Group Conference Call Minutes

Initiatives Oversight Committee

Purpose:
provides general oversight for the coordination and development of air quality strategies necessary to promote the implementation of the Grand Canyon Visibility Transport Commission's recommendations.

Membership:
Members
representatives from three tribes, three states, a federal land manager, and EPA representative, and two representatives each from the environmental and industrial communities

Significant Work Products:
- WRAP Comments On Draft Guidance (02/10/06) PDF
- WRAP Letter Seeking Coordination of Regional Haze SIP Submittal Dates (11/03/03)
  - Letter to Senators Inhofe and Baucus PDF
  - Letter to Senators Stevens and Byrd PDF
  - Letter to Representatives Tauzin and Dingell PDF
  - Letter to Representatives Young and Obey PDF

    - Map of PM-2.5 designations and haze SIP due dates GIF (40 kb) or PPT (700 kb)
- Letter to Lydia Wegman (EPA) by IOC/TOC Chairs Containing updated questions to those sent on 01/18/02.
    - Letter PDF (01/07/03)
    - EPA Response PDF (03/03)
- Final EPA Protocol for Reviewing 309 SIPs PDF(03/31/03)
- Draft EPA Protocol for Reviewing 309 SIPs PDF (03/10/03)
- Cover Letter to Draft EPA Protocol PDF (03/10/03)
- Discussion paper: Options for Preserving the WRAP's SO2 Annex in Federal Multi-Pollutant Legislation for Electric Utilities DOC WPD (04/22/02)
- Letter to Lydia Wegman (EPA) Containing 19 questions regarding the regional haze rule and SIPs PDF (01/18/02)

2006 Events
05/23/06 WRAP Workshop on Carbon, Fire and Dust, Sacramento, CA
01/10/06 WRAP Workshop on Sulfate, Nitrate, and Reasonable Progress, Tucson, AZ

2003 Events
07/28/03 NOx Issues in the West, Denver, CO
03/18/03 WRAP Forums and Planning Team Meeting, Santa Fe, NM

2002 Events
10/09/02 IOC Meeting, Tempe, AZ
10/07/02 Planning Team Meeting, Tempe, AZ
07/25/02 Planning Team Meeting, Denver, CO
07/11/02 IOC Meeting, Denver, CO
03/20/02 IOC Meeting Minutes and Documents, Tempe, AZ

2001 Meetings
12/13/01 IOC Meeting Minutes, San Diego, CA PDF
09/05/01 Planning Team Meeting, Seattle, WA
07/23/01 IOC Conference Call Minutes DOC
06/18/01 IOC Meeting Minutes, Portland, OR DOC
04/30/01 IOC Conference Call Minutes DOC

2000 Events
11/09/00 IOC Meeting Agenda
09/15/00 IOC Conference Call Minutes
08/23/00 IOC Conference Call Minutes
03/28/00 IOC Meeting Minutes
01/31/00 IOC Conference Call Minutes
01/10/00 IOC Meeting Minutes

Technical Oversight Committee

Purpose:
The TOC identifies technical issues and tasks necessary to support the activities of the WRAP and refers these issues to the technical forums. The TOC identifies issues to be addressed by the forums, based on input, priorities, and directions from the WRAP. The TOC reviews any recommendations made by the forums and subsequently makes its own recommendations to the WRAP.

Membership:
Members

Representatives from three tribes, three states, a federal land manager, and EPA representative, and two representatives each from the environmental and industrial communities

Significant Work Products:
- Technical Support System (TSS)
- GIS Landuse Database
- Aoh Phase II Project

Major Projects:
- Attribution of Haze WG

Meetings:

2009 Events
12/10/09 TOC/Co-Chairs Conference Call
09/24/09 TOC/Co-Chairs Conference Call
07/28/09 TOC/Co-Chairs Conference Call
06/23/09 TOC/Co-Chairs Conference Call
04/09/09 TOC/Co-Chairs Conference Call
03/26/09 TOC/Co-Chairs Conference Call
03/11/09 TOC 2010-11 WRAP Workplan Review Meeting
02/25/09 TOC/Co-Chairs Conference Call
01/08/09 TOC/Co-Chairs Conference Call

2008 Events
12/11/08 TOC/Co-Chairs Conference Call
11/06/08 TOC/Co-Chairs Conference Call
10/09/08 TOC/Co-Chairs Conference Call
09/24/08 TOC/Co-Chairs Conference Call
09/04/08 TOC/Co-Chairs Conference Call
08/07/08 TOC/Co-Chairs Conference Call
07/29/08 Workshop on Regional Emissions & Air Quality Modeling Studies *(Interactive)*
07/11/08 TOC/Co-Chairs Conference Call

06/13/08 TOC/Co-Chairs Conference Call
05/29/08 TOC/Forum & WG Co-Chairs 2009 Workplan Call
05/15/08 Workshop on Monitoring & Data for Regional Analysis *(Interactive)*
05/09/08 TOC/Co-Chairs Conference Call
04/11/08 TOC/Co-Chairs Conference Call
03/14/08 TOC/Co-Chairs Conference Call
02/08/08 TOC/Co-Chairs Conference Call

2007 Events
11/02/07 TOC/Co-Chairs Conference Call
09/25/07 Regional Haze Emissions Inventories Meeting, Salt Lake City, UT
06/19/07 TSS Orientation & Review Workshop, Denver, CO
06/01/07 TOC/Co-Chairs Conference Call
05/04/07 TOC/Co-Chairs Conference Call
04/06/07 TOC/Co-Chairs Conference Call
03/02/07 TOC/Co-Chairs Conference Call
02/02/07 TOC/Co-Chairs Conference Call
01/05/07 TOC/Co-Chairs Conference Call

2006 Events
12/01/06 TOC Conference Call (Notes: PDF or DOC)
11/06/06 TOC Conference Call (Notes: PDF or DOC)
10/06/06 TOC Conference Call (Notes: PDF or DOC)
09/01/06 TOC Conference Call - Cancelled
08/04/06 TOC Conference Call
07/07/06 TOC Conference Call (Notes: PDF or DOC)
06/02/06 TOC Conference Call (Notes: PDF or DOC)
05/05/06 TOC Conference Call
04/07/06 TOC Conference Call (Notes: PDF or DOC)
03/03/06 TOC Conference Call (Notes: PDF or DOC)
02/13/06 TOC Conference Call

- February 13, 2006 Draft: EPA PM NAAQS Proposal of January 17, 2006
- Technical Comments by WRAP PDF or DOC

02/03/06 TOC Conference Call (Notes: PDF or DOC)
01/06/06 TOC Conference Call (Notes: PDF or DOC)

- Forums Update PDF or DOC

2005 Events
12/02/05 TOC Conference Call
11/04/05 TOC Conference Call
10/07/05 TOC Conference Call
09/02/05 TOC Conference Call
08/05/05 TOC Conference Call
07/08/05 TOC Conference Call
04/08/05 TOC Conference Call
02/11/05 TOC Conference Call
01/13/05 TOC Conference Call

2004 Events
12/06/04 TOC Conference Call
11/08/04 TOC Conference Call
10/14/04 TOC Conference Call
09/17/04 TOC Conference Call
08/12/04 TOC Conference Call
07/13/04 TOC WIGIMS Call
07/08/04 TOC Co-Chairs Call
07/07/04 TOC WIGIMS Call
06/17/04 TOC Conference Call
05/13/04 TOC Co-Chairs Meeting, San Francisco, CA
04/15/04 TOC Conference Call
03/12/04 TOC Conference Call
02/12/04 TOC Conference Call
01/26/04 TOC Technical Summit, Tempe, AZ
01/08/04 TOC Conference Call

2003 Events
12/04/03 TOC Conference Call
11/13/03 TOC Conference Call
09/11/03 TOC Conference Call Documents

- Meeting Notes PDF, DOC or WPD
- Agenda PDF or DOC
- 2004 Workplan and Budget Requests (08/18/03) XLS
- WIGIMS Scope of Work (07/17/03) PDF or DOC
- Attribution of Haze Workgroup Mission Statement (09/11/03) PDF, DOC or WPD
- Technical Forum's Status Report PDF or DOC

07/11/03 TOC Conference Call

- Meeting Notes PDF or WPD
- Agenda PDF or DOC
- July 2003 Technical Forums Update PDF or DOC

06/13/03 TOC Conference Call Notes PDF, DOC or WPD
05/05/03 Technical Oversight Committee Meeting, Denver, CO
03/18/03 WRAP Forums and Planning Team Meeting, Santa Fe, NM
03/07/03 TOC Conference Call

- Agenda DOC
- Status of Technical Forums Summary DOC
- Notes PDF

02/10/03 Technical Oversight Co-Chairs Meeting, Scottsdale, AZ

- Meeting Minutes PDF

01/17/03 TOC Conference Call Notes PDF

2002 Events
12/13/02 TOC Conference Call Summary DOC
10/09/02 TOC & Technical Co-Chairs Meeting, Tempe, AZ

10/07/02 Planning Team Meeting, Tempe, AZ
07/25/02 Planning Team Meeting, Denver, CO
07/09/02 WRAP Technical Conference & Presentations, Denver, CO
06/12/02 TOC Technical Oversight Committee Meeting, Seattle, WA
04/19/02 TOC Conference Call Summary DOC
03/07/02 Technical Oversight Committee Meeting, Scottsdale, AZ

- Meeting Notes DOC

01/10/02 TOC & Technical Co-Chairs Conference Call

2001 Events
12/17/01 TOC & Technical Co-Chairs Conference Call
11/29/01 TOC & Technical Co-Chairs Conference Call
10/25/01 TOC Conference Call Summary
09/05/01 Planning Team Meeting, Seattle, WA
06/21/01 TOC & Technical Co-Chairs Conference Call Summary PDF
03/29/01 TOC & Technical Co-Chairs Meeting Summary PDF
07/16/01 TOC Meeting Agenda, Denver CO PDF
Forums:

Air Pollution Prevention Forum

Purpose:
Created by the WRAP to examine barriers to use of renewable energy and energy efficient technologies, identify actions to overcome such barriers, and recommend potential renewable energy and energy efficiency programs and policies that could result in a reduction of air pollution emissions from energy production and energy end-use sectors in the Grand Canyon Visibility Transport Region.

Membership:
Members
Representatives of state energy and public utility agencies, tribal environmental groups, private utilities, alternative energy enterprises and other stakeholders

Significant Work Products:
Energy Efficiency Flier (PDF, 03/22/04)

- WRAP Policy on Renewable Energy and Energy Efficiency As Pollution Prevention Strategies For Regional Haze (April 2003) DOC
- Economic Assessment of Implementing the 10/20 Goals and Energy Efficiency Recommendations (October 2002) DOC
- Recommendations of the AP2 Forum to Increase the Generation of Electricity from Renewable Sources (06/30/00) Final PDF
    - Appendices A-D PDF

- Appendix E XLS
- Appendices F-G PDF

Other Major Projects:

- Renewable Energy Credits / WREGIS
- Tribal Resources
- Quantitative Work Group

Meetings:

2003 Events
05/20/03 Pollution Prevention Workshop for Preparation of 309 Plans, Portland, OR

2002 Events
06/06/02 Forum Meeting, Portland, OR
02/19/02 Forum & SIP Guidebook Meetings

2001 Events
03/15/01 Forum Meeting Summary, Sacramento, CA DOC

2000 Events
12/05/00 Forum Meeting Summary, Portland, OR
Agenda for the AP2 Meeting
05/31/00 Forum Meeting Summary, San Francisco, CA
05/09/00 Presentation at Meeting, Phoenix, AZ
03/13-14/00 Meeting, Portland, OR
01/31 - 02/01/00 Meeting San Diego, CA

Dust Emissions Joint Forum

Purpose:
To consolidate the WRAP's efforts involving dust. Previously, three forums had worked on dust issues: the Mobile Sources Forum, the Research and Development Forum, and the Emissions Forum.

Membership:
Members
Representatives of state and local air and transportation planning agencies, tribal environmental programs, federal land management agencies, with stakeholders from industrial and agricultural interests.

Significant Work Products:

Major Projects

- New Mexico Pilot – Demonstration of use of analytical tools for planning
- Definition of Dust – Document to distinguish natural and anthropogenic sources of fugitive dust emissions
- Fine Fraction of Fugitive Dust – Document with research results and recommendations on AP-42 PM2.5 emission factors
- Causes of Dust Analysis – Report evaluating relative importance of different source categories to total dust concentrations
- Fugitive Dust Emissions from Wind Erosion – Evaluation of estimating methodologies for wind-blown fugitive dust.
- Fugitive Dust Handbook – A reference document for estimating cost effectiveness of alternate dust control techniques

Meetings:

2006 Events
12/12/06 DEJF Conference Call
10/24/06 DEJF Conference Call
09/26/06 DEJF Conference Call Notes: PDF or DOC
05/23/06 WRAP Workshop on Fire, Carbon and Dust, Sacramento, CA
02/28/06 DEJF Conference Call PDF or DOC

2005 Events
11/15/05 DEJF Meeting, Tempe, AZ
10/24/05 DEJF Conference Call PDF or DOC
08/23/05 DEJF Conference Call PDF or DOC
05/12/05 DEJF Meeting, Palm Springs, CA
05/10/05 Fugitive Dust Control Conference, Palm Springs, CA
04/26/05 DEJF Conference Call PDF or DOC
03/22/05 DEJF Conference Call PDF or DOC
02/22/05 DEJF Conference Call PDF, WPD or DOC
01/25/05 DEJF Conference Call PDF or DOC
01/04/05 DEJF Conference Call PDF, DOC or WPD

2004 Events
11/30/04 DEJF Conference Call PDF or DOC
11/15/04 DEJF & AoH Work Group Meeting, Las Vegas, NV

- DEJF & AoH Work Group Meeting Agenda PDF or DOC
- DEJF Meeting Minutes by Lee Gribovicz PDF or DOC or WPD
- DEJF Meeting Attendee List PDF or DOC
- Fugitive Dust Handbook and Website PDF or PPT
  Richard Countess, Countess Environmental (1/15, 1:15p)

- Dust Emission Research in the Northern Chihuahuan Desert of NM PDF (3.8 MB)
  Dale Gillette, NOAA (1/15, 2:15p)
- Projection of 2018 Dust Emission Inventory PDF or DOC
  Lee Alter and Tom Moore, WGA (1/15, 3:30p)
- Dust Watch Proposal PDF or PPT
  Lee Alter, WGA (1/15, 3:30p)
- Overview of AoH Report - Process & Status PDF or PPT
  Joe Adlhoch, Air Resource Specialists (11/16, 9:30a)
- DEJF Windblown Dust Model – Results & Status PDF or PPT
  Gerard Mansell, ENVIRON (11/16, 10:30a)

10/22/04 DEJF Conference Call Minutes PDF or DOC
09/28/04 DEJF Conference Call Minutes PDF or DOC
08/24/04 DEJF Conference Call Minutes PDF, WPD or DOC
08/13/04 DEJF Conference Call Minutes PDF or WPD
07/27/04 Dust Emissions Joint Forum Meeting, Reno, NV

- Agenda PDF or DOC
- Minutes PDF or WPD
- Forum Overview and Timeframes, Lee Alter PDF or PPT
- Update on Dust Handbook, Richard Countess PDF or PPT
- Update on Windblown Dust Inventory, Gerry Mansell, PDF or PPT
- Update on Ambient Analysis of 20% Worst Days, Jin Xu, PDF or PPT
- Dust Monitoring and Modeling at Owens Lake, Duane Ono, PDF or PPT
- Recent CA Legislation and Control Measures, Mel Zeldin, PDF or PPT
- Using Satellite Imagery to Improve Dust Emission Inventories, Chat Cowherd, PDF or PPT
- Using Satellite Imagery to Identiry Dust Emission Areas and Compliance, David Groeneveld (forthcoming)
- Fugitive Dust Research at DRI, Hampden Kuhns, PDF or PPT

05/25/04 Dust Emissions Joint Forum Conference Call Minutes PDF or DOC
04/27/04 Dust Emissions Joint Forum Conference Call

- Call Minutes PDF or WPD
- Agenda PDF or DOC
- Draft Work Plan for Development of a Fugitive Dust Handbook and Website PDF or DOC

03/23/04 Dust Emissions Joint Forum Conference Call Minutes PDF or WPD
02/24/04 Dust Emissions Joint Forum Meeting, Las Vegas, NV

- Agenda PDF or DOC
- Minutes PDF
- Rd. dust measurement techniques (Rodney Langston) PDF or PPT
- Transportation conformity and haze issues (Susan Hardy) PDF or PPT
- Notes on the definition and categorization of dust (Lee Alter) PDF or DOC
- Dust impacts on the 20% worst visibility days (Vic Etyemezian) PDF or PPT
- Notes on dust impacts on the 20% worst days (Lee Alter) PDF or DOC
- Summary/recs for a wind-blown dust inventory (Gerry Mansell) PDF or PPT
- Additional recs for a wind-blown dust inventory (Michael Uhl) PDF or PPT
- Next steps for a wind-blown dust inventory (Tom Moore) PDF or PPT

- Comparison of the Fugitive Dust Model to Emission at Keeler Dunes (Duane Ono) PDF or PPT

02/10/04 Dust Emissions Joint Forum Conference Call Minutes PDF or DOC
01/13/04 Dust Emissions Joint Forum Conference Call Minutes PDF or DOC

2003 Events
12/16/03 Dust Emissions Joint Forum Conference Call Minutes PDF or DOC
11/14/03 Dust Emissions Joint Forum Conference Call Minutes PDF or DOC
10/29/03 Emissions Joint Forum & Dust Emissions Joint Forum Meeting, Las Vegas, NV
03/19/03 WRAP Forums and Planning Team Meeting, Santa Fe, NM

2002 Events
11/06/02 Dust Emissions Joint Forum Meeting, Las Vegas, NV

2001 Events
05/07/01 Teleconference on WRAP Dust Issue DOC
The Emissions Forum coordinated a conference call on fugitive dust issues in the WRAP 1996 Base Year Emission Inventory, and on potential cooperative efforts between the WRAP/EPA/WESTAR to address these concerns.

