for Wyoming Mining Association

P.O. Box 866
Cheyenne, WY 82007

Draft "White Paper"
Status of CAAA Section 234
Regulatory and Technical Issues Update

May 2011
2390-10

by McVehil-Monnett Associates, Inc.

44 Inverness Drive East, Building C
Englewood, CO 80112
(303) 790-1332

Table of Contents

List of Figures

List of Tables

List of Appendices

1.0 Introduction

McVehil-Monnett Associates, Inc. (MMA) has prepared this update on the status of Section 234 of the 1990 Clean Air Act Amendments (CAAA) under contract to the Wyoming Mining Association (WMA). The scope of the effort was also developed with cooperation from the Air Quality Division of the Wyoming Department of Environmental Quality (AQD).

CAAA Section 234 recognized that as of 1990, the U.S. Environmental Protection Agency (EPA) lacked adequate air quality modeling tools to accurately predict short-term concentrations of particulate matter (PM_{10}) from surface coal mines. Provisions of the section required EPA to make revisions to the tools available at the time (specifically the Industrial Source Complex (ISC) model and emission factors found in AP-42) such that significant over-prediction was eliminated, prior to requiring states to use such tools. U.S. EPA was given three (3) years from the date of the enactment of the amendments to make such revisions. Until EPA made such demonstrations, provision of the section gave states the option of employing empirically based modeling approaches. See details in Section 2.0 of this report.

Because nearly 21 years have passed since the passage of the 1990 amendments, some have suggested that the provisions in Section 234 are no longer valid. Those arguments have made note that the principal EPA air quality model of 1990, ISC, has been replaced by a newer model, AERMOD, and that this newer model must have, in some ways, eliminated the significant over-prediction biases found in ISC. Unfortunately, as described in detail in the following sections of this report, U.S. EPA's efforts to improve air quality modeling tools to eliminate excessive over-prediction have proved unsuccessful to this day, more than 20 years later.

In the following sections of this report, MMA provides an update and overview of several topics that relate directly to the present status of Section 234. In Section 2.0, MMA describes the provision and lists the series of EPA-sponsored studies that were an outgrowth of the legislation. Those studies culminated in a final statement from EPA in 1996 admitting that efforts to improve their modeling tools had failed the criteria established by EPA and other stakeholders and affirming EPA's belief that alternative, empirical approaches for managing air quality were appropriate moving forward. MMA also provides a recent decision from the Wyoming Supreme Court affirming the notion that the issue of model over-prediction has not been sufficiently addressed.

In Section 3.0, MMA provides a brief history of the Wyoming State Implementation Plan (SIP) as it relates to management of air resources in the Powder River Basin (PRB) as affected by surface coal mines. In particular, MMA focuses on the process through which Wyoming established an agreement with EPA, consistent with Section 234, for the management of air resources in the PRB. That agreement relies primarily on empirical, monitored air quality data and best available work practices at PRB coal mines.

In Section 4.0 of this report, MMA provides an account of how Wyoming further manages PRB air resources, in particular, the issue of minor source increment consumption, through the redesignation process afforded by Section 107 of the Clean Air Act.

For additional background, in Section 5.0, MMA provides an account of how the ambient particulate matter (PM) standards have evolved at the state and federal levels. A brief overview of PM trends is then provided in the following Section 6.0.

EPA's primary guidance on the application of air quality models to the management of air resources is embodied in its Guideline on Air Quality Models (GAQM). This "guideline" is actually codified in the Federal Register at 40 CFR Part 51, Appendix W. In Section 7.0, MMA tracks the policy in the GAQM specific to modeling of fugitive dust emissions, its historical reliance on the ISC model that is specifically referenced in CAAA Section 234, its ultimate conversion to reliance on the "AERMOD" model for those purposes as of 2005, and how Wyoming's continued reliance on ISC to this day is still recognized by EPA pursuant to EPA comments found in the most recent formal update of GAQM via the Federal Register.

Because the limitations identified in CAAA Section 234 specifically referenced the emission factors found in AP-42 as of 1990, in Section 8.0 MMA tracks the changes in AP-42 that have occurred with respect to surface coal mining factors subsequent to the passage of the 1990 amendments. That review shows that very few changes have been made, and that many recommendations made in the Section 234 review phase have not been completed as of this date.

Finally, in Section 9.0, MMA provides the results of a model comparison/performance study MMA conducted to assess whether the advent of AERMOD remedied the strong bias towards excessive

over-prediction found in the earlier ISC model. That comparison, done for two different sizes of hypothetical yet realistic PRB mining scenarios, shows that AERMOD has not remedied the problems identified by Congress in 1990. In fact, AERMOD predicts higher than ISC for the cases of maximum predicted concentrations that drive air quality permitting decisions.

A brief summary and conclusions are provided in Section 10.0 of this report.

Note that there is an enormous amount of information referenced in this report, ranging from Federal Register notices to EPA study results and Wyoming guidance documents. Due to the magnitude of this information, it is provided in digital format only, on an accompanying CD.

2.0 CAAA Section 234 Summary

The following section was included with the Clean Air Act Amendments of November 15, 1990:

SEC. 234. FUGITIVE DUST.
(a) Prior to any use of the Industrial Source Complex (ISC) Model using AP-42 Compilation of Air Pollutant Emission Factors to determine the effect on air quality of fugitive particulate emissions from surface coal mines, 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, under section 110 or parts C or D of title I of the Clean Air Act, 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. Such revisions shall be completed not later than 3 years after the date of enactment of the Clean Air Act Amendments of 1990. Until such time as the Administrator develops a revised model for surface mine fugitive emissions, the State may use alternative empirical based modeling approaches pursuant to guidelines issued by the Administrator.

As a result of the direction given in Section 234, EPA, the State of Wyoming and the Wyoming Mining Association participated in a study initiated in 1991, the results of which are reported in the following 7 documents[1]:

"Review of Surface Coal Mining Emission Factors" - EPA-450/R-95-007 July 1991

"Development of a Plan for a Surface Coal Mine Study" - EPA-450/R-95-008 October 1991

"Surface Coal Mine Study Plan" - EPA-450/R-95-009 March 1992

"Surface Coal Mine Emission Factor Field Study" - EPA-450/R-95-010 January 1994

"Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase I" – EPA-454/R-94-024 July 1994

"Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase II – Model Evaluation Protocol" - EPA-454/R-94-025 October 1994

"Modeling Fugitive Dust Impacts from Surface Coal Mining Operations – Phase III – Evaluating Model Performance" - EPA 454/R-96-002 December 1995

The study culminated with the final report evaluating model performance. The conclusion of the model performance evaluation is presented from the EPA Phase III document referenced above in its entirety as follows:

8.0 Summary & Conclusions

A three-step process to identify the best-performing model for predicting the impacts of particulate emissions from surface coal mines and to identify significant overprediction was described in the model evaluation protocol (EPA, 1995a). This report is the first part of this three-step process.

This report compares the performance of the Industrial Source Complex (ISC2) dispersion model with the new ISC3 model which contains improved algorithms for area sources, open pit sources, and dry deposition. Observed data include on-site meteorological data and 24-hour air quality data for TSP and PM_{10} from a nine-station network distributed in and around a surface coal mine in Wyoming's Powder River Basin. Time-resolved information about mining operations (source activity) was collected during each 24-hour monitoring period. Emission rates from all significant sources operating during the monitoring period (traffic on haul roads and equipment operations) were obtained using the existing AP-42 emission factors, new emission factors and site specific emission factors. Emissions were adjusted by the effects of mitigation measures. Eight modeling groups consisting of a combination of: a dispersion model, an emission factor, a set of source location and activity level, and geometric method for source representation for both TSP and PM_{10}. Model performance was compared using objective statistical measures. Appendix G provides a guide to the emissions and modeling data base used in this analysis.

The results of the model evaluation study show that:

1. *The improved ISC3 model with new emission factors performs better than the original ISC2 model and original factors at predicting ambient concentrations of PM_{10} and TSP from a surface coal mine.*

2. *The improved ISC3 model performed better for TSP than PM_{10}.*

3. *There are statistical differences among pairs of models. The ISC3 model with emission rates averaged by shift over the length of the study (lowest emission resolution) performed better than the others.*

4. *In spite of the improved performance of the ISC3 model, the model significantly overpredicts (as defined in the protocol) for PM_{10} but not for TSP.*

5. *The receptors where overpredictions occur are generally the same for both PM_{10} and TSP. This suggests a common deficiency in either characterizing the emissions or the dispersion in some unique fashion for these particulate receptors.*

Other analyses that are left for further study include: 1) a comparison between the trends and relationships in the observed concentration values and meteorological data in this period with a 5-year historical data period in the Powder River Basin; 2) a sensitivity analysis to examine model response under various meteorological conditions, examine source characterization input, and evaluate boundaries of model use.

MMA has searched the relevant EPA history and we find no record or evidence of any other remaining analyses referenced in the final paragraph above ever being completed by EPA. EPA's efforts to make the demonstration required by Section 234 come to an end with a letter dated June 26, 1996 from John Sietz of EPA[2] to Senator Alan Simpson, Wyoming, that the model still over-predicts for PM_{10}. The letter states that the emission factors developed through the studies will be incorporated into AP-42. The concluding paragraph of the Sietz letter states:

> *"Since the model still appears to overpredict the impacts of surface coal mines, the Agency does not plan to use it for regulatory applications involving these sources. As a consequence, the regulatory procedures currently in place will remain in effect. These procedures are contained in the January 24, 1994 Memorandum of Agreement (MOA) between EPA Region VIII and the State (copy enclosed) and were summarized in the Federal Register on September 12, 1995 (60 FR 47290). The MOA allows the State to conduct monitoring in lieu of short term modeling for assessing coal mining-related impacts in the Powder River Basin. We believe that these procedures provide adequate protection for the environment and are also acceptable to the stakeholders. At this time, we and the various stakeholders believe that the interim procedures work well, and therefore we do not currently plan any further analyses. If in the future EPA is able to correct the model's tendency to overpredict as described above, it may, of course, review these regulatory procedures."*

The revised emission factors were incorporated into AP-42 in July of 1998 as documented in "Revision of Emission Factors for AP-42 Section 11.9 Western Surface Coal Mining, Revised Final Report", September 1998[3]. This report briefly summarizes the emission factor studies completed under Section 234. The major revision to Section 11.9 was to reference the emission factor calculation for vehicle traffic (haul trucks, light-to-medium vehicles, and scrapers in travel mode) to AP-42 Section 13.2.2, the unpaved road emission factor equation. There is a note below the footnotes to the emission factor table in Section 11.9 as follows:

> *Note: Section 234 of the Clean Air Act of 1990 required EPA to review and revise the emission factors in this Section (and models used to evaluate ambient air quality impact), to ensure that they did not overestimate emissions from western surface coal mines. Due to resource and technical limitations, the haul road emission factors were isolated to receive the most attention during these studies, as the largest contributor to emissions. Resultant model evaluation with revised emission factors have improved model prediction for total suspended particulate (TSP); however, there is still a tendency for overprediction of particulate matter impact for PM-10, for as yet undetermined causes, prompting the Agency to make a policy decision not to use them for regulatory applications to these sources. However, the technical consideration exists that no better alternative data are currently available and the information should be made known. Users should accordingly use these factors with caution and awareness of their likely limitations.*

The above referenced 1998 footnote and the 1996 Seitz letter are the last references found to any type of concluding statements from EPA regarding actions under Section 234.

