# Colorado – Rocky Mountain National Park:
# Class I area Reasonable Progress Profile Analysis

## Rocky Mountain IMPROVE monitoring site
## October 25, 2007 Draft

**Background**

The Regional Haze Rule (RHR) requires each haze State Implementation Plan to set 2018 Reasonable Progress Goals (RPGs) for the average Worst (20% haziest) and average Best (20% clearest) days for each Class I area in that state, using the IMPROVE data collected during the 2000-04 baseline monitoring period as the starting point. By 2018, the average Worst days are expected to make "reasonable progress" through the control of sources to improve visibility on those haziest days, considering a number of factors. By 2018, the Best days are not to be degraded, i.e., the 2018 RPG is to be the same or better than the 2000-04 monitored Best days. A number of source category control programs (federal mobile rules, state smoke management programs, state BART/Better-than-BART controls, point and area source controls implemented since the 2002 baseline emissions inventory year, et cetera) have already been included in the analysis of the likely 2018 RPG values for each Class I area in the WRAP region.

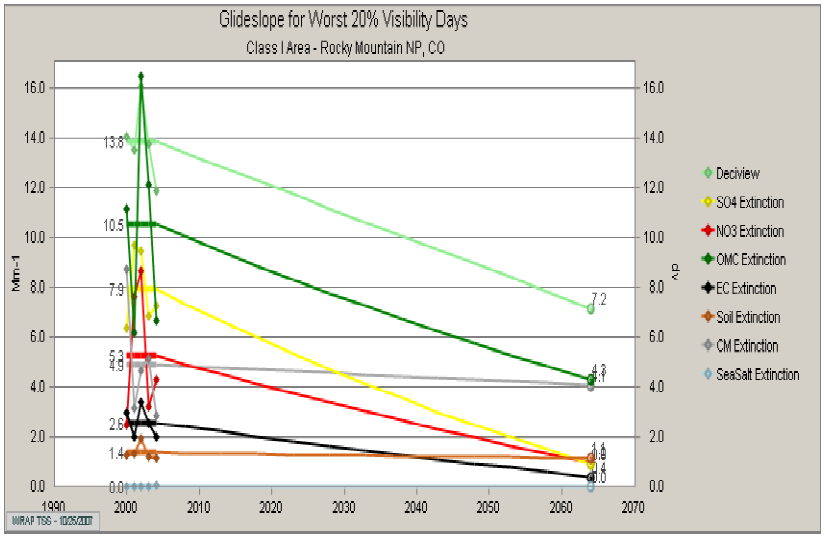
Behind the RPG concept is the known relationship between emissions reductions and improved visibility/reductions in haze. In the West, consideration of the contribution of emissions to 2000-04 baseline conditions on the Worst and Best days, in terms of natural versus anthropogenic and controllable versus uncontrollable emissions is necessary, given the magnitude of natural and uncontrollable emissions in the West. Detailed assessments and 2018 projections of controllable anthropogenic sources have been made by WRAP Forums and Workgroup to account for the list of federal and states' control technologies, programs, and strategies known to be in effect by 2018. In contrast, natural and uncontrollable emissions were held constant in the regional haze modeling for the 2018 planning milestone, as predictions about change by 2018 and interannual variation in these emissions were not possible.

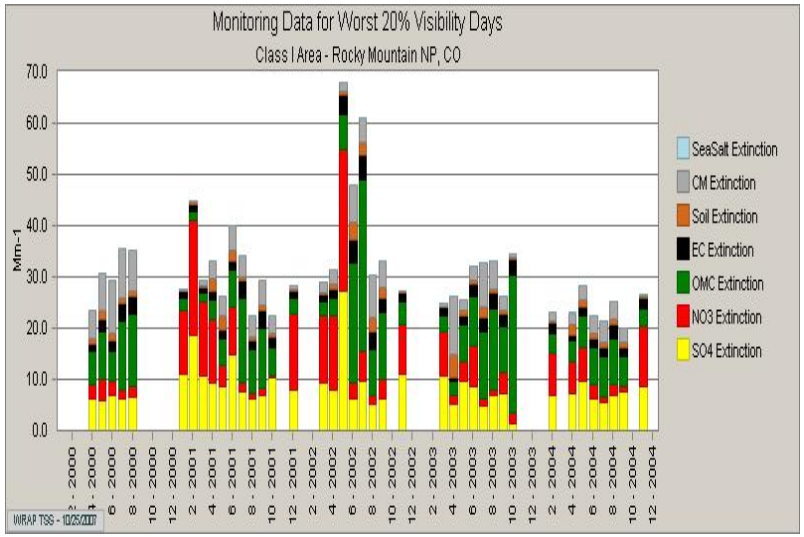
To assist haze planners in setting RPGs, and to assess the need and potential for any additional controls beyond those already included in the current WRAP region haze analyses, this document describes the analysis to be performed for each Class I area in the WRAP region. This document is intended for use by those knowledgeable in the details of the RHR and associated planning requirements. WRAP staff will provide standard analyses of the nature and causes of haze at each Class I area monitoring site, then each state would carry the process to complete analyses to provide the state sufficient information to set reasonable progress goals and determine long-term strategies in their SIP.

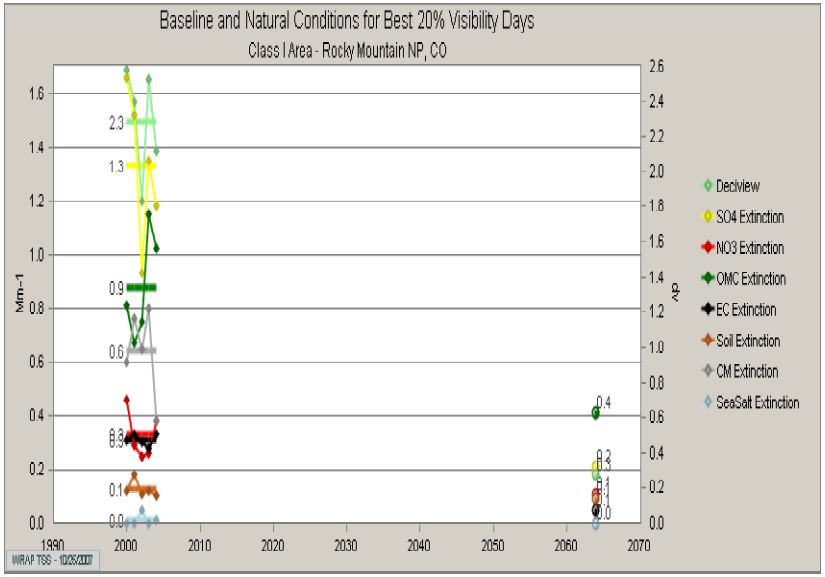
**Weight of Evidence Analysis Process – Colorado: Rocky Mountain National Park Class I area**

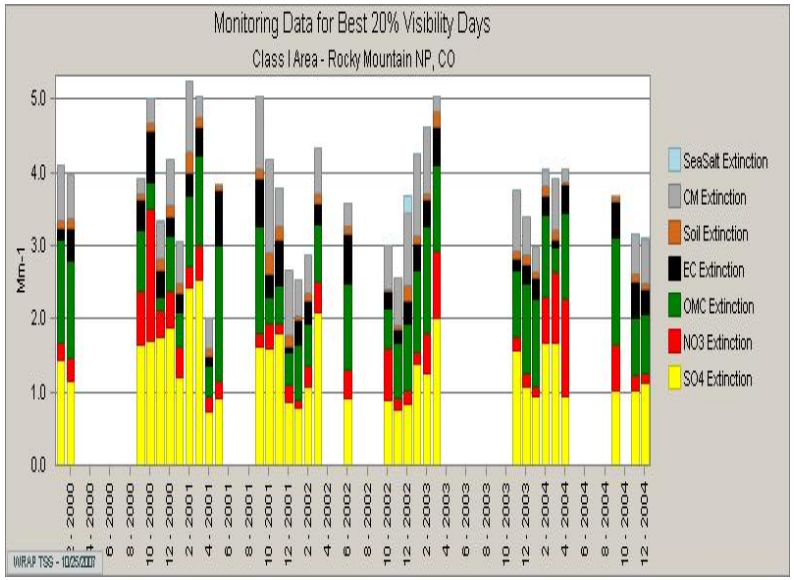
The monitoring, modeling, and emissions data and source apportionment results for this Class I area is represented by the Rocky Mountain IMPROVE monitoring site.

1) Rocky Mountain National Park Class I area 2000-04 baseline period light extinction budget measured at the Rocky Mountain IMPROVE monitoring site.