2000 Events
12/14/00 Research and Development Forum Fugitive Dust Workshop, Las Vegas, NV

Economic Analysis Forum

Purpose:
To provide the WRAP and WRAP forums with projections of econometric parameters needed to forecast changes in emissions, and assessments of the economic effects of pollution controls on the region and sub-regions, including Indian Country.

Membership:
Members
Representatives of state and local economic analysis and council of government organizations, EPA, federal land management agencies and stakeholders.

Significant Work Products:
Major Projects

- Economic Analysis Framework
- Framework Application Test

Meetings:

2003 Events
03/18/03 WRAP Forums and Planning Team Meeting, Santa Fe, NM
Economic Analysis Forum Meeting Agenda PDF

2002 Events
12/13/02 Economic Analysis Framework Workshop, Denver, CO

Emissions Forum

Purpose:
To oversee the development of a comprehensive emissions tracking and forecasting system which can be utilized by the WRAP, or its member entities, monitors the trends in actual emissions, and forecasts the anticipated emissions which will result from current regulatory requirements and alternative control strategies.

Membership:
Members
Representatives of state and tribal air programs, EPA and federal land managers, with stakeholders from industrial and environmental interests. Membership on the forum is augmented by a workgroup of state staff members that work on emissions inventories

Significant Work Products:
Major Projects

- EDMS Operations & Maintenance – Primary source of comprehensive emissions data bases for base-year and projection years
- Oil/Gas Area Source Emissions/Controls – Ongoing evaluation of existing and state-of-the-art controls for oil and gas production facilities
- Stationary/Area Source Emission Projections – Planning emission estimates for base year
- Updating Mobile Source Emissions – Evaluation of effects on mobile source emissions from recent federal requirements
- EDMS Project Page – Working interactive webpage that users can access regional emissions data, develop reports for decision makers and the public
- AK Aviation Inventory – Emission estimates from aviation sector of transportation emissions in Alaska

Meetings:

2009 Events
11/18/09 Emission Forum EDMS Work Group Call
09/30/09 EDMS Status Call
07/29/09 EDMS Status Call
05/27/09 EDMS Status Call & Webinar
03/25/09 EDMS Status Call
02/27/09 Emission Forum Call
02/19/09 Emission Forum Call
01/28/09 EDMS Status Call

2008 Events
11/19/08 EDMS Status Call
09/24/08 EDMS Status Call
07/31/08 EDMS Status Call
06/11/08 Emission Forum Call
06/02/08 EPA 17th International Emission Inventory Conference
05/28/08 EDMS Status Call
03/26/08 EDMS Status Call
01/30/08 EDMS Status Call

2007 Events
12/12/07 EDMS Status Call
10/24/07 EDMS Status Call
08/28/07 EDMS Status Call
08/23/07 Emissions Forum Call
06/27/07 EDMS Status Call
05/30/07 EDMS Status Call
05/01/07 EDMS Status Call
03/29/07 EDMS Status Call
02/28/07 EDMS Status Call
01/17/07 EDMS Status Call

2006 Events
11/30/06 Emissions Forum Call, Call Notes: PDF or DOC
10/18/06 Emissions Forum Meeting, Spokane, WA
08/14/06 Emissions Forum Call
08/02/06 EDMS Steering Committee Call
07/12/06 Emissions Forum Meeting, Portland, OR
05/31/06 Emissions Forum Call
04/18/06 Emissions Forum Meeting, Tempe, AZ
02/07/06 Emissions Forum Meeting, Santa Fe, NM
01/18/06 Emissions Forum Call

2005 Events
12/05/05 Emissions Data Management System Web Training Call
12/02/05 Emissions Forum Call (Notes: PDF)
10/05/05 Emissions Forum Call (Notes: PDF or DOC)
09/27/05 Emissions Forum Meeting, Missoula, MT
06/21/05 Emissions Forum Call
05/24/05 Emissions Forum Call (Notes: PDF or DOC)
04/26/05 Alaska Regional Haze Technical Analysis Meeting
02/10/05 Emissions Forum Call (Notes: PDF or DOC)
01/26/05 Emissions Forum Meeting, San Diego, CA

2004 Events
12/10/04 Emissions Forum Call (Notes: PDF or DOC)

11/08/04 Emissions Forum Call
10/19/04 Emissions Forum Meeting & EDMS Training, Boise, ID
08/05/04 Emissions Forum Call
07/14/04 Emissions Forum Meeting, Reno, NV
06/18/04 Emissions Forum Call
05/11/04 EDMS Project Workshop
04/09/04 Emissions Forum Call
03/24/04 Emissions Forum Meeting, Santa Fe, NM
02/03/04 Emissions Forum Call

2003 Events
10/28/03 Emissions Forum & Dust Emissions Forum Joint Meeting, Las Vegas, NV
10/14/03 NARSTO Workshop on Innovative Emission Inventory Methods, Austin, TX
09/05/03 Emissions Forum Call
07/01/03 Emissions Forum Meeting, Portland, OR
05/07/03 Emissions Data Management System Needs Assessment Workshop, Denver, CO
03/19/03 WRAP Forums and Planning Team Meeting, Santa Fe, NM

2002 Events
11/14/02 Emissions Forum Meeting, Tempe, AZ
05/23/02 Emissions Forum Workplan & Budget Meeting, Salt Lake City, UT
04/03/02 Emissions Forum/EI Work Group Conference Call Minutes DOC or WPD
01/29/02 Emissions Forum Meeting, Phoenix, AZ

2001 Events
09/27/01 Emissions Forum & Emissions Work Group Meeting, UC Riverside
05/14/01 Emissions Forum Meeting, Spokane, WA
05/07/01 Teleconference on WRAP Dust Issue DOC
02/01/01 Emissions Forum Final Meeting Minutes PDF or WPD
2000 Events
07/11/00 Emissions Forum Final Meeting Minutes WPD
08/30/00 Emissions Forum Final Meeting Minutes WPD

Fire Emissions Joint Forum

Purpose:
to assist the Western Regional Air Partnership in addressing the Grand Canyon Visibility Transport Commission's (GCVTC) Recommendations on fire, and to implement requirements of §309 of the regional haze rule.

Membership:
Members
Representatives of state and tribal agencies with specialties in fire and smoke management, EPA, federal land managers and stakeholders representing industrial, agricultural, environmental interests

Significant Work Products:
Major Projects

- Annual Emission Goal
- Basic Smoke Mgmt. Programs
- Emissions
  -Phase I Fire EI
  -Phase II Fire EI
  -Phase III/IV Fire EI
  -InterRPO Wildfire EI
- Emissions Reduction Techniques
- Enhanced Smoke Management Programs
- Fire Tracking Systems
- National Fire Emissions Technical Workshop
- Natural Background
- Non-Burning Alternatives on Agricultural Lands
- Non-Burning Alternatives on Wildlands
- Prescribed Fire Plan Assessment
- Public Education and Outreach
- Regional Coordination
- TWIST (Technical WRAP-up Implementation Support Team)

Meetings:

2009 Events
12/17/2009 Fire Emissions Tracking System (FETS) Project Call
10/13/09 Fire Emissions Tracking System (FETS) Project Call
08/31/09 Fire Emissions Tracking System (FETS) Project Meeting
03/04/09 Smoke & Fire Emissions Forum Call
02/24/09 Smoke & Fire Emissions Forum Call
02/18/09 FETS Webinar for Data Analysts and Air Quality Planners
01/15/09 FEJF Conference Call
01/14/09 FETS Smoke Management Program Webinar

2008 Events
12/10/08 FETS Data Provider Webinar
11/20/08 FEJF Conference Call
08/26/08 FEJF Conference Call
03/31/08 FEJF Conference Call
01/29/08 FEJF Conference Call

2007 Events
09/26/07 FEJF Meeting, Salt Lake City, UT
06/25/07 FEJF Conference Call
05/29/07 FEJF Conference Call
04/24/07 FEJF Conference Call

02/22/07 Fire Emissions Joint Forum Meeting, San Diego, CA
01/30/07 FEJF Conference Call

2006 Events
11/28/06 FEJF Conference Call
10/17/06 Fire Emissions Joint Forum Meeting, Spokane, WA
07/11/06 Fire Emissions Joint Forum Meeting, Portland, OR
05/23/06 WRAP Workshop on Fire, Carbon and Dust, Sacramento, CA
04/25/06 FEJF Conference Call
03/28/06 FEJF Conference Call
03/07/06 FEJF Meeting, Albuquerque, NM
01/24/06 FEJF Conference Call

2005 Events
12/20/05 FEJF Conference Call Notes PDF or DOC
11/30/05 FEJF Meeting, Seattle, WA
10/25/05 FEJF Conference Call Notes PDF or DOC
09/28/05 FEJF Meeting, Missoula, MT
08/23/05 FEJF Conference Call Notes PDF or DOC
07/26/05 FEJF Conference Call Notes PDF or DOC
06/07/05 FEJF Meeting, Denver, CO
02/23/05 FEJF Meeting, Salt Lake City, UT
02/09/05 Inter-RPO Fire and Smoke Technical and Policy Coordination Meeting, Round Rock, TX

2004 Events
12/08/04 FEJF Meeting, Las Vegas, NV
09/08/04 FEJF Meeting, Worley, ID
06/16/04 308/309 Smoke Management Planning Workshop, Portland, OR
06/15/04 FEJF Meeting, Portland, OR
05/04/04 National Fire Emissions Technical Work Shop, New Orleans, LA
03/10/04 FEJF Meeting, San Diego, CA

2003 Events
12/10/03 FEJF Meeting, Tucson, AZ
- Agenda PDF or DOC
- Attendee List PDF or DOC
- Presentation: Plans for Fire Emissions Inventories (Moore) PPT
- Presentation: Fire Emissions from 30,000' - Regional Haze Planning Needs and Level(s) of Effort (Moore/Alter) PPT
- Issue Paper: FEJF De Minimis Task Team PDF or DOC

09/24/03 FEJF Meeting, Portland, OR
- Agenda PDF or DOC
- Draft Minutes PDF or DOC
- Attendee List PDF or DOC
- Emission Reduction Techniques for Agricultural Burning and Wildland Fire PDF or PPT

(Draft Annotated Bibliography, Indices, and Summary Table—Kenneth Meardon, MACTEC)

- Lee Alter's WRAP Update Power Point Presentation PDF or PPT
- FEJF Draft 04 Workplan PDF or DOC
- Dave Randall's Model Sensitivity Runs Presentation PDF
- De-minimus outline PDF or DOC

06/03/03 FEJF Meeting, San Francisco, CA
03/18/03 FEJF Meeting, Santa Fe, NM

2002 Events
12/10/02 FEJF Meeting, Jackson, WY
Includes Meeting Documents and Presentations from the meeting.
(Updated 12/24/02)
09/18/02 FEJF Meeting, Phoenix, AZ
05/15/02 FEJF Meeting, Coeur d'Alene, ID
04/26/02 FEJF Conference Call PDF
02/06/02 FEJF Meeting, Tucson, AZ PDF
ARCHIVE - 2001 and earlier

Mobile Sources Forum

Purpose:
Initially, in its first couple of years (2000-02), the MSF led the development of a WRAP-wide mobile source emission inventory and worked with the Air Quality Modeling Forum to define and analyze the significance of mobile sources with respect to the requirements of §309 of the regional haze rule. Federal promulgation of emission and fuel standards successfully addressed mobile source emissions for regional haze. The Mobile Sources Forum is now actively engaged in facilitating state and local diesel retrofit programs.

Membership:
Members
Representatives of state agencies with specialties in mobile source and transportation planning, EPA, and other federal agencies involved in transportation, stakeholders from the auto manufacturing and fuel supply industry and environmental organizations.

Significant Work Products:
Major Projects

- Offroad Diesel Retrofit Guidance Document
- Offroad Retrofits
- Offroad Retrofit Economic Analysis
- Updating Mobile Source Emissions

Meetings:

2008 Events
03/19/08 EPA Region 8 Diesel Retrofit Boot Camp/Grant Funding Workshop, Salt Lake City, UT
02/19/08 Mobile Source Forum Call

2007 Events
06/07/07 Workshop for Developing And Implementing A State Funded Retrofit Program
05/03/07 Mobile Sources Forum Call
03/22/07 Mobile Sources Forum Call
01/30/07 Mobile Sources Forum Call
2006 Events
10/03/06 WRAP Diesel Retrofit Boot Camp, Las Vegas, NV

2005 Events
01/27/05 WRAP Member Offroad Retrofit Program Workshop, San Diego, CA

2003 Events
07/16/03 Workshop on EPA's Nonroad Proposal, Denver, CO

2002 Events
10/30/02 Mobile Sources Forum Meeting, Denver, CO
10/09/02 MSF/IOC Conference Call

- The Forum was invited participate in the IOC Meeting via speakerphone for the following mobile source agenda item: Discussion of ***Preliminary Mobile Source Significance Test Modeling Results*** PPT (Revised IOC Mobile Source Power Point presentation)

04/15/02 Mobile Sources Forum Meeting, Denver, CO

2001 Events
07/25/01 Mobile Sources Forum Meeting Agenda DOC

2000 Events
06/07/00 Mobile Sources Forum Meeting Minutes PDF

Sources In and Near Class I Areas Forum

Purpose:
To help implement those recommendations by working with parks and local communities to develop and implement strategies to minimize emissions and the resulting visibility impacts.

Membership:
Members
Representatives from state and federal land management agencies, stakeholders from hearth products industries and environmental interests

Significant Work Products:
Major Projects

- Evaluation of PM10 SIPs
- In-Park Emissions
- Near Emissions
- Gateway Community Demo Project

Meetings:

2002 Events
(12/10/02) Sources In and Near Class I Areas Forum Meeting, Novato, CA
The Forum will review and finalize the workplan that its contractor (ENVIRON) will follow in characterizing emissions near Class I areas throughout the WRAP region. The meeting will be held from 12-3 at ENVIRON's offices in Novato, CA. (Posted 11/21/02)
Sources In and Near Class I Areas Forum
1999 Meeting Minutes (zip file)

Stationary Sources Joint Forum

Purpose:
The Stationary Sources Joint Forum (SSJF) was established in January 2004 and replaces the Market Trading Forum (MTF). See comments below. The SSJF is focused more broadly on stationary source issues throughout the WRAP and their relationship to Section 308 SIP requirements. Stationary source issues addressed include BART, reasonable progress goals, oil and gas emissions and control technologies for electricity generating units.

