

Development of Improved PM Emission Estimates and Dispersion Model Performance for Surface Mines

Bill Monnett

McVehil-Monnett Associates, Inc.

Englewood, Colorado

- The Problem -
 - model predictions \neq monitored concentrations
- The Potential “Fix”
 - Proposal from McVehil-Monnett Associates (MMA) and the Midwest Research Institute (MRI) to the National Mining Association (NMA) to Conduct Fugitive Dust Model Validation/Improvement Studies

THE “PROBLEM”

- “...for purposes of new source review or for purposes of demonstrating compliance with national ambient air quality standards for particulate matter applicable to periods of 24 hours or less, the Administrator shall analyze the accuracy of such model and emission factors and make revisions as may be necessary to eliminate any significant over-prediction of air quality effect of fugitive particulate emissions from such sources.”¹
 - Review of Surface Coal Mining Emission Factors - EPA 454/R-95-007
 - Development of A Plan For A Surface Coal Mine Study - EPA 454/R-95-008
 - Surface Coal Mine Plan - EPA 454/R-95-009
 - Surface Coal Mine Emission Factor Field Study - EPA 454/R-95-010
 - Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase I - EPA 454/R-94-024
 - Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase II Model Evaluation Protocol - EPA 454/R-94-025
 - Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase III Evaluating Model Performance- EPA 454/R-96-002

¹CAAA Section 234, 1990

THE “PROBLEM”

- “... In spite of the improved performance, however, at this time the model does not meet the evaluation criteria that we, the industry, and the State of Wyoming had jointly agreed to. There is still a tendency for overprediction of air concentrations for particulate matter less than 10 micrometers (PM10)....”²
- “.. The causes of the overprediction for this particular class of sources are as yet undetermined....”²

²Letter to Senator Simpson from John Seitz, Director OAQPS - 6/26/96

THE “PROBLEM” (Continued)

- Model over-prediction poses major obstacle to permitting mine assets!
 - Magnitude of short-term concentration predictions simply not seen in real world sampling.
- EPA’s Guideline on Air Quality Models (GACM) provides little, if any guidance.
- Revised ambient standards will accentuate modeling issues.
- In absence of Federal guidance, states free to model as they please
 - high degree of variability from state to state. Examples:
 - Wyoming
 - Nevada
 - New Mexico
 - South Carolina
 - Colorado
 - Montana
 - California
 - Alaska

Revisions to PM Ambient Standards

- October 17, 2006 EPA published revised PM Ambient Standards
 - PM_{10} retained 24 hr. standard of $150 \mu\text{g}/\text{m}^3$ in lieu of PM_{coarse} eliminated annual standard of $50 \mu\text{g}/\text{m}^3$
 - $PM_{2.5}$ revised 1996 24 hr. standard to $35 \mu\text{g}/\text{m}^3$ retained 1996 annual standard of $15 \mu\text{g}/\text{m}^3$
 - PM_{coarse} future standards for PM between 2.5 and $10 \mu\text{m}$ likely

Revisions to PM Ambient Standards

- Revised and retained PM_{2.5} and PM₁₀ and potential for future PM_{coarse} standards all remain of critical importance to the mining community
- Effect and timing of PM_{2.5} implementation is yet to be determined
- Retained 24 hr. PM₁₀ standard remains critical issue for mine development
- Effect of elimination of annual PM₁₀ standard in state permitting unclear

Emission Factors

- TSP and PM₁₅ emission factors have been developed and published beginning in the late 1970s and early 1980s
- PM₁₀ and PM_{2.5} factors have been published using a multiplier of TSP or PM₁₅
- Review of current AP-42 emission factors reveal factors for all mining operations only exist for TSP

Shortcomings specific to AP-42 Section 11.9 on Western Surface Coal Mining

- “Newest” measurements date from 1992 (Section 234)
- No other data newer than 1980, but
 - haul trucks have much larger capacity
 - draglines have become prevalent
 - PM standards reference different size basis

Shortcomings specific to Section 11.9 (cont'd)

- No measurements (other than 234 study) directly reference PM_{10}
- No measurements directly reference $PM_{2.5}$
- Most factors based on UW-DW: What are implications if we know modeling is inaccurate?
- Cannot independently verify EF equations from earlier PEDCo/MRI studies
- No formal background document ever prepared

Emission Factors

- What was true for PM_{10} in 1992 is even more critically important for $PM_{2.5}$ now
- $PM_{2.5}$ emission factors simply do not exist for most operations at surface mines
- Any $PM_{2.5}$ emission inventory at any surface mine -- coal or not -- requires very gross assumptions be made.

Dispersion Models

- In spite of Section 234 findings, some states require short-term modeling of fugitive emissions for permitting
- Models have changed – Section 234 study done with ISCST and the current EPA recommended model is AERMOD
- No further EPA-sponsored work on coal emission factors or short-term modeling accuracy since 1995

Summary

Emission Factors --

- “Newest” data over 15 years old
- Limited applicability for PM_{10}
- $PM_{2.5}$ data virtually non-existent
- “Newest” data not incorporated into AP-42

Summary (cont'd)

Dispersion Models –

- Short-term modeling shown to be inaccurate for at least PM_{10} (and almost assuredly for $PM_{2.5}$ as well)
- Models provide incorrect physical representation of most dust sources
- Models can't simulate plume depletion mechanisms
- Revision is drawn-out process requiring extensive review

Summary (cont'd)

EPA –

- Replaced ISC with AERMOD, but has not followed through on Section 234 studies
- No EPA-sponsored work on coal emission factors or short-term modeling accuracy since 1995
- Section 234 information not incorporated into AP-42 or modeling guidance

Proposal Overview

- Not a start from scratch proposal - build on work from 234 study
- Not contemplating the development of totally new dispersion models because of the time it traditionally takes for EPA review and approval

Proposal Overview

- Phased Project Design
 - 1) Detailed Project Design (in collaboration with industry representatives)
 - 2) Emission and Ambient Monitoring
 - 3) Data Analysis; Determination of Emission Factors and Development of Modeling Requirements and Methods
 - 4) Model Testing and Validation
 - 5) Documentation of Model Accuracy and Final Report