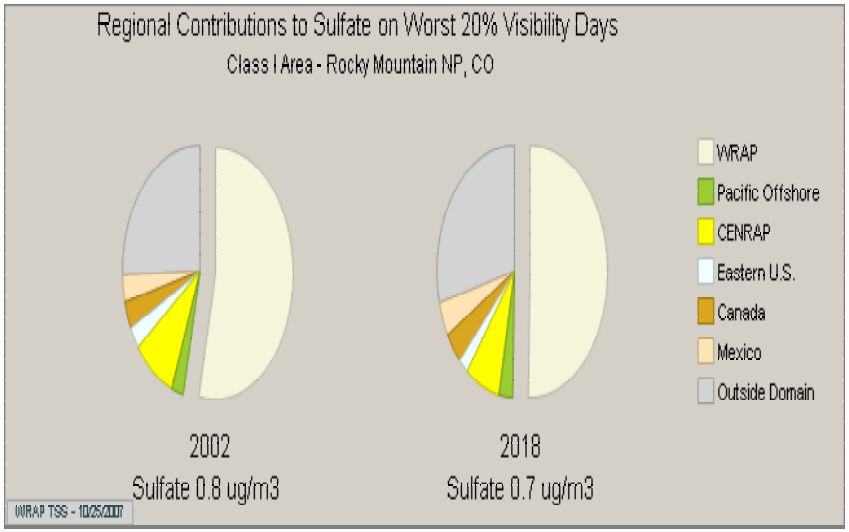



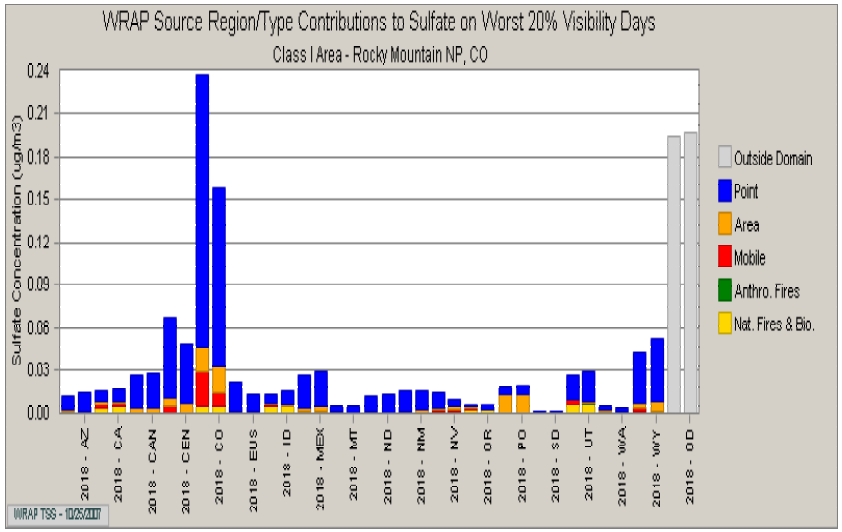



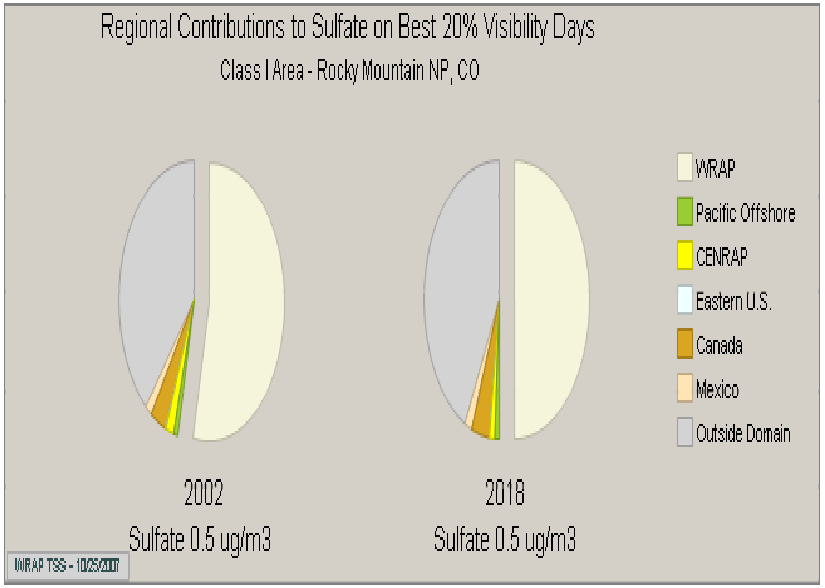



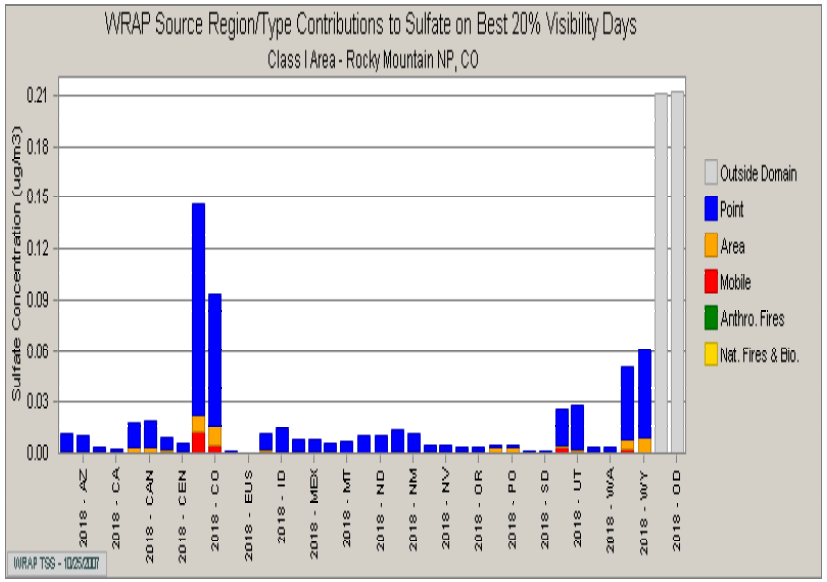
2) Emissions sources and regions shown to be/potentially affecting the Rocky Mountain National Park Class I area reported by emissions related to measured IMPROVE species (controllable/uncontrollable and natural/anthropogenic)