Membership:
Members
Representatives of state and tribal air agencies, EPA and federal land managers, with stakeholders from industrial, electric utility and environmental interests.

Significant Work Products:
Major Projects

- Oil/Gas Area Source Emissions/Controls
- EGU NOx Controls
- Stationary/Area Source Data Pivot Tables
- Stationary/Area Source Emission Projections
- General BART Information
- Identifying BART-Eligible Sources
- EPA's IAQR

Meetings:

2006 Events
11/14/06 SSJF Meeting, Tempe, AZ
08/16/06 SSJF Meeting, Salt Lake City, UT
05/30/06 SSJF/309 Workgroup Call on SO2 PDF or DOC
05/10/06 Oil and Gas Workgroup Call PDF or DOC
05/05/06 AMC Conference Call Notes PDF or DOC
02/01/06 SSJF Meeting, Denver, CO

2005 Events
09/07/05 SSJF Meeting, Denver, CO
05/10/05 SSJF Meeting, Palm Springs, CA
02/23/05 SSJF Meeting, Salt Lake City, UT

2004 Events
12/13/04 SSJF Meeting, Tempe, AZ

- Update on Identifying BART-eligible sources PDF ZIP
- Tribal Point Source Project PDF or PPT

2003 SO2 Emissions and Milestone Report PDF or PPT

- Attribution of Haze Project Update PDF or PPT

06/02/04 SSJF Meeting, Denver, CO

- Agenda PDF or DOC
- Minutes PDF or WPD
- Summary of Action Items and Future Work (Pat Cummins) PDF or DOC
- Identification of BART-eligible sources (project update) PDF or PPT
- EPA's summary of BART reproposal PDF or PPT
- Status of WRAP comments on BART reproposal (update) PDF or PPT
- EPA's analysis of EGU NOx controls in the West PDF or PPT and XLS
- EPA's analysis of the CAIR's impact on SO2 emissions in the 309 states PDF or PPT
- Lee Alter's summary of EGU NOx emissions XLS
- Overview of oil and gas development emissions and haze issues PDF or PPT
- Attribution of haze (project update) PDF or PPT

04/13/04 SSJF Conference Call Notes PDF or DOC
02/18/04 Stationary Sources Joint Forum Meeting, Denver, CO

- Agenda PDF or DOC
- Minutes PDF or WPD
- BART Overview PDF or PPT
- WRAP Technical Approach PDF or PPT
- EPA Update on BART, IAQR, and Hg PDF or PPT
- Issues related to expanding EPA’s proposed Interstate Air Quality Rule (IAQR) to cover regional haze in the West PDF or DOC

Archived

NOTE: The Market Trading Forum was originally organized to develop SO2 milestones and a backstop trading program for major point sources under 40CFR 51.309 to implement recommendations of the Grand Canyon Visibility Transport Commission. In 2004, after the 309 SIPs were submitted the MTF was re-organized and established new goals to develop BART, Reasonable Progress Goals, Long-term strategies for point sources under 40CFR 51.308

Market Trading Forum (Archive Status as of 1/2004 – activities related to § 309)

Technical Analysis Forum

Purpose:
The Technical Analysis Forum was formed in December 2006 by the Technical Oversight Committee. The TAF will coordinate and manage the processing, display, delivery, and explanation of technical data for regional haze planning activities. The TAF will assume responsibility for combining the participants and maintaining the activities and ongoing projects of the Ambient Air Monitoring & Reporting Forum, the Air Quality Modeling Forum, and the Attribution of Haze Workgroup. See comments below

Membership:
Members
A large membership of several representatives from each WRAP state, several tribes, EPA regions, federal land management agencies with technical expertise in emissions, monitoring and modeling. Stakeholder representation is from industry and environmental interests.

Significant Work Products:
Major Projects

- Technical Support System Website
    - *Technical Support System Project Page*
- Regional Modeling Center
- VIEWS Website
- Causes of Haze Website

Meetings:

2009 Events
03/02/09 Technical Analysis Forum Call
02/24/09 Technical Analysis Forum Call
01/14/09 Technical Analysis Forum PRP18b SoW Call

2008 Events

10/21/08 Technical Analysis Forum PRP18b SoW Call
10/14/08 Technical Analysis Forum Call
09/11/08 TAF Technical Workshops' Findings Report Review Call
09/03/08 Technical Analysis Forum Call
08/12/08 Technical Analysis Forum Call
07/08/08 Technical Analysis Forum Call
06/06/08 Technical Analysis Forum Call
05/12/08 NASA ROSES TSS-CMAQ Project Kickoff Meeting
04/22/08 Revised O3 NAAQS - Effects in the West Call
04/01/08 Technical Analysis Forum Call
03/03/08 Technical Analysis Forum Call

2007 Events
12/17/07 Technical Analysis Forum Call
12/10/07 Natural Conditions Report Review Call
11/15/07 Technical Analysis Forum Call
10/11/07 Technical Analysis Forum Meeting, San Francisco, CA
08/20/07 Technical Analysis Forum Call
07/16/07 Technical Analysis Forum Call
06/13/07 Technical Analysis Forum Call
05/22/07 Technical Analysis Forum Meeting, Boise, ID
04/16/07 Technical Analysis Forum Call
03/19/07 Technical Analysis Forum Call
02/26/07 Technical Analysis Forum Call
02/06/07 Technical Analysis Forum Meeting, Las Vegas, NV
01/08/07 Technical Analysis Forum Call

Archived

NOTE: The following forums and workgroups were merged in 2006 into the Technical Analysis Forum
Air Monitoring and Reporting Forum (Archive Status as of 12/06)
Air Quality Modeling Forum (Archive Status as of 12/06)
Attribution of Haze Work Group (Archive Status as of 12/06)

Tribal Data Development Work Group

Also **Tribal Caucus**

Purpose:
To assist and advise WRAP on gathering tribal air quality data and other air quality issues related to the WRAP mission from Tribes in the WRAP area. The TDD-WG will work with the other WRAP forum and non-tribal communities to improve understanding communities of protocols and processes for obtaining and using tribal data.

Membership:
Members

Members or employees of federally recognized tribes in the WRAP area that will be impacted by WRAP decisions.

Significant Work Products:

- 2002 and 2018 Point Source and Oil & Gas Area Source Inventory for Tribes
- TEISS (Tribal Emission Inventory Software Solution)
  - Description PDF
  - Software Development Plan PDF
  - Appendix C: Emission Estimation Methods PDF
  - Appendices D-G PDF

Meetings:

2007 Events
08/28/07 Tribal Caucus Meeting, Denver, CO
07/17/07 TDDWG Meeting, Worley, ID
04/16/07 TDDWG Meeting, San Diego, CA
01/23/07 TDDWG Meeting, Palm Springs, CA

2006 Events
11/28/06 WRAP Tribal Technical & Policy Workshop, Albuquerque, NM
10/12/06 TDDWG Meeting, Scottsdale/Fountain Hills, AZ (Fort McDowell Yavapai Nation)
09/11/06 Tribal Caucus Meeting, Whitefish, MT
07/26/06 TDDWG Meeting, Lewiston, ID
05/01/06 NTEC Conference, Temecula, CA
04/10/06 Advanced EI/TEISS Technical Assistance Training, Seattle, WA
03/28/06 TEISS Training, Las Vegas, NV
03/14/06 TDDWG & Inter-RPO Tribal WG Joint Meeting Albuquerque, NM
02/21/06 TEISS Training, Las Vegas, NV

2005 Events
12/12/05 Tribal Caucus Meeting, Palm Springs, CA
12/07/06 TDDWG Meeting, Santa Fe, NM
11/01/05 Advanced EI/TEISS Technical Assistance Training, Phoenix, AZ
08/17/05 TDDWG Meeting, Polson, MT
05/16/05 Tribal Caucus Meeting, Phoenix, AZ
05/03/05 NTEC Conference, Greenbay, WI
01/19/05 TDDWG Meeting, Lake Tahoe, NV

2004 Events
11/09/04 Tribal Caucus Meeting Salt Lake City, UT
10/19/04 TDDWG Meeting, Boise, ID
10/12/04 Tribal Caucus Call
10/05/04 National Tribal Air Association's 3rd Annual Conference
09/07/04 TDDWG Conference Call
08/10/04 Tribal Caucus Call
06/29/04 TDDWG Meeting, Tempe, AZ

04/05/04 Tribal Caucus Meeting, Tempe, AZ
03/02/04 National Tribal Forum Series on Air Quality, San Diego, CA
02/09/04 TDDWG Meeting, Las Vegas, NV

2003 Events
11/13/03 TDDWG Meeting, Las Vegas, NV
10/13/03 Alaska Tribal Conference on Environmental Management, Anchorage, AK
10/13/03 Tribal Caucus Meeting, Salt Lake City, UT
09/16/03 WRAP Tribal Policy and Technical Workshop, Albuquerque, NM
08/06/03 TDDWG Meeting, Seattle, WA
04/28/03 TDDWG Meeting, Sacaton, AZ
04/01/03 Tribal Air Caucus Meeting, Portland, OR

2002 Events
05/22/02 Tribal Caucus Meeting, Salt Lake City, UT
04/08-09/02 TDDWG Meeting, RMC, Riverside, CA
01/08-09/02 TDDWG Meeting, Phoenix, AZ

2001 Events
09/26/01 Meeting Minutes
01/24/01 Meeting Minutes
05/31/01 Meeting Minutes
09/13/01 TDDWG Meeting, Albuquerque, NM
01/24/01 TDDWG Meeting, Las Vegas, NV, PDF or DOC

2000 Events
01/13/00 TDDWG Meeting, Phoenix, AZ

1999 Events
06/17/99 TDDWG Meeting
Additional TDDWG Meeting Minutes for 1999 (zip file)

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.11.b
Consultation: Federal Land Manager Review

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

APPENDIX III.K.11.b

Consultation:

Federal Land Manager Review

(This page serves as a placeholder for two-sided copying)

Federal Land Manager Review

The State of Alaska provided an opportunity for FLM consultation at least 60 days prior to holding any public hearing on the SIP. This SIP was submitted to the FLMs on June 24, 2010 for review and comment. Comments were received from the FLMs on August 23, 2010. As required by 40 CFR Section 51.308(i)(3), the FLM comments and State responses are presented here.

FLM Review Sections:

August 23, 2010 comment letter from the United States Department of the Interior, U.S. Fish and Wildlife Service (FWS) and National Park Service (NPS)

Alaska Regional Haze Plan Response to Federal Land Manager Comments (*including* **Response to March 11, 2010 comment letter from the United States Department of the Interior, National Park Service (NPS)**

March 11, 2010 comment letter from the United States Department of the Interior, National Park Service (NPS)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
National Wildlife Refuge System
Branch of Air Quality
7333 W. Jefferson Ave., Suite 375
Lakewood, CO 80235-2017

IN REPLY REFER TO:

FWS/ANWS-AR-AQ

RECEIVED
AUG 3 0 2010
ADEC AQ

August 23, 2010

Ms. Alice Edwards, Acting Director
Division of Air Quality
Alaska Department of Environmental Conservation
PO Box 111800
Juneau, AK 99501

Subject: Regional Haze State Implementation Plan Comments

Dear Ms. Edwards:

On June 23, 2010, the State of Alaska submitted for Federal Land Manager review the proposed revisions to the Alaska State Air Quality Control Plan [State Implementation Plan (SIP)], describing its proposal to improve air quality regional haze impacts at mandatory Class I areas across your region. We appreciate the opportunity to work closely with the State through the initial evaluation, development, and, now, subsequent review of this plan. Cooperative efforts such as these ensure that, together, we will continue to make progress toward the Clean Air Act's goal of natural visibility conditions at all of our most pristine National Parks and Wilderness Areas for future generations.

This letter acknowledges that the U.S. Department of the Interior, U.S. Fish and Wildlife Service (FWS) and the National Park Service (NPS), have received and conducted a substantive review of your proposed Regional Haze Rule implementation plan in fulfillment of your requirements under the federal regulations 40 CFR 51.308(i)(2). Please note, however, that only the U.S. Environmental Protection Agency (EPA) can make a final determination regarding the document's completeness and, therefore, ability to receive federal approval from EPA.

As outlined in a letter to each State dated August 1, 2006, our review focused on eight basic content areas. The content areas reflect priorities for the Federal Land Management agencies, and we have enclosed comments associated with these priorities. We look forward to your response, as per section 40 CFR 51.308(i)(3). For further information, please contact Tim Allen (FWS) at (303) 914-3802 or Pat Brewer (NPS) at (303) 969-2153.

TAKE PRIDE IN AMERICA

Again, we appreciate the opportunity to work closely with the State of Alaska and compliment you on your hard work and dedication to significant improvement in our nation's air quality values and visibility.

Sincerely,

Sandra V. Silva

Sandra V. Silva, Chief
Branch of Air Quality
Fish and Wildlife Service

John Bunyak

John Bunyak, Acting Chief
Air Resources Division
National Park Service

Enclosure (1)

cc:

Cindy Heil, Acting Program Manager
Division of Air Quality
Department of Environmental Conservation
619 E. Ship Creek, Ste. 249
Anchorage, AK 99501

Richard Albright, Director
Office of Air, Waste, and Toxics
US EPA Region 10
1200 Sixth Avenue Suite 900
Seattle, WA 98101

Brian McManus, Deputy Chief
USFWS Branch of Fire Management
National Interagency Fire Center
3833 South Development Ave.
Boise, ID 83705

Todd Logan, Refuge Chief
USFWS Alaska Regional Office
1011 East Tudor Road, MS 225
Anchorage, Alaska 99503

Steve Delehanty, Refuge Manager
Alaska Maritime National Wildlife Refuge
95 Sterling Highway, Suite 1 MS 505
Homer, AK 99603

Paul Anderson, Superintendent
Resources, Science and Learning
Denali National Park
P.O. Box 9
Denali Park, AK 99755-0009

Todd Hawes
U.S. EPA OAQPS
Mail Code C539-04
Research Triangle Park, NC 27711

U.S. Fish and Wildlife Service
And
National Park Service
Comments Regarding
Alaska Regional Haze Rule State Implementation Plan
August 23, 2010

On June 23, 2010, the State of Alaska submitted the Alaska State Air Quality Control Plan [State Implementation Plan (SIP)] Revision for the Regional Haze Program, pursuant to the requirements codified in Federal rule at 40 CFR 51.308(i)(2), to the U.S. Department of the Interior, U.S. Fish and Wildlife Service (FWS) and National Park Service (NPS).

The air program staff of the FWS and NPS has conducted a substantive review of the Alaska plan and provides the comments listed below. We are providing these comments to the State and ask that these be included in the official public record. We look forward to a response as per section 40 CFR 51.308(i)(3), and we are willing to work with the Alaska Department of Environmental Conservation (ADEC) staff towards resolving any of the issues discussed below. For further information, please contact Tim Allen with FWS at (303) 914-3802 or Pat Brewer (NPS) at (303) 969-2153.

Overall Comments

Overall the Alaska draft SIP is comprehensive and well written. It has a descriptive Executive Summary, a detailed discussion of monitoring data, source contributions, and existing regulations.

Specific Comments

Chapter K.3 Alaska and Air Quality

1. The SIP should include a commitment to future air quality monitoring to support the regional haze demonstration.

2. *Page K.3-12 and page K.4-46:* EPA's *Guidance for Tracking Progress under the Regional Haze Rule* lists Denali Headquarters as the official IMPROVE site and Trapper Creek as the protocol site. NPS will be providing additional comments in a separate letter regarding the IMPROVE monitoring sites and park description.

3. *Section E. Bering Sea Wilderness Area (pg K.4-118*): While monitoring data are not available for the Bering Sea, Alaska needs to consider source contributions and potential impacts to this wilderness area.

Chapter K.5 Emissions Inventory

1. *Section A: Baseline and Future-Year Inventories*: ADEC should clarify the emissions assumed for 2018 for the Golden Valley Electric Association (GVEA) – Healy Power Plant [Healy] Units 1 and 2, located less than four miles from Denali National Park. The Denali Borough 2018 emissions listed in Appendix III.K5 are much lower than the allowable emissions for Healy Unit 2, and supporting documentation in the current Title V renewal permit indicates Unit 2 will be restarted before the year 2018. If the Healy Unit 1 and 2 emissions were not included in the 2018 emission inventory, then the implications of not including the emissions should be discussed in the interpretation of the Weighted Emissions Potential (WEP) analysis for Denali.