We make special note that the issue of Section 234 was a key argument in a recent Wyoming Supreme Court Case[4]. In the case of Sierra Club v. Wyoming Department of Environmental Quality and Medicine Bow Fuel & Power, LLC, no less an authority than that court concluded that no evidence was presented by the appellant that EPA has remedied the problem of model over-prediction as noted by Congress back in 1990:

> *Second, the Sierra Club points out that the statute refers to the ISC Model, an older model that has been replaced by one called AERMOD. The Simpson Amendment expressly provides that "[u]ntil such time as the Administrator develops a revised model for surface mine fugitive emissions, the State may use alternative empirical based modeling approaches pursuant to guidelines issued by the Administrator." DEQ contends that AERMOD still produces a "high degree of uncertainty in modeling short-term fugitive impacts." Accordingly, DEQ and Medicine Bow assert that the Simpson Amendment continues to authorize the use of analytical techniques other than modeling to predict the short-term air quality impacts of fugitive particulate emissions. The Sierra Club has not cited any authority indicating that the EPA has revised either model so as, in the words of the Simpson Amendment, to "eliminate any significant over-prediction of air quality effect of fugitive particulate emissions from such sources."*

Attached documentation:

[1] All of the Section 234 EPA Reports referenced
[2] June 26, 1996 Seitz letter to Senator Simpson
[3] September 1998 Revised Final Report for AP-42 Section 11.9 Western Surface Coal Mining
[4] Wyoming Supreme Court Decision S-10-0105, March 9, 2011

3.0 Wyoming Ambient Air State Implementation Plan (SIP) - Abbreviated History as it Relates to CAAA Section 234

Prior to 1987, the Wyoming Air Quality Standards and Regulations (WAQSR) contained no definition of "ambient air". The Air Quality Division was following a provision in the Wyoming Environmental Quality Act that limited regulatory authority as follows:

35-11-1104. Limitation of scope of provisions.

(a) Nothing in this act:

(i) Grants to the department or any division thereof any jurisdiction or authority with respect to pollution existing solely within commercial and industrial plants, works or shops;

The federal definition of "ambient air" is found in 40 CFR Part 50 as follows:

---

§ 50.1 Definitions.

(e) Ambient air means that portion of the atmosphere, external to buildings, to which the general public has access.

The following definition of "ambient air" was adopted by the Wyoming Environmental Quality Council on April 30, 1987:

(c) Ambient air, for the area bounded by Townships 40 through 52 North, and Ranges 69 through 73 West, inclusive, of the Sixth Principal Meridian, Campbell and Converse Counties, in the Powder River Coal Basin, is defined as that portion of the atmosphere, external to buildings, to which the general public has access. For surface mining operations, the application of this definition will be limited to only those lands that are necessary to conduct mining operations as determined by the Administrator of the Wyoming Air Quality Division.

The Air Quality Division submitted the definition to EPA as a State Implementation Plan (SIP) revision on September 6, 1988. This submission kicked off a long and complicated set of arguments and negotiations involving EPA, the Wyoming Air Quality Division and the Wyoming Mining Association. EPA expressed concerns with the modeling analysis submitted with the SIP, the protection of Prevention of Significant Deterioration (PSD) increments, and the limits on public access. The issue of limits to public access was resolved through negotiation of language to be

included in surface coal mining permits. The issue of PSD increment protection was addressed by the CAA Section 107 redesignation process. A summary of the Section 107 redesignation history is addressed in Section 4.0 of this document.

The primary dispute then became the dispersion modeling conducted by Wyoming in issuing air quality permits to the surface coal mines in the Powder River Basin (PRB), the area affected by the ambient air definition. During the review of the SIP, EPA concluded Wyoming was not utilizing EPA-approved modeling tools to determine the air quality impacts from the surface mining operations. Wyoming was using the CDMW model to predict annual impacts and did not model for the 24-hour ambient standard. Wyoming's position on short-term modeling from the start was that adequate tools were not available and that sufficient ambient air monitoring was being in conducted in the PRB to demonstrate compliance with the 24-hour ambient PM standards.

After a period of negotiation regarding modeling tools and ambient monitoring data, Wyoming submitted the following information and commitments to EPA on March 28 and 29, 1990:

1) A description of the PRB ambient particulate monitoring network and detailed analysis of the year 1989 monitoring results. Quality assurance documentation for the monitoring network by company was submitted.
2) A work description and schedule to initiate the development of modeling tools for fugitive emission from the PRB coal mines.
3) A work schedule to develop and implement an EPA approvable monitoring network in the PRB.
4) A commitment to initiate remedial action if an exceedance of the ambient standard is monitored.
5) A commitment to perform a 30-year life of mine modeling study by April 1, 1993.
6) A commitment to initiate remedial action if an exceedance of the ambient standard or PSD increment is predicted by the 30-year life of mine modeling exercise.
7) An update on the activities regarding the CAA Section 107 redesignation process and revisions to the PSD regulations to eliminate the need for PSD increment analysis in the PRB.

On September 4, 1990, EPA determined that with the commitments made by the State in the

March 28 and 29, 1990 submittals, the Ambient Air SIP was administratively and technically complete.

On November 15, 1990, President George H.W. Bush signed the Clean Air Act Amendments of 1990 which included Section 234 "Fugitive Dust". With enactment of the CAAA of 1990, Wyoming's commitment to develop modeling tools for the fugitive emissions from the PRB coal mines was no longer applicable and the responsibility shifted to EPA. The schedule for performing the 30-year life of mine modeling study was also impacted by the CAAA.

EPA reviewed the 1989 ambient air data and there were negotiations regarding quality assurance requirements and monitoring siting. In August of 1990, EPA issued a memorandum stating the review of the 1989 ambient PM data from the PRB demonstrated compliance with the National Ambient Air Quality Standards (NAAQS). The Division submitted the PRB ambient monitoring network design to EPA in January 1991. Negotiations continued through 1991 and 1992 regarding monitor siting and quality assurance plans. In June of 1992, the Division submitted to EPA the negotiated monitoring relocations and quality assurance procedures for the ambient network in the PRB.

On August 26, 1992, EPA issued a federal notice[5] proposing to approve the Ambient Air SIP. The history of the negotiations between the State and EPA is well documented in EPA's proposed decision. The proposal documented the shift in responsibility for developing modeling tools for surface coal mines from the State to EPA. The proposal also documented the revisions to the time schedule for Wyoming to submit a modeling protocol and to complete the 30-year life of mine modeling study.

Wyoming and EPA continued negotiations regarding the adequacy of the PRB monitoring network, implementation of best available work practices (BAWP) and state enforcement authority as applied to the PM NAAQS. As a result of the negotiations, a Memorandum of Agreement (MOA) was developed and signed by Wyoming on December 22, 1993 and EPA on January 24, 1994[6]. The agreement entitled "Memorandum of Agreement on Procedures for Protecting PM_{10} NAAQS in the Powder River Basin" was based on continued ambient air quality monitoring rather than the implementation of a 30-year life of mine modeling study. The MOA outlines two procedures to be implemented if a PM_{10} exceedance is monitored:

Procedure I

In the event of an exceedance of the PM10 NAAQS or Prevention of Significant Deterioration (PSD) increment in the Powder River Basin, the State expeditiously uses all necessary compliance tools, including enforcement of Best Available Work Practices (BAWP) requirements in the State permits, to eliminate the likelihood of future exceedances of the PM10 NAAQS or PSD increment caused by the contributing source(s).

Procedure II

If, in the opinion of the EPA, the State does not initiate timely and appropriate action to address these exceedances, or if timely State action does not effectively resolve the issue of exceedances (i.e., a violation of the PM10 NAAQS results following the timely and successful completion of any corrective action required by the State), the EPA will reevaluate the need for the State to implement a 30-year life-of-mine study.

In order for EPA to pursue this approach, the State must agree in writing to the requirements outlined below for best available work practices at mines, enforcement, and PSD increments, and with the monitoring requirements summarized in Section 4.0 below.

As part of the MOA, the State was to oversee the ambient monitoring networks operated by the mines and ensure that the items in the MOA pertaining to the State's ambient network apply to the PRB ambient monitoring network. The State provided a description of the existing permit conditions requiring implementation of BAWP and a letter from the Attorney General[7] regarding enforcement authority.

The issue with PSD increment consumption was addressed through the CAA Section 107 redesignation process. The Section 107 redesignation process and history is addressed in Section 4.0.

As a result of the MOA, EPA moved forward with the approval of the Ambient Air SIP. A supplemental notice of proposed approval was published in the June 23, 1994 Federal Register[8]. The final notice of approval was published September 12, 1995[9]. The final rule was effective October 12, 1995. The MOA was made part of the Wyoming SIP and can be found referenced in the current Code of Federal Regulations at 40 CFR Part 52.2620(d) EPA-approved source-specific requirements, XVII and 40 CRF Part 52.26355(c)(22)(ii)(A)[10].

Attached documentation:

[5] August 26, 1992 Federal Register – Proposed Approval of the Ambient Air SIP
[6] January 24, 1994 Letter from EPA with final signed Memorandum of Agreement (MOA)
[7] December 3, 1993 Letter from Wyoming Attorney General on enforcement authority
[8] June 23, 1994 Federal Register – Supplemental Notice of Approval of Ambient Air SIP
[9] September 12, 1995 Federal Register – Final Approval of Ambient Air SIP
[10] 40 CFR Part 52.2620 through 52.2635 – Wyoming SIP

4.0 CAA Section 107 Redesignation - Summary

One of the issues raised by EPA after the submission of the Wyoming Ambient Air SIP was that of PSD increment consumption in the Powder River Basin. When the definition of ambient air was adopted, the Wyoming PSD regulations defined the baseline area for PM as the entire state. The Wyoming PSD regulations also established the baseline date as August 7, 1977. This meant that all major and minor sources constructed anywhere in the State after the baseline date would consume the available PM increment. At that time, the PM increment was set in terms of Total Suspended Particulates (TSP). While the coal mines in the PRB were minor sources with respect to PSD, the trigger date for minor source increment consumption had been set by regulation, so emissions from the mines consumed increment at that time. EPA would not move forward on the Ambient Air SIP without a demonstration that the TSP increments in the PRB were not exceeded due to minor source growth, principally from the surface coal mines.

The State revised the PSD regulations providing for definitions of “minor source baseline date” and “baseline area” consistent with the federal definitions. This allowed for the establishment of the Powder River Basin as a separate baseline area with a new minor source baseline date. The PSD rule revisions were adopted September 5, 1990 and were effective state regulations October 30, 1990. EPA approved the revisions on May 24, 1991[11].

With the regulation revisions in place, the State defined the Powder River Basin attainment area for PSD purposes. Within the area there had been two PSD permit applications filed that were determined to be complete applications. The trigger date for minor source increment consumption is the date of the first complete PSD application in the area. The Hampshire Energy Project and the Pacific Power & Light Wyodak II Plant had both been determined to be complete applications, therefore establishing minor source baseline dates in the immediate vicinity (within their significant impact areas) of those two facilities.

Section 107 of the Clean Air Act (CAA) states:

(e) Redesignation of air quality control regions
(1) *Except as otherwise provided in paragraph (2), the Governor of each State is authorized, with the approval of the Administrator, to redesignate from time to time the air quality control regions within such State for purposes of efficient and effective air quality management. Upon such redesignation, the list under subsection (d) of this*

section shall be modified accordingly.

EPA described their policy regarding redesignation in the January 14, 1993[12] Federal Register Notice:

> *EPA has specific policy governing the redesignation of baseline areas, as discussed in the August 7, 1980 Federal Register in which the current federal PSD regulations were adopted (see 45 FR 52676). That notice provides for redefining baseline areas through area redesignations pursuant to Section 107 of the CAA, "as long as no PSD source has located in, or significantly impacted on a clean area being considered for redesignation, the area can be redesignated as a new attainment or unclassifiable area, even if the area [was] previously part of a larger clean area in which the baseline date had been set" (see 45 FR 52716). Under this redesignation policy, an ambient air quality impact greater than or equal to 1 ug/m^3 is considered to be a significant impact (see 45 FR 52716). EPA's policy was reaffirmed in EPA's October, 1990 draft New Source Review Workshop Manual (see page C.9).*

In accordance with the EPA policy, Wyoming developed three area designations, the Powder River Basin Attainment Area, the Hampshire Energy Attainment Area, and the Pacific Power and Light Attainment Area. On February 11, 1992 the Governor of Wyoming submitted a request that the areas be redesignated. Following negotiations and a revision submitted by the State on September 18, 1992, EPA approved the requested redesignation by Federal Register Notice on January 14, 1993. The approval affectively untriggered the minor source baseline date in the PRB and TSP increment consumption was resolved.