a. Source apportionment by species, source category, and state/region – sulfate

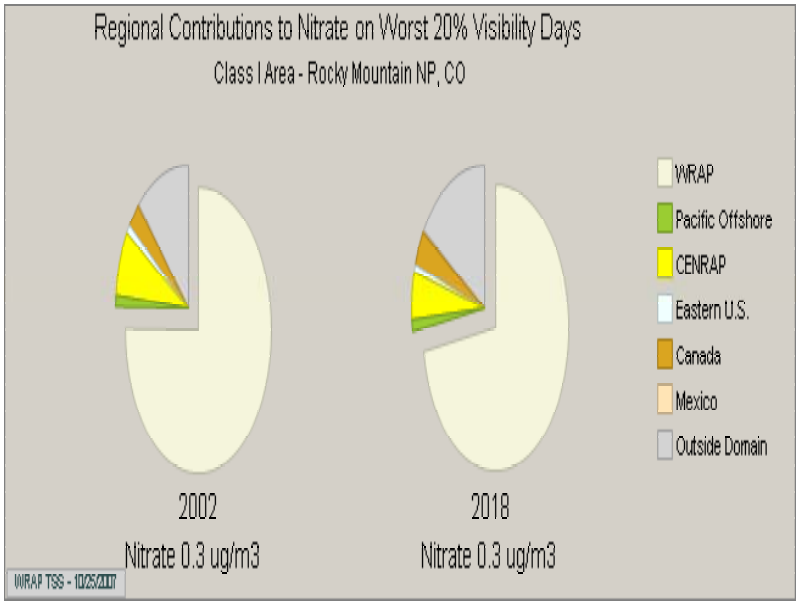


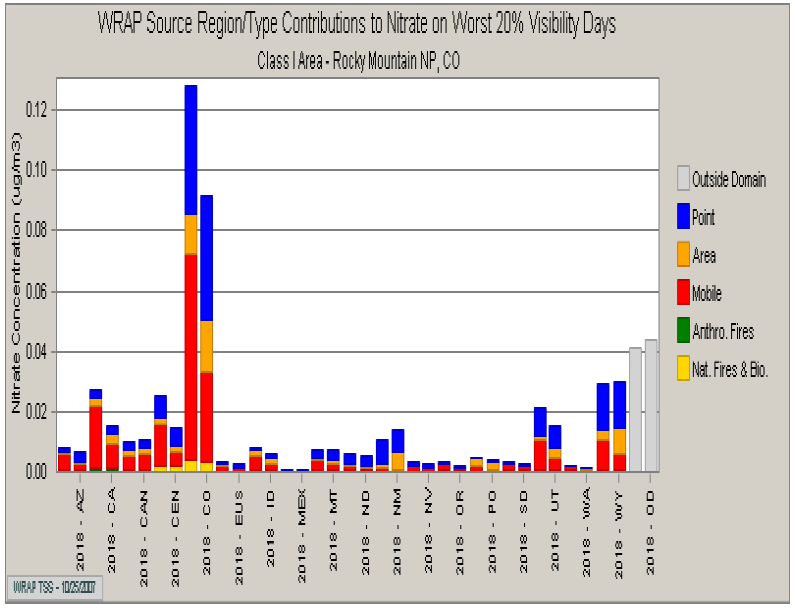



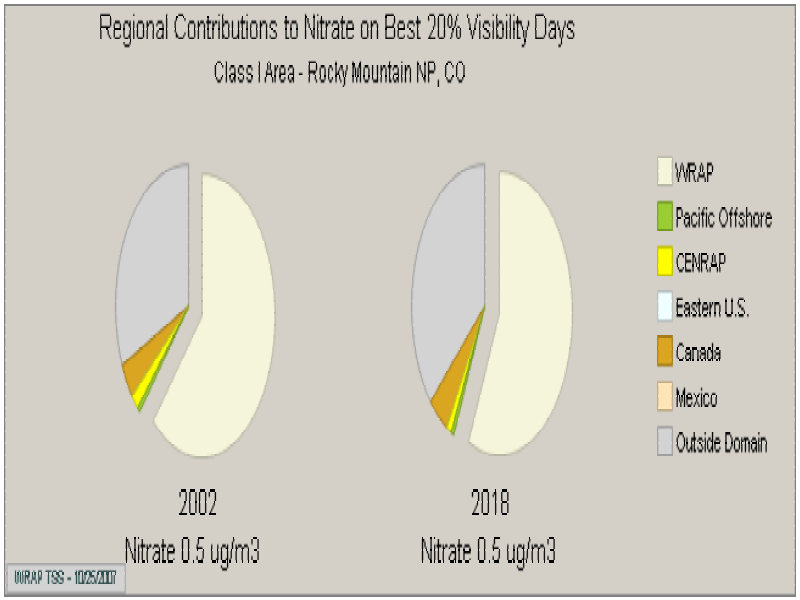



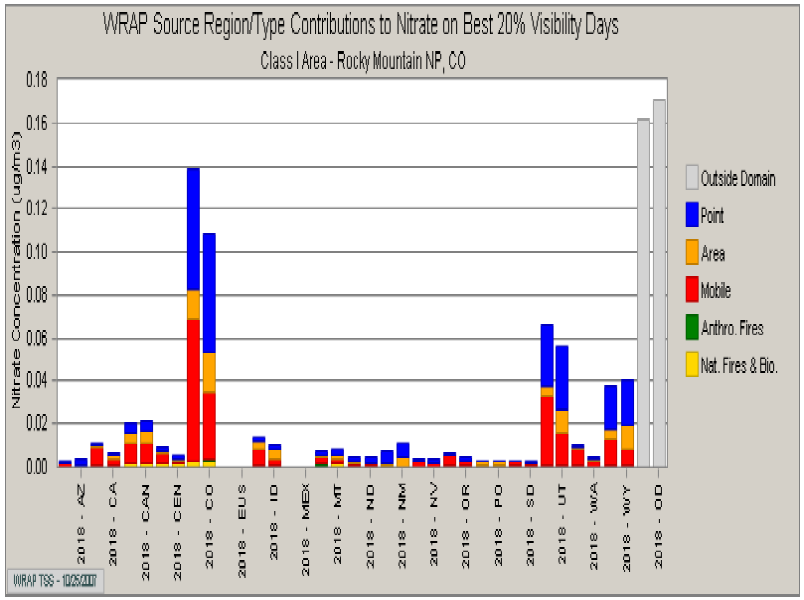



b. Source apportionment by species, source category, and state/region – nitrate

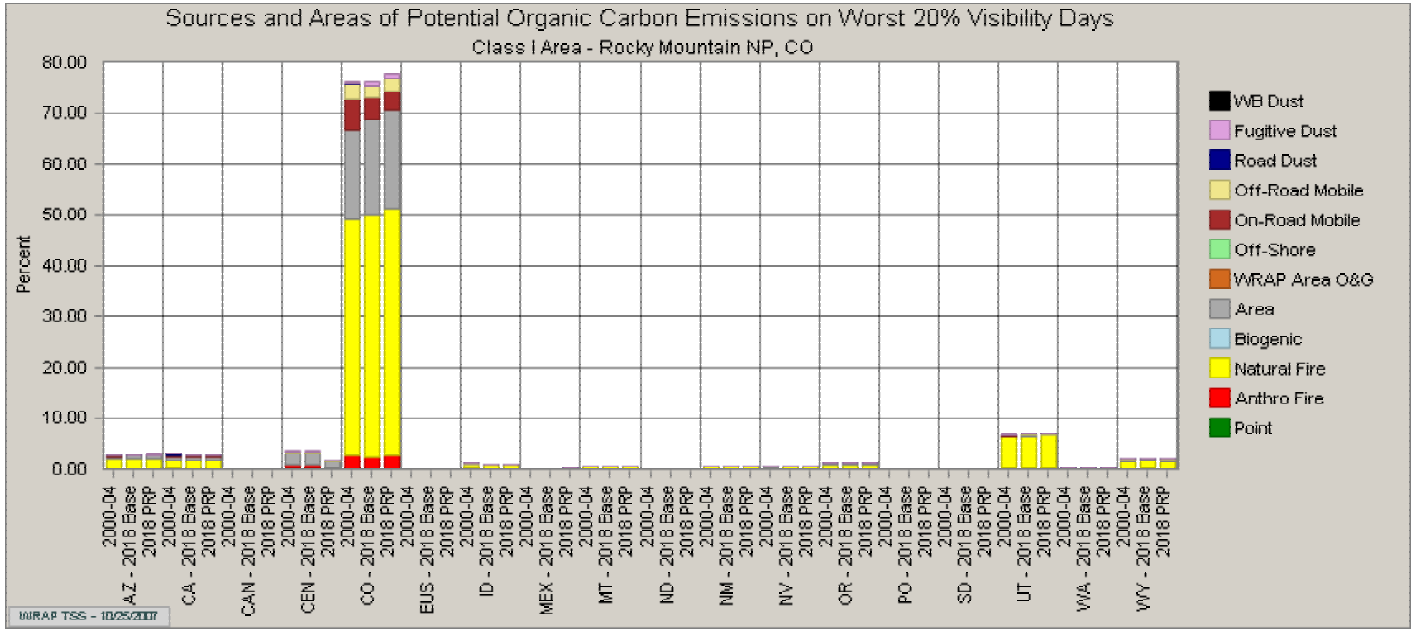


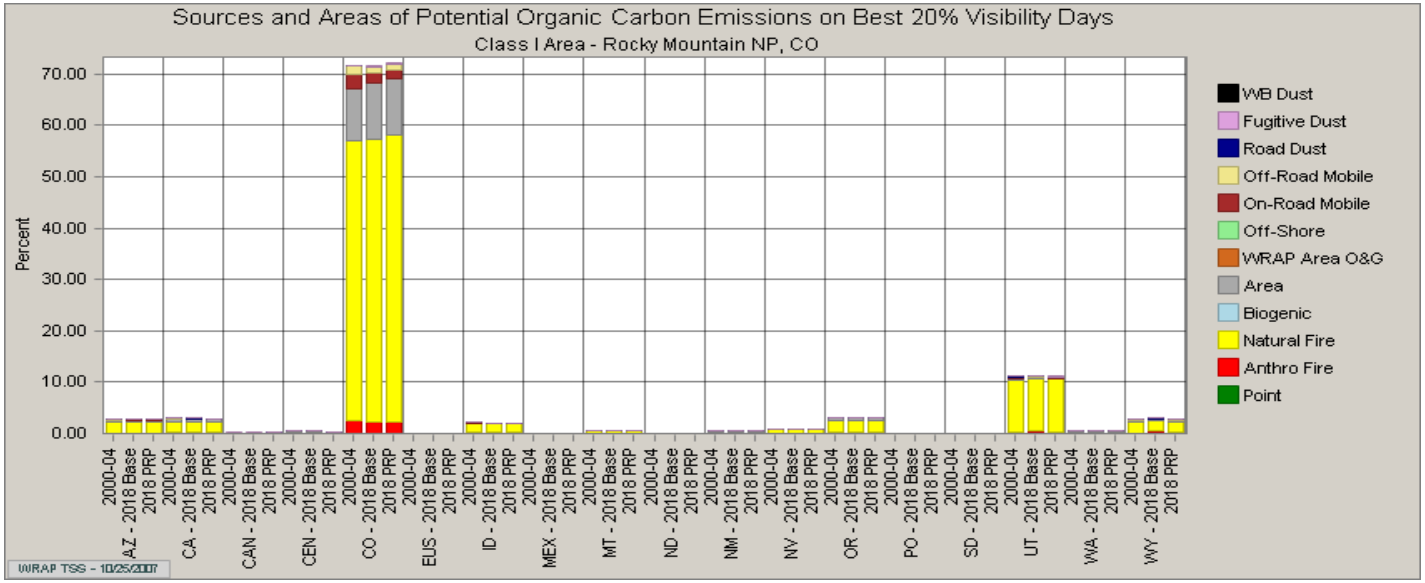



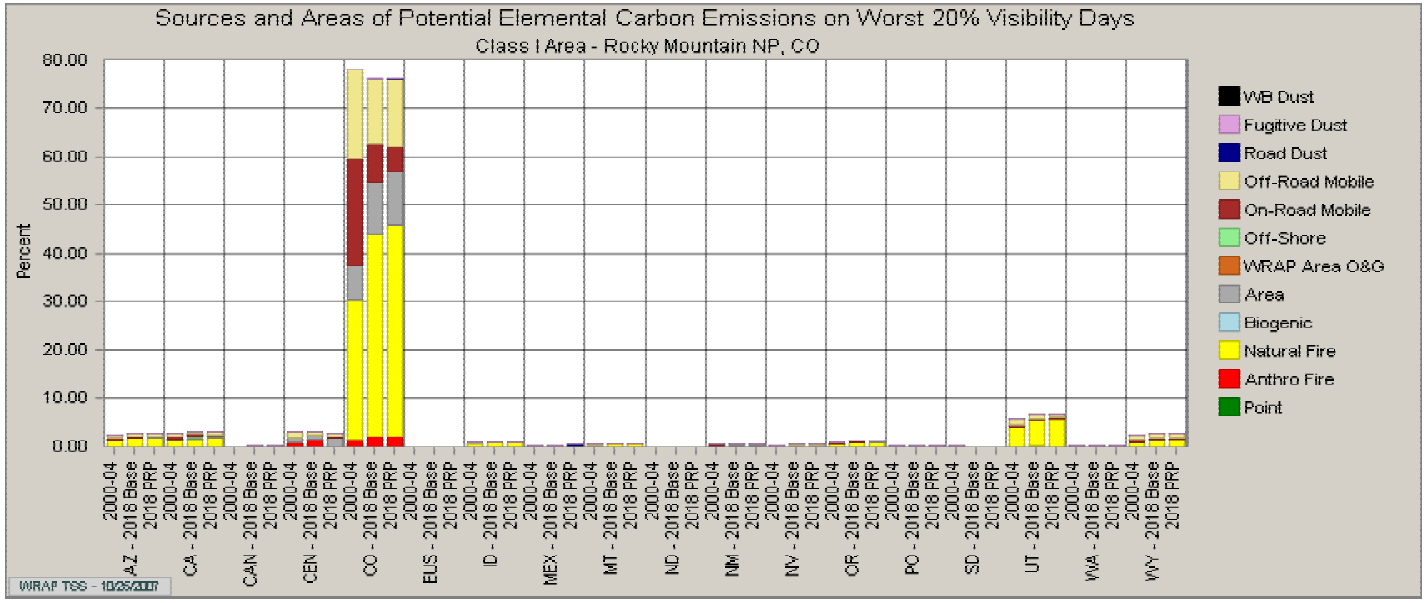



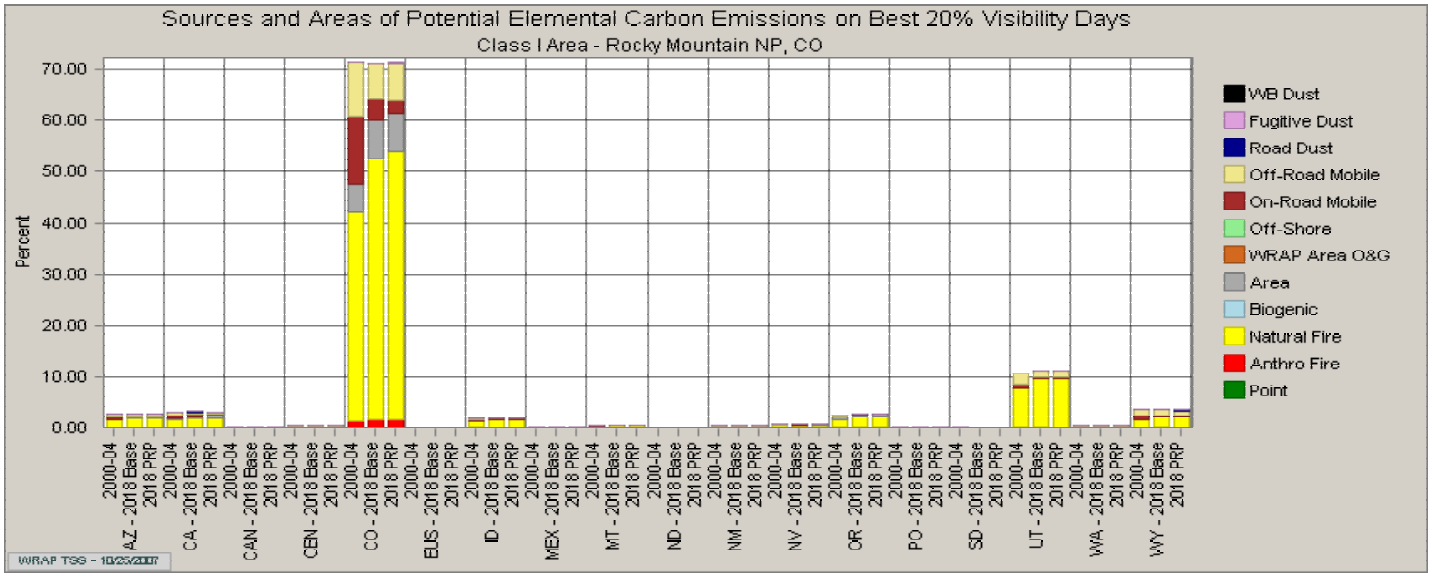
c. Source apportionment by species, source category, and state/region – organic carbon



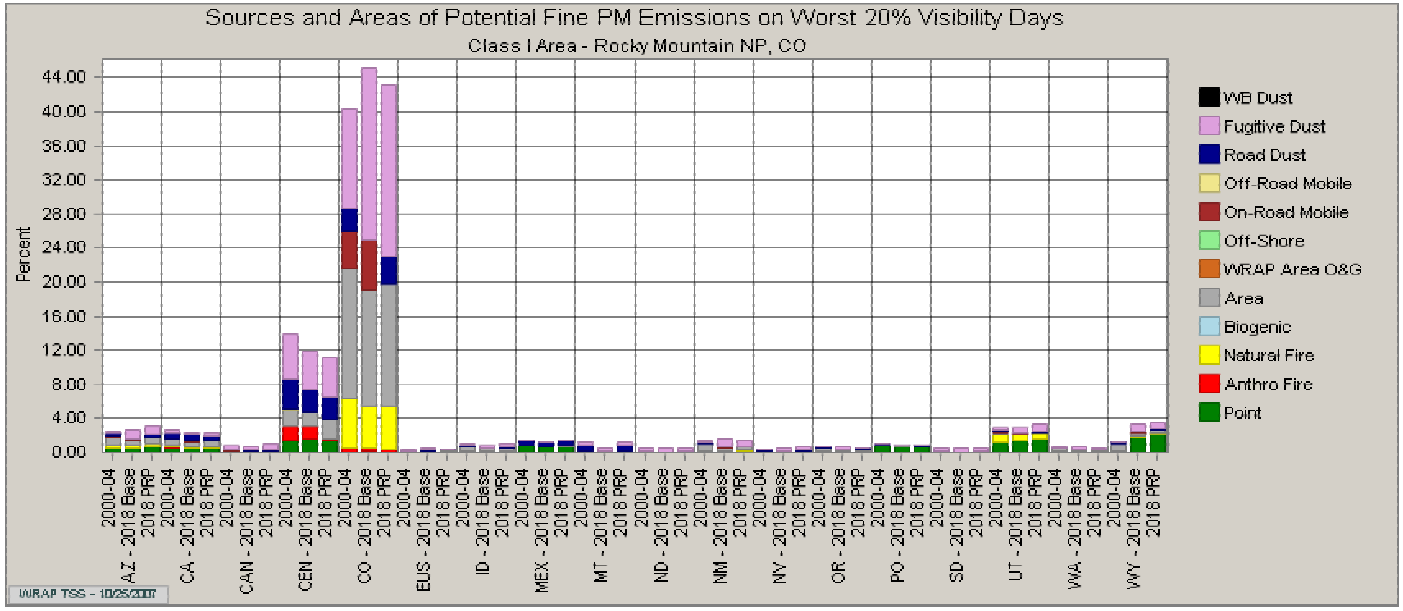



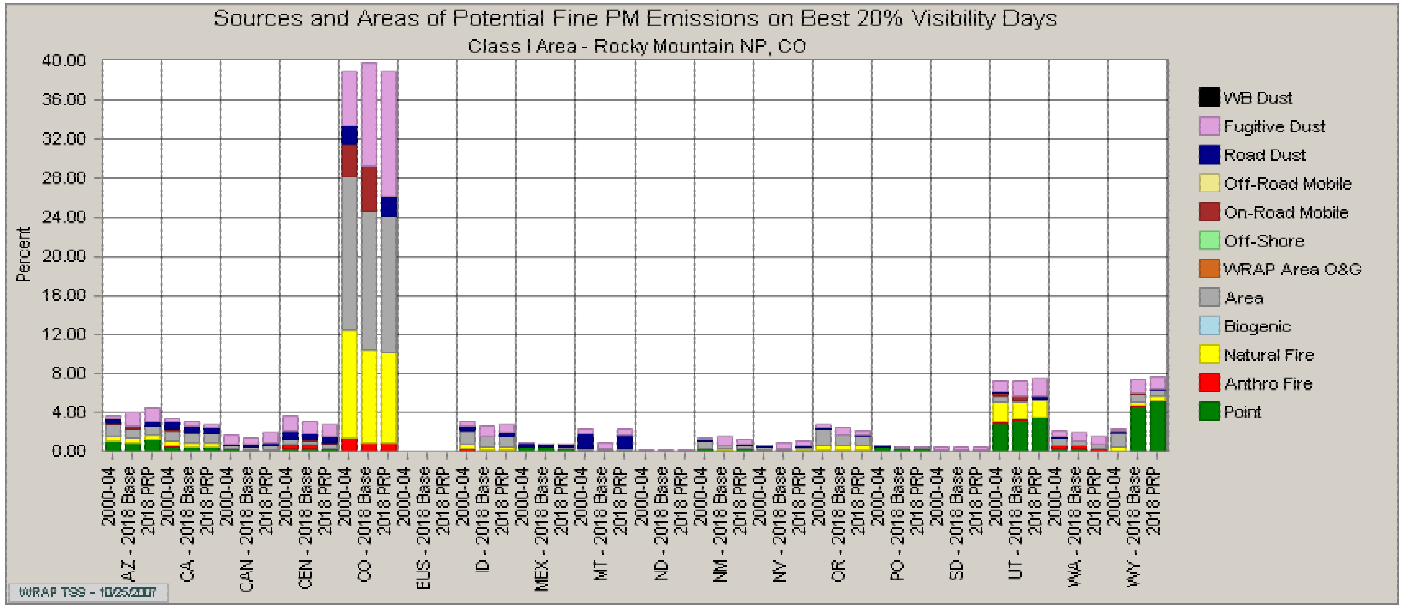
d. Source apportionment by species, source category, and state/region – elemental carbon