2. *Section B: 2002 Baseline Inventory and Section D Inventories for Specific Source Categories (pg K.5-3 and K.5-4):* Alaska states that fire data were obtained from the WRAP Fire inventory efforts. ADEC should clarify if Alaska provided state-generated fire activity data to WRAP or if the WRAP relied on wildfire data from federal records. In addition ADEC should explain why the prescribed fire emissions appear to be extremely low, given the open burning discussion in Section K.9.C.1.

Chapter K.6 Best Available Retrofit Technology (BART)

1. Regarding the Agrium, Kenai Nitrogen Operations Plant, ADEC proposed that BART emission limits for nitrogen oxides, sulfur dioxide, and particulate matter for BART eligible units be set at zero, since the plant is not currently operating. Reducing the federally-enforceable emission limits for these units to zero, and specifying that a new Prevention of Significant Deterioration (PSD) permit application, review, and approval, would be needed prior to any future operation of the units, is acceptable to us for meeting the Regional Haze Rule obligations for this source.

2. In a letter dated March 11, 2010, the National Park Service commented on Alaska's BART determination for GVEA's Healy Plant Unit 1. At this time, a response to these comments has not been received. The major concern identified in the letter was Alaska's determination that Selective Non-catalytic Reduction (SNCR) is considered BART for Healy Unit 1 based on a remaining useful life of eight years (shutdown in 2024). The BART guidelines (40 CFR 51, Appendix Y, Section IV.D.4.k.2) require that if the shutdown date "affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation." Alaska must make the shutdown of Healy Unit 1 in 2024 legally enforceable. If the shutdown is not made legally enforceable, then BART would be the use of Selective Catalytic Reduction as previously determined by Alaska.

Chapter K.9 Reasonable Progress Goals

1. *Section 2. Identification of Sources for Four Factor Analysis (pg K.9-4):* Alaska needs to demonstrate that it is making reasonable progress in reducing anthropogenic emissions within the state. Alaska's approach to determine which source categories to evaluate is appropriate. Alaska should extend the analysis to consider feasible controls for individual sources within these sources categories. The WRAP point source pivot tables identify the major individual sources within each source category. Visibility impacts from sources exempted from BART (e.g., Anchorage Municipal Light &Power, and Conoco Phillips Alaska Inc) and Healy Unit 2 are not negligible and controls for these sources should be considered as part of the reasonable progress analysis. CALPUFF could be used to consider the cumulative visibility impacts of the major industrial sources.

2. *Section E:* ADEC should clarify that the reasonable progress goals for 2018 were set by comparing the percentage changes in anthropogenic contributions between 2002 and 2018 from the WEP analyses to the target uniform rate of progress by 2018.

3. In the Reasonable Progress section, the SIP should mention the anthropogenic sources near Bering Sea (e.g. oil and gas production) and how the emissions changes between 2002 and 2018 for these sources might affect visibility in the Bering Sea Wilderness area.

Alaska Regional Haze Plan Response to Federal Land Manager Comments

FLM comments are paraphrased rather than quoted in their entirety. The complete comment letter precedes this response.

Comment K.3-1: The SIP should include a commitment to future air quality monitoring to support the regional haze demonstration.

Response: Explicit commitment to future air quality monitoring has been added to section III.K.10, Commitment to Future 308 Plan Revisions.

Added text: *Revisions and progress reports depend on future visibility monitoring. Assessment of monitoring strategy and analysis of monitoring data is required for progress reports. Alaska will depend on the IMPROVE monitoring program to collect and report data for reasonable progress tracking of the three Alaska Class 1 Areas currently monitored. Because Regional Haze is a long-term tracking program with a 60-year implementation period, Alaska expects the configuration of the monitors, sampling site locations, laboratory analysis methods and data quality assurance, and network operation protocols will not change, or if changed, will remain directly comparable to those operated by the IMPROVE program during the 2000-2004 Regional Haze baseline period. Technical analyses and reasonable progress goals in this plan are based on data from these sites.*

Alaska plans to use data reported by the IMPROVE program with the analysis tools found at the Visibility Information Exchange Web System (VIEWS), and those sponsored by the WRAP. Alaska will depend on the routine, timely reporting of monitoring data by the IMPROVE program to VIEWS for the tracking reasonable progress. Alaska will continue to rely on U.S. EPA to operate the IMPROVE monitoring network.

Comment K.3-2: EPA's Guidance for Tracking Progress under the Regional Haze Rule lists Denali Headquarters as the official IMPROVE site and Trapper Creek as the protocol site.

Response: The status of the two sites in EPA's Guidance for Tracking Progress under the Regional Haze Rule does not represent the current status of the two monitoring sites. The IMPROVE monitor near the park's headquarters was the original IMPROVE site, but due to topographical barriers, such as the Alaska Range, it was determined that this was not adequately representative of the entire Class I area. Therefore, Trapper Creek, just south of the park boundary, was chosen as a second site for an IMPROVE monitor and is now the official Denali IMPROVE site and the headquarters site is now the protocol site. The Trapper Creek site was chosen to characterize any transport from the Anchorage area, the most densely populated region in the state. The status of the two sites has been clarified in section III.K.3.C.2.a and III.K.4.C.1.a.

Comment K.3-3: Section E. Bering Sea Wilderness Area (p. K.4-118). While monitoring data are not available for Bering Sea, Alaska needs to consider source contributions and potential impacts to this wilderness area.

Response: Additional information about source contributions and potential impacts has been added to section III.K.4.E, Bering Sea Wilderness Area.

Comment K.5.1: Baseline and Future Year Inventories. ADEC should clarify the emissions assumed for 2018 for the GVEA – Healy Units 1 and 2, located less than four miles from Denali National Park. The Denali Borough 2018 emissions listed in Appendix II.K.5 are much lower than the allowable emissions for Healy Unit 2, and supporting documentation in the current Title V renewal permit indicates Unit 2 will be restarted before the year 2018. If the Healy Unit 1 and 2 emissions were not included in the 2018 emission inventory, then the implications of not including the emissions should be discussed in the interpretation of the Weighted Emission Potential (WEP) for Denali.

Responses: Additional information and clarification has been added throughout the draft SIP document. These are presented below in the format: **Section, Preceding text, Added text** (in italics).

> **Section: III.K.5.C.**
> **Preceding text:**
> **C. 2018 Future-Year Inventory**
>
> The 2018 inventory was developed to reflect emission levels projected to calendar year 2018, accounting for forecasted changes in source activity and emission factors. Population projections compiled by the Alaska Department of Labor and Workforce Development (DOLWD) at five-year intervals through 2030 by individual borough and census area were used to grow 2002 baseline activity to 2018 for most of the source categories, with a couple of exceptions.
>
> First, fire sector emissions for wildfires were held constant, reflecting the fact that one cannot reasonable forecast any change in wildfire activity through the state between 2002 and 2018. (As explained later, modest reductions in prescribed burn emissions were assumed, consistent with WRAP 2018b Phase III Fire Inventory forecast.) Second, activity from small port commercial marine vessel activity in 2002 was assumed to be identical to that obtained for calendar year 2005.
>
> Emission factors specific to calendar year 2018 were also developed for source sectors affected by regulatory control programs and technology improvements. These source sectors included on-road and non-road mobile sources (except commercial marine vessels and aviation) and stationary point sources.

Added text:
While the methodology adopted to forecast the 2018 inventory ensures that there is continuity in the emission sources and activity levels represented, it fails to account for structural changes that will occur. For example, within the stationary source sector, some of the point sources operating in 2002 have already shut down; nevertheless their emissions are forecast to grow in proportion to the population growth rate. Similarly, new and or permitted sources that are not currently operating may be in operation in 2018 and their emissions are not included in the 2018 forecast. An example of a source that has shut down is the Agrium facility located in the Kenai. An example of a permitted source that did not operate in 2002, is not currently operating, but could operate in future years is the Healy Clean Coal Project (HCCP). To the extent that the status of these and other facilities are known their impact on forecasted emissions and visibility will be discussed to provide a more accurate view of potential impacts.

Section III.K.7.B.
Preceding text:
It is useful to contrast the change in total WEP values with the summaries reached for the top three boroughs for each site to see if any revisions are needed:

- Denali – The large increase in point source SOx from the Kenai seen in Table III.K.7-1 is largely offset by reductions from other sources to a value of less than 1.0. All of the other anthropogenic sources show either a decline or a negligible increase.

Added text:
These forecasts do not account for the emissions from the HCCP at the GVEA facility in Healy (i.e., unit # 2). That facility did not operate in 2002 and is not currently operating, but is permitted to operate. If brought on line, the point source NOx emitted within the Denali Borough would increase by a factor of 4.0 and the SOx would increase by a factor of 2.8 (based on permitted not actual emissions). This increase would make the Denali Borough the largest sources of anthropogenic emissions and the second largest source of all emissions impacting the Denali monitors.

Section III.K.9.D.
Preceding text:
Denali – The WEP analysis shows the anthropogenic contribution of each of the pollutants impacting Denali varies considerably: $PM_{2.5}$ and NH_3 are at the low end, with values well below 10%; while VOC, NOx and SOx values range from roughly one third to one half of the total. It also shows that modest changes are projected for all of the pollutants impacting this site. For the key pollutants, NOx emissions are forecast to decline slightly while SOx emissions are forecast to increase slightly. The WEP analysis presented in Section III.K.7 showed the dominant boroughs impacting Denali included Yukon Koyukuk and Southeast Fairbanks (primarily natural fires impacting all of the pollutants) and Fairbanks North Star (point sources impacting SOx) and Denali (area

sources impacting VOC). The BART analysis presented in Section III.K.6 showed GVEA's Healy Power Plant has a SO_2 limit in place so no increase in nearby SOx emissions can occur. It also showed that significant visibility improvements in Denali can be expected from additional NOx controls that will be implemented at that facility.

Added text:
These forecasts do not account for the emissions from the HCCP at the GVEA facility in Healy (i.e., unit # 2). That facility did not operate in 2002 and is not currently operating, but is permitted to operate. If brought on line, the point source NOx emitted within the Denali Borough would increase by a factor of 4.0 and the SOx would increase by a factor of 2.8 (based on permitted not actual emissions). This would substantially increase the WEP forecast of NOx and SOx emissions impacting the Denali monitors.

Section III.K.9.E.
Preceding text:
Denali – Figure III.K.9-1 shows the URP glide path is quite modest relative to the baseline values (i.e., a 0.6 deciview reduction over a 14-year period). It also shows there is considerable variance in the 2000-2006 deciview measurements, which produce a standard deviation of 0.5 deciview. It is clear the WEP trend falls well within the resulting 95% confidence bounds surrounding the URP glide path. This indicates that there is no difference between the flat (i.e., no change) WEP forecast of pollutants impacting the site and the URP reduction target computed for 2018.

Added text:
The WEP forecast does not account for emissions from GVEA's HCCP (i.e., Healy unit # 2). As previously noted, that facility did not operate in 2002, is not currently operating, but is permitted to operate. If it is brought on line, the permitted NOx and SOx emission levels would cause the WEP trend line to fall well above the 95% confidence bounds surrounding the URP glide path.

ADEC is well aware that changes in the operating status of major point sources have the potential to significantly impact visibility levels in one or more of the Class I areas. At this point the information available for assessing the potential effects of the HCCP facility on Denali visibility is mixed. While the WEP analysis shows the potential for negative impacts, the PSD modeling analysis for that facility demonstrated little potential for visibility impacts from plumes and haze derived that facility's operations. Another consideration is that HCCP is a clean coal demonstration project that integrates a slagging, multi-staged coal combustor system with an innovative sorbent injection / spray dryer absorber / baghouse exhaust gas scrubbing system. Since many of the coal fired boiler control options considered in the four-factor analysis have already been implemented at this facility, the modeling results provide conflicting views of the potential impacts and the facility has an active permit, as a result ADEC is not mandating additional controls prior to startup through this SIP.

Section III.K.10.
Preceding text:
In accordance with the requirements listed in Section 51.308(g) of the federal regional haze rule, ADEC commits to submitting a report on reasonable progress to EPA every five years following the initial submittal of the SIP, with the first report to be submitted by July 31, 2013. The reasonable progress report will evaluate the progress made towards the reasonable progress goal for each mandatory Class I area located within Alaska and in each mandatory Class I area located outside Alaska, which may be affected by emissions from Alaska.

Added text: *It will also assess whether emissions from any new major point source have the potential to impact Class I visibility. If this occurs, ADEC will reassess the need for control of these sources and further evaluate controls options during this five-year period to determine whether additional emission reductions in these sources would improve Class I area visibility in the next planning period.*

Comment K.5-2: ADEC should clarify if Alaska provided state-generated fire activity data to WRAP, or if the WRAP relied on wildfire data from federal records. In addition, ADEC should explain why the prescribed fire emissions appear to be extremely low, given the open burning discussion in Section K.9.C.1.

Response: As for all WRAP states, Alaska fire inventory data were generated with consideration of both Federal Fire History data (Fed-5 data) and WRAP Phase II data. WRAP Phase II data were compiled and refined by the Fire Emissions Joint Forum (FEJF) from state-provided fire activity data. For most WRAP states, baseline wildfire, prescribed burning, and wild land fire use emission inventories were created by scaling the respective Phase II inventory up or down based on an analysis of independently derived Fed-5 activity data across the baseline period. Unlike most other states, for Alaska in 2002 the two data sources differed greatly, with Fed-5 data exceeding Phase II acreages by a factor of 1.5. Implementing the scalar development techniques applied to other states would have produced unreasonably low baseline targets for Alaska (and Utah). Therefore, the contractor, with concurrence from the Emissions Task Team of the FEJF, elected to use the average of the Fed-5 acres (2000-2003), as the baseline targets for Alaska (and Utah). The state was directly consulted about land cover, fuel loading and blackened acreage distributions. The final reports and data are found at the FEJF site for *WRAP Phase III & IV Fire Emission Inventories for the 2000-04 Baseline Period and 2018 Projection Year*, Final Report Development of 2000-04 Baseline Period and 2018 Projection Year Emission Inventories (http://www.wrapair.org/forums/fejf/tasks/FEJFtask7Phase3-4.html).

From Section K.9.C.1 Prescribed fire emissions are very low because prescribed fire acreage is low, typically less than five percent of the entire burned acreage. Prescribed fires may be planned for large acreages, but only rarely do suitable conditions allow for their implementation. The Regional Haze rule requires that in developing it LTS the state consider smoke management techniques for agricultural and forestry management purposes, including plans as currently exist within the State for these purposes.

Comment K.6.1: This comment does not ask for a response.

Comment K.9.1: Identification of Sources for Four Factor Analysis. Alaska needs to demonstrate that it is making reasonable progress in reducing anthropogenic emissions within the state. Alaska's approach to determine which source categories to evaluate is appropriate. Alaska should extend the analysis to consider feasible controls for individual sources within these source categories. Visibility impacts from sources exempted from BART and Healy Unit 2 are not negligible and controls for these sources should be considered as part of the reasonable progress analysis. CALPUFF could be used to consider the cumulative visibility impacts of the major industrial sources.

Response: In Sections III.K.9.E of the draft SIP, Determination of Reasonable Progress Goals, the variability in monitored visibility measurements is used to establish confidence bounds on the URPs. For the first milestone year, 2018, emission reductions due to ongoing air pollution programs, source retirement, and other controls described in this SIP result in visibility levels falling within the identifiable URP uncertainty. For this reason, ADEC does not see any current benefit in modeling of individual BART-exempt sources. This does not preclude addressing the issue in future SIP revisions.

Comment K.9-2: ADEC should clarify that the reasonable progress goals for 2018 were set by comparing the percentage changes in anthropogenic contributions between 2002 and 2018 from the WEP analyses to the target rate of uniform progress by 2018.

