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Re-Evaluation of Montana's Air Quality Program

http://www.mdt.mt.gov/research/projects/planning/cmaq.shtml

Introduction

The purpose of this project was to refine Montana's current methods for identifying Montana Air and Congestion Initiative (MACI) program projects, to make recommendations to improve and implement the MACI program, and to keep the program oriented toward high-value investments for Montana communities. This project also evaluated the best use of Federal Congestion Mitigation and Air Quality (CMAQ) funds for each of Montana's transportation-related pollutants.

What We Did

A current picture of Montana's air pollution situation was developed by examining three key pieces of information:

1. 2009-2011 ambient air quality monitoring data for Montana sites,
2. The U.S. Environmental Protection Agency's (EPA's) designations of Montana areas with respect to the National Ambient Air Quality Standards (NAAQS), and
3. Source apportionment studies from the Montana areas with potential fine particulate nonattainment problems to identify the sources that have contributed to winter time 24-hour average fine particulate concentrations. This provided important information about which areas in Montana have unhealthful air quality levels and whether transportation sources are important contributors in any air pollution problem areas.

The major tasks in this research project included:

- Review CMAQ program past practices in Montana and acknowledge the potential changes under MAP-21 legislation.
- Review CMAQ Program Federal funding practices and how these guidelines affect Montana – plus the changes that may be coming via the MAP-21 program.
- Perform a risk assessment to identify which Montana communities have the greatest risk of health effects associated with current criteria air pollutant (CAP) exposure and to identify Montana areas prone to future transportation-related issues.
- Identify emission reductions that are potentially achievable by different types of CMAQ measures. Then, these estimates along with the estimated contributions of transportation sources in each Montana area of interest were used to compute county-specific emissions reduction potentials of CMAQ measures in Montana.
- The above analyses were used to identify priority CMAQ measures that are most worthwhile for Montana areas to adopt.
- Based on prioritization, a set of emission quantification spreadsheet tools were developed for the Montana Department of Transportation (MDT) to estimate the emission reductions associated with priority CMAQ projects.

What We Found

Table 1. Montana Ambient Air Quality Data for Criteria Pollutants with Respect to Ambient Standards 2009-2011

Pollutant	Averaging Time	Form	Level	Montana Area Values Above/Near the NAAQS
PM_{10}	24-hour Annual	1 ExEx over 3 years Mean 3 Year average	150 µg/m^3 50 µg/m^3	None None
$PM_{2.5}$	24-hour Annual	98th percentile 3 year average Mean – 3 year average	35 µg/m^3 12 µg/m^3	Lewis and Clark (45), Silver Bow (39) Lincoln (12), Silver Bow (12)
SO_2	1-hour	99th percentile 3 year average	75 ppb	Yellowstone (79)
Ozone	8-hour	4th high daily max 3 year average	75 ppb	None
CO	1-hour 8-hour	1 ExEx 1 ExEx	35 ppm (23)* 9 ppm	None None

Source: EPA 2012

*MAAQS
ExEx= Expected Exceedance

At project initiation, the three most recent years of ambient air quality data (2009-2011) for Montana monitoring sites were reviewed and compared with existing Federal and State ambient air quality data standards. This analysis is summarized in Table 1. This table shows that particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}), ozone, and carbon monoxide (CO), in Montana have measured air quality concentrations below the ambient standards. This is a distinctly different picture than Montana faced when the Federal CMAQ program began, and Montana had three CO nonattainment areas and ten PM_{10} nonattainment areas. Based on 2009-2011 data, Lewis and Clark County and Silver Bow County particulate matter with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) monitors show potential exceedances of the 24-hour average $PM_{2.5}$ NAAQS. EPA recently lowered the level of the annual average $PM_{2.5}$ NAAQS to 12 micrograms per cubic meter (µg/m^3) from 15 µg/m^3, and there are monitors in both Lincoln and Silver Bow Counties with annual mean values for 2009-2011 that are very close to this standard. The process of making final designations of $PM_{2.5}$ nonattainment areas for the revised $PM_{2.5}$ NAAQS takes about two years, so the designations will likely become effective in 2015.