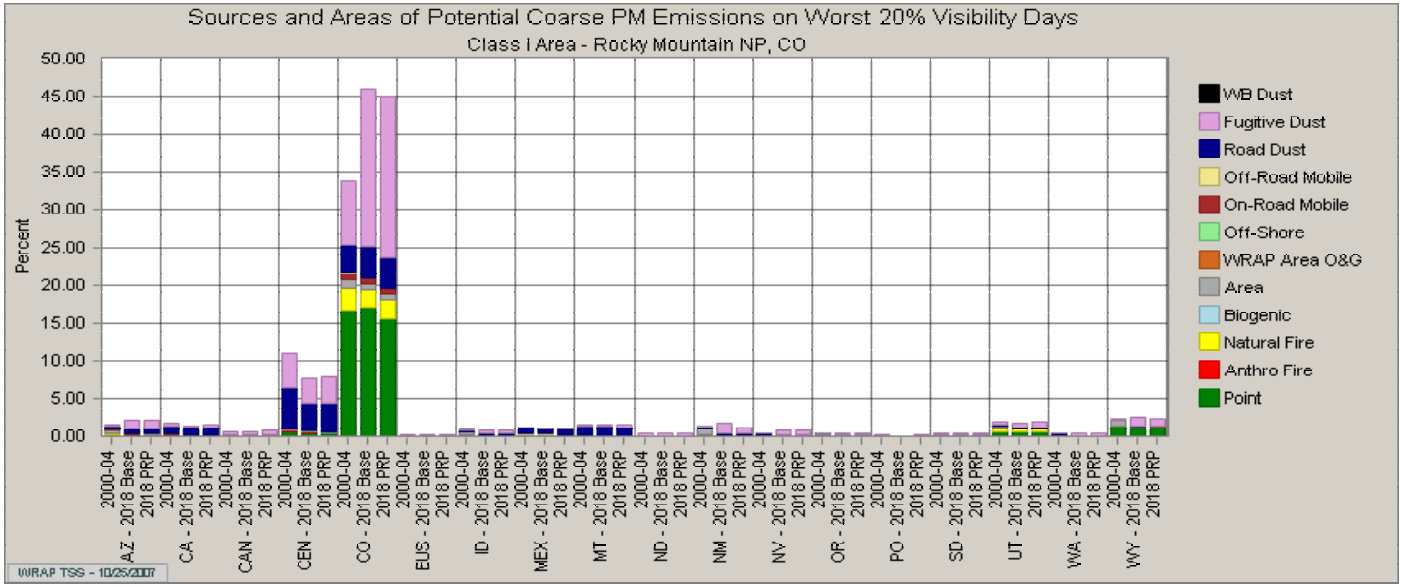



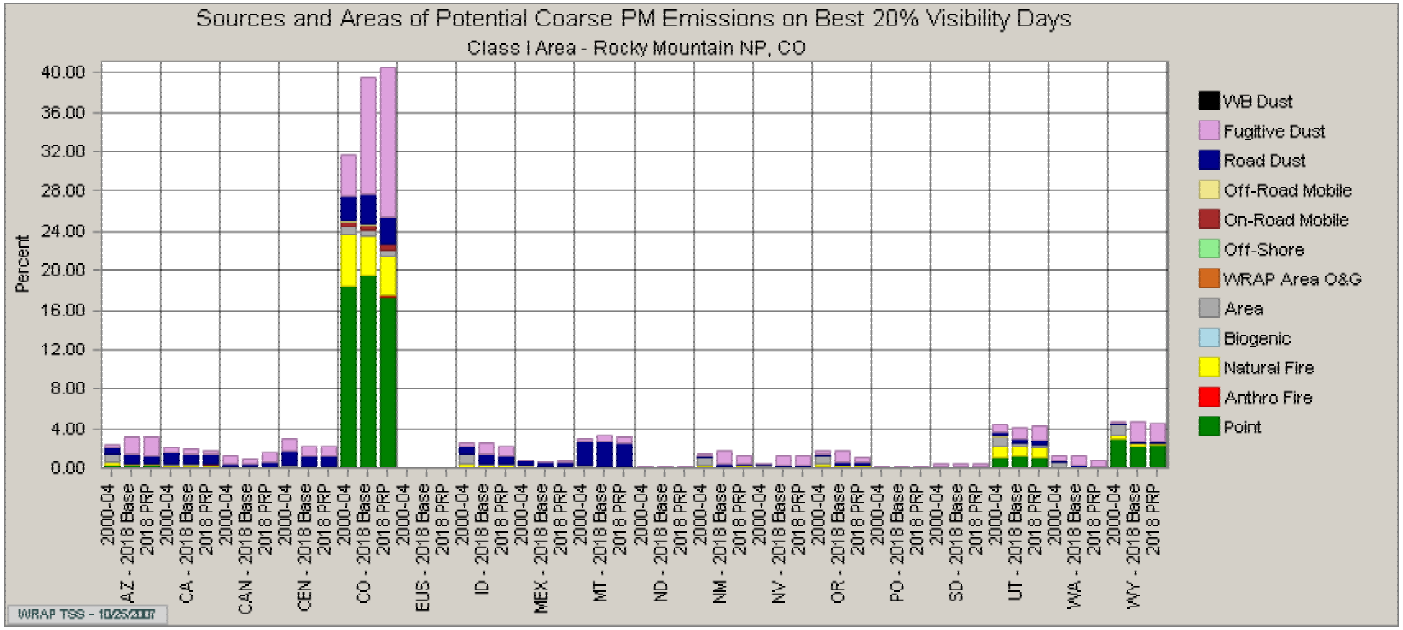
e. Source apportionment by species, source category, and state/region – fine soil



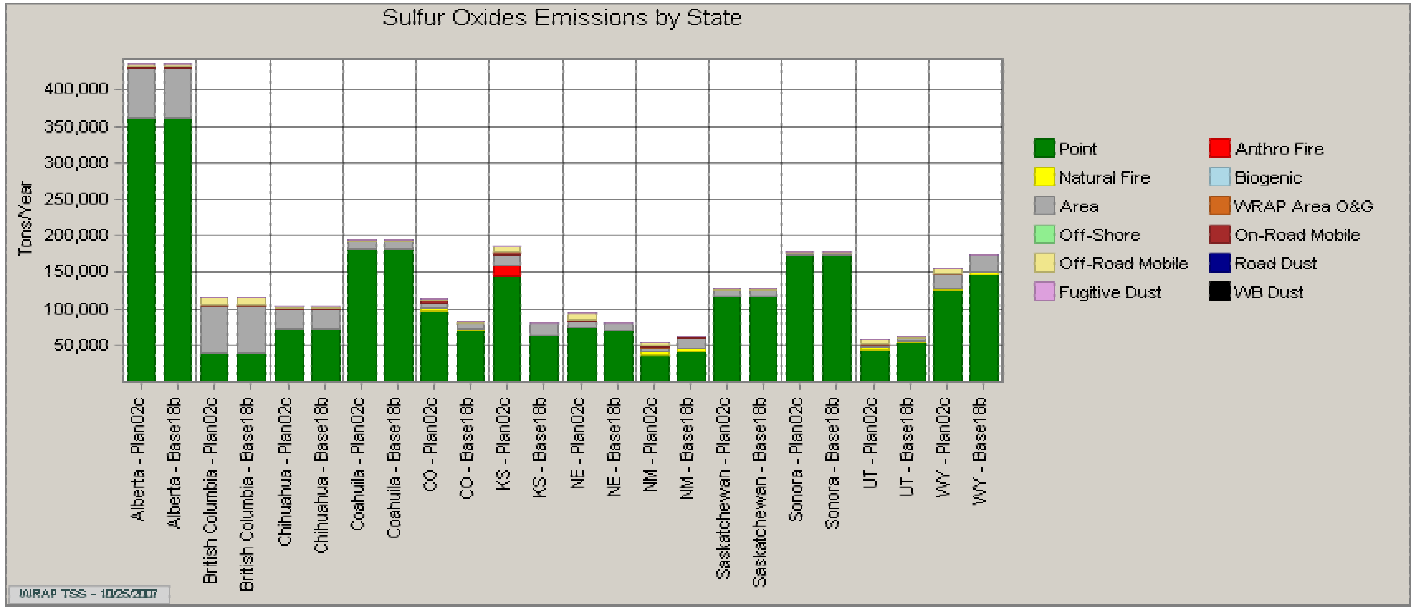



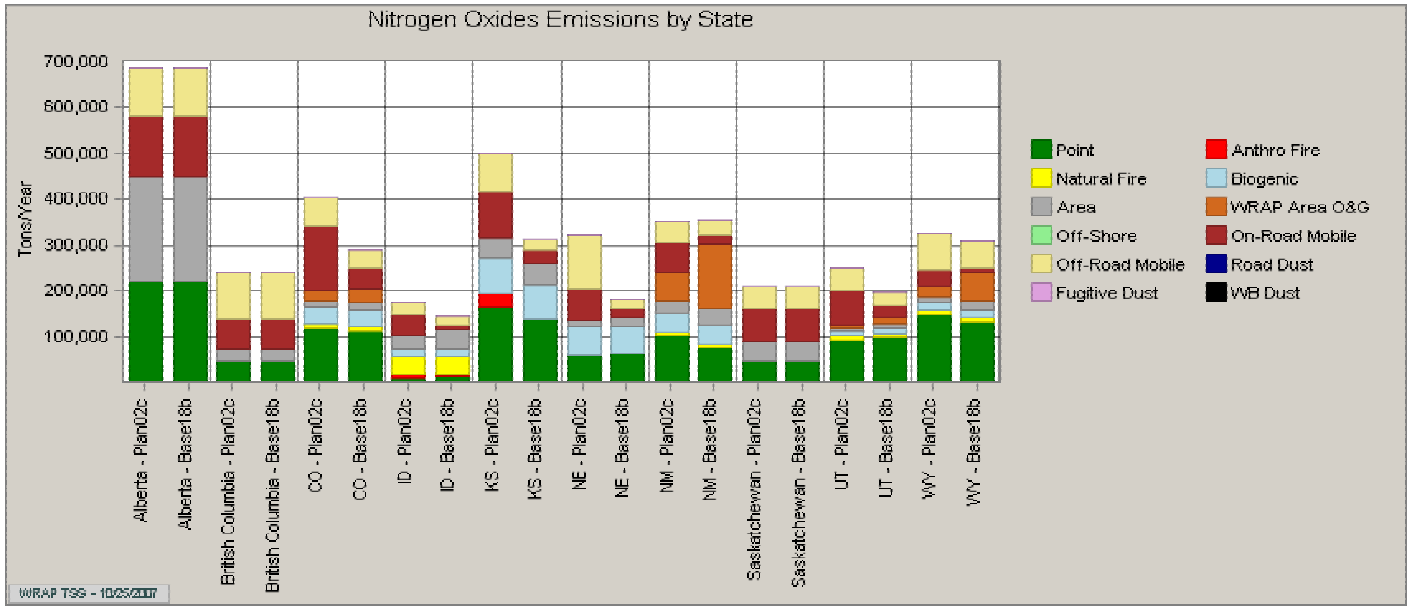
f. Source apportionment by species, source category, and state/region – coarse material