Response: The process by which reasonable progress goals were defined is described in section III.K.9-E, Determination of Reasonable Progress Goals. To further clarify, ADEC has added a summary paragraph to the end of the section: "*To summarize, RPGs for 2018 were set by first comparing the percentage change in anthropogenic contributions between 2002 and 2018 from the WEP analyses to the target uniform rate of progress for 2018, and then in addition evaluating the uncertainty of the URP targets relative to the forecasted WEP reductions*."

Comment K.9-3: In the Reasonable Progress section, the SIP should mention the anthropogenic sources near Bering Sea (e.g. oil and gas production) and how the emissions changes between 2002 and 2018 for these sources might affect visibility in the Bering Sea Wilderness area.

Response: Additional information about anthropogenic sources and potential impacts between 2002 and 2018 has been added to section III.K.4.E, Bering Sea Wilderness Area.

Comment K.6.2: Healy BART – Comments from both the August 23, 2010 letter and the March 11, 2010 letter are addressed below. The March 11, 2010 letter found at the end of this Appendix.

Response:
ADEC acknowledges the August 23, 2010, NPS comments regarding the potential to force GVEA to shutdown Healy Unit 1 in 2024:

> The major concern identified in the letter was Alaska's determination that Selective Non-catalytic Reduction (SNCR) is considered BART for Healy Unit 1 based on a remaining useful life of eight years (shutdown in 2024). The BART guidelines (40 CFR 51, Appendix Y, Section IV.D.4.k.2) require that if the shutdown date "affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation." Alaska must make the shutdown of Healy Unit 1 in 2024 legally enforceable. If the shutdown is not made legally enforceable, then BART would be the use of Selective Catalytic Reduction as previously determined by Alaska.

ADEC recognizes that under 40 CFR 51, Appendix Y, Section IV.D.4.k.2[1] there is a requirement to ensure that the BART determination is enforceable. However, Alaska Statutes do not allow forward regulation or forward permitting beyond the lifespan of the current permit. Title V permits are issued for a 5-year span, meaning that the Title V permit renewal that is currently in process for GVEA Healy Unit 1 will be issued for the time period of 2010-2015 or 2011-2016. It is not possible, therefore, to include language requiring the shutdown of the facility in 2024, if it is not already shutdown by that date, in the current renewal permit.

ADEC addressed the issue of including language in the final report which would require shutdown during the response to request for informal review received from GVEA. In GVEA's request for review, they asserted that there was nothing in the BART regulations that would permit the Department to shut down Unit I. In response, ADEC stated:

> The Department fully expects the useful life of Healy Unit I will end in 2024, based on GVEA's representations in their BART submittals. If circumstances change and it makes sense to operate Healy Unit I beyond 2024, the Department

[1] k. How does a state take into account a project's ''remaining useful life'' in calculating control costs?

1. A state may decide to treat the requirement to consider the source's ''remaining useful life'' of the source for BART determinations as one element of the overall cost analysis. The ''remaining useful life'' of a source, if it represents a relatively short time period, may affect the annualized costs of retrofit controls. For example, the methods for calculating annualized costs in EPA's *OAQPS Control Cost Manual* require the use of a specified time period for amortization that varies based upon the type of control. If the remaining useful life will clearly exceed this time period, the remaining useful life has essentially no effect on control costs and on the BART determination process. Where the remaining useful life is less than the time period for amortizing costs, you should use this shorter time period in your cost calculations.
2. For purposes of these guidelines, the remaining useful life is the difference between:

   (1) The date that controls will be put in place (capital and other construction costs incurred before controls are put in place can be rolled into the first year, as suggested in EPA's *OAQPS Control Cost Manual*); you are conducting the BART analysis; and
   (2) The date the facility permanently stops operations. Where this affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation.

will evaluate the situation at that time. The Regional Haze SIP provides additional opportunities to evaluate visible impacts of Healy Unit 1 under the reasonable progress process. In regards to a shutdown under the BART rules, GVEA should be aware that the BART guidelines (BART Guidelines 40 CFR 51, Appendix Y, Section IV.D.4.k.2) do provide for the implementation of BART or the shutdown of a BART eligible unit should that unit operate beyond the useful life presumed in the BART determination.

The language in the revised final report reads:

9.1 BART Emission Limits

The final BART emission limits recommended for Healy Unit 1 in accordance with 18 AAC 50.260(l) are summarized in Table 9-1 below. As discussed herein, the BART emission limits are based on an 8-year remaining useful life for Healy 1 (from calendar year 2016) which is provided for at Section IV.D.4.K of 40 CFR 51, Appendix Y. The BART emission limits are compared to current permitted pollutant emission limits which remain in effect.

The final BART determination to not require SCR was not dependant on Healy Unit 1 closing by 2024. In making the revised, final BART determination, ADEC opted for setting the emission limit based on what could be achieved with SNCR rather than SCR based on an evaluation of the cost factors and the other factor in the 5 Factor Analysis over an 8 year life span (after 2016). ADEC's evaluation of the data available at the time of the reevaluation showed that the costs of SNCR equivalent emission reductions fit with the goals of emission reductions without requiring technology that would be significantly more expensive without a significantly increased result.

Alaska Department of Environmental Conservation (ADEC) Response to National Park Service (NPS) Comments from March 11, 2010, On ADEC's Final Best Available Retrofit Technology (BART) Determination for Golden Valley Electric Association (GVEA), Healy Power Plant, Unit 1 September 9, 2010

The Alaska Department Of Environmental Conservation (ADEC) received your March 11, 2010, letter conveying the National Park Service's concerns regarding the ADEC's Best Available Retrofit Technology (BART) determination for Golden Valley Electric Association's (GVEA) Healy Unit 1, dated February 9, 2010. ADEC recognizes that EPA's Regional Haze rule requires consultation with the Federal Land Managers on the state's Regional Haze State Implementation Plan (RH SIP) and appreciates your feedback on this important component of the plan. However, there was also a regulatory review process that the state adhered to and completion of that process delayed a formal response to your comments.

Under 18 AAC 50.260(m), an informal review of the final BART determination may be requested as prescribed in 18 AAC 15.185 and an adjudicatory hearing of the final BART determination may be requested as prescribed in 18 AAC 15.195 – 18 AAC 15.340. The deadline for submitting requests for informal reviews is within 15 days after receiving the department's decision and the deadline for seeking an adjudicatory hearing is within 30 days after a decision is made. Your comments were received through email by my staff on March 11, 2010, and were outside the regulatory window for informal review and do not request an adjudicatory hearing. As a result, we are now addressing your comments as part of our on-going and required consultation on the SIP, outside of the regulatory review process in 18 AAC 50.260(m). We are addressing your concerns related to Steps 3, 4, and 5 of the BART determination process from your March 11, 2010 letter.

It is important to note that ADEC's determination is based on the known analysis and information provided through the BART determination public comment period to complete the Regional Haze SIP. GVEA submitted the BART analysis, and ADEC reviewed the analysis following the 5 step BART process. Since the end of the public comment period, more information has become available regarding BART determinations throughout the nation. However, a reevaluation of the available existing data or new data would require more time, associated costs, and possible additional comments from the affected sources. The comments were considered in the context of: "Is this new information that would result in a change in the ADEC determination? " We recognize that the record should include a documented analysis of the BART process.

NPS Comments on ADEC's BART determination for NO_x Control at Healy Unit 1

STEP 3-- Evaluate Control Effectiveness of Remaining NO_x Control Technologies
ADEC cites the expected NO_x emission rates for these technologies in Table 5-1 of its final BART report.

NPS Comment: In the Response to Comments document, ADEC acknowledged our concerns that GVEA's SCR NO_x control efficiency and related emission limit were understated, but noted the data we provided in June 2009 reflect SCR performance for systems operating only during the ozone season. ADEC determined, due to uncertainty in continuous system operation in a harsh Alaska environment, with only limited time for catalyst cleaning and system maintenance, the proposed GVEA emission limit of 0.07 lb/mmBtu assuming 75% NO_x control was adequate to evaluate the SCR retrofit option.

NPS continues to believe that SCR can achieve at least 90% NO_x control and reduce emissions to 0.05 lb/mmBtu or lower. We provided evidence in our June 2009 comments that vendors have quoted NO_x levels as low as 0.05 lb/mmBtu. The references below provide additional information from industry sources that supports our understanding that SCR can achieve 90% reduction[2] and reduce emissions to 0.05 lb/mmBtu or lower[3] on coal-fired boilers. EPA Clean Air Markets (CAM) data for 2009 (Appendix A.) show that SCR can achieve year-round emissions of 0.05 lb/mmBtu or lower at 19 coal-fired EGUs, two of which are wet-bottom, wall-fired units like Healy #1. Based on vendor guarantees, we continue to believe that SCR is capable of 0.05 lb/mmBtu (or lower) annual NO_x emissions at Healy #1.

Department Response: *The potential for other SCR systems capable of achieving an emission rate of 0.05 lb NOx/MMBtu (or less) is acknowledged, as reflected in both the March 11, 2010 submittal by the NPS and the Department's prior related discussion in the Response to Comments (RTC) document, NPS Comment 1 (page 35 of 50), and Section 5.1 of the Final Determination Report (as revised on June 1, 2010). However, it is emphasized that the Department has considered the entirety of information and the full array of results from the BART five-factor analysis and the conclusion remains the same pertaining to the SCR control option. By example, the following further consideration is offered:*

Assuming a more restrictive SCR option emission limit of 0.05 lb NOx/MMBtu would result in an average cost effectiveness of about $15,000/ton of pollutant removed (8-year amortization period; with about 342 tons NOx reduction at this emission limit. This cost effectiveness is only marginally lower than the $15,762/ton cost effectiveness (Table 6-1 of the Final BART Report), based on 313 tons NOx removed at 0.07 lb/MMBtu. This annualized cost does not affect the projected total installed capital and operating costs presented in Table 6-1 of the Final Report. The lowered annual cost effectiveness remains almost 10 times the presumptive cost metric

[2] May 2009 Institute of Clean Air Companies white paper titled "Selective Catalytic Reduction (SCR) Control of NO_x Emissions form Fossil Fuel-Fired Electric Power Plants" and the June 13, 2009 "Power" magazine article "Air Quality Compliance: Latest Costs for SO2 and NOx Removal (effective coal clean-up has a higher–but known–price tag)" *by* Robert Peltier. http://www.masterresource.org/2009/06/air-quality-compliance-latest-costs-for-so2-and-nox-removal-effective-coal-clean-up-has-a-higher-but-known-price-tag/

[3] 12/15/09 presentation by Rich Abram of Babcock Power to the Minnesota Pollution Control Agency. Not only does Babcock Power say that SCR can achieve 0.05 lb/mmBtu, they are currently designing systems to go as low as 0.02 lb/mmBtu.

established by EPA in the BART rule preamble (i.e., $1,500/ton). For the reasons provided in the RTC document (page 39 of 50, Comment 4), visibility predictions are not linear with respect to emission rate and are not readily revised versus the values shown in Final Report Table 8-1 for this control option; however, based on results already predicted, the decreased emission rate would result in an approximate 0.025 deciview improvement which is deemed insignificant. In general, this lower rate results in the same conclusion presented in the Final Report.

NPS Comment from March 11, 2010: We assert that this provision of the BART guidelines requires ADEC, if it accepts the 2024 shutdown as a basis for an eight-year amortization period, to include this shutdown date as a federally or State enforceable permit condition. The provision (40 CFR 51, Appendix Y, Section IV.D.4.k.2) states:

> For purposes of these guidelines, the remaining useful life is the difference between:
>
> > (1) The date that controls will be put in place . . . .; and
> > (2) The date the facility permanently stops operations. **Where this affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation.** (Emphasis added)

If ADEC has the authority to require installation of BART in less than five years after SIP approval, then ADEC should exercise that authority. It is likely that the less capital-intensive control options could be implemented more quickly than five years. If the remaining useful life is extended because the control technology becomes operational before 2016, that control option would be less expensive on an annualized basis. ADEC should pursue this option.

ADEC is currently working to reissue the Title V permit for Healy Unit 1. We recommend that this permit revision include shutdown of Healy Unit 1 by 2024 as a permit condition, if the BART determination for NO_x control at Healy Unit 1 is a control technology other than SCR.

NPS Comment from August 23, 2010: The major concern identified in the August 23, 2010, letter was Alaska's determination that Selective Non-catalytic Reduction (SNCR) is considered BART for Healy Unit 1 based on a remaining useful life of eight years (shutdown in 2024). The BART guidelines (40 CFR 51, Appendix Y, Section IV.D.4.k.2) require that if the shutdown date "affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation." Alaska must make the shutdown of Healy Unit 1 in 2024 legally enforceable. If the shutdown is not made legally enforceable, then BART would be the use of Selective Catalytic Reduction as previously determined by Alaska.

Department Response: *ADEC acknowledges the NPS comments of March 11, 2010 (above top) and the August 23, 2010,(above below) regarding the potential to require GVEA to shutdown Healy Unit 1 in 2024; ADEC recognizes that under 40 CFR 51, Appendix Y, Section IV.D.4.k.2*[4]

[4] k. How do I take into account a project's ''remaining useful life'' in calculating control costs?

3. For purposes of these guidelines, the remaining useful life is the difference between:

EPA recommends that if the date a facility permanently stops operation is used to calculate control costs that the date should be used to establish an enforceable restriction on operations. However, this is a recommendation in the BART Rule and not a requirement.

ADEC addressed the issue of including language in the final report which would require shutdown during the response to request for informal review received from GVEA. In GVEA's request for review, they asserted that there was nothing in the BART regulations that would permit the Department to shut down Unit 1. In response, ADEC stated:

> *The Department fully expects the useful life of Healy Unit 1 will end in 2024, based on GVEA's representations in their BART submittals. If circumstances change and it makes sense to operate Healy Unit 1 beyond 2024, the Department will evaluate the situation at that time. The Regional Haze SIP provides additional opportunities to evaluate visible impacts of Healy Unit 1 under the reasonable progress process. In regards to a shutdown under the BART rules, GVEA should be aware that the BART guidelines (BART Guidelines 40 CFR 51, Appendix Y, Section IV.D.4.k.2) do provide for the implementation of BART or the shutdown of a BART eligible unit should that unit operate beyond the useful life presumed in the BART determination.*

The language in the revised final report reads:

> ***9.1 BART Emission Limits***
>
> *The final BART emission limits recommended for Healy Unit 1 in accordance with 18 AAC 50.260(l) are summarized in Table 9-1 below. As discussed herein, the BART emission limits are based on an 8-year remaining useful life for Healy 1 (from calendar year 2016) which is provided for at Section IV.D.4.K of 40 CFR 51, Appendix Y. The BART emission limits are compared to current permitted pollutant emission limits which remain in effect.*

As discussed in the Response to Comments document (page 37 of 49) and the tables found at the end of the document, ADEC established the BART determination based on a comparison of the costs of control between an 8 year expected life span and a 15 year expected life span of Healy Unit 1. The tables show that the costs did not differ significantly, and the considerably higher costs of an SCR system over other control options, regardless of either expected life span, resulted in ADEC determining that the benefits to be achieved at the higher cost of SCR would not result in a significant visibility improvement/cost.

NPS Comment: Re-evaluate Control Costs

(1) The date that controls will be put in place (capital and other construction costs incurred before controls are put in place can be rolled into the first year, as suggested in EPA's *OAQPS Control Cost Manual*); you are conducting the BART analysis; and

(2) The date the facility permanently stops operat*ions. Where this affects t*he BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation.

We commend GVEA for retaining the services of a reputable vendor of NO_x control equipment and systems to provide a site-specific estimate of the costs of SNCR and SCR. However, we note that an additional $8.6 million in capital costs was added to the Fuel Tech SCR Capital Cost Estimate Total of $13.3 million and additional 20% contingency costs were applied to both the Capital and Operation and Maintenance (O&M) costs. The costs used by Fuel Tech were substantially higher than provided by GVEA in Appendix A of its initial BART submittal. We request a more detailed explanation for those additional costs.

