



Regional Modeling for Stationary Source Control Strategy Evaluation

Stationary Sources Joint Forum Meeting

September 7-8, 2005

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Presentation Topics

- **Purpose is to gather input on regional modeling approach & analysis steps**
- **Review selected materials from Evaluation of the CALPUFF Chemistry Algorithms, A&WMA Annual Meeting, June 21-25, 2005, R. Morris, S. Lau & B. Koo, ENVIRON International Corp.**
- **Using Regional Modeling tools for source-specific modeling**
- **Suggest process and timing for preparation and completion of Regional Modeling Protocol by the WRAP Regional Modeling Center**

Potential Roles for WRAP

Regional Grid Modeling

- Estimate 2018 base base visibility (late 2005)
- Estimate the net effect of strategies contained in haze SIPs/TIPs
- Evaluate effectiveness of strategies for stationary (and other) sources
- Demonstrate that an alternative to BART is better than BART

Potential Roles for WRAP

Regional Grid Modeling

- Provide source-specific visibility benefit information to ...
 - Determine appropriate BART benchmark for use in an alternative program
 - Determine BART
- For states using or requiring CALPUFF to determine BART, the WRAP can ...
 - Provide meteorological data sets
 - Provide additional guidance on use of CALPUFF
 - Provide forum for coordinating state analyses

Basic Idea of Source-Specific Modeling

Visibility Improvements Predicted to Result from SO₂ and NO_x Reductions at Facility X.

State	Class I Area	Base Case	Control Case			
			1	2	3	
			Number of Days > 0.5 dv			
UT	Area 1					
	Area 2					
AZ	Area 3					
	Area 4					
			Improvement in 98th Percentile (dv)			
UT	Area 1					
	Area 2					
AZ	Area 3					
	Area 4					
			Improvement Averaged Across 20% Worst Days (dv)			Improvement Needed to Meet UROP (dv)
UT	Area 1					
	Area 2					
AZ	Area 3					
	Area 4					

Challenges with BART/CALPUFF

- BART is a blunt instrument applied in isolation of ...
 - Non-eligible sources
 - Other source categories
 - Natural contributions of smoke and dust
 - Emission trends
- CALPUFF is a “threshold model” used to determine if a new/modified source would consume available increments for primary pollutant or exceed AQRV thresholds

Challenges with BART/CALPUFF

- **EPA 2001 draft “Guidance for Demonstrating Attainment of the Air Quality Goals for PM_{2.5} and Regional Haze”:**
 - **“States should use a regional scale photochemical grid model to estimate the effects if a control strategy on secondary components of PM. Changes in primary components may be estimated using a numerical grid model (with no chemistry), a Lagrangian model, or in some cases a receptor model” (EPA, 2001, pg. 169)**
 - **CALPUFF is a Lagrangian puff model that EPA FP modeling explicitly states should not be used for SO₄ and NO₃ impacts**

Challenges with BART/CALPUFF

- Can you evaluate CALPUFF chemistry using real-world data?
- **Extensive PM measurement networks across US that measure real-world SO₄ and NO₃**
 - **IMPROVE, CASTNet, STN, SEARCH**
- **CALPUFF typically applied to one or small group of sources – inconsistent with measurements that are due to all sources**
 - **Running CALPUFF with all sources become computationally prohibitive or must perform extensive source combination**

Challenges with BART/CALPUFF

- SO_4 and NO_3 formation chemistry out of date, inaccurate
 - Developed in 1983; overly simplistic; chemistry not suitable for ambient conditions less than 50° F
 - Neglects major variables and processes
- Greatly overstates SO_4 and NO_3 in winter
 - Overestimates visibility impacts by 100-1000% in many cases
- Understates SO_4 in summer, overstates NO_3
- NO_3 particularly inaccurate, overstated and unreliable
- Model not recommended for sources within 50 km or greater than 400 km from Class I areas

BART-Eligible Source Identified in Draft ERG Report with 50 km Radii



Using Regional Modeling Tools for Source-Specific Impact Analysis

- **Emissions are tracked from stack, but gridded to 36 km² or 12 km²**
- **Receptor is grid cell covering Class I area monitor site**
 - **Provides better estimate of the modeled impact of chemical species' amounts from a BART source, as fraction of the total impairment measured, than does CALPUFF**
 - **Does not generate isopleths of variation of impact at the same level of resolution as CALPUFF**
- **Estimated change in visibility from BART controls likely to be less in Regional Model than from CALPUFF**

Planning Emissions and Modeling Analyses for the “Don’t CAIR” region

- **First, need to think through questions that need to be answered**
- **Need information about agencies’ plans**
- **Need to compile sufficiently complete information and/or agreement from regulatory agencies considering the use of the “source-specific BART” analysis approach**
 - **About estimates of emissions reductions**
 - **About [any] results from state or source CALPUFF modeling**
 - **Need information by end of 2005**
- **Agencies considering the use of the “reasonable progress” option allows Regional Modeling Center to apply regional model to BART and other point sources**

Potential Process for Regional Modeling Protocol

- **Compile 2018 BART source likely emissions reductions data – 9-12/05**
- **Compile source-specific BART modeling input data – 9-12/05**
- **Same time – compile into master spreadsheet of individual BART sources**
 - Emissions (projected 2018 base case and PTE)
 - Expected emissions reductions beyond current controls
 - Other supporting data
- **Run “zero-out” simulations of NH₃ and VOC at BART sources using tagged emissions in regional model – late 2005**
- **When spreadsheet complete as possible, compile regional “BART emissions reductions” EI scenarios and tag those emissions in model to estimate visibility changes**
- **Conduct other regional analyses of SO₂ Annex (expansion), other alternative programs, etc.**

Concept Table for Data* needed for Regional BART & Better Than BART Analyses

Source	2018 NO _x Emissions (tons)	Permitted PTE NO _x Emissions (tons)	Current Control Level (%)	Likely Emissions Reductions from applying Advanced Combustion Controls (%)	Likely Emissions Reductions from applying Presumptive Limits (%)	BART Emissions Reductions (%)
BART Source 1						
BART Source 2						
BART Source 3						
Source...n						

* - This example for NO_x, would also have similar table for SO₂

Comments/questions/next steps?