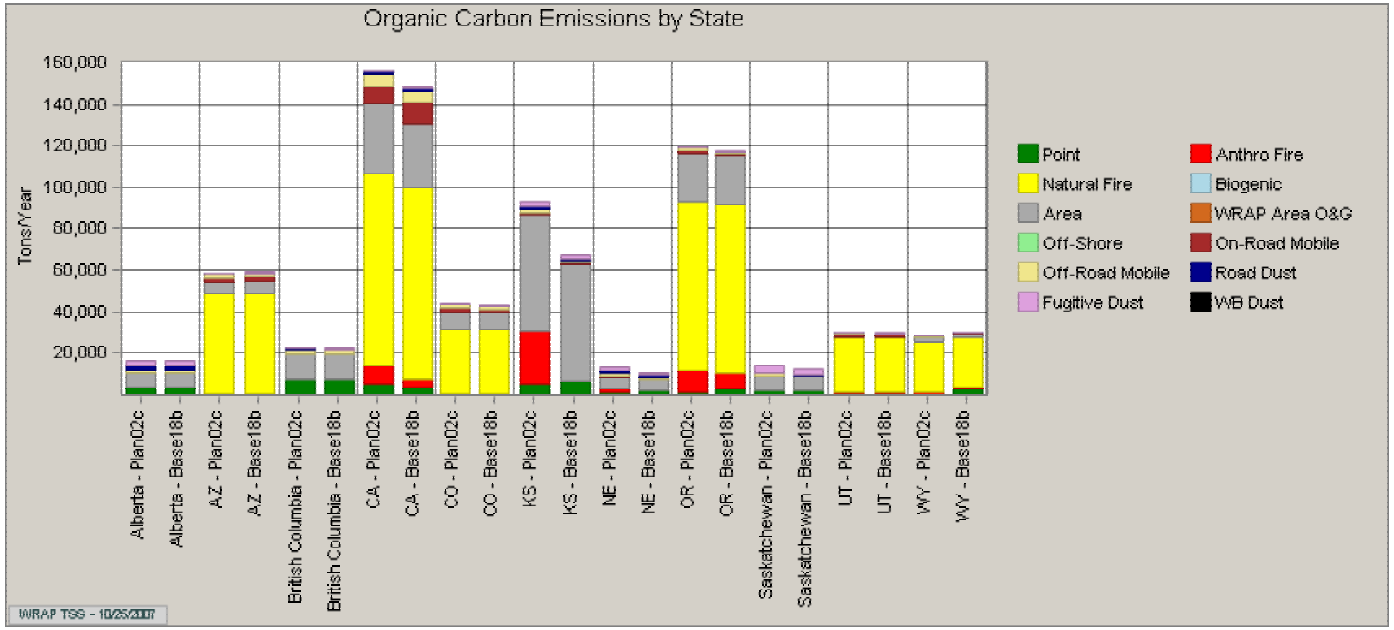


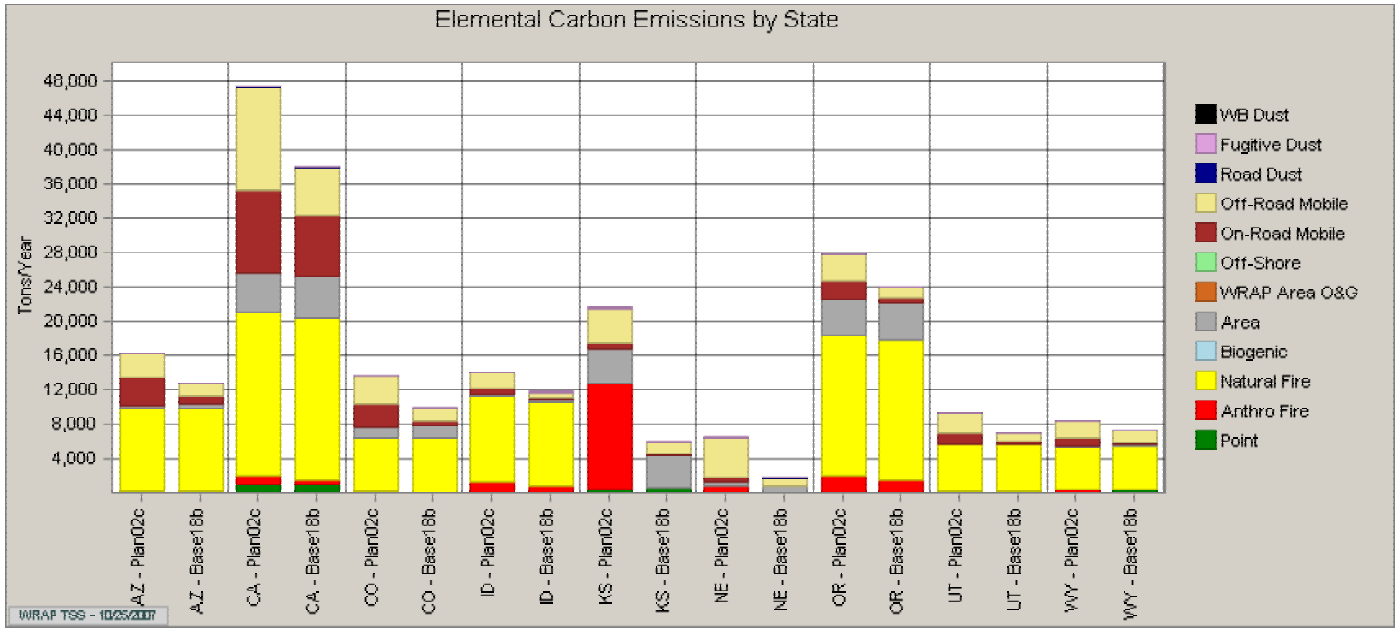



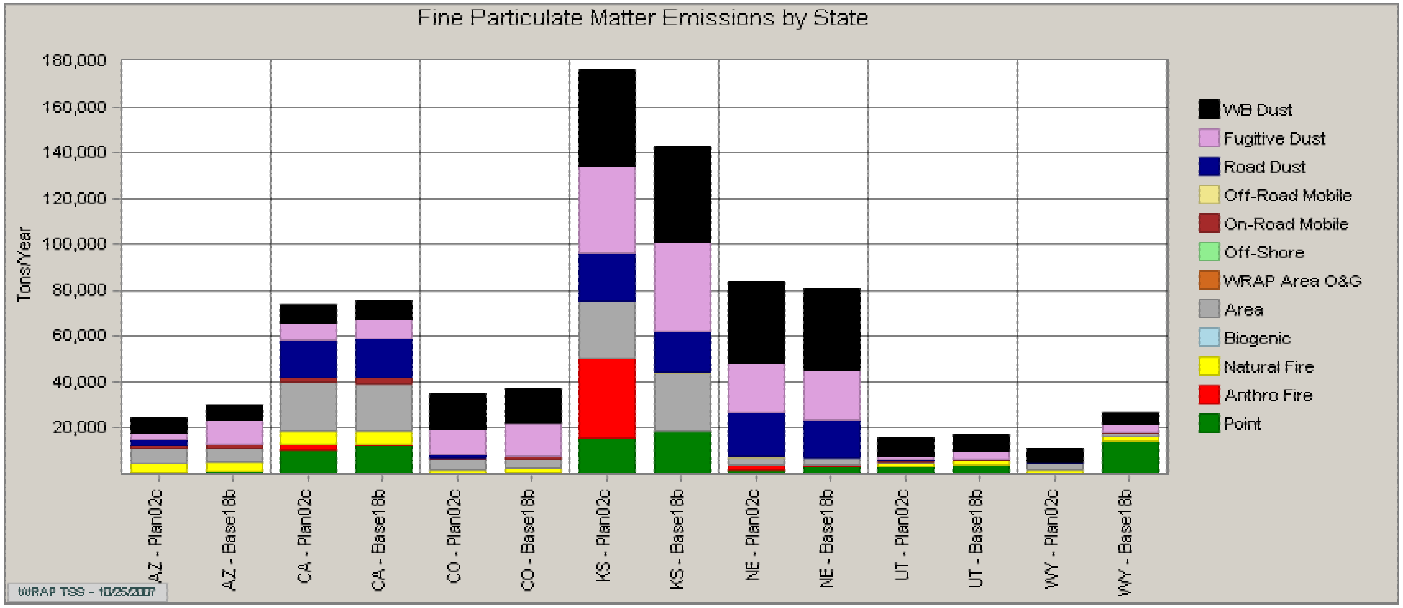
g. What are the emissions in the top 4 to 6 source areas for each species?

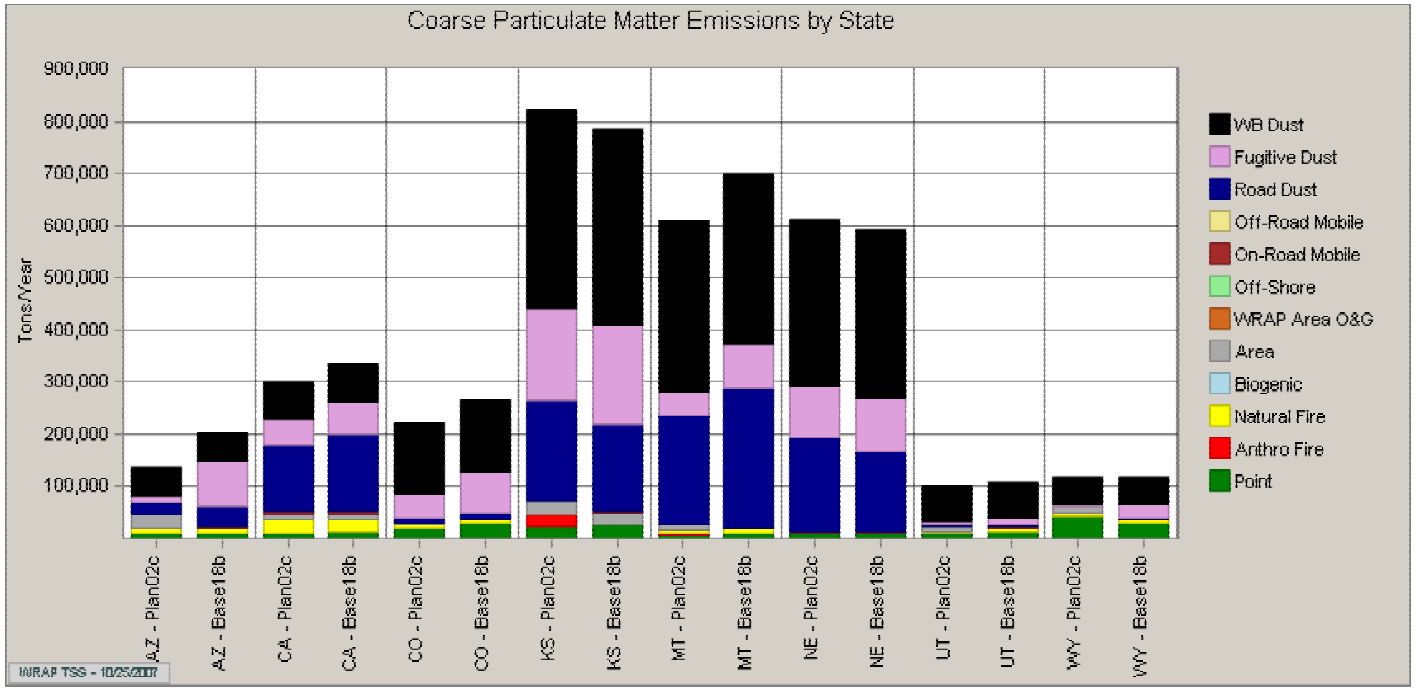



Organic Carbon Emissions by State
Tons/Year
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
Alberta - Plan02c
Alberta - Base18b
AZ - Plan02c
AZ - Base18b
British Columbia - Plan02c
British Columbia - Base18b
CA - Plan02c
CA - Base18b
CO - Plan02c
CO - Base18b
KS - Plan02c
KS - Base18b
NE - Plan02c
NE - Base18b
OR - Plan02c
OR - Base18b
Saskatchewan - Plan02c
Saskatchewan - Base18b
UT - Plan02c
UT - Base18b
WY - Plan02c
WY - Base18b
Point
Anthro Fire
Natural Fire
Biogenic
Area
WRAP Area O&G
Off-Shore
On-Road Mobile
Off-Road Mobile
Road Dust
Fugitive Dust
WB Dust
WRAP TSS - 10/25/2007