Department Response: *Except for minor discrepancies with the GVEA June 2009 revised cost analysis that we cited in Section 6.1 of the Final Report, we conducted a general review of the information presented by GVEA and found it to be reasonable. ADEC did conduct a review in consideration of the 5 step BART process, the reputable GVEA vendor, increased costs, and the required time elements for the BART/RH SIP submittal. The NPS has the same Fuel Tech report and detailed SCR cost spreadsheets (prepared by CH2M Hill) that we received as part of the GVEA June 2009 comments submittal.*

The Fuel Tech Study had the following cost elements (all are costs associated with the SCR installation): $13.3 million for the purchase price of the SCR, plus $5 Million for miscellaneous capital costs based on the re-design to retrofit the SCR unit. These costs include other equipment, fans, duct work, bracing, and other elements related to the retrofit on the 25 MW unit. An additional 20% contingency was applied to the combined capital cost basis of $3.6 million. The total SCR installed capital cost, therefore, would be $21,860,887.

NPS Comment: We continue to disagree with GVEA's use of the CUECost tool rather than the EPA Control Cost Manual to develop cost estimates for SCR. The EPA Control Cost Manual is more appropriate for units as small as 25 MW. ADEC in the Response to Comments document acknowledges that the SCR cost information in the CUECost manual is most applicable to units with capacities ranging from 100 to 200 MW, units that are larger than Healy Unit 1.

Department Response*: The NPS concern about the use of CUECost is noted. ADECs Response to Comment document addresses the use of the CUECost tool in the responses to the GVEA comments (page 18 of 49) and to the NPS comment 2 (page 38 of 50).*

The CUECost was used in conjunction with specific data. The BART Guideline supports the use of site–specific design and conditions that affect the cost of particular BART analyses. GVEA used a reputable contractor, Fuel Tech, to conduct their site specific study and revised their SCR cost evaluation using the Fuel Tech data for their CUECost cost analysis. GVEA included a revised economic analysis for SCR based on the Fuel Tech information with their June 15 and June 19, 2009, comment letters.

ADEC's contractor reviewed Appendix B submitted by the NPS. When the NPS used the EPA cost control with the same numbers that ADEC used in the CUECost analysis, the results were $15,782/ton and the NPS results were $15,748/ton. The lower cost shown in NPS comments of $12,794 was achieved using a combination of numbers from the ADEC analysis and default numbers, not data specific to the site.   ADEC finds it unlikely that using the EPA control cost manual estimation tool would result in a different conclusion for BART.

NPS Comment: Finally, ADEC used an 8% interest rate instead of the 7% rate specified by the EPA Cost Manual.

Because the OFA w/ROFA® option is only marginally more expensive (on a $/ton basis) that the proposed SNCR, and because the $/dV is still well below the national average, we request that ADEC provide information on how those costs were derived and re-evaluate this option using the 7% interest rate recommend by the EPA Control Cost manual. In conducting that re-evaluation, we ask that ADEC provide information on the amount of time necessary to install this option.

Department Response: *ADEC's BART determination was based on the full analysis using the 5 step process. Please review Section 8 of the Final Report, in particular pages 41 & 42, that spells out the bases for the determination, items1-13. ADEC has concerns that the time and expense required to continue to reanalyze the data will do little to advance the BART determination and would further delay the submittal of the Regional Haze SIP. At the time the analysis was submitted by GVEA, the 8% rate appeared to be reasonable for the cost of capital for a co-op utility the size and scope of GVEA.*

The change to the 7% rate would affect the cost but not the end conclusion. The 7% rate would apply to all control options; therefore the ratio of cost vs. benefit would remain the same. An emission rate based on SNCR control technology was determined not solely on cost, but for the reasons listed on pages 41 & 42 in the Final Report. The costs of three control options (Table 8-1) were within range of one another, and the SCR option was a significant magnitude higher. NPS has often commented that cost is not the only factor for a BART determination but now is requesting that one option be reevaluated based solely on cost. In addition, there is a request that a study or increased analysis be done at the time for installation. ADEC would need to solicit a contractor or request the analysis from GVEA. This will only cause delay in the Regional Haze SIP with no clear evidence that the conclusion will change.

NPS Comment: In January 2009, we provided a summary of SCR retrofit capital investment costs for BART eligible boilers in the range of $80/kW to $270/kW. The site-specific SCR cost ($874/kW) shown in Table 6-1 is more than three times greater than the upper bound of this cost range. We continue to believe that the $874/kW cost estimate provided by ADEC is overestimated. Industry data cited in footnote 1 continue to indicate that capital costs greater than $200/kW are very unusual. We recognize that the size and location of Healy #1 would likely result in higher SCR costs, but we continue to question the $874/kW capital cost estimate.

ADEC estimates the average annual cost-effectiveness for NO_x control on Healy 1, based on eight-year amortization of capital costs, ranges from $847/ton for the optimization of the current

LNB+OFA system to over $15,700 for existing combustion controls plus SCR on Healy 1. Using the ADEC estimates for Capital and certain O&M costs, and assuming that SCR would reduce NO_x emissions to 0.05 lb/MMBtu, our application of the EPA Cost Manual yielded $12,794/ton for SCR at Healy Unit 1 (Please see Appendix B.).

Department Response*: ADEC addressed the cost of SCR option in the Response to Comment Document, Comment 2, (page 38 of 50). The Fuel Tech report is a site-specific study conducted by a reputable contractor. While an exhaustive study might have resulted in the adjustment of specific elements of the report, the final conclusion is not likely to change. The example of the $874/kW capital cost is based on the Fuel Tech report and their analysis.*

Even if the NPS figures represent the cost of SCR, those figures result in a cost of $12,794/ton for SCR -- 8.5 times greater than the presumptive BART cost of $1,500/ton. Thus, further refinement of the cost figure would not change the department's conclusion that SCR does not represent BART.

STEP 5 – Evaluate Visibility Impacts.

NPS Comment: BART is not necessarily the most cost-effective control option. All of the options evaluated result in cost/deciview values that are well below the $13 - $20 million average $/dV costs that are being proposed as BART by other sources and states.[5]

Department Response: *The BART analysis is a case by case determination using the 5 factors in the BART Guideline. With respect to the emission limit content, please see the Response to Comment Document, NPS comment 1. ADEC acknowledges the NPS comment; however, the average cost of BART projects nationwide is certainly a moving target. NPS's compilation table is updated on a regular basis with national data from units of various size. The summary statistics provided in Appendix A to the Findings Report, and the related discussions in Sections 8.1 and 8.2, would not be altered based on the new summary data. In addition, the GVEA analysis includes a site specific SCR cost study. ADEC's analysis compared "apples to apples" when we first reviewed the NPS summary data, meaning we looked at units similar to Healy, not the total range of much larger units. The cost of $13-$20 million average for $/dV is for BART sources of much larger size than the GVEA 25 MW source.*

NPS Comment: It is likely that GVEA has underestimated the visibility improvement that would result from any NO_x reductions. This is because time is required for NO_x to react with atmospheric ammonia to form the ammonium nitrate particles that impair visibility. Unless transport winds from Healy #1 to DNPP are very slow, it is unlikely that the NO_x would have had sufficient transport time to react to form secondary aerosol particles by the time it reaches the nearest boundary of the park.

Department Response: *All the Alaskan BART eligible sources were evaluated using the CALPUFF modeling suite, in accordance with 18 AAC 50.260. GVEA has evaluated visibility impacts consistent with the rule, as discussed in Section 7 of the Findings Report.*

[5] Our most recent compilation of BART projects was sent to ADEC recently.

NPS Comments on ADEC's BART determination for SO_2 Control at Healy Unit 1

NPS Conclusions and Recommendations on SO_2 BART

- In general, the ADEC report was well-written, clearly followed the five-step BART process, and thoroughly explained ADEC's conclusions.
- It is essential that any evaluation that is contingent upon shutdown of Healy #1 by a specific date must contain an enforceable condition to validate that evaluation.
- ADEC presented a full suite of SO_2 control options but did not adequately assess the effectiveness of the LSD and WLS options. As a result, ADEC has underestimated the benefits of adding LSD or WLS scrubbers.
- ADEC has overestimated the costs associated with adding LSD or WLS scrubbers.
- It is likely that visibility improvement greater than those predicted by GVEA would be found if a more-refined, receptor-by-receptor analysis is conducted throughout DNPP. This would result in an even lower cost/deciview.
- BART is not necessarily the most cost-effective option. The increased sorbent injection option evaluated results in a cost/deciview value that is well below the $13 - $20 million average $/dV costs that are being proposed as BART by sources and states. Increased sorbent injection should be considered as a viable BART option.

Department Response: *The Department addressed the NPS comments on SO_2 in the Response to Comment Document of January 15, 2010. Please refer to NPS comments 7 -9 (pages 40-43 of 49) and Sanjay Narayan's comments (pages 29-31 of 49)*

There were several key considerations which factored in the Department's determination.

In regards to the effectiveness of the wet scrubbing, the NPS acknowledges the lack of evidence and the content of the fuel as factor. Page 9 of the NPS March 11 comment letter states:

> "However, we also understand that ADEC would be reluctant to assume that either type of scrubber can achieve such low limits without evidence that scrubbers have achieved or been permitted at these rates. And, we recognize that SO_2 removal efficiency and the controlled emissions are highly dependent upon the fuel quality and the resulting uncontrolled SO_2 emissions."

In consideration of the cost impact on the tiny 25MW facility without specific site data and clear indications that the fuel sulfur content is an issue, additional analysis which would result in increased costs and extend the time for the SIP submittal is not likely to result in a change in the final conclusion.

NPS commented that, "visibility improvement greater than those predicted by GVEA would be found if a more-refined, receptor-by-receptor analysis is conducted throughout DNPP."

A receptor-by-receptor analysis is not required in the BART Guideline.

GVEA used the full range of DNPP receptors in the CALPUFF visibility modeling analysis, as taken from http://www2.nature.nps.gov/air/maps/Receptors/index.cfm (see Section 7.1 of the Findings Report). Ranked delta-deciview visibility impacts were determined by GVEA using CALPOST for the pre- and post-control scenarios. While the BART Guideline requires a comparison of the 98th percentile days for the pre- and post-control scenarios, GVEA conducted the required comparative assessment using maximum delta-deciview values (pre- versus post-control) since only one year of meteorological data was used in the analysis. This is consistent with Department BART modeling requirements. The comparative analysis results were presented in Section 7.4 of the Findings Report. Although the comment on the full range of receptors is acknowledged, a receptor-by-receptor analysis is not required in the BART Guideline.

In addition, the increase potential of a brown plume only 8km from the DNPP must be considered in the BART determination.

Alaska Regional Haze Rule State Implementation Plan
Technical Corrections

Comment : Page (III.K.) 2-19: It would be helpful if Table III.K.2-2 were repeated immediately before the charts and graphs in section III.K.4, to serve as a key to the IMPROVE abbreviations.
Response: This table is a key to pollutant species, abbreviations, and color representation in charts and figures throughout the document. We have chosen not to repeat the table, because it would lengthen the document substantially. Instead we rely on legends embedded in images, and textual identification of aerosol species and color relationships.

Comments:

Page 3-10: "Bettles" is the correct spelling.

Page 3-11: Please correct the following errors in the description of Denali NP&P:

- The park is not "almost treeless." A large portion of the park is forested.
- The park road is 92 miles long, not 89, and it extends into the center of the park, not the northeastern corner.
- The 130-yard access road to the air quality monitoring site also provides access to a water treatment facility, not a single-family residential cabin.
- The main visitor season runs mid-May to mid-September, not the other way around.

Page 3-12: Site description, continued:

- The Denali NP&P monitoring site, not the highest point of Healy Ridge, is located approximately two miles west of the Nenana River.
- Windy Pass is nowhere near the monitoring site (and it is south, not east, of the monitoring site).

Page 3-13: There are no longer any Federal Reference Method $PM_{2.5}$ monitors located at Denali NP&P.

Page 4-2: second to last paragraph: monitoring began at three sites in 2001, not 2002 (2002 was the first full year of sampling).

Page 4-20: Typo in the note for Figure 4-7: Total aerosol extinction should be 26.6, not 26.2.

Page 4-46: Available baseline data, first paragraph:

- The Denali NP&P monitoring site is not located in or near a canyon.
- It is incorrect to describe the Trapper Creek site as being on the "southern border" of the park. The Trapper Creek station is located more than 20 miles from the park boundary.
- Monitoring began at Trapper Creek in 2001, not 2002.

Page 4-46, second to last paragraph: The second reference to Trapper Creek baseline extinction should be 8.8 Mm^{-1}, not 6.8.

Page 8-4: Healy Unit 2 is located 3.8 miles from Denali NP&P, not 8 miles.

Response: These details have been checked, and changes have been made including slight changes to the surrounding text. Because the park road falls entirely in the northeastern area of the Park, it cannot be described as "the center of the park".

Comment: Page 4-8: Table 4-3 appears to contain a typo and an apparent rounding error. The Simeonof worst haze natural conditions should be 15.6 dv, not 5.6. The Tuxedni 10-year glide slope should be 0.5 dv, rounded up from 0.465 or 0.467. If the Tuxedni 10-year glide slope is 0.5 dv, then on Page 4-6, the last sentence should indicate that only Denali falls below the ranges for the rest of the country. This will also affect the notation at the bottom of Figure 4-2 and the text on Page 4-18.

Response: The Simeonof figure has been corrected. A slight discrepancy in natural conditions estimates and 10-year glide slopes originated in the Final Report of the Natural Haze Levels II committee to the RPO Monitoring/Data Analysis Workgroup. This discrepancy has been resolved, and now affects only Figures III.K.4-1&2.

Comment: Pages 3-3 to 3-6: Please consider referring to Asian anthropogenic emissions separately from Asian dust. Both are transported across the Pacific Ocean into Alaska, but not all transport events contain both components.

Response: Asian anthropogenic emissions and Asian dust do contribute separately to trans-boundary pollution entering Alaska. Sources of these emissions are discussed in sections

III.K.3.B and Appendix III.K.3. The baseline analysis does not separate effects of anthropogenic and erosional emissions from Asia. These emissions do not currently drive designation of best or worst days for Alaska's Class 1 areas. It may be anticipated that these emission sources will increase independently between now and 2018, and that the contribution of one or both to Worst Days at Alaska's Class 1 areas will change as well.

United States Department of the Interior
NATIONAL PARK SERVICE
Air Resources Division
P.O. Box 25287
Denver, CO 80225

TAKE PRIDE® IN AMERICA

IN REPLY REFER TO:

March 11, 2010

N3615 (2350)

Alice Edwards, Director
Division of Air Quality
Alaska Department of Environmental Conservation
410 Willoughby Ave., Suite 303
P. O. Box 111800
Juneau, Alaska 99811-1800

Dear Ms. Edwards:

The purpose of this letter is to convey the concerns of the National Park Service (NPS) with the Alaska Department of Environmental Conservation's (ADEC's) final Best Available Retrofit Technology (BART) determination for Golden Valley Electric Association's (GVEA's) Healy Unit 1. Healy Unit 1 is located approximately six km from Denali National Park and Preserve (DNPP), a Class I air quality area administered by the NPS. Based on GVEA's air quality modeling analyses, emissions from Unit 1 cause visibility impairment at DNPP. We would like to work with ADEC and GVEA to further mitigate these impacts.

ADEC published a preliminary BART determination on May 12, 2009, that proposed Selective Catalytic Reduction (SCR) technology as BART for nitrogen oxide (NO_x) emissions controls for Healy Unit 1. In addition, ADEC proposed the existing dry sorbent injection system for sulfur dioxide (SO_2) controls and the existing reverse gas baghouse system for particulate matter controls as BART for Unit 1. During public comment on the preliminary BART determination, the NPS commented in support of SCR for NO_x controls and recommended additional evaluation of SO_2 controls. Following public comment, ADEC revised its BART determination for NO_x controls at Healy Unit 1 to be Selective Non-Catalytic Reduction (SNCR) technology rather than SCR. This decision was documented in ADEC's Final BART Determination Report dated January 19, 2010, which was released on February 9, 2010. We have several concerns with this decision. Our detailed comments are enclosed, and summarized below.