While Table 1 indicates Yellowstone County has sulfur dioxide (SO_2) concentrations above the 1-hour SO_2 ambient standard, the transportation contribution to SO_2 in that area is insignificant.

With recent air quality monitoring showing that $PM_{2.5}$ is likely to be the most important criteria pollutant in Montana in the next air pollution planning horizon, recent Montana source apportionment studies were evaluated. This information – for the transportation-related sources – is summarized in Table 2. The information in Table 2 is from wintertime chemical mass balance (CMB) studies performed in 2007 and 2008. The street sand component represents contributions from re-entrained road dust. Table 2 shows that transportation sources contribute 10 percent or less to the $PM_{2.5}$ mass in the areas. This suggests that funding projects to reduce transportation source emissions in these areas will provide limited air quality improvement.

An air pollution community risk analysis was performed using current air quality readings for each Montana area (county), an indicator of the relative risk of exposure to concentrations of each pollutant and their populations. Table 3 summarizes the results of this community risk analysis. The normalized community risk values in Table 3 can be used by MDT to determine which areas of the state are likely to benefit the most by investments which reduce transportation source emissions that contribute to observed air quality concentrations in the state.

Table 2. Transportation Related Source Contributions to $PM_{2.5}$ Mass

Transportation-Related Sources	Libby	Belgrade	Butte	Hamilton	Helena	Kalispell	Missoula
Street Sand	0.2%	4.0%	3.0%	0.9%	3.3%	1.9%	0.9%
Automobiles	4.5	2.0	3.7	0	2.2	0.8	0.0
Diesel	5.3	0.4	0.2	0	0.3	7.2	5.2
Total	***10.0***	***6.4***	***6.9***	***0.9***	***5.8***	***9.9***	***6.1***

Source: Ward 2007, 2008 (a-d), and 2009

In addition, the CMAQ projects and measures that provide the greatest emission reduction/air quality improvement potential in Montana communities were identified. This analysis examined both the emission reduction potential of individual strategies as well as the current transportation source emissions in Montana areas. The analysis was used to identify top priority CMAQ measures for which emission reductions and cost effectiveness tools were developed.

Table 3. Montana Counties and Normalized Risk Index Values

County	Normalized Community Risk
Missoula	1.00
Flathead	0.83
Gallatin	0.68
Lewis and Clark	0.68
Yellowstone	0.68
Cascade	0.37
Silver Bow	0.31
Ravalli	0.25
Lake	0.18
Lincoln	0.15
Rosebud	0.11
Sanders	0.05

A set of emission quantification spreadsheet tools were developed to estimate the emission reductions associated with CMAQ project types. The tool categories developed include:

- Traffic flow improvements projects;
- Street sweeping and flush truck purchases;
- Road paving programs; and
- Vehicle miles traveled and trip reduction projects.

In addition, a separate spreadsheet tool was developed to allow users to estimate the cost effectiveness of these project types using the tool-estimated emission reductions.

What the Researchers Recommend

Based on the findings of this research, the following recommendations are offered to MDT:

- **Concentrate MACI discretionary funding in high-risk areas, based on Montana Department of Environmental Quality (DEQ) requisites.** The normalized community risk values can be used by MDT to determine which areas of the state are likely to benefit the most by investments which reduce transportation source emissions that contribute to observed air quality concentrations in the state.

- **Continue efficient equipment purchase programs.** Continue to purchase street sweepers and other air quality equipment to replace current equipment in areas where this equipment has been effective in bringing PM_{10} concentrations below the NAAQS. Program expansion is not warranted given CMB study findings of sand/salt contributions to $PM_{2.5}$ measurements and street sweeping is not likely to be an effective $PM_{2.5}$ emission reduction option.

- **Invest in congestion management options that achieve significant improvements in average speed (> 10 mph).** Traffic flow/ intersection channelization improvements will likely achieve the highest emission reductions. Use of operational strategies provides a toolbox of alternatives that can be implemented to mitigate growing congestion. The benefits of successful operational strategies are multiple – faster, more reliable trips, improved safety, and reduced environmental impacts. Traditional arterial signal systems operate with fixed timings based upon expected volumes during certain portions of the day. Adaptive signal control technologies can adjust to handle varying traffic conditions that may differ from fixed-time operations to improve traffic flow.