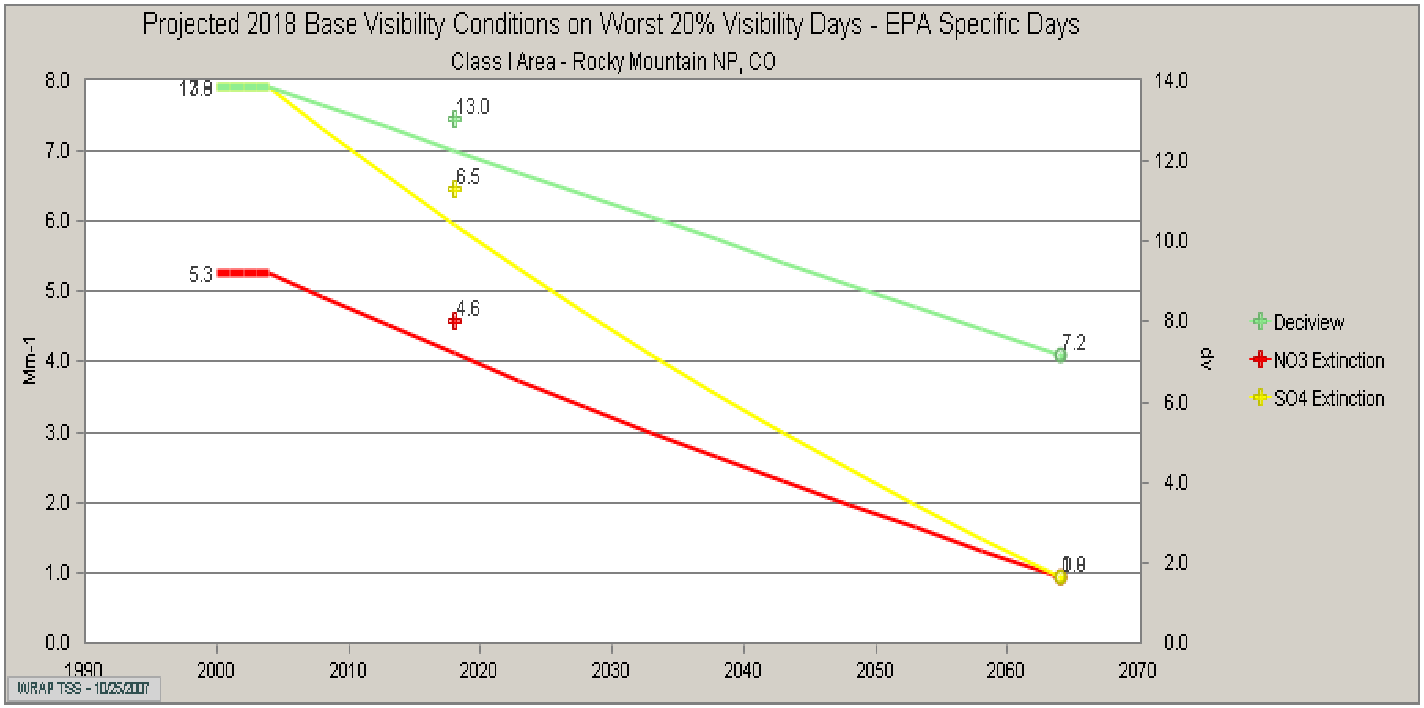

Elemental Carbon Emissions by State
Tons/Year
48,000
44,000
40,000
36,000
32,000
28,000
24,000
20,000
16,000
12,000
8,000
4,000
AZ - Plan02c
AZ - Base18b
CA - Plan02c
CA - Base18b
CO - Plan02c
CO - Base18b
ID - Plan02c
ID - Base18b
KS - Plan02c
KS - Base18b
NE - Plan02c
NE - Base18b
OR - Plan02c
OR - Base18b
UT - Plan02c
UT - Base18b
WY - Plan02c
WY - Base18b
WB Dust
Fugitive Dust
Road Dust
Off-Road Mobile
On-Road Mobile
Off-Shore
WRAP Area O&G
Area
Biogenic
Natural Fire
Anthro Fire
Point
WRAP TSS - 10/25/2007

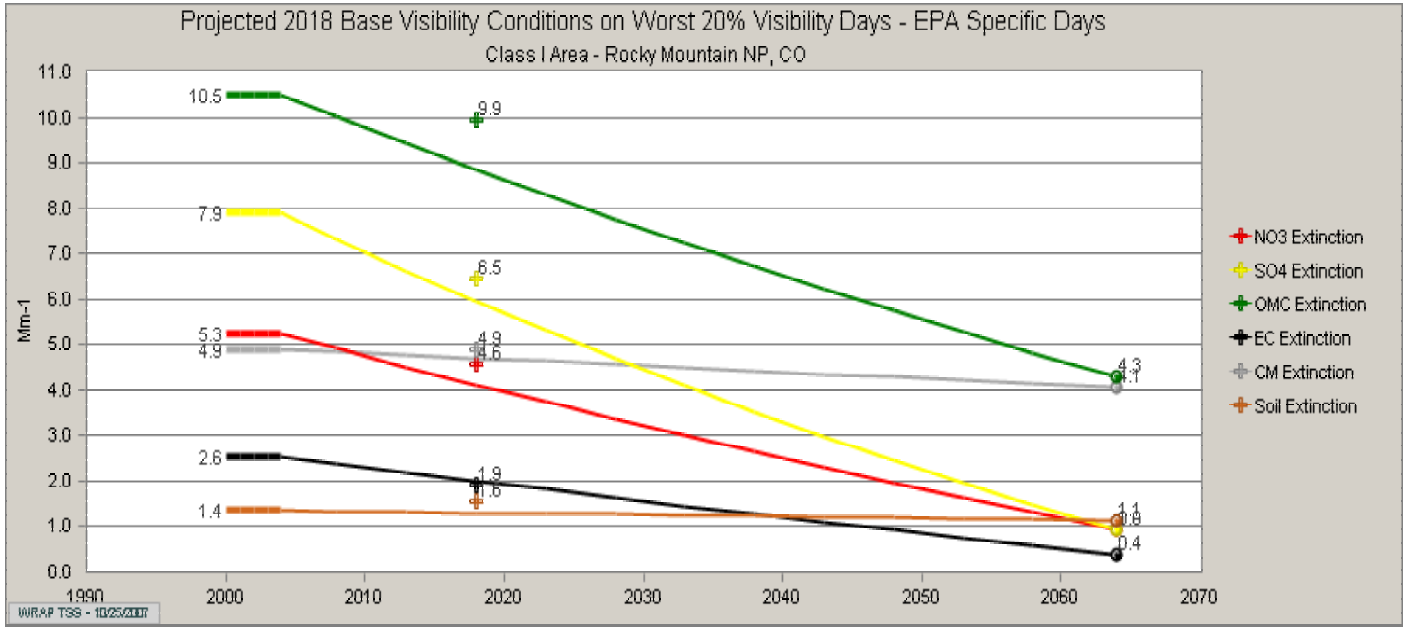

Fine Particulate Matter Emissions by State
Tons/Year
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
AZ - Plan02c
AZ - Base18b
CA - Plan02c
CA - Base18b
CO - Plan02c
CO - Base18b
KS - Plan02c
KS - Base18b
NE - Plan02c
NE - Base18b
UT - Plan02c
UT - Base18b
WY - Plan02c
WY - Base18b
WB Dust
Fugitive Dust
Road Dust
Off-Road Mobile
On-Road Mobile
Off-Shore
WRAP Area O&G
Area
Biogenic
Natural Fire
Anthro Fire
Point
WRAP TSS - 10/25/2007

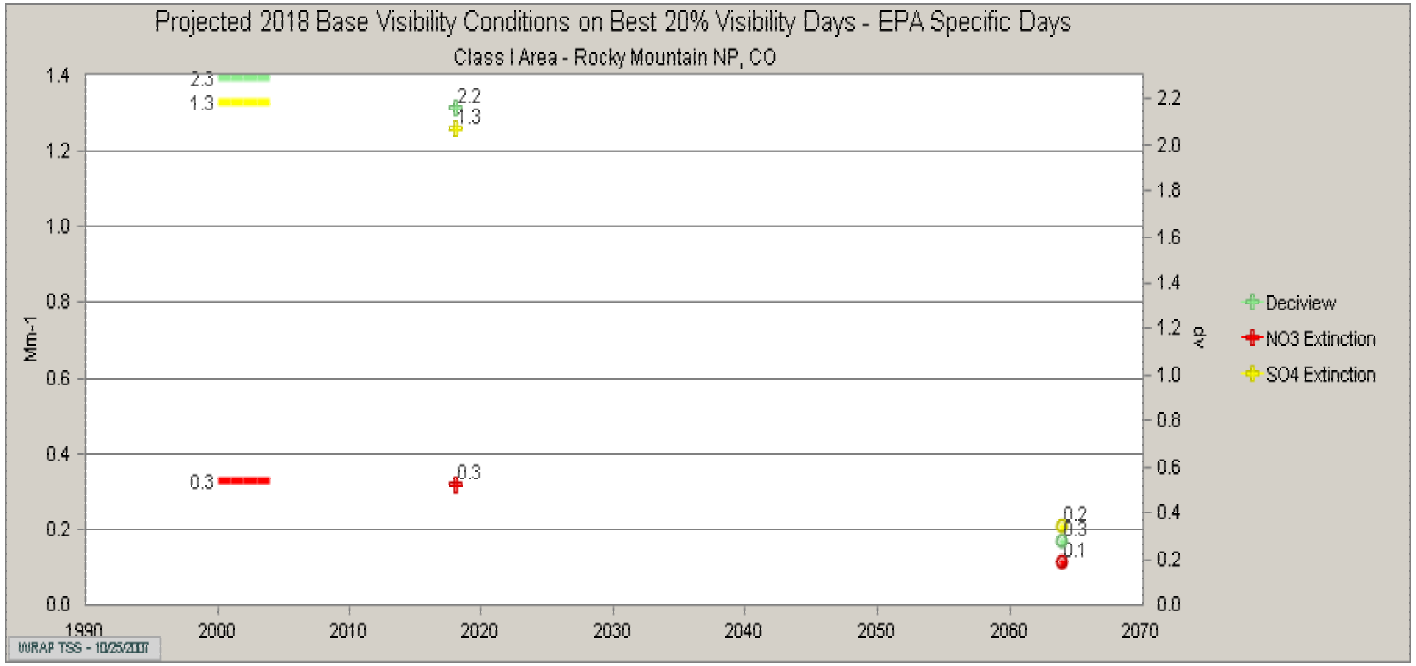

Coarse Particulate Matter Emissions by State
Tons/Year
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
AZ - Plan02c
AZ - Base18b
CA - Plan02c
CA - Base18b
CO - Plan02c
CO - Base18b
KS - Plan02c
KS - Base18b
MT - Plan02c
MT - Base18b
NE - Plan02c
NE - Base18b
UT - Plan02c
UT - Base18b
WY - Plan02c
WY - Base18b
WB Dust
Fugitive Dust
Road Dust
Off-Road Mobile
On-Road Mobile
Off-Shore
WRAP Area O&G
Area
Biogenic
Natural Fire
Anthro Fire
Point
WRAP TSS - 10/25/2007