A key factor in ADEC's revised BART determination is GVEA's revised assumption that the remaining useful life for Healy Unit 1 is approximately 15 years from 2009 (i.e., a 2024 unit shutdown). If EPA approves the Alaska Regional Haze State Implementation Plan in 2011 and five years are allowed for installation of control technology, then control equipment would begin operation in 2016. If Unit 1 shuts down in 2024, then the appropriate cost amortization period for capital costs is eight years. ADEC accepted the eight-year amortization period, and based its control cost calculations on that assumption. The BART guidelines (40 CFR 51, Appendix Y, Section IV.D.4.k.2) require:

> For purposes of these guidelines, the remaining useful life is the difference between:
>
> (1) The date that controls will be put in place. . . . ; and
> (2) The date the facility permanently stops operations. **Where this affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation.** (emphasis added)

Because ADEC accepted the 2024 shutdown as a basis for an eight-year amortization period, it should include this shutdown date as a federally-or State-enforceable permit condition. Without enforceable shutdown in 2024, SNCR is not an acceptable BART determination, and ADEC should revert back to its original determination that SCR is BART. Since the Title V operating permit for the Healy Power Plant is partway through the renewal process, we recommend that ADEC include such a shutdown provision in the final Title V permit.

We remain concerned that GVEA and ADEC are understating the potential efficiency of NO_x and SO_2 controls and overstating the potential costs of these controls. In the enclosed comments, we provide additional references to industry cost and efficiency data. Using the approved EPA Control Cost Manual, we find lower costs per ton and costs per deciview than those reported by GVEA and ADEC. Because Unit 1 is so close to Denali National Park and Preserve, the cost per deciview of visibility improvement for SCR is very favorable, at $5.5 million/dv. Therefore, we still believe that SCR technology for Healy Unit 1 is feasible. We also request that ADEC reconsider the additional benefits of the ROFA® and Rotamix® NO_x control technologies and reassess those technologies as BART alternatives to SNCR. Furthermore, we request that ADEC consider additional SO_2 emissions reductions through increased injection of dry sorbent.

Finally, we are concerned that because ADEC made a substantive change from its proposed SCR BART determination to its final SNCR determination, ADEC should have provided us and the public an opportunity to comment on the change before making a final BART determination. Nevertheless, we understand that ADEC intends to consider public comments on this final BART determination as part of the comment period for the Regional Haze State Implementation Plan. We appreciate the additional comment opportunity and will provide any follow-up comments at that time.

We would welcome the opportunity to continue discussions of BART control options for Unit 1. In the meantime, if you have any questions regarding this matter, please contact Don Shepherd of my staff at (303) 969-2075.

Sincerely,

John Bunyak

John Bunyak
Chief, Policy, Planning and Permit Review Branch

Enclosure

cc: (w/enc.)
Steve Body
U.S. EPA, Region 10
1200 Sixth Avenue, Suite 900
Seattle, Washington 98101

Kathryn K. Lamal, C.P.G.
Vice President Power Supply
758 Illinois Street
P.O. Box 71249
Fairbanks, Alaska 99707-1249

National Park Service (NPS) Comments on
Alaska Department of Environmental Conservation (ADEC)'s Final
Best Available Retrofit Technology (BART) Determination for
Golden Valley Electric Association (GVEA), Healy Power Plant, Unit 1
March 11, 2010

Description and Background

Healy #1 is a 25-MW unit located in Healy, Alaska, approximately six kilometers from Denali National Park and Preserve (DNPP), a Class I area administered by the NPS. The Healy plant is operated by Golden Valley Electric Association (GVEA). Unit #1 is a wall-fired, wet-bottom boiler manufactured by Foster Wheeler. Low NOx burners (LNB) and over-fired air (OFA) ports were installed in 1996. Particulate emissions are collected by a reverse gas baghouse installed in the early 1970s. Sulfur oxides are controlled by a dry sorbent injection system installed in 1999. At the present time sodium bicarbonate is the sorbent which is injected into the flue gas after the air heater.

ADEC contracted with Enviroplan Consulting to review the BART control analysis submitted in July 2008 by GVEA. ADEC published a preliminary BART determination on May 12, 2009, that proposed Selective Catalytic Reduction (SCR) technology as BART for nitrogen oxide (NO_x) emissions controls for Healy Unit 1. ADEC proposed the existing dry sorbent injection system for sulfur dioxide (SO_2) controls and the existing reverse gas baghouse system for particulate matter (PM_{10}) controls as BART for Unit 1. During public comment on the preliminary BART determination, the NPS commented in support of SCR and recommended additional evaluation of SO_2 controls. Following public comment, ADEC revised the BART determination for NO_x controls at Healy Unit 1 to be Selective Non-Catalytic Reduction (SNCR) technology rather than SCR. This decision was documented in ADEC's Final BART Determination Report dated January 19, 2010. We have several concerns with this decision. Our comments are discussed in detail below.

NPS Comments on ADEC's BART determination for NO_x Control at Healy Unit 1

STEP 1 -- Identify All Available Retrofit NO_x Control Technologies,

NPS agrees with the ADEC's conclusions on available technologies:

- Optimizing the Existing Low NO_x Burner/Over-Fire Air System (LNB/OFA)
- Rotating Opposed Fire Air (ROFA®)
- ROFA® with Rotamix®
- Selective Non-Catalytic Reduction (SNCR)
- Selective Catalytic Reduction (SCR)

STEP 2-- Eliminate Technically Infeasible Options,

We agree with the ADEC's approach.

STEP 3-- Evaluate Control Effectiveness of Remaining NO_x Control Technologies

ADEC cites the expected NO_x emission rates for these technologies in Table 5-1 of its final BART report.

Table 5-1: Control Effectiveness of the NOx Control Options for Healy 1

Control Technology	Control (1) Efficiency (%)	Projected Emission Rate (lb/mmBtu)
Current Operation (LNB w/OFA)	-	0.28
Optimize Existing LNB w/OFA	18	0.23(2)
LNB w/OFA & SNCR	32	0.19
Replace OFA with ROFA®	46	0.15
ROFA and Rotamix®	61	0.11
LNB w/OFA & SCR	75	0.07

(1) Relative to the current controlled baseline emission rate of 0.28 lb/mmBtu.
(2) Presumptive limit for > 200 MW wall fired boilers burning sub-bituminous coal

In the Response to Comments document, ADEC acknowledged our concerns that GVEA's SCR NO_x control efficiency and related emission limit were understated, but noted the data we provided in June 2009 reflect SCR performance for systems operating only during the ozone season. ADEC determined, due to uncertainty in continuous system operation in a harsh Alaska environment, with only limited time for catalyst cleaning and system maintenance, the proposed GVEA emission limit of 0.07 lb/mmBtu assuming 75% NO_x control was adequate to evaluate the SCR retrofit option.

NPS continues to believe that SCR can achieve at least 90% NO_x control and reduce emissions to 0.05 lb/mmBtu or lower. We provided evidence in our June 2009 comments that vendors have quoted NO_x levels as low as 0.05 lb/mmBtu. The references below provide additional information from industry sources that supports our understanding that SCR can achieve 90% reduction[6] and reduce emissions to 0.05 lb/mmBtu or lower[7] on coal-fired boilers. EPA Clean Air Markets (CAM) data for 2009 (Appendix A.) show that SCR can achieve year-round emissions of 0.05 lb/mmBtu or lower at 19 coal-fired EGUs, two of which are wet-bottom, wall-fired units like Healy #1. Based on vendor guarantees, we continue to believe that SCR is capable of 0.05 lb/mmBtu (or lower) annual NO_x emissions at Healy #1.

We agree with the GVEA assumptions for performance of the SNCR, ROFA®, and ROFA and Rotamix® technologies.

[6] May 2009 Institute of Clean Air Companies white paper titled "Selective Catalytic Reduction (SCR) Control of NO_x Emissions form Fossil Fuel-Fired Electric Power Plants" and the June 13, 2009 "Power" magazine article "Air Quality Compliance: Latest Costs for SO2 and NOx Removal (effective coal clean-up has a higher–but known–price tag)" by Robert Peltier. http://www.masterresource.org/2009/06/air-quality-compliance-latest-costs-for-so2-and-nox-removal-effective-coal-clean-up-has-a-higher-but-known-price-tag/

[7] 12/15/09 presentation by Rich Abram of Babcock Power to the Minnesota Pollution Control Agency. Not only does Babcock Power say that SCR can achieve 0.05 lb/mmBtu, they are currently designing systems to go as low as 0.02 lb/mmBtu.

STEP 4-- Evaluate Impacts and Document the Results

Set Federally- or State-enforceable permit condition for shutdown of Healy Unit 1
In comments provided in June 2009 on the proposed BART determination, GVEA indicated that the remaining useful lifetime of Healy #1 is approximately 15 years from current (2009). GVEA requested that ADEC approve revised cost analyses that used an eight-year cost amortization period in accordance with the BART guidelines (40 CFR 51, Appendix Y, Section IV.D.4.k). This request is based on the assumptions that the EPA will approve the Alaska regional haze State Implementation Plan (SIP) in 2011 and that GVEA will have five years to install BART controls, with BART emission limits effective by 2016. If Healy Unit 1 shuts down in 2024 (15 years from 2009), the cost amortization period for BART controls would be eight years.

ADEC in the Response to Comments supports GVEA's use of the eight-year amortization period. ADEC notes that pursuant to the same provision of the BART rule (40 CFR 51, Appendix Y, Section IV.D.4.k), the Department could require the shutdown of Healy #1 should GVEA otherwise plan to operate the unit beyond the stated useful lifetime (2024).

We assert that this provision of the BART guidelines requires ADEC, if it accepts the 2024 shutdown as a basis for an eight-year amortization period, to include this shutdown date as a federally or State enforceable permit condition. The provision (40 CFR 51, Appendix Y, Section IV.D.4.k.2) states:

> For purposes of these guidelines, the remaining useful life is the difference between:
>
> (1) The date that controls will be put in place . . . .; and
> (2) The date the facility permanently stops operations. **Where this affects the BART determination, this date should be assured by a federally- or State-enforceable restriction preventing further operation.** (emphasis added)

If ADEC has the authority to require installation of BART in less than five years after SIP approval, then ADEC should exercise that authority. It is likely that the less capital-intensive control options could be implemented more quickly than five years. If the remaining useful life is extended because the control technology becomes operational before 2016, that control option would be less expensive on an annualized basis. ADEC should pursue this option.

ADEC is currently working to reissue the Title V permit for Healy Unit 1. We recommend that this permit revision include shutdown of Healy Unit 1 by 2024 as a permit condition, if the BART determination for NO_x control at Healy Unit 1 is a control technology other than SCR.

Re-evaluate Control Costs
During the June 2009 comment period, GVEA provided a refined cost analysis for the SCR retrofit option that was prepared by Fuel Tech, a consulting company that specializes in SNCR and SCR application. GVEA contracted with Fuel Tech to inspect the Healy plant; gather additional site-specific data; and more fully assess the capital cost impact associated with a

retrofit SCR system designed to meet the 0.07 lb/mmBtu preliminary BART NO_x emission limit. Fuel Tech issued a findings report and cost evaluation on June 10, 2009.

We commend GVEA for retaining the services of a reputable vendor of NO_x control equipment and systems to provide a site-specific estimate of the costs of SNCR and SCR. However, we note that an additional $8.6 million in capital costs was added to the Fuel Tech SCR Capital Cost Estimate Total of $13.3 million and additional 20% contingency costs were applied to both the Capital and Operation and Maintenance (O&M) costs. The costs used by Fuel Tech were substantially higher than provided by GVEA in Appendix A of its initial BART submittal. We request a more detailed explanation for those additional costs.

We continue to disagree with GVEA's use of the CUECost tool rather than the EPA Control Cost Manual to develop cost estimates for SCR. The EPA Control Cost Manual is more appropriate for units as small as 25 MW. ADEC in the Response to Comments document acknowledges that the SCR cost information in the CUECost manual is most applicable to units with capacities ranging from 100 to 200 MW, units that are larger than Healy Unit 1. Finally, ADEC used an 8% interest rate instead of the 7% rate specified by the EPA Cost Manual. The table below summarizes those differences, and we request explanations for these increased costs relative to the Cost Manual or the previous GVEA submittal.

Cost Item	**EPA Cost Manual**	**Enviroplan (ADEC) report**
Annual Interest Rate	7%	8%
Cost Item	**EPA Cost Manual**	**Fuel Tech**
Annual Maintenance Cost	$ 327,913	$ 433,512
Annual Reagent Cost	$ 46,536	combined w. maint.
Annual Electricity Cost	$ 105,963	$ 414,131
Catalyst Replacement Cost	$ 61,802	$ 90,000
Operating Life of Catalyst (hours)	24,000	16,000
Cost Item	**GVEA Appendix A**	**Fuel Tech**
Catalyst Cost, Initial ($/m3)	$ 3,000	$ 8,000
Catalyst Cost, Replacement ($/m3)	$ 3,000	$ 8,000
Electrical Power Cost ($/MWh)	$ 50.00	$ 107.34
29% Ammonia Solution Cost ($/ton)	$ 400.00	$ 450.00

Table 6-1 provides a summary of annual costs using an eight-year capital cost amortization period, the total tons of NO_x removed, and the average annual cost effectiveness for each NO_x retrofit control system.

Table 6-1: NOx Cost Effectiveness Summary for Healy 1

Remaining Useful Life	Cost Item	Optimize Existing LNB w/OFA	SNCR	ROFA	ROFA/ Rotamix	SCR(1)
8 Years(2)	Total Installed Capital Cost	$20,000 ($1/kw)	$2,538,900 ($102/kw)	$4,572,000 ($183/kw)	$6,912,000 ($276/kw)	$21,860,887($874/kw)
	Capital(3) Recovery	$3,480	$441,794	$795,574	$1,202,757	$3,804,013
	Fixed and Variable O&M Costs	$0	$122,191	$138,852	$287,309	$1,125,172
	Total Annualized Cost	$3,480	$563,985	$934,426	$1,490,066	$4,929,185
	Tons NOx (4) Removed	74	134	194	253	313
	Average Cost Effectiveness ($/ton)	$47	$4,208	$4,827	$5,886	$15,762
	Incremental Cost Effectiveness ($/ton)	$47	$9,409	$6,219	$9,328	$57,734

Notes:
(1) Based on the 0.28 lb/mmBtu scenario as presented in the June 15, 2009 letter to ADEC from Kristen DuBois of GVEA.
(2) Based 40 CFR 51, Appendix Y, Section IV.D.4.k (i.e., a 15-year remaining useful lifetime (from 2009) for Healy 1 specified by GVEA and an expected AK regional haze SIP emission limit and pollution control install applicability date of 2016).
(3) Based on a capital recovery factor of 0.17401 for 8 years at 8%.
(4) Relative to baseline emission rate of 0.28 lb/mmBtu.

In January 2009, we provided a summary of SCR retrofit capital investment costs for BART eligible boilers in the range of $80/kW to $270/kW. The site-specific SCR cost ($874/kW) shown in Table 6-1 is more than three times greater than the upper bound of this cost range. We continue to believe that the $874/kW cost estimate provided by ADEC is overestimated. Industry data cited in footnote 1 continue to indicate that capital costs greater than $200/kW are very unusual. We recognize that the size and location of Healy #1 would likely result in higher SCR costs, but we continue to question the $874/kW capital cost estimate.

ADEC estimates the average annual cost-effectiveness for NO_x control on Healy 1, based on eight-year amortization of capital costs, ranges from $47/ton for the optimization of the current LNB+OFA system to over $15,700 for existing combustion controls plus SCR on Healy 1. Using the ADEC estimates for Capital and certain O&M costs, and assuming that SCR would reduce NO_x emissions to 0.05 lb/MMBtu, our application of the EPA Cost Manual yielded $12,794/ton for SCR at Healy Unit 1 (Please see Appendix B.).

STEP 5 – Evaluate Visibility Impacts.

Table 7-1 below, from ADEC's Final BART Determination Report, shows the visibility improvement and annual costs for NO_x control options.

Table 7-1: Visibility Improvement and Annual Costs for NOx Control Options*

BART Controls	Highest dV Reduction (ΔdV)	Reduction in Avg. No. of Days Above 0.5 dV (Days)	Annualized Cost ($/Year)	Cost per dV Reduction ($/dV Reduced)	Cost per Reduction in No. of Days Above 0.5 dV ($/Day Reduced)
Optimizing Existing LNB w/ OFA	0.560	43	$3,480	$6,214	$81
Replace OFA w/ ROFA®	0.671	56	$934,426	$1,392,587	$16,686
Replace OFA w/ ROFA® and Rotamix®	0.736	67	$1,490,066	$2,024,546	$22,240
LNB/OFA/SNCR	0.620	51	$563,985	$909,653	$11,059
LNB/OFA/SCR	0.786	71	$4,929,185	$6,271,228	$69,425

*Reflects 8-year capital cost amortization period.