- **Consider more than just air quality benefits when evaluating CMAQ-eligible projects.** Based on Montana's nonattainment areas and what this study found about the culpable sources for nonattainment, on-road vehicle control strategies would be expected to provide limited air quality benefits in Montana areas. The focus of CMAQ funding should be on measures that help maintain attainment status in the areas/pollutants where transportation sources are most important. While air pollution emission reductions are an important attribute of CMAQ funding decisions for Montana, the lack of any strong transportation influence on existing or expected future Montana nonattainment problems means that MDT will want to also consider variables other than air quality impact when selecting projects for CMAQ funding.

- **Use the tools developed to estimate benefits of CMAQ-eligible projects.** Project deliverables include descriptions of methods and tools (in MS Excel) that allow MDT to estimate the emission reductions and cost effectiveness of CMAQ/ MACI measures and projects. These tools use EPA's latest guidance (AP-42) and the latest approved emission factor model (MOVES 2010b) to calculate the potential emission reductions from proposed projects. As new MOVES model versions are released by EPA, consider updating emission rates in the tools.

- **Take advantage of opportunities to use CMAQ funds in conjunction**

with other transportation spending programs. States may choose to transfer a limited portion of their CMAQ apportionment to some of the other Federal-aid highway programs, such as the Surface Transportation Program, National Highway System, Highway Bridge Program, Interstate Maintenance, Recreational Trails Program, and the Highway Safety Improvement Program. Montana may transfer CMAQ funds up to 50 percent of the amount of the state's annual apportionment, minus the amount Montana would have received if total CMAQ funding were $1.35 billion.

- **Consider providing outreach/ training to Montana staff and stakeholders in using the emission reduction and cost effectiveness tools developed for this research project.** While the methods descriptions and associated spreadsheets are designed to be user friendly, there may be value in providing some training to new users of these materials, along with user support in order to ensure that the tools are being used correctly by staff. It is expected that MDT will use the results of the project evaluations prepared using these tools to provide information about expected emission reductions and project cost effectiveness to the FHWA CMAQ database.
- **Review MAP-21 guidance document when it becomes available to determine how FHWA wants to implement the CMAQ program under MAP-21 legislation.** MAP-21 calls for a state that has $PM_{2.5}$ nonattainment and maintenance areas to use a portion of its CMAQ funds for projects that reduce $PM_{2.5}$ in such areas. Diesel retrofits are highlighted in MAP-21 as eligible to effect such mitigation. Further information about this will be provided in the future. However, diesel retrofits are unlikely to produce much $PM_{2.5}$ air quality improvement in Montana's $PM_{2.5}$ nonattainment areas – as shown by CMB analyses.

As written, it appears that MAP-21 may force Montana to spend significant amounts of its future CMAQ funds for diesel retrofits in the Libby $PM_{2.5}$ nonattainment area. The most recent (2007-2008) CMB modeling that was performed for Libby indicates that diesels contribute about 5 percent of the total wintertime $PM_{2.5}$ mass in the nonattainment area. This CMB estimate is consistent with recent emission summaries for the area. Therefore, it is recommended that MDT work with the FHWA to invest as little funding as possible for diesel retrofits in Libby. Another option is to work in cooperation with the Montana DEQ to get $PM_{2.5}$ concentrations in Libby below the NAAQS and to have this nonattainment area redesignated to attainment.

References

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Ward 2009: T.J. Ward. "The Kalispell, Montana $PM_{2.5}$ Source Apportionment Research Study," Final Report, The University of Montana, Missoula, MT, August 31, 2009.

For More Details . . .

The research is documented in Report FHWA/MT-13-004/Re-evaluation of Montana's Air Quality Program.

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MDT Implementation Status
August 2013

The technical panel and Planning Division staff met June 2013 to discuss the results and recommendations of this research project. Responses to project recommendations are documented in an implementation report available on the project website at: http://www.mdt.mt.gov/research/projects/planning/cmaq.shtml

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