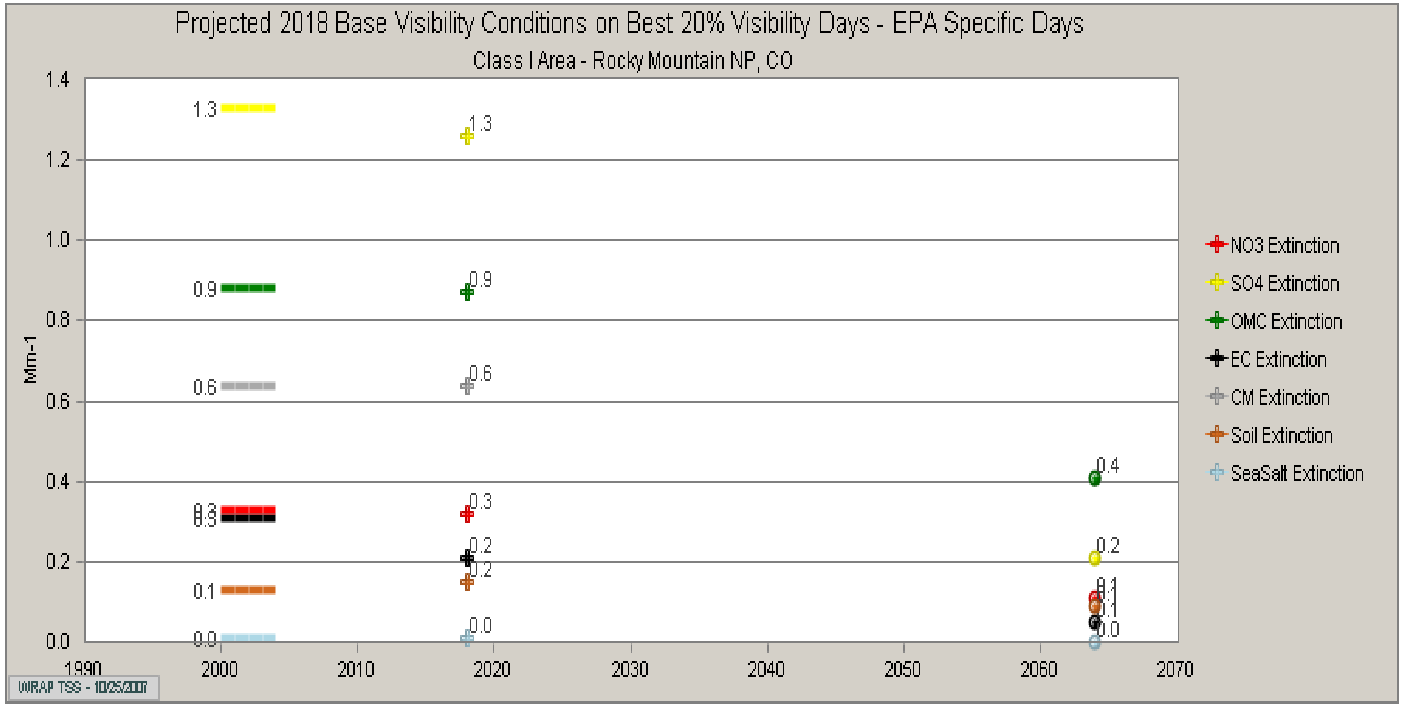
h. How much visibility change is predicted in regional modeling and 2018 visibility projections based on on-the-books controls summarized next (see [*file posted on WRAP website*] for detailed description of emissions inputs to modeling scenarios)

- Smoke Management Programs accounted for using Emissions Reduction Techniques applied to 2000-04 average Fire emissions
- New permits and state/EPA consent agreements since 2002 reviewed with each state
- Ozone and PM2.5 SIPs (California)
- State Oil and Gas Emissions control programs
- Mobile sources
    - Heavy Duty Diesel (2007) Engine Standard
    - Tier 2 Tailpipe
    - Large Spark Ignition and Recreational Vehicle Rule
    - Nonroad Diesel Rule
- Combustion Turbine and Industrial Boiler/Process Heater/RICE MACT
- VOC 2-, 4-, 7-, and 10-year MACT Standards
- Known BART (CO, UT, ND, OR [Boardman] – to date)
- Presumptive SO2 BART for rest of WRAP region

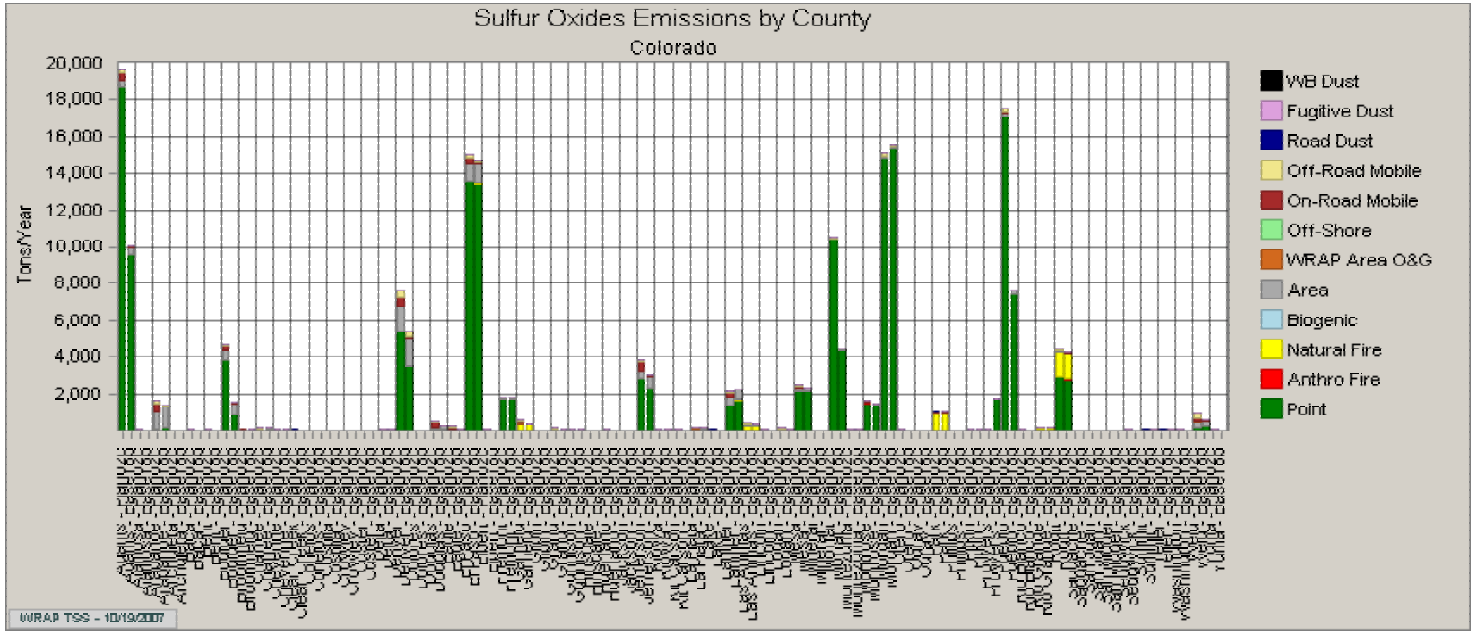


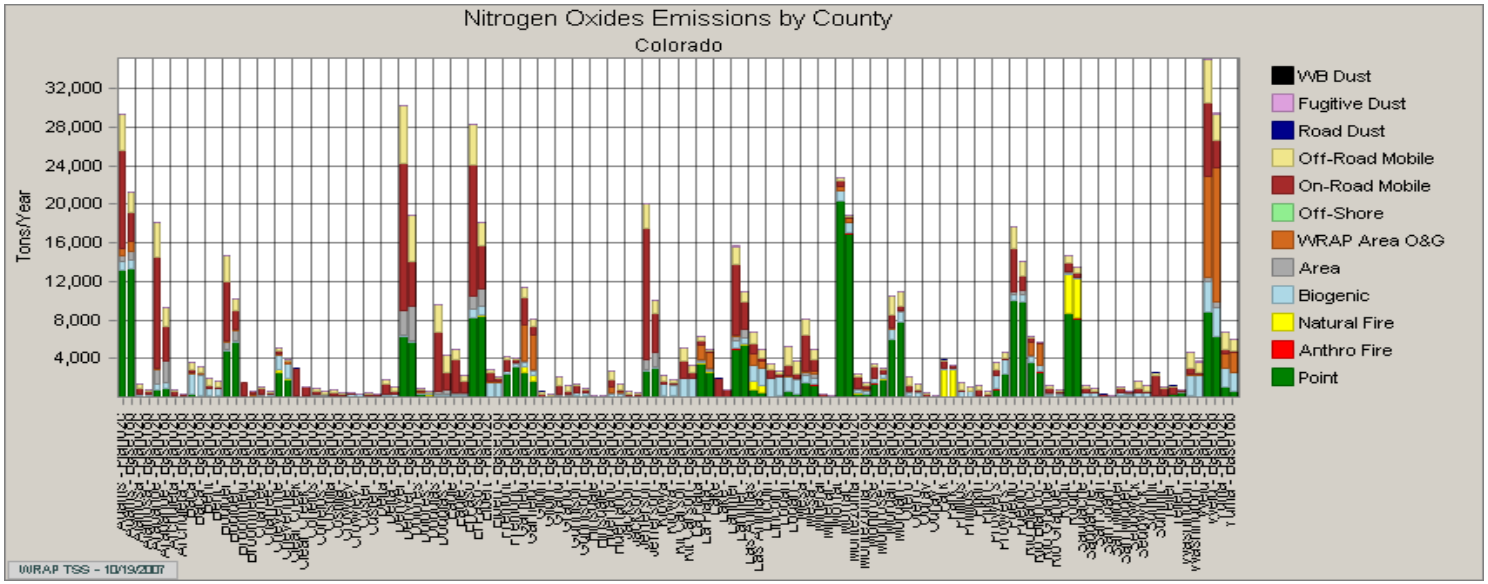

Projected 2018 Base Visibility Conditions on Worst 20% Visibility Days - EPA Specific Days
Class I Area - Rocky Mountain NP, CO
Mm-1
NO3 Extinction
SO4 Extinction
OMC Extinction
EC Extinction
CM Extinction
Soil Extinction
WRAP TSS - 10/25/2007

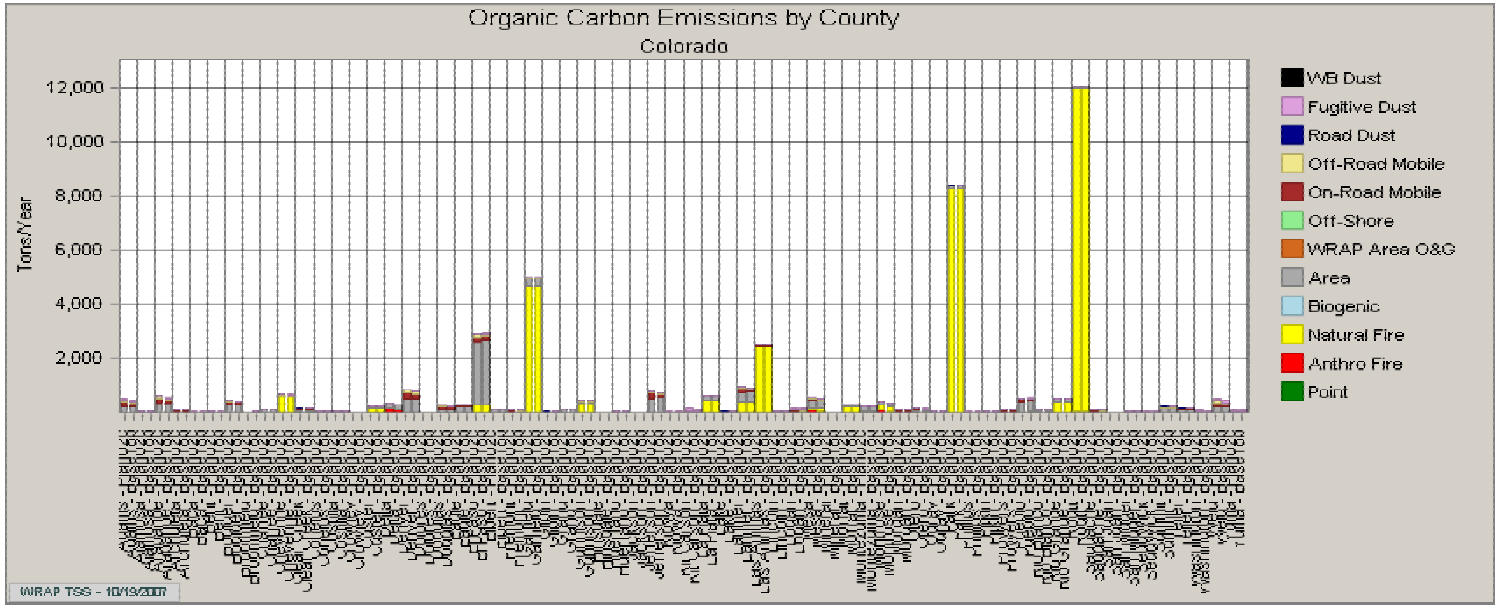

Projected 2018 Base Visibility Conditions on Best 20% Visibility Days - EPA Specific Days
Class I Area - Rocky Mountain NP, CO
Mm-1
dv
Deciview
NO3 Extinction
SO4 Extinction
WRAP TSS - 10/25/2007