BART is not necessarily the most cost-effective control option. All of the options evaluated result in cost/deciview values that are well below the $13 - $20 million average $/dV costs that are being proposed as BART by other sources and states.[8]

It is likely that GVEA has underestimated the visibility improvement that would result from any NO_x reductions. This is because time is required for NO_x to react with atmospheric ammonia to form the ammonium nitrate particles that impair visibility. Unless transport winds from Healy #1 to DNPP are very slow, it is unlikely that the NO_x would have had sufficient transport time to react to form secondary aerosol particles by the time it reaches the nearest boundary of the park.

ADEC proposed NO_x BART for Healy Unit #1

Table 8-1 from ADEC’s Final BART Determination Report presents the BART five-step review process for each NO_x control option considered by GVEA. The cost effectiveness information is based on an eight-year remaining useful lifetime of Healy #1.

ADEC’s final BART determination for Healy Unit #1 was based on a NO_x emission limit consistent with a new SNCR system. The finding is not the installation of SNCR; rather, it is the NO_x emission limit that would be achieved should GVEA opt to install an SNCR system on Healy 1 to comply with this limit. ADEC believes the NO_x emission limit equivalent to the SNCR control retrofit option for Healy #1 represents the best combination of factors (steps evaluated) under the BART rule and regional haze program for the purpose of improving visibility impairment at DNPP.

ADEC has determined the NO_x BART emission limit for Healy #1 to be the equivalent of the existing LNB/OFA system with a new SNCR system; however, ADEC has set the NO_x emission limit at 0.20 lb/mmBtu rather than 0.19 lb/mmBtu. This determination is based on consideration of all elements of the BART five-step evaluation process, including the general cost acceptability ($/ton and $/dV); the proximity of Healy #1 to DNPP; the additional reduction in NO_x emissions; and related predicted visibility improvement at DNPP necessary for ADEC to meet the reasonable progress compliance goals by 2064.

[8] Our most recent compilation of BART projects was sent to ADEC recently.

Table 8-1: Comparison Matrix of the GVEA-Evaluated NOx Control Options as they Relate to the BART 5-Step Evaluation Process

	BART Analysis Steps				
Control Option	**Identify All Control Options (Step 1)**	**Eliminate Technically Infeasible Options (Step 2)**	**Evaluation of Control Effectiveness(2) (Step 3)**	**Cost-Effectiveness and Impacts Analysis(3) (Step 4)**	**Visibility Impact Evaluation(4) (Step 5)**
Existing LNB w/OFA(1)	Option Identified	Option Accepted	0% (0.28 lb/mmBtu)	N/A	N/A
Optimize Existing LNB w/OFA	Option Identified	Option Accepted	18% (0.23 lb/mmBtu; 74 add'l tons NOx removed)	$47/ton NOx (annual) $47/ton NOx (incremental) $6,214/deciview	0.560 deciview improvement; 43 day improvement
LNB w/OFA, plus new SNCR system	Option Identified	Option Accepted	32% (0.19 lb/mmBtu; 134 add'l tons NOx removed)	$4,208/ton NOx (annual) $9,409/ton NOx (incremental) $909,653/deciview	0.620 deciview improvement; 51 day improvement
Replace OFA w/ROFA®	Option Identified	Option Accepted	46% (0.15 lb/mmBtu; 194 add'l tons NOx removed)	$4,827/ton NOx (annual) $6,219/ton NOx (incremental) $1,392,587/deciview	0.671 deciview improvement; 56 day improvement
Replace OFA w/ROFA® & Rotamix®	Option Identified	Option Accepted	61% (0.11 lb/mmBtu; 253 add'l tons NOx removed)	$5,886/ton NOx (annual) $9,328/ton NOx (incremental) $2,024,546/deciview	0.736 deciview improvement; 67 day improvement
LNB w/OFA, plus new SCR system	Option Identified	Option Accepted	75% (0.07 lb/mmBtu; 313 add'l tons NOx x removed)	$15,762/ton NOx (annual) $57,734/ton NOx (incremental) $6,271,228/deciview	0.786 deciview improvement; 71 day improvement

Notes:

(1) The existing controlled NOx baseline emission rate is 0.28 lb/mmBtu (30-day average).

No effectiveness, capital or operating costs, or visibility improvements are applicable to this existing control scenario.

(2) Percent control (%) is relative to the existing controlled baseline configuration for Healy 1, defined as LNB+OFA NOx control system; sodium bicarbonate sorbent dry FGD SO2 control system; and 12 compartment reverse-gas fabric filter particulate (with coincident SO2) control system.
The NOx emission limit corresponding to the option; and the additional amount of NOx removed (tons/year) for this control scenario versus existing baseline is also shown.

(3) Cost-effectiveness estimates based on 8-year Healy 1 remaining useful lifetime.

(4) Visibility impacts for each option are relative to existing baseline conditions.

NPS Conclusions and Recommendations on NO_x BART

- In general, the ADEC report was well-written, clearly followed the five-step BART process, and thoroughly explained ADEC's conclusions.
- It is essential that any evaluation that is contingent upon shutdown of Healy #1 by a specific date must contain an enforceable condition to validate that evaluation.
- ADEC presented a full suite of NO_x control options and, except for SCR, adequately assessed their effectiveness.
- SCR can achieve a lower NO_x emission rate than evaluated by ADEC. As a result, ADEC has underestimated the benefits of adding SCR.
- ADEC has not fully explained, or justified, and, in some cases, has overestimated the costs associated with adding SCR We continue to believe that the $874/kW cost estimate

provided by ADEC/Enviroplan is overestimated. Industry data cited in footnote 1 continues to indicate that capital costs greater than $200/kW are very unusual. We recognize that the size and location of Healy #1 would likely result in unusually high SCR costs, but we continue to question the high capital costs estimated by ADEC.

- It is likely that visibility improvements greater than those predicted by GVEA would be found if a more-refined, receptor-by-receptor analysis is conducted throughout DNPP. This would result in an even lower cost/deciview.
- We commend ADEC for determining that NO_x emissions should be reduced below the level proposed by GVEA. However, BART is not necessarily the most cost-effective option. All of the options evaluated result in cost/deciview values that are well below the $13 - $20 million average $/dV costs that are being proposed as BART by other sources and states. Therefore, all of the NO_x control options evaluated represent reasonable alternatives for BART.
- Because the OFA w/ROFA® option is only marginally more expensive (on a $/ton basis) that the proposed SNCR, and because the $/dV is still well below the national average, we request that ADEC provide information on how those costs were derived and re-evaluate this option using the 7% interest rate recommend by the EPA Control Cost manual. In conducting that re-evaluation, we ask that ADEC provide information on the amount of time necessary to install this option.

NPS Comments on ADEC's BART determination for SO_2 Control at Healy Unit 1

We agree with ADEC's selection of SO_2 control options and its assessments of their technical feasibility.

ADEC has underestimated the effectiveness of wet scrubbing.

ADEC should use expected annual emissions in estimating the annual emission reductions for each control option. If we assume that the uncontrolled SO_2 emissions are 0.6 lb/mmBtu, it is reasonable to expect that a Lime Spray Drier (LSD) can reduce those uncontrolled annual emissions by 90% down to 0.06 lb/mmBtu. Likewise, a Wet Limestone Scrubber (WLS) is generally assumed to be able to reduce emissions by 95% or down to 0.03 lb/mmBtu in this case. However, we also understand that ADEC would be reluctant to assume that either type of scrubber can achieve such low limits without evidence that scrubbers have achieved or been permitted at these rates. And, we recognize that SO_2 removal efficiency and the controlled emissions are highly dependent upon the fuel quality and the resulting uncontrolled SO_2 emissions. Our review of the CAM database (Appendix C) leads us to conclude that, for the purpose of these estimates, LSD can be assumed to achieve 0.07 lb/mmBtu and the WLS option 0.04 lb/mmBtu on an annual basis.

ADEC has overestimated the costs of the technically-feasible SO_2 control options.

The "Average Cost Effectiveness" values estimated by ADEC for the LSD and WLS scrubber options are incremental costs, not true average costs, and, as such, cannot be compared to any costs except other incremental costs. A more appropriate basis for estimating the cost-effectiveness of the LSD and WLS scrubbers is to compare the annual cost of each option to the total annual tons of SO_2 removed. For example, if the LSD has an annual cost of $2,201,647 and it removes 90% of 892 tons per year of uncontrolled potential SO_2 emissions, the cost-effectiveness of the LSD system becomes $2,591/ton, which is substantially lower than the $9,237 estimated by ADEC. Furthermore, ADEC used an 8% interest rate instead of the 7% rate specified by the EPA Cost Manual.

<u>Proposed SO_2 BART for Healy #1</u>

Table 8-2 summarizes the BART five-step review for the SO_2 control options. The cost effectiveness information is based on an eight-year remaining useful lifetime of Healy Unit 1.

We have the same concern as stated for the NO_x control analysis that if cost-effectiveness is based on an eight-year amortization period for capital costs, then shutdown of Unit 1 in 2024 must be made federally- or state-enforceable.

Table 8-2: Comparison Matrix of the GVEA-Evaluated SO2 Control Options as they Relate to the BART 5-Step Evaluation Process

	BART Analysis Steps				
Control Option	**Identify All Control Options (Step 1)**	**Eliminate Technically Infeasible Options (Step 2)**	**Evaluation of Control Effectiveness(2) (Step 3)**	**Cost-Effectiveness and Impacts Analysis(3) (Step 4)**	**Visibility Impact Evaluation(4) (Step 5)**
Existing Dry(1) FGD System (Sodium Bicarbonate Sorbent)	Option Identified	Option Accepted	0% (0.30 lb/mmBtu)	N/A	N/A
Optimize Existing FGD System by Increasing Sorbent Injection	Option Identified	Option Accepted	40% (0.18 lb/mmBtu; 179 add'l tons SO2 removed)	$4,218/ton SO2 (annual) $4,218/ton SO2 (incremental) $3,015,208/deciview	0.250 deciview improvement; 39 day improvement
Install Lime Spray Dryer Semi-Dry FGD System	Option Identified	Option Accepted	50% (0.15 lb/mmBtu; 223 add'l tons SO2 removed)	$9,337/ton SO2 (annual) $29,813/ton SO2 (incremental) - $2,397,400/deciview	-0.870 deciview improvement; 20 day improvement
Install Wet Limestone FGD System	Option Identified	Option Accepted	77% (0.07 lb/mmBtu; 343 add'l tons SO2 removed)	$10,275/ton SO2 (annual) $12,033/ton SO2 (incremental) - $3,033,847/deciview	-1.160 deciview improvement; 18 day improvement

(1) The existing controlled SO2 baseline emission rate is 0.30 lb/mmBtu (30-day average).
No effectiveness, capital or operating costs, or visibility improvements are applicable to this existing control scenario.
(2) Percent control (%) is relative to the existing controlled baseline configuration for Healy 1, defined as LNB+OFA NOx control system; sodium bicarbonate sorbent dry FGD SO2 control system; and 12 compartment reverse-gas fabric filter particulate (with coincident SO2) control system. The SO2 emission limit corresponding to the option; and the additional amount of SO2 removed (tons/year) for this control scenario versus existing baseline is also shown.
(3) Cost-effectiveness estimates based on 8-year Healy 1 remaining useful lifetime. Negative values ($/dV) for lime spray dryer and wet FGD reflects a worsening (i.e., increase) in maximum predicted visibility impacts compared to baseline.

(4) Visibility impacts for each option are relative to existing baseline conditions.

ADEC "has determined that final SO_2 BART for Healy 1 is the current FGD configuration and no additional controls are recommended for the Healy 1 boiler to reduce SO_2 emissions. The emission limit equivalent to the existing FGD system will be set by the Department as the BART emission limit for SO_2."

ADEC's five-factor analysis for the increased sorbent injection option developed the following data:

- 40% reduction (0.18 lb/mmBtu; 179 additional tons SO_2 removed)
- \$4,218/ton SO_2 (annual) \$4,218/ton SO_2 (incremental)
- 0.250 deciview improvement; 39 day improvement
- \$3,015,208/deciview

ADEC rejected the increased sorbent injection option because of "an insignificant predicted improvement in visibility at DNPP. ADEC found that the cost for this option is within the dollar per deciview (\$/dv) metric for all EGUs as cited by the NPS survey (Appendix A of the ADEC/ENVIRONPLAN report); but it is about 2.5 to 3 times greater than the median and mean values (\$/ton) in that database. ADEC also found a disparity when comparing the almost same NO_x and SO_2 cost effectiveness values. The final recommended NO_x BART option (emission limit equivalent to SNCR) has a cost effectiveness of \$4,208/ton, with a coincident significant predicted visibility improvement of 0.620 dv; however, a similar SO_2 cost effectiveness for the optimized FGD option (\$4,218/ton) results in only a 0.25 dv predicted improvement in visibility. ADEC stated that this cost disparity supports the NO_x control, but does not support the optimization SO_2 control option. ADEC also expressed concern that the increased sorbent injection option could result in the increased potential for visibility impairing brown plume."

The BART Guidelines state that an improvement in visibility need not be perceptible in order to be considered in the BART determination. Even though GVEA has estimated that increased sorbent injection would yield a 0.25 dV improvement, by ADEC's calculations, this still results in a cost-effectiveness of \$3.0 million/deciview, which is clearly cost-effective when compared to the \$20 million/dV national average cost for SO_2 BART reductions.

ADEC reviewed the cost effectiveness data supplied by NPS (see Appendix A) for all EGUs that indicate respective median and mean SO_2 cost effectiveness values of \$1379/ton and \$1721/ton; and about \$14.5 million/dv and \$10.5 million/dv. ADEC concluded that there are few small EGUs (<100 MW) included in the data and that data were not easily compared to costs for Healy Unit 1. (There are only four EGUs in the NPS survey data with capacities less than 100 MW, and median and mean cost effectiveness values of about \$5000/ton). Please note that the size of Healy Unit 1 is irrelevant when evaluating cost-effectiveness, whether in terms of \$/ton or in \$/dV, as size is already accounted for in the costing techniques and the survey.

The brown plume potential is not known, but can be tested by increasing the sorbent injection rate using the existing equipment.

NPS Conclusions and Recommendations on SO_2 BART

- In general, the ADEC report was well-written, clearly followed the five-step BART process, and thoroughly explained ADEC's conclusions.
- It is essential that any evaluation that is contingent upon shutdown of Healy #1 by a specific date must contain an enforceable condition to validate that evaluation.
- ADEC presented a full suite of SO_2 control options but did not adequately assess the effectiveness of the LSD and WLS options. As a result, ADEC has underestimated the benefits of adding LSD or WLS scrubbers.
- ADEC has overestimated the costs associated with adding LSD or WLS scrubbers.
- It is likely that visibility improvement greater than those predicted by GVEA would be found if a more-refined, receptor-by-receptor analysis is conducted throughout DNPP. This would result in an even lower cost/deciview.
- BART is not necessarily the most cost-effective option. The increased sorbent injection option evaluated results in a cost/deciview value that is well below the $13 - $20 million average $/dV costs that are being proposed as BART by sources and states. Increased sorbent injection should be considered as a viable BART option.

NPS Appendices:

Appendix A. SCR less than 0.06 lb per mmbtu.xls

Appendix B. Modified NPS version of OAQPS Cost Manual CC+SCR for Healy.xls

Appendix C. CAM SO2 data 2000 - 2009.xls

Alaska Department of Environmental Conservation

Amendments to:
State Air Quality Control Plan

Volume III: Appendix III.K.11.c
Consultation: Public Participation and Review

Appendix to
Section III. K: Areawide Pollutant Control Program for Regional Haze

Public Review Draft

October 7th, 2010

Appendix III.K.11.c

Consultation: Public Participation and Review

Note: After the close of the public comment period, Appendix III.K.11.c will be amended to include the Alaska Department of Environmental Conservation's response to written and oral comments on the Areawide Pollutant Control Program for Regional Haze.