A third redesignation occurred following a complete PSD application filed by Kennecott-Puron in 1994. The Governor of Wyoming submitted a request for redesignation on December 19, 1994 and EPA approved the redesignation by Federal Register Notice on September 12, 1995[13]. Again this action effective untriggered the minor source baseline date.

The redesignation actions allowed the Ambient Air SIP to move forward and EPA noticed final approval on September 12, 1995. The redesignated areas are incorporated into Federal Regulations in Part 81, Designation of Areas for Air Quality Planning Purposes at 81.351 and in the Wyoming PSD Regulations in the definition of “Baseline Area” (WAQSR Chapter 6, Section 4(a)).

Two additional PSD permits were determined to be complete in 1997. These applications were the

ENCOAL Project and the Two Elk Power Project. The ENCOAL application was deemed complete March 6, 1997 and the Two Elk application was deemed complete August 5, 1997. The March 6, 1997 complete application for ENCOAL triggered the minor source baseline date. All minor source growth since March 6, 1997 is increment consuming. The State developed additional Section 107 redesignation areas and the Governor submitted a request for redesignation for the ENCOAL PSD baseline area and the Two Elk PSD baseline area on October 6, 1998. EPA has not acted on the redesignation request and has given the State verbal indication that is it unlikely that they will act on the redesignation request.

The end result of the inaction by EPA is that the minor source baseline date has been triggered. As a result, increases in PM emissions since March 6, 1997 are consuming PSD increment. In addition, there have been other PSD permitting actions in the PRB that would also trigger minor source baseline dates even if the EPA would act on the older 1997 request. These PSD applications are: Black Hills Power & Light, WYGEN 2 (2001) and WYGEN 3 (2005); and Basin Electric, Dry Fork Station (2005). There may be others that were deemed complete, but the permitting process stalled with no final action.

Attached documentation:

[11] May 24, 1991 Federal Register Approval – PSD Rule Revisions
[12] January 14, 1993 Federal Register Approval - Designation of Areas for Air Quality Planning Purposes, Wyoming
[13] September 12, 1995 Federal Register Approval - Designation of Areas for Air Quality Planning Purposes, Wyoming

5.0 Ambient Particulate Matter (PM) Standards - History and Summary of Current Standards

The following section describes the PM National Ambient Air Quality Standards (NAAQS) as adopted by EPA and incorporated into the Wyoming Ambient Air Quality Standards and Regulations as Wyoming Ambient Air Quality Standards (WAAQS).

Primary and secondary ambient air quality standards are defined in 40 CFR Part 50 as follows:

> *National primary ambient air quality standards define levels of air quality which the Administrator judges are necessary, with an adequate margin of safety, to protect the public health. National secondary ambient air quality standards define levels of air quality which the Administrator judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.*

The history of the ambient air quality standards as set by EPA and subsequent adoption into the Wyoming Air Quality Standards and Regulations (WAQSR) is described in the following outline:

<u>NAAQS – TSP</u>
Established 1971
Primary Standards: 260 µg/m^3 – 24 hour
75 µg/m^3 – annual geometric mean
Secondary Standards: 150 µg/m^3 – 24 hour
60 µg/m^3 – annual geometric mean

<u>WAAQS – TSP</u>
Federal Secondary Standards adopted into WAQSR - 1972

<u>NAAQS – PM_{10}</u>
Established July 1, 1987
EPA revised the level and form of the primary standards
TSP standards were replaced
Primary Standards: 150 µg/m^3 – 24 hr/no more than one expected exceedance per year
50 µg/m^3 – annual/expected annual arithmetic mean
Secondary Standards: identical to primary standards

<u>WAAQS – PM_{10}</u>
Adopted Federal Standards – February 13, 1989
Maintained TSP 24 hour standard of 150 µg/m^3 – February 13, 1989
EPA approved PM_{10} SIP July 10, 1990 – effective August 10, 1990

NAAQS – PM_{10}/$PM_{2.5}$

Effective September 16, 1997 – published July 18, 1997 FR

PM_{10} – retained 1987 Standards

Primary Standards: 150 µg/m^3 – 24 hr/no more than one expected exceedance per year per App. K

50 µg/m^3 – annual/expected annual arithmetic mean per App. K

Secondary Standards: identical to primary standards

$PM_{2.5}$

Primary Standards: 65 µg/m^3 – 24 hr/98th percentile is less than standard per App. N

15 µg/m^3 – annual arithmetic mean per App. N

Secondary Standards: identical to primary standards

WAAQS – $PM_{2.5}$

Adopted Federal Standards – March 30, 2000

Removed 24 Hour TSP Standard from Wyoming Rule – March 30, 2000

NAAQS – PM_{10}/$PM_{2.5}$

Effective December 18, 2006 – published October 17, 2006

PM_{10} – retained 1987 24 Hour standard/vacated annual standard

Primary Standard: 150 µg/m^3 – 24 hr/no more than one expected exceedance per year per App. K

Secondary Standard: identical to primary standard

$PM_{2.5}$ – reduced 24 hour standard/retained annual standard

Primary Standards: 35 µg/m^3 – 24 hr/98th percentile is less than standard per App. N

15 µg/m^3 – annual arithmetic mean per App. N

Secondary Standards: identical to primary standards

WAAQS – PM_{10}/$PM_{2.5}$

PM_{10} – retained PM_{10} annual standard – March 30, 2010

$PM_{2.5}$ – adopted Federal $PM_{2.5}$ 24 hour standard – March 30, 2010

ONGOING NAAQS REVIEW

During the last NAAQS review and regulatory action on PM standards, EPA proposed a PM_{coarse} standard ($PM_{10-2.5}$) of 70 µg/m^3 on a 24-hour basis. The proposed PM_{coarse} standard was not promulgated and the PM_{10} 24-hour standard was retained. The PM NAAQS review is an ongoing process and the PM_{coarse} issue is the subject of ongoing study as discussed in the October 2006 rulemaking[14]:

"The Administrator has concluded that it is a priority to establish a robust research program that

will enable future PM NAAQS reviews to make more informed decisions that will provide more targeted protection against the effects only of those coarse particles and related source emissions that prove to be of concern to public health. The Administrator also notes that the need for a standard for thoracic coarse particles has already been upheld based upon evidence of health effects considerably more limited than now available (ATA I, 175 F.3d at 1054)."
October 17, 2006 FR p. 61185

In the PM_{coarse} standard proposal, EPA also proposed that "agricultural sources, mining sources, and other similar sources of crustal material shall not be subject to control in meeting this standard."

Since there was no final action on the PM_{coarse} standard there was also no final action on the proposed exemption, however comments regarding the proposed exemption were discussed in the final rulemaking.

However, the Committee went on to say that ''the CASAC neither foresaw nor endorsed a standard that specifically exempts all agricultural and mining sources, and offers no protection against episodes of urban-industrial PM10–2.5 in areas of populations less than 100,000.'' The Committee recommended the ''expansion of our knowledge of the toxicity of rural dusts rather than exempting specific industries (e.g mining, agriculture)'' from control under the standard (id at 5). October 17, 2006 FR p. 61188

In addition, EPA disagrees with these commenters that there is sufficient evidence to exclude crustal materials from the coarse particle indicator regardless of the degree of contamination. Although there is some evidence that coarse particles of natural geologic origin are relatively non-toxic in their uncontaminated form, the Criteria Document notes that such particles may become sufficiently ''contaminated by toxic trace elements or other components from previously deposited fine PM,'' to cause health effects (EPA, 2004a, 8–344). Indeed, the urban coarse PM associated with adverse health effects in the studies discussed above was, by mass, predominantly crustal in origin. October 17, 2006 FR p. 61189

As EPA's new research program produces speciated monitoring data, thereby improving scientific knowledge, revealing more specific and precise information about coarse particle composition and relative toxicity, and about the distribution of ambient coarse particle mixes of varying composition, it will be appropriate in a future review to revisit the option of a PM10–2.5 standard with a variable level or a qualified indicator. October 17, 2006 FR p. 61195

The PM NAAQS process is ongoing and can be tracked at the following site:

http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html.

Attached documentation:

[14] October 17, 2006 Federal Register – National Ambient Air Quality Standards for Particulate Matter – Final Rule

6.0 PRB Ambient Monitoring Review

The following section describes the review of the PM_{10} and $PM_{2.5}$ data from the Powder River Basin for the period of 1991 through 2010 (partial year). The data were obtained from the Wyoming Air Quality Division monitoring section, and are shown here as reported to EPA in the Air Quality System.

PM_{10} Review Summary

Attached is a map of the existing PM_{10} monitoring sites as obtained from the Wyoming Air Quality Division for the year 2009 (Figure 1). This map gives the general layout of the PM_{10} monitoring sites with respect to the mining operations in the PRB. The historical data have been reviewed and summarized in Table 1:

Table 1. PRB PM_{10} Monitoring Data Review Summary

Mine	Year PM_{10} Monitoring Began	Total Number of Samples	Number of Samples > 150 µg/m^3	Year of Last Exceedance
Buckskin	1991	7,819	2	2002
Rawhide	2004	4,368	none	
Dry Fork	1993	1,671	none	
Eagle Butte	1993	3,530	1	2007
Wyodak/Clovis	2004	2,841	1	2005
Caballo	2002	6,127	none	
Belle Ayr	1992	3,186	none	
Cordero Rojo	1991	4,186	none	
Coal Creek	1991	1,379	none	
Jacobs Ranch	1991	5,449	1	2001
North Rochelle	1999	4,966	7	2007
Black Thunder	1991	9,109	17	2008
North Antelope/Rochelle	1998	9,648	6	2008
Antelope	1997	3,948	3	2010

Data obtained from Wyoming AQD as reported to EPA's Air Quality System, 1991 - 2010 (partial year)

The PM_{10} data were also examined for trends at sites that had long-term data records. The trends are presented in Figures 2 through 6 for the following sites:

Gillette
Buckskin – Site 884 – Buckskin West site on map
Belle Ayr – Site 892 – Belle Ayr Site BA4 on map
Cordero Rojo – Site 889 – Cordero Rojo Site S10 on map
Black Thunder – Site 891 – Black Thunder Site 36 on map

The plots give a general indication of trends over the years from the north to the south of the PRB, including the City of Gillette.

<u>$PM_{2.5}$ Review Summary</u>

$PM_{2.5}$ monitoring began in the PRB in 1999 at four sites, Buckskin, Belle Ayr, Black Thunder, and Antelope. The data summaries from each monitor are presented graphically in Figures 7 though 10. Again, the data give a general indication of trends over the years from the north to the south of the PRB.

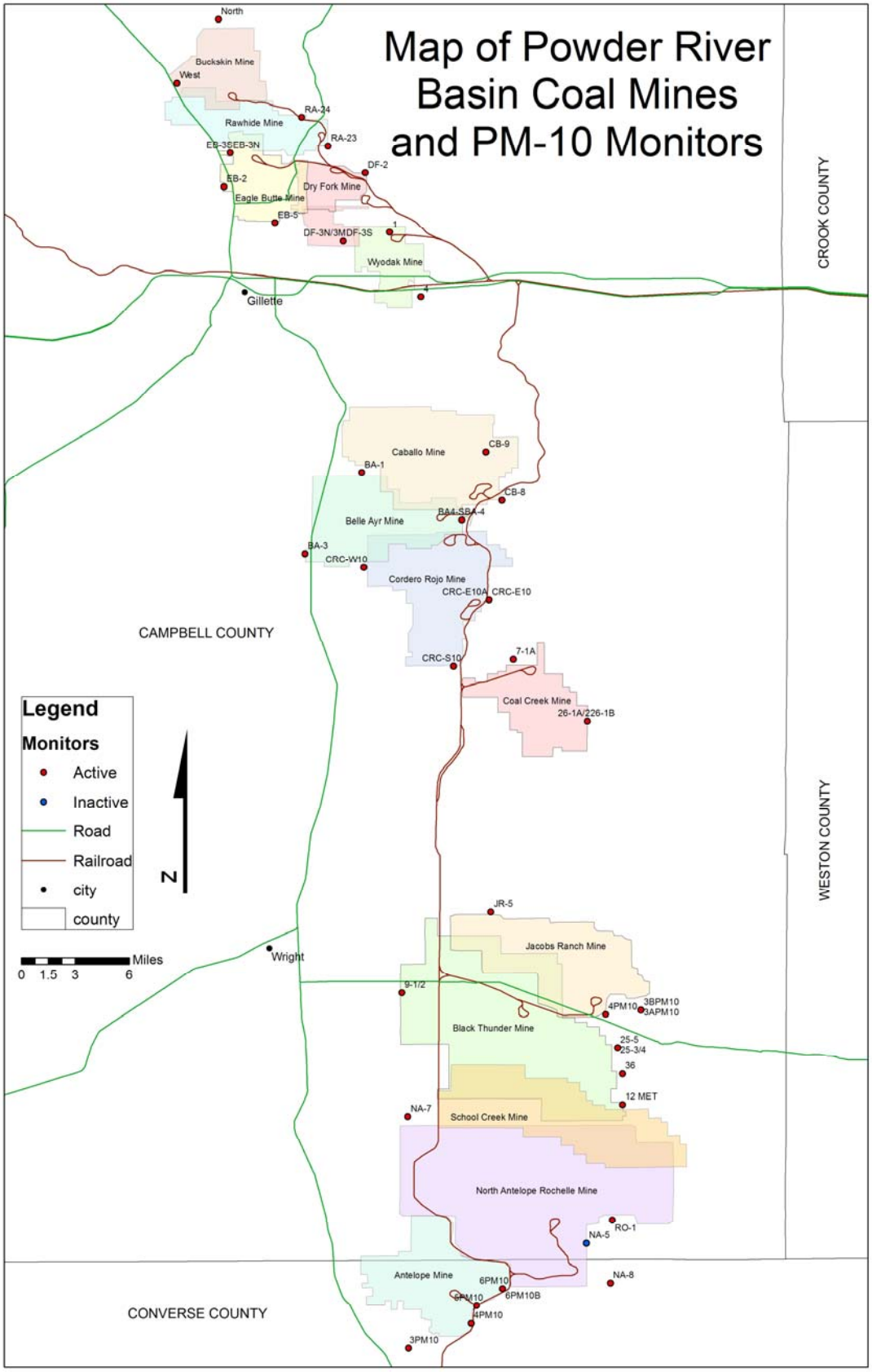

Figure 1. Existing PM_{10} Monitoring Sites

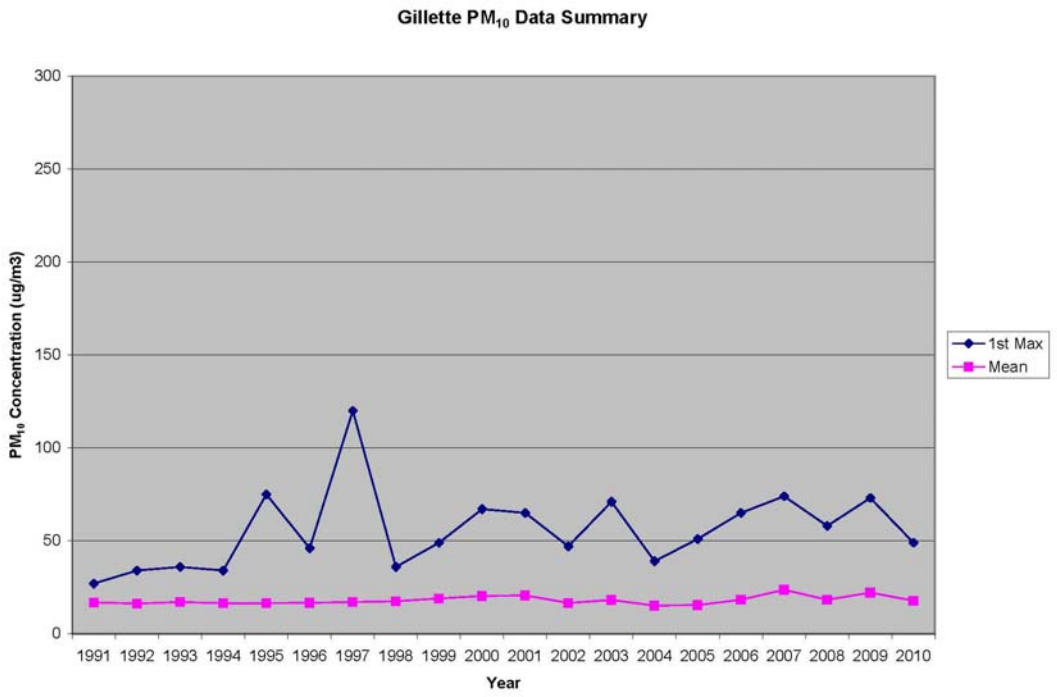

Figure 2. Gillette PM_{10} Data Summary

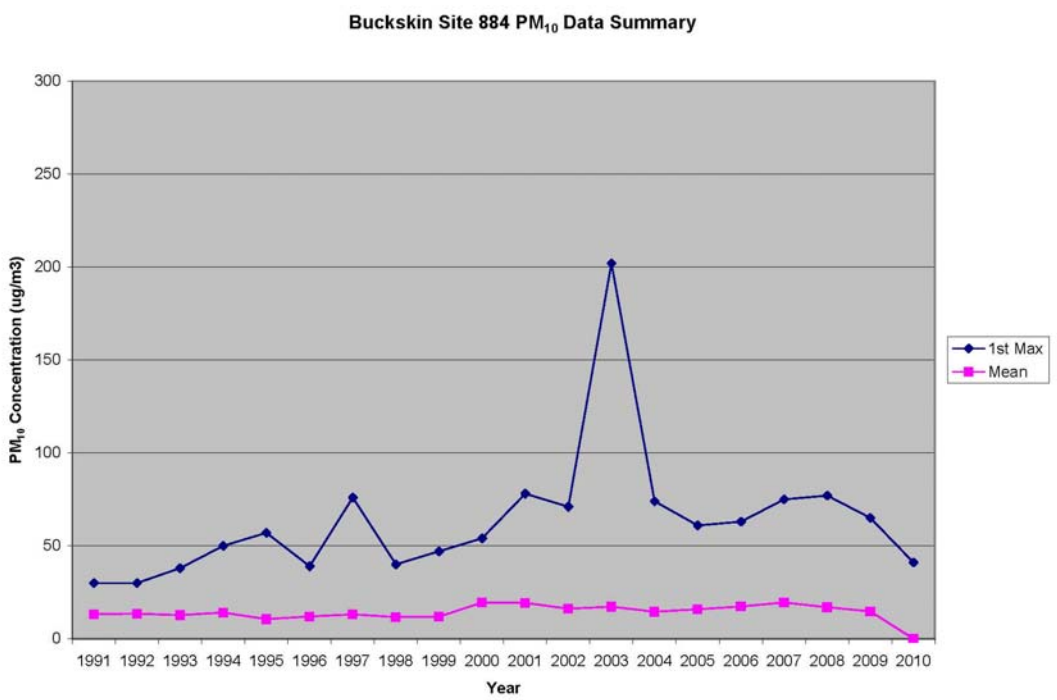

Figure 3. Buckskin PM_{10} Data Summary

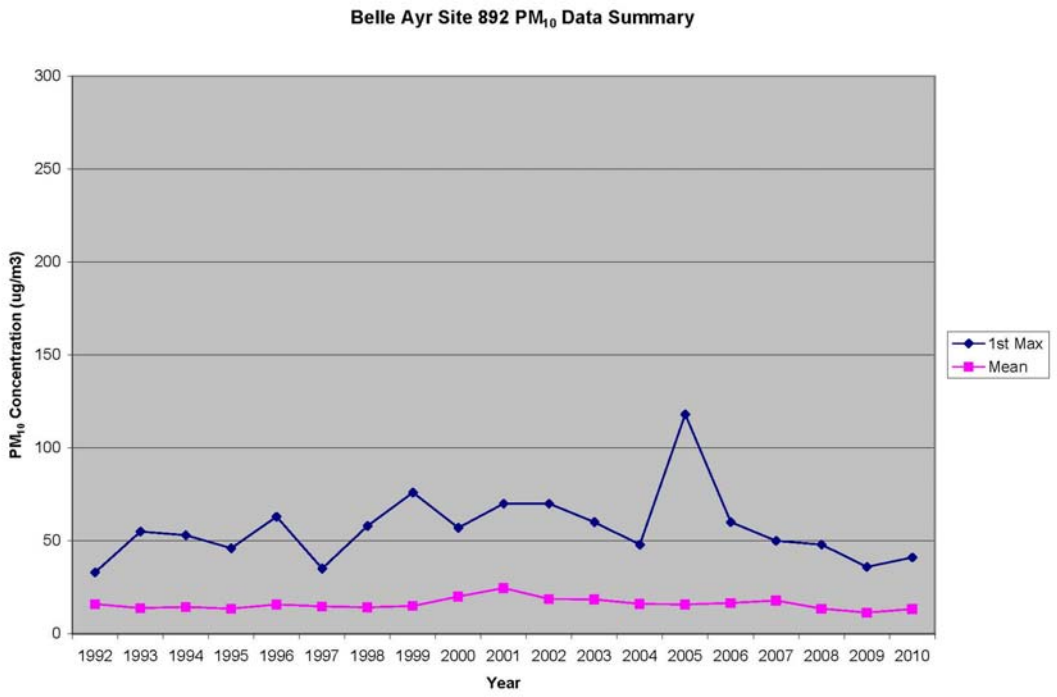

Figure 4. Belle Ayr PM_{10} Data Summary

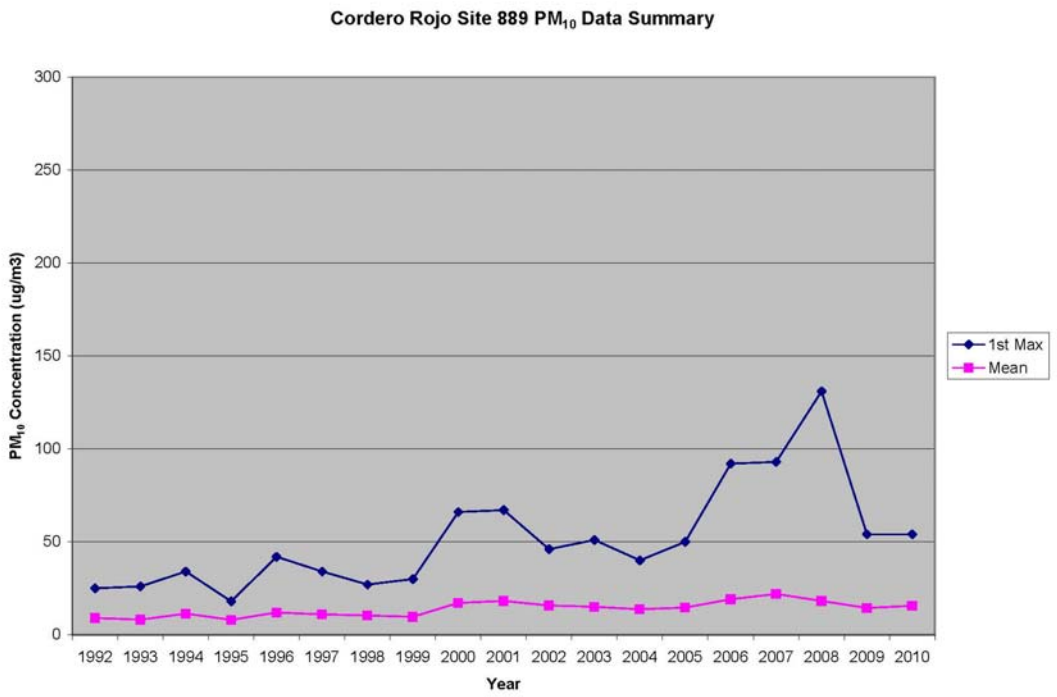

Figure 5. Cordero Rojo PM_{10} Data Summary

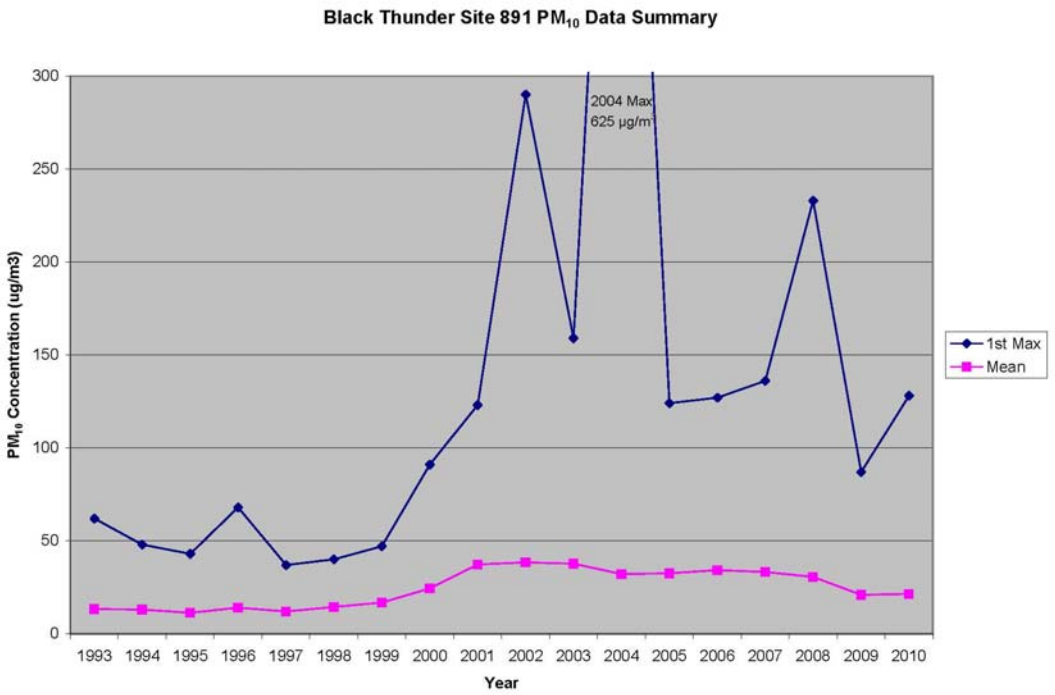

Figure 6. Black Thunder PM_{10} Data Summary

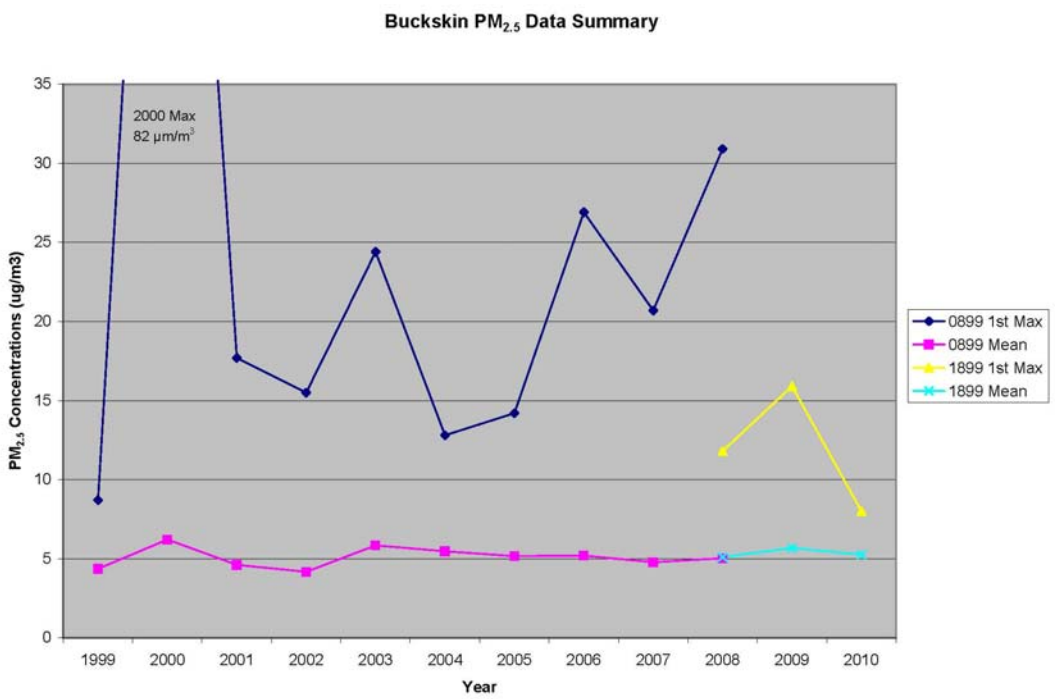

Figure 7. Buckskin $PM_{2.5}$ Data Summary

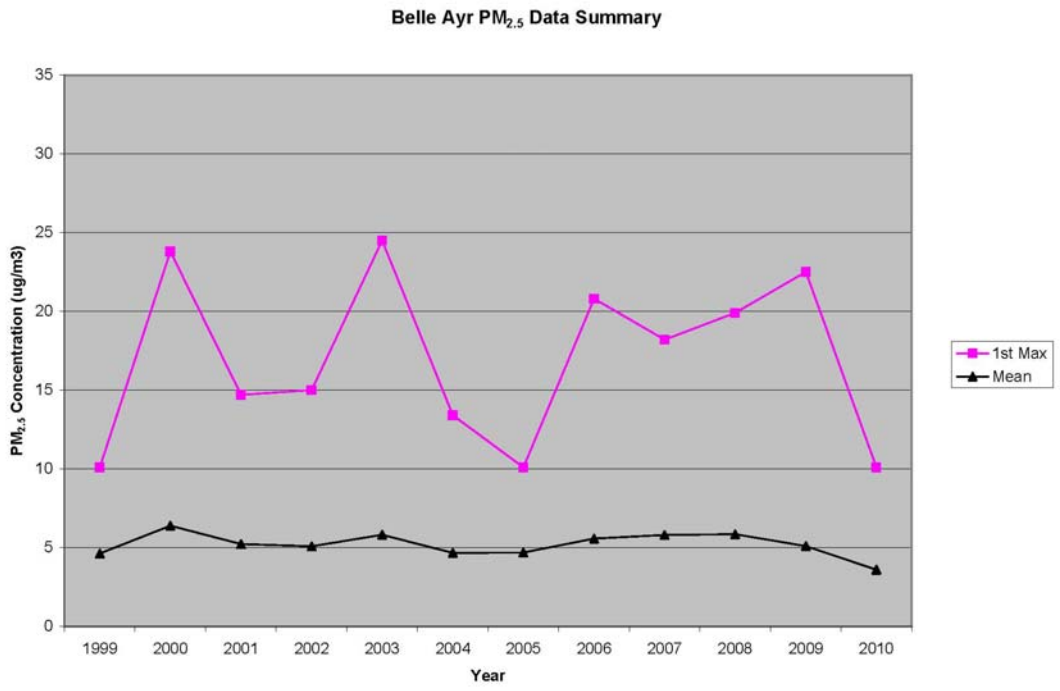

Figure 8. Belle Ayr $PM_{2.5}$ Data Summary

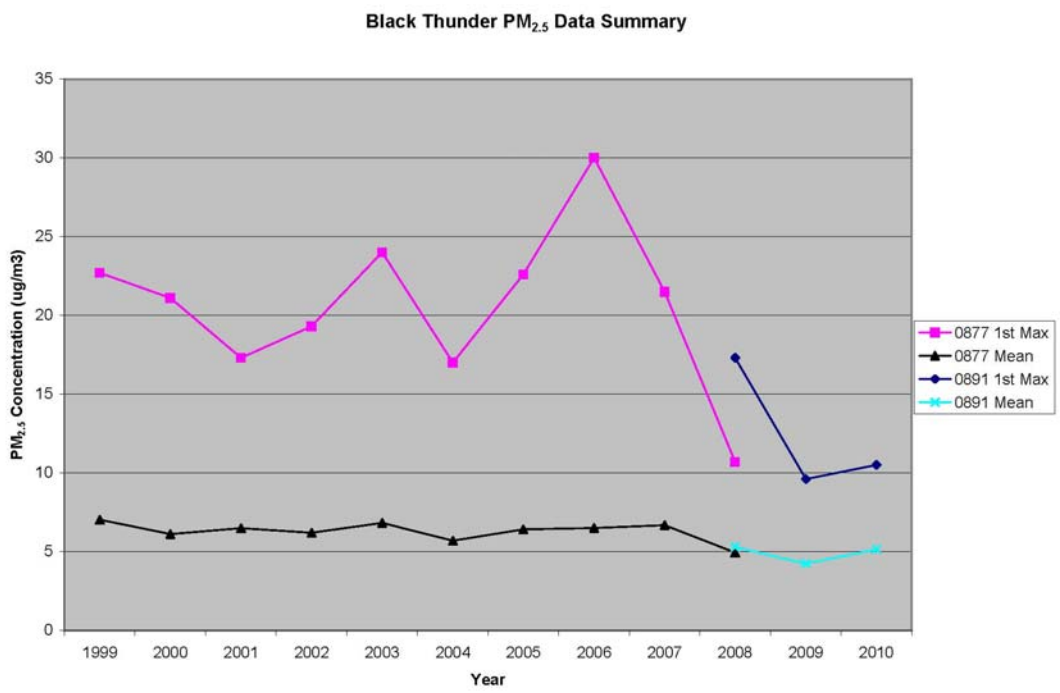

Figure 9. Black Thunder $PM_{2.5}$ Data Summary

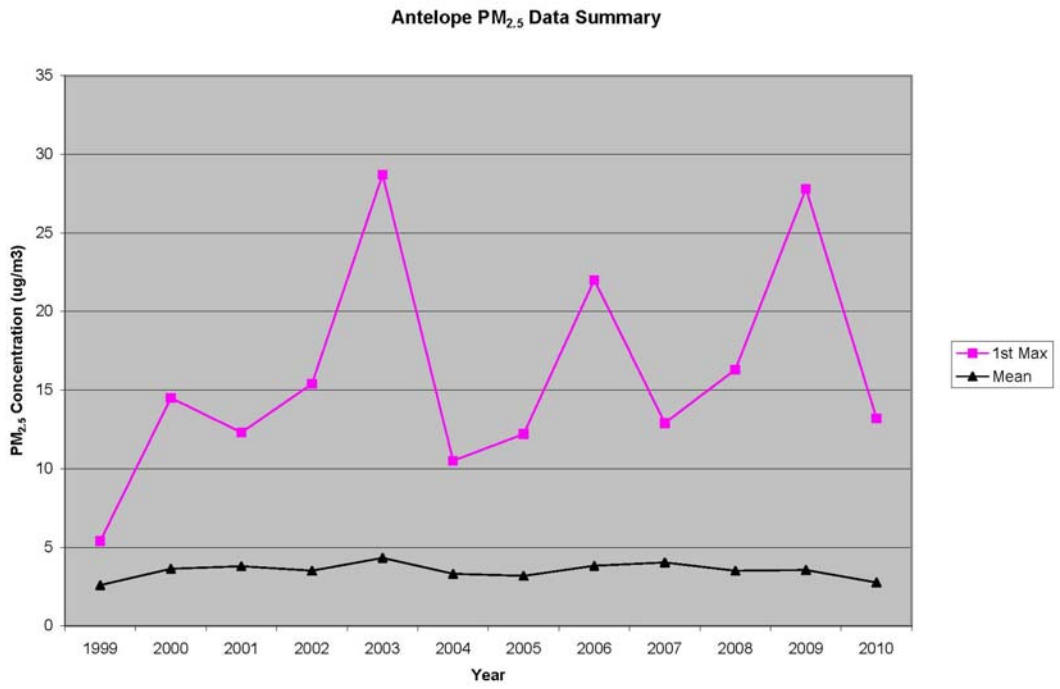

Figure 10. Antelope $PM_{2.5}$ Data Summary

7.0 Guideline on Air Quality Models (GAQM) and Revisions to 40 CFR Part 51 Appendix W

The purpose of the Guideline on Air Quality Models, from the November 9, 2005 Federal Register Notice for the revisions to Appendix W of 40 CFR Part 51, is described as follows:

> *The Guideline is used by EPA, States, and industry to prepare and review new source permits and State Implementation Plan revisions. The Guideline is intended to ensure consistent air quality analyses for activities regulated at 40 CFR 51.112, 51.117, 51.150, 51.160, 51.166, and 52.21.*

The references to 40 CFR Part 51 made in the purpose of the GAQM require use of guideline models in SIP modeling (51.112 Demonstration of Adequacy), in permit modeling (51.160 Legally enforceable procedures), and in PSD modeling (51.166 Prevention of significant deterioration).

The original guideline was published in 1978 and incorporated by reference in the Prevention of Significant Deterioration (PSD) regulations. The GAQM is referenced in the WAQSR in the PSD regulations (WAQSR Chapter 6, Section 4). The GAQM was updated and revised in 1986, 1993, and again in 1995. The GAQM was published as Appendix W in the Federal Register format in August of 1996. The last revision to the GAQM was made in 2005.

Prior to the 2005 revision to the GAQM, guidance for modeling fugitive dust sources presented in the August 12, 1996 version of Appendix W for fugitive emissions was as follows:

> *7.0 Other Model Requirements*
> *…..*
> *7.2 Recommendations*
> *7.2.1 Fugitive Dust/Fugitive Emissions*
> *a. Fugitive dust usually refers to the dust put into the atmosphere by the wind blowing over plowed fields, dirt roads or desert or sandy areas with little or no vegetation. Reentrained dust is that which is put into the air by reason of vehicles driving over dirt roads (or dirty roads) and dusty areas. Such sources can be characterized as line, area or volume sources. Emission rates may be based on site-specific data or values from the general literature.*
> *b. Fugitive emissions are usually defined as emissions that come from an industrial source complex. They include the emissions resulting from the industrial process that are not captured and vented through a stack but may be released from various locations within the complex. Where such fugitive emissions can be properly specified, the ISC model, with consideration of gravitational settling and dry deposition, is the recommended model. In some unique cases a model developed specifically for the*

situation may be needed.
c. Due to the difficult nature of characterizing and modeling fugitive dust and fugitive emissions, it is recommended that the proposed procedure be cleared by the appropriate Regional Office for each specific situation before the modeling exercise is begun.

Based on the 7th Conference on Air Quality Modeling held in June of 2000, the EPA incorporated AERMOD into the GAQM by Federal Register Notice on November 9, 2005[15]. There was no discussion in the preamble regarding fugitive emissions and limited discussion in the preamble on area sources. The guidance revised the recommendations on modeling fugitive dust as follows:

5.2 Recommendations
…..
5.2.2.2 PM–10
…..
e. Fugitive dust usually refers to dust put into the atmosphere by the wind blowing over plowed fields, dirt roads or desert or sandy areas with little or no vegetation. Reentrained dust is that which is put into the air by reason of vehicles driving over dirt roads (or dirty roads) and dusty areas. Such sources can be characterized as line, area or volume sources. Emission rates may be based on site specific data or values from the general literature. Fugitive emissions include the emissions resulting from the industrial process that are not captured and vented through a stack but may be released from various locations within the complex. In some unique cases a model developed specifically for the situation may be needed. Due to the difficult nature of characterizing and modeling fugitive dust and fugitive emissions, it is recommended that the proposed procedure be cleared by the Regional Office for each specific situation before the modeling exercise is begun.

The basic change to the guidance was to remove the reference to the ISC model. Otherwise the language regarding guidance on fugitive emissions remains the same.

In the preamble of the November 9, 2005 Federal Register Notice with the publication of the present version of the GAQM, the following statement was made regarding comments received during the public notice period:

IV. Discussion of Public Comments and Issues From Our April 21, 2000 Proposal
All comments submitted to Docket No. A–99–05 are filed in Category IV–D. We summarized these comments, developed detailed responses, and documented conclusions on appropriate actions in a Response-to-Comments document. In this document, we considered and discussed all significant comments. Whenever the comments revealed any new information or suggested any alternative solutions, we considered this prior to taking final action.

In response to comments from Ken Rairigh (Wyoming) on the continued use of ISC3LT for PM_{10} and NO_x modeling at Wyoming surface coal mines, EPA responded[16]:

> *"The use of ISC3LT for surface mining application has previously been negotiated and approved, and therefore meets grandfathering provisions for such applications. Even though ISC3LT was proposed for withdrawal and curtailment, that proposal does not affect grandfathered agreements." Summary of Public Comments and EPA Responses Docket A-99-05 Item V-C-01 February 2003.*

Based on review of the EPA response to comments, one can confidently argue that continued use of ISC3LT is sanctioned even with the ISC model being removed from the GAQM.

Current guidance from AQD on modeling fugitive emissions from surface coal mines is the February 27, 2006 guidance memo[17]. That memo is currently on the AQD web site and is recognized as the current AQD guidance. The modeling requirements for surface coal mining operations per the AQD memo:

> ISCLT3 required with Wyoming Emission Factors for PM_{10}
>
> If emission factor for an activity in not available in Wyoming factors utilize AP-42
>
> Model annual PM_{10} concentrations only

Short term particulate standards are to be addressed as follows:

> *→ A discussion of ambient air quality monitoring data from the applicant's mine is to be included. This discussion shall include a summary of the data for the previous three (3) years, along with accompanying coal and overburden production statistics. A map showing current locations of ambient and meteorological monitoring sites in relation to pit areas, disturbed acreage, overburden spoils, haul roads, the current LNCM boundary, and proposed LNCM boundary (as applicable) are to be included.*
> *→ The application should contain a discussion of ambient air quality monitoring data from the designated group of neighboring mines for the previous three years. A demonstration shall be provided to show that modifications to the applicant's mining operations will not cause or contribute to ambient violations at neighboring mine's monitoring sites.*
> *→Historical ambient monitored PM_{10} concentrations can be acquired from the AIRS database. If current monitored data is required, or additional monitored data is required that is not in the AIRS database, the applicant should contact Judy Shamley in the Sheridan field office for additional ambient monitored data.*

Thus, little has changed in GAQM with respect to how EPA views the modeling of fugitive dust sources such as surface coal mines. No advances have been made as a result of EPA's adoption of AERMOD as their preferred model, and EPA still recognizes Wyoming's right to use the earlier ISC model.

Attached documentation:

[15] November 9, 2005 Federal Register – Revision to Guideline on Air Quality Models
[16] February 2003 EPA Summary of Public Comments and EPA Responses, 7th Conference on Air Quality Modeling, Washington, D.C., June 28-29, 2000
[17] February 27, 2006 AQD Guidance Memo – PRB Coal Mine Permitting Guidance

8.0 Particulate Matter (PM) Emission Factors - History and Summary of Current Factors

The following section describes the history of the development and the current PM emission factors as used by the State of Wyoming and in the EPA emission factor publication AP-42.

Wyoming Emission Factors

The Wyoming emission factors for emission sources of fugitive dust were initially introduced in a November 14, 1978 memo from AQD Engineering Manager Chuck Collins[18]. The initial TSP factors were revised to account for PM of 30 microns in size or smaller and were published in a January 24, 1979 memo from Chuck Collins[19]. These factors, with adjustments for PM_{10}, remain the basis of the emission estimates for permitting surface coal mines in Wyoming.

The primary references for the emission factors are as follows:

---

(1) EPA-908/l-78-003, "Survey of Fugitive Dust from Coal Mines", by PEDCo Environmental, Inc., February, 1978.
(2) EPA-908/l-76-008, "Wyoming Air Quality Maintenance Area Analysis", by PEDCo Environmental, Inc., May, 1976.
(3) AP-42 "Compilation of Air Pollutant Emission Factors (Supplements 1-8)", May, 1978.
(4) PEDCo 1976, "Evaluation of Fugitive Dust Emissions from Mining", by PEDCo Environmental, Inc., April, 1976.
(5) C. Cowherd and R.V. Hendriks, "Development of Fugitive Dust Emission Factors for Industrial Sources", Paper No. 78-55.4, Annual Meeting Air Pollution Control Association, Houston, Texas (June, 1978).

Adjustments to the TSP emission factors were documented in two memoranda from AQD Administrator Dan Olson dated February 10, 1988 and March 21, 1990[20]. The PM_{10} adjustment documented in the two memos is 30% of the TSP emission being PM_{10}. References cited in the adjustment for the PM_{10} fraction are as follows:

EPA -1982 Characterization of PM-10 & TSP Air Quality Around Western Surface Coal Mines (PEDCo)
EPA – 1978 Survey of Fugitive Dust from Coal Mines (PEDCo)
EPA – AP-42 Compilation of Air Pollutant Emission Factors - Table 8.24-2

These emission factors and adjustments remain the basis of the AQD's current permitting activities

for surface mining operations in Wyoming.

AP-42 Emission Factors

AP-42 Section 8.24 "Western Surface Coal Mining" was initially published in Supplement 14 of the Third Edition of AP-42[21]. Factors were published for TSP, PM_{15} and $PM_{2.5}$. The primary reference for the initial emission factors was:

---

1. *K. Axetell and C. Cowherd, Improved Emission Factors for Fugitive Dust from Western Surface Coal Mining Sources, 2 Volumes, EPA Contract No. 68-03-2924. U.S. Environmental Protection Agency, Cincinnati, OH, July 1981.*

The coal storage pile equation in AP-42 was from:

---

4. *K. Axetell, Survey of Fugitive Dust from Coal Mines, EPA-908/1-78-003, U.S. Environmental Protection Agency, Denver, CO, February 1978.*

Section 8.24 was revised in "Supplement B to Compilation of Air Pollutant Emission Factors, Volume 1" in September of 1998. This revision incorporated a PM_{10} emission factor into the table. All references for the emission factors remained the same.

Section 8.24 was reformatted in the January 1995 publication of the Fifth Edition of AP-42. The number of the section was changed from 8.24 to 11.9 Western Surface Coal Mining. The emission factors and the references remained the same.

Additional emission factor work was done as a result of Section 234 beginning with the *Review of Surface Coal Mining Emission Factors*, EPA-454/R95-007, July 1991. A good summary of the work done on emission factors and the revision of AP-42 on Western Surface Coal Mining as a result of Section 234 is found in the MRI Revised Final Report, September 1998[22] and is provided verbatim below:

Section 2
Revision of AP-42 Section on Western Surface Coal Mining

Section 234 of the CAAA directed EPA to examine available emission factors and dispersion models to

address potential overestimation of the air quality impacts of surface coal mining. Over the past 4 years, a series of studies have not only reviewed available emission factors but also collected new field measurements at a mine in Wyoming's Powder River Basin against which those factors could be compared and revised as necessary.

This section describes how AP 42 Section 11.9—"Western Surface Coal Mining"— has been revised in response to the newer studies. The section begins with a brief overview of the recent studies. Particular emphasis is placed on changes that have occurred in "typical operating practices" since the time that the original data base supporting the current AP-42 emission factors was assembled. For example, common haul truck capacities are now two to three times greater than those represented in the old emission factor data base.

2.1 Background

The current version of AP-42 Section 11.9 (included as Section 8.24 in earlier editions) was first drafted in 1983[4] and made use of field data collected during the late 1970s and early 1980s.[5,6] Minor changes to this section were subsequently made; the changes were related to (a) emissions from blasting and (b) estimating PM-10 emissions.

As noted above, Section 234 of the CAAA directed EPA to examine available emission factors and dispersion models to address potential overestimation of the air quality impacts of surface coal mining. An initial study[1] thoroughly reviewed emission factors either currently used for or potentially applicable to inventorying particulate matter emissions at surface coal mines. For each anthropogenic emission source, the current emission factor was reviewed. The report concluded that additional source testing was necessary to address major shortcomings in the data base. Table 1 summarizes recommendations made in Reference 1. (G. E. Muleski, Review of Surface Coal Mining Emission Factors, EPA-454/R-95-007,
U. S. Environmental Protection Agency, Research Triangle Park, NC, July 1991.)

A second planning program[2] recommended an "integrated" approach to field measurements and combined extensive long-term air quality and meteorological monitoring with intensive short-term, source-directed testing. This approach would have effectively isolated separate steps in the emission factor/dispersion model methodology. As a practical matter, funding was inadequate to support the integrated approach. Under the revised multiyear approach, source-directed measurements were to be conducted first.

TABLE 1. RECOMMENDATIONS MADE IN REFERENCE 1

Source Category	*Recommendations*
General	• *Recommended collection of field test data specific to the PM-10 size fraction.* • *Stressed need for independent test data against which the performance of various emission factors could be assessed.*
Light- and medium-duty vehicular traffic	• *Noted that, when applied to independent data, vehicular traffic the current emission factor could overpredict by an order of magnitude.* • *Recommended collection of newer, independent field data at surface coal mines.*
Haul trucks	• *Noted important changes in* *-- size of haul trucks commonly used* *-- degree of dust control/compaction of permanent haul roads* *since the time that the test data supporting AP42 were collected.* • *Recommended that collection of new haul truck emission data form a central focus of any field study.*
Scrapers	• *Stressed need for independent test data to assess emission factor performance.*
Coal/overburden material transfers (e.g., shovel, truck unloading, dragline, etc.)	• *Stressed need for independent test data to assess emission factor performance.*

Testing occurred during the fall of 1992 at the Cordero Mine in Wyoming's Powder River Basin.[3] Thirty-six PM-10 emission tests, distributed over various sources and five test sites, were performed. In keeping with priorities established in the earlier emission factor review,[1] a majority of the field effort was devoted to emissions from haul truck traffic. A fairly broad spectrum of haul road dust control was tested, ranging from essentially unimproved overburden haul routes to extremely well-controlled coal haul roads. TSP emission tests were run concurrently with 22 of the PM-10 tests. In addition, three PM-10 and three TSP tests of light-duty captive traffic on permanent coal haul roads were completed. These tests were performed to quantify the importance of light-duty versus haul truck traffic on the roads. Finally, two tests of scraper travel also were conducted.

The end result of the emission factor work completed under Section 234 revisions incorporated into AP-42 was to update Section 13.2.2 Unpaved Roads[23] based on the factors developed through the measurements taken at the Cordero Mine in 1992 and removed the haul road factor from

Section 11.9 Western Surface Coal Mining[24]. The emission factor table 11.9-1 for Western Surface Coal Mining was revised slightly by a revision to the blasting factor, incorporated a reference to Section 13.2.2 for all vehicle traffic, and incorporated emission factor rating for the four particle sizes (TSP, PM_{15}, PM_{10} and $PM_{2.5}$). The emission factors as well as the basis for all other mining operations remain the same as initially published in 1983 – there were no changes or updates as the result of Section 234.

The following recommendations were made in the initial review and planning stage of the emission factor study work, but were not completed:

1) Review stressed need for independent test data to assess emission factor performance for coal/overburden material transfers (e.g. shovel, truck unloading, dragline, etc.)
2) Only two tests were conducted on scraper travel; again recommendation was for independent test data to assess emission factor performance.
3) A second planning program recommended an "integrated" approach to field measurements and combined extensive long-term air quality and meteorological monitoring with intensive short-term, source-directed testing. This approach would have effectively isolated separate steps in the emission factor/dispersion model methodology. As a practical matter, funding was inadequate to support the integrated approach.

Thus, little changed in AP-42 as a result of the studies conducted in support of Section 234. In the absence of significant changes to these emissions factors, one can conclude that significant improvements in overall model performance would not be expected and that the over-prediction bias recognized in Section 234 remains to this day with respect to AP-42.

Attached documentation:

[18] November 14, 1978 Chuck Collins Memo on Fugitive Dust Emission Factors
[19] January 24, 1979 Chuck Collins Memo on Fugitive Dust Emission Factors
[20] February 10, 1988 and March 21, 1990 Dan Olson Memos on PM10 Adjustment
[21] AP-42 Section 8.24 Western Surface Coal Mining 1983
[22] MRI Revised Final Report, Sept. 1998 Revision of Emission Factors for AP-42 Section 11.9
[23] AP-42 Section 13.2.2 Unpaved Roads
[24] AP-42 Section 11.9 Western Surface Coal Mining

9.0 Modeling Analysis

MMA conducted a modeling analysis to determine whether EPA's current model (AERMOD) would yield significant improvements over the ISC Short Term (ISCST) model in the prediction of short-term particulate concentrations for surface mining operations. Two mines were "created" for the AERMOD vs. ISCST modeling, one designed to produce 50 million tons per year (MMTPY) of coal, the other designed to produce 100 MMTPY. Mining parameters and pit sequences were typical of PRB surface mines of equivalent size. Each mine was modeled for PM_{10} for short-term (24-hour) concentration predictions. Each mine was also placed in a separate geographical location, with separate meteorology and receptor elevations. AERMOD version 09292 was used with regulatory default options selected. ISCST version 02035 was also used with default options.

A PM_{10} emission inventory was developed for each mine based loosely on data from existing operations. The 50 MMTPY mine contains one active pit area, with coal haulage to a single truck dump (Figure 11). Overburden removal was assumed to be performed by truck/shovel only. The 100 MMTPY mine had three active pits, and coal hauled to three dumps (Figure 12). Overburden removal was performed by both truck/shovel and dragline. Emission factors used reflected current AQD methodology, as did the various parameters used within the emission factors (e.g., vehicle speeds, material moisture and silt percentages, emission control efficiencies, etc.). Total PM_{10} emissions from the 50 MMTPY mine were roughly 1,700 tons per year, and nearly 2,700 tons per year from the 100 MMTPY mine.

The meteorological data files required to perform the modeling analyses differ between the ISCST and AERMOD modeling systems. Equivalent meteorological input files were created from base meteorological data for use in each model.

A nested receptor grid was placed around each mine. Receptors within 50 meters of any source were deleted from the grid. Receptors were spaced at 100-meter intervals to a distance of 1000 meters from the mining sources. At distances of 1000 to 3000 meters from the sources, receptors were spaced at 250 meters. Finally, receptors were spaced at 500 meters at distances of 3000 to 8000 meters from the sources. See Figures 13 and 14 for the receptor grids used for the 50 MMTPY and 100 MMTPY mines, respectively.

Mine source locations, receptor locations, and the appropriate 7.5 minute digital elevation models (DEMs) were used as inputs to EPA's terrain processor, AERMAP. AERMAP extracts the elevations for all sources and receptors within the domain of the DEMs, which were then used in the modeling files. The 50 MMTPY and 100 MMTPY mines were placed at different sites, each near the mine's respective meteorological data source location.

Modeling Results

Predicted PM_{10} concentrations within each receptor group were ranked and then compared between modeling systems for both mine scenarios. For example, all concentrations predicted by AERMOD within the 100-meter interval receptor group at the 50 MMTPY mine were ranked by magnitude, as were all ISCST-predicted concentrations within the 100-meter group at the same mine. The ranked concentrations were then compared between the two models (1st high AERMOD vs. 1st high ISCST, 2nd high AERMOD vs. 2nd high ISCST, etc.). The ranked comparisons were performed for each of the three receptor interval groups (100-meter, 250-meter, and 500-meter).

Results of these comparisons for the 50 MMTPY mine are presented in Figure 15 (100-meter receptors), Figure 16 (250-meter receptors) and Figure 17 (500-meter receptors). The black diagonal lines in these graphs indicate the case where AERMOD results would exactly correspond to ISCST results. The actual model results are shown in blue. Model results above the diagonal black line indicate where AERMOD predicted higher concentrations than ISCST. Results below the diagonal show cases where AERMOD predicted lower concentrations than ISCST.

The 100-meter receptor comparison (Figure 15) shows that for PM_{10} concentrations predicted by ISCST at or above the 24-hour standard of 150 µg/m^3, AERMOD would also predict concentrations that exceed the standard, indicating AERMOD shows no improvement to the over-predictive tendency of ISCST. In fact, Figure 16 shows that AERMOD would predict concentrations in the 250-meter receptor set above the standard in cases where ISCST would not. Figure 17 also shows that AERMOD concentrations tend to be higher than ISCST concentrations in the 500-meter receptor set. Both the 250-meter receptor set and 500-meter receptor set comparisons demonstrate a strong tendency for AERMOD to predict higher concentrations than ISCST in the upper range of concentrations.

Results of the comparisons for the 100 MMTPY mine show similar tendencies, and are displayed in Figure 18 (100-meter receptors), Figure 19 (250-meter receptors), and Figure 20 (500-meter receptors). For the 100-meter receptors, AERMOD predicts exceedances of the 24-hour standard in cases where ISCST predicts concentrations below the standard, and consistently predicts concentrations higher than ISCST in the range of concentrations that would be critical decision points in the permitting process. The trend for AERMOD to predict higher concentrations than ISCST is also seen in Figures 19 and 20 for the other two receptor sets. All three receptor set comparisons for the 100 MMTPY mine again demonstrate the strong tendency for AERMOD to predict higher concentrations than ISCST at the upper range of concentrations.

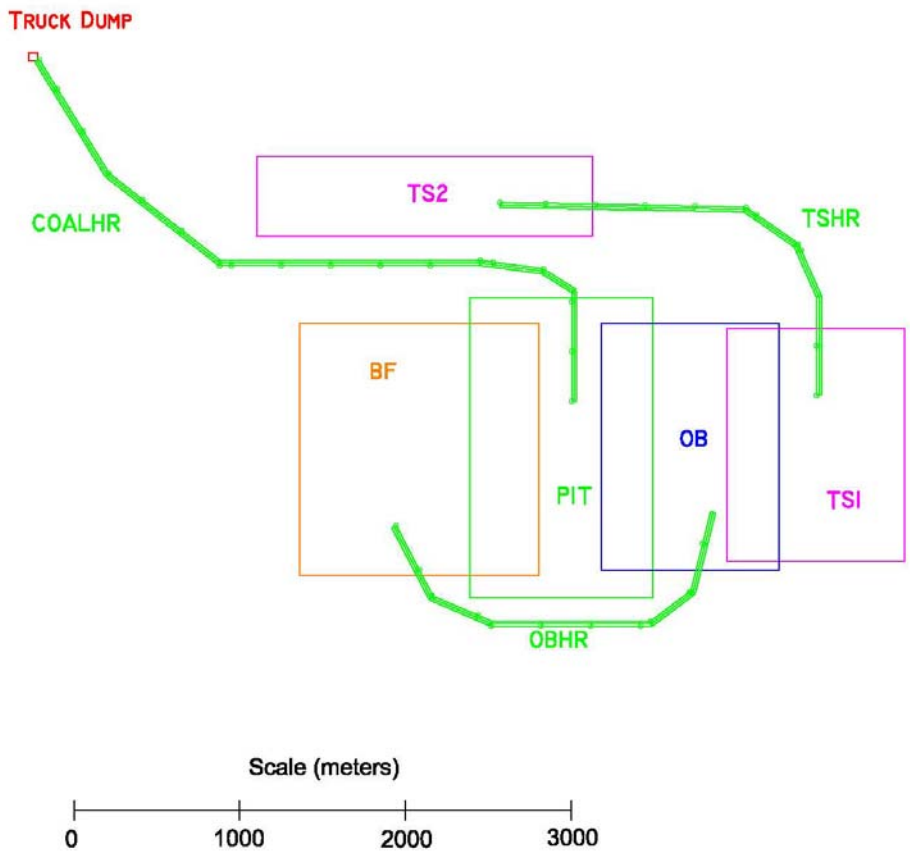

Figure 11. 50 MMTPY Mine Plan Modeled Area Sources

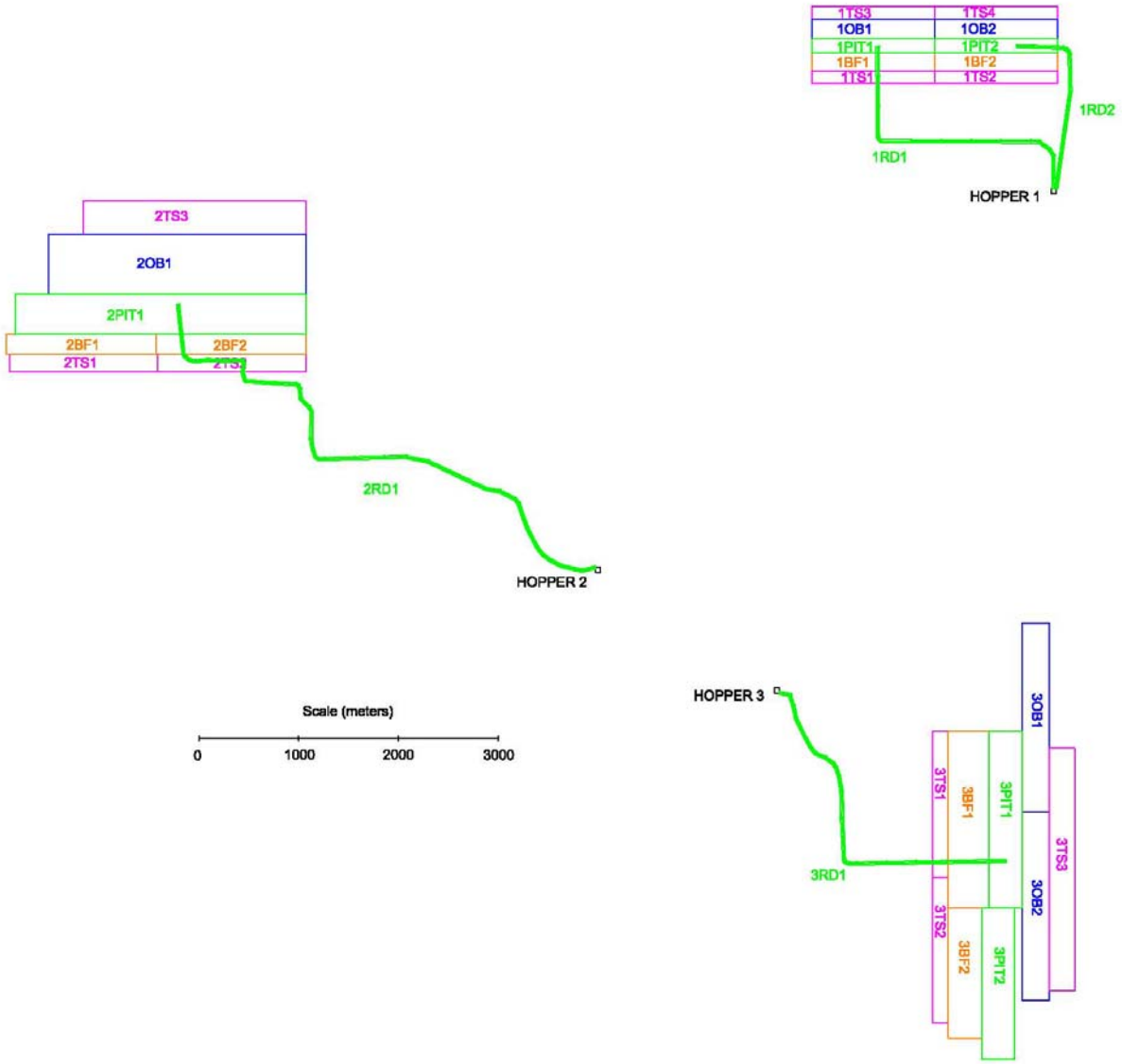

Figure 12. 100 MMTPY Mine Plan Modeled Area Sources

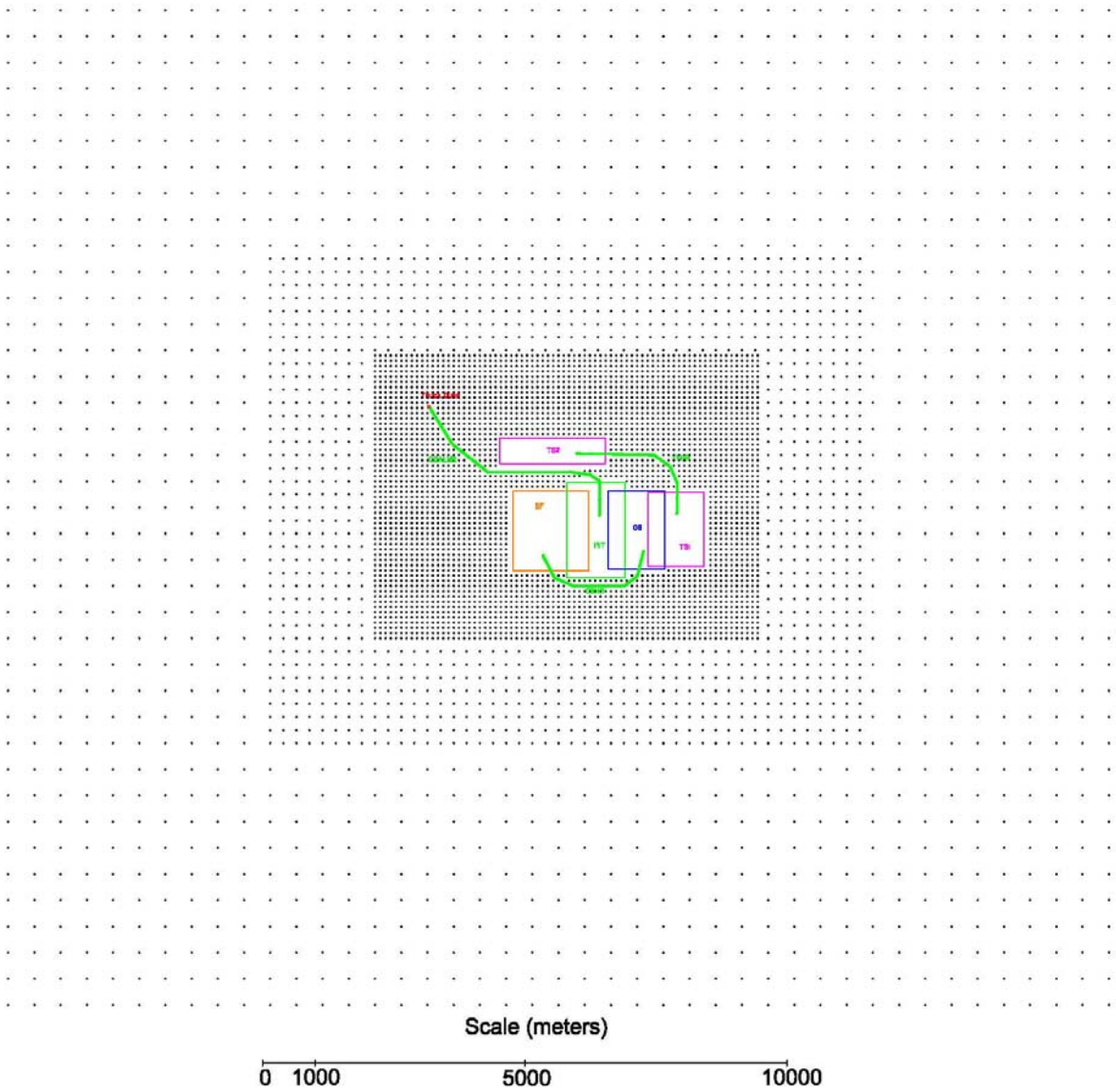

Figure 13. 50 MMTPY Mine Plan Receptor Grid

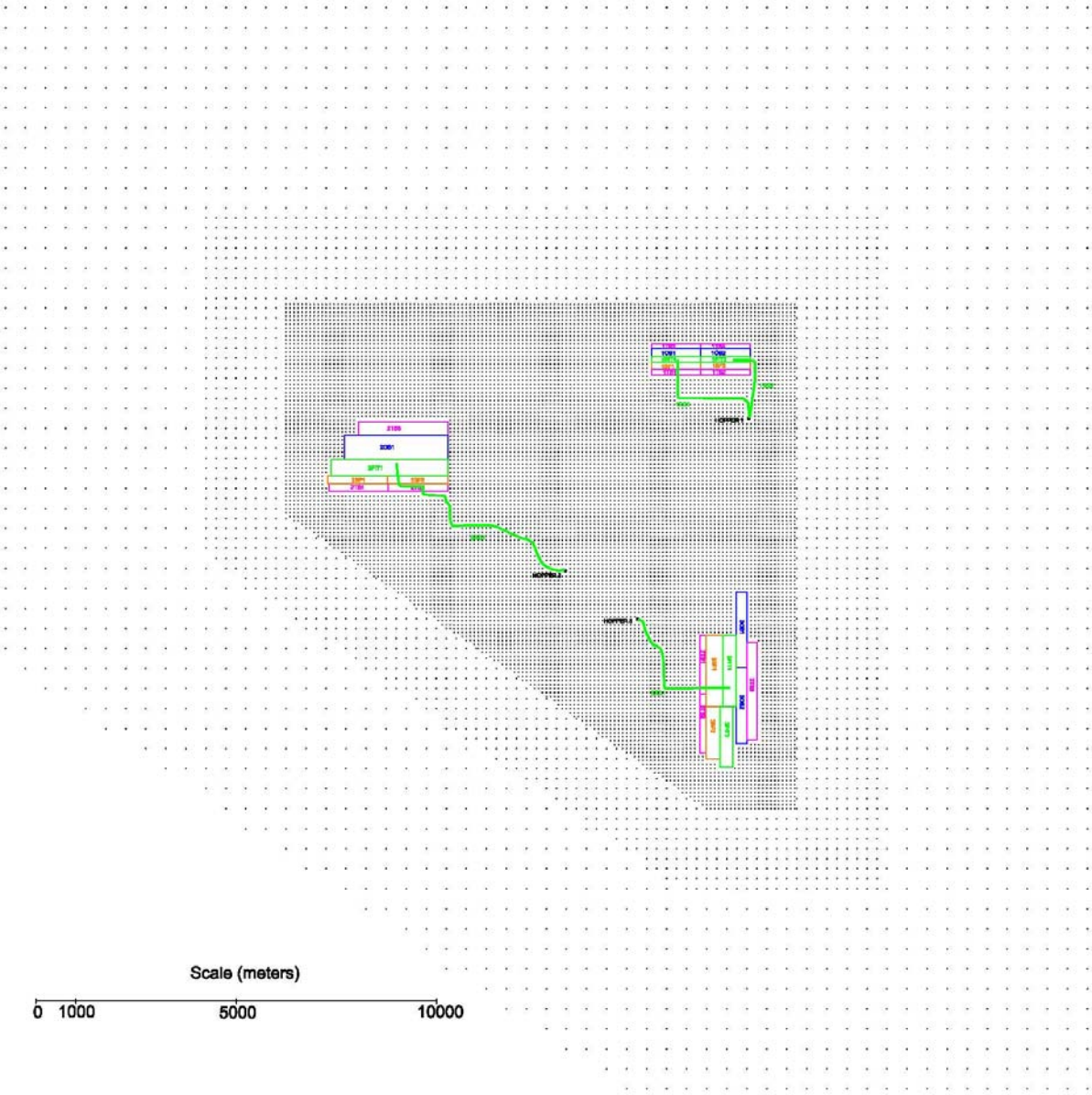

Figure 14. 100 MMTPY Mine Plan Receptor Grid