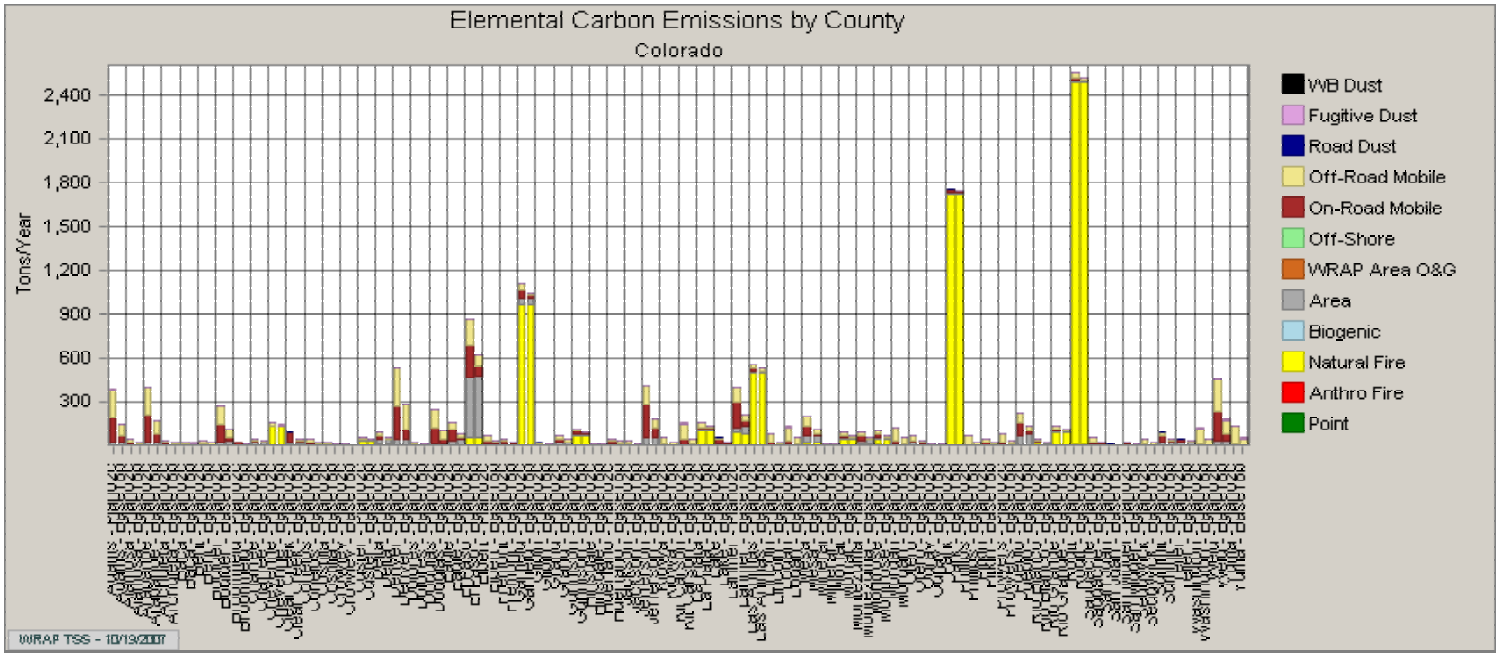

Projected 2018 Base Visibility Conditions on Best 20% Visibility Days - EPA Specific Days
Class I Area - Rocky Mountain NP, CO
Mm-1
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1990
2000
2010
2020
2030
2040
2050
2060
2070
NO3 Extinction
SO4 Extinction
OMC Extinction
EC Extinction
CM Extinction
Soil Extinction
SeaSalt Extinction
WRAP TSS - 10/25/2007

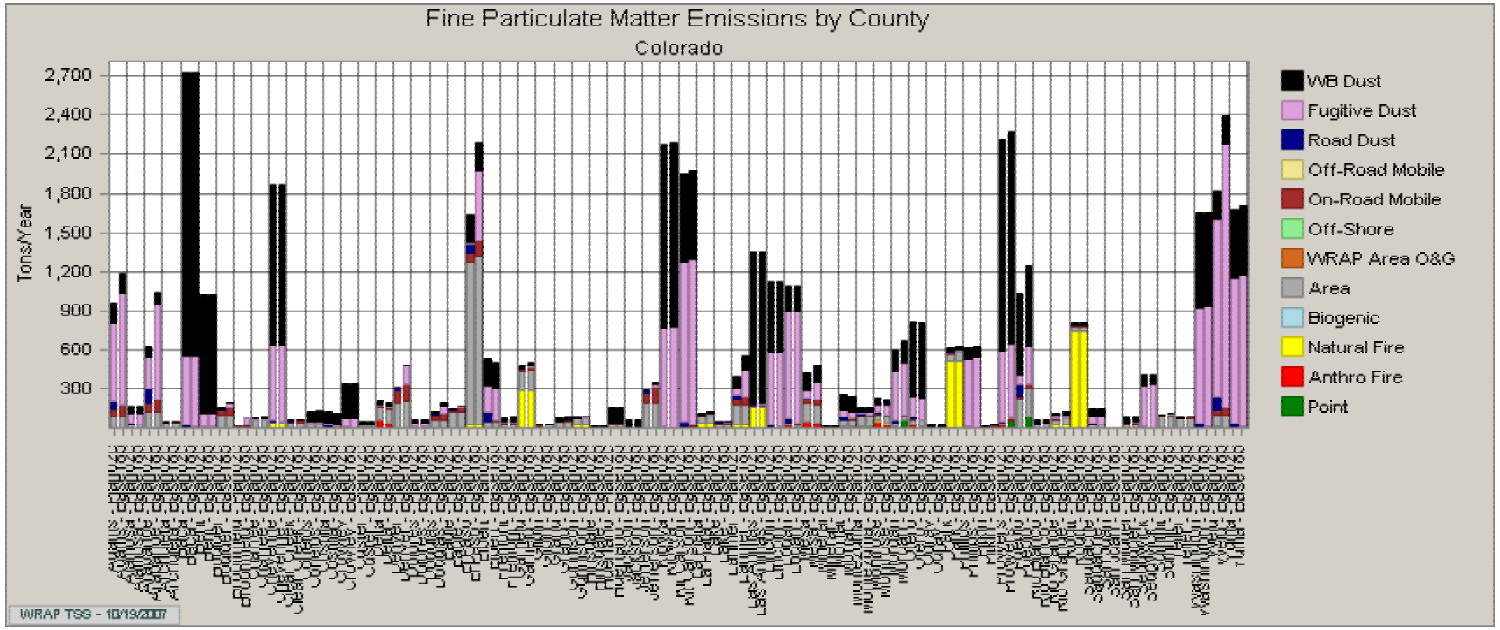
3) What are the emissions sources in Colorado, potentially affecting the Rocky Mountain National Park Class I area?

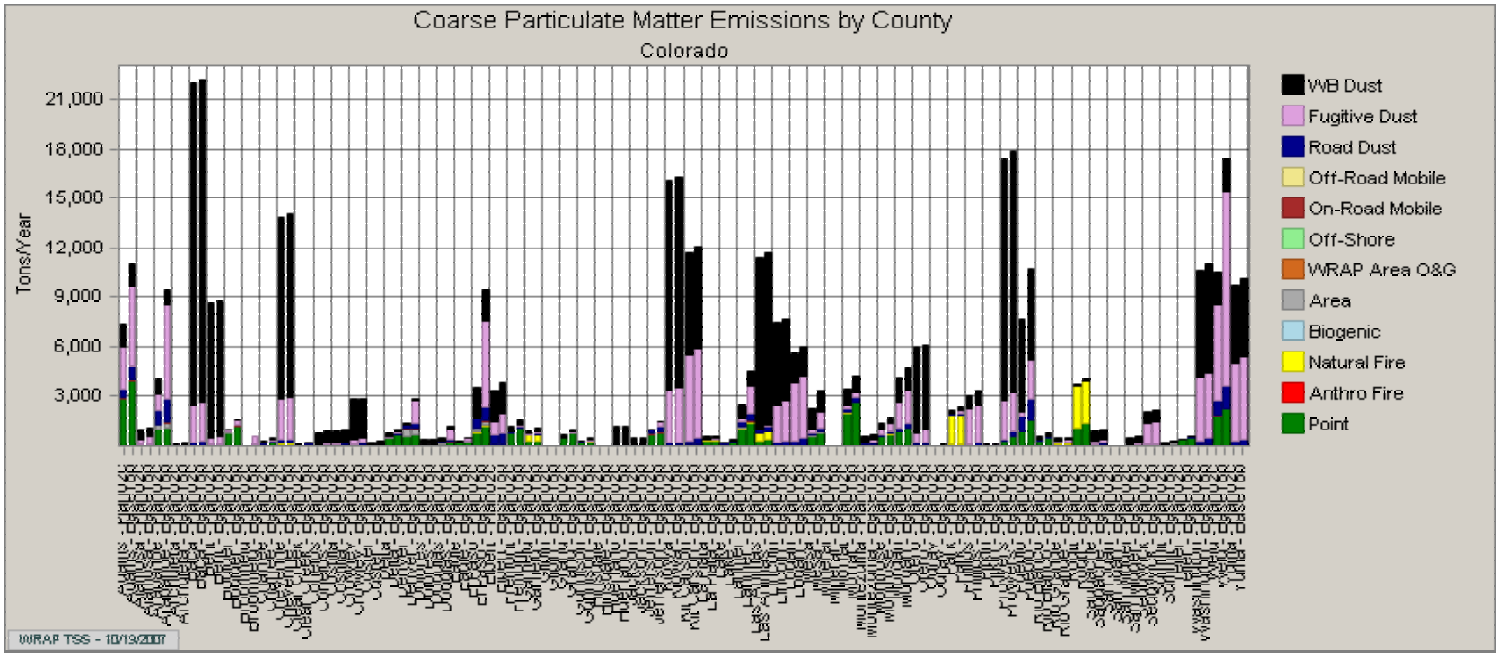



Organic Carbon Emissions by County
Colorado
Tons/Year
12,000
10,000
8,000
6,000
4,000
2,000
WB Dust
Fugitive Dust
Road Dust
Off-Road Mobile
On-Road Mobile
Off-Shore
WRAP Area O&G
Area
Biogenic
Natural Fire
Anthro Fire
Point
WRAP TSS - 10/19/2007


Elemental Carbon Emissions by County
Colorado
Tons/Year
2,400
2,100
1,800
1,500
1,200
900
600
300
WB Dust
Fugitive Dust
Road Dust
Off-Road Mobile
On-Road Mobile
Off-Shore
WRAP Area O&G
Area
Biogenic
Natural Fire
Anthro Fire
Point
WRAP TSS - 10/19/2007


Fine Particulate Matter Emissions by County
Colorado
Tons/Year
2,700
2,400
2,100
1,800
1,500
1,200
900
600
300
WB Dust
Fugitive Dust
Road Dust
Off-Road Mobile
On-Road Mobile
Off-Shore
WRAP Area O&G
Area
Biogenic
Natural Fire
Anthro Fire
Point
WRAP TSS - 10/19/2007


Coarse Particulate Matter Emissions by County
Colorado
Tons/Year
21,000
18,000
15,000
12,000
9,000
6,000
3,000
WB Dust
Fugitive Dust
Road Dust
Off-Road Mobile
On-Road Mobile
Off-Shore
WRAP Area O&G
Area
Biogenic
Natural Fire
Anthro Fire
Point
WRAP TSS - 10/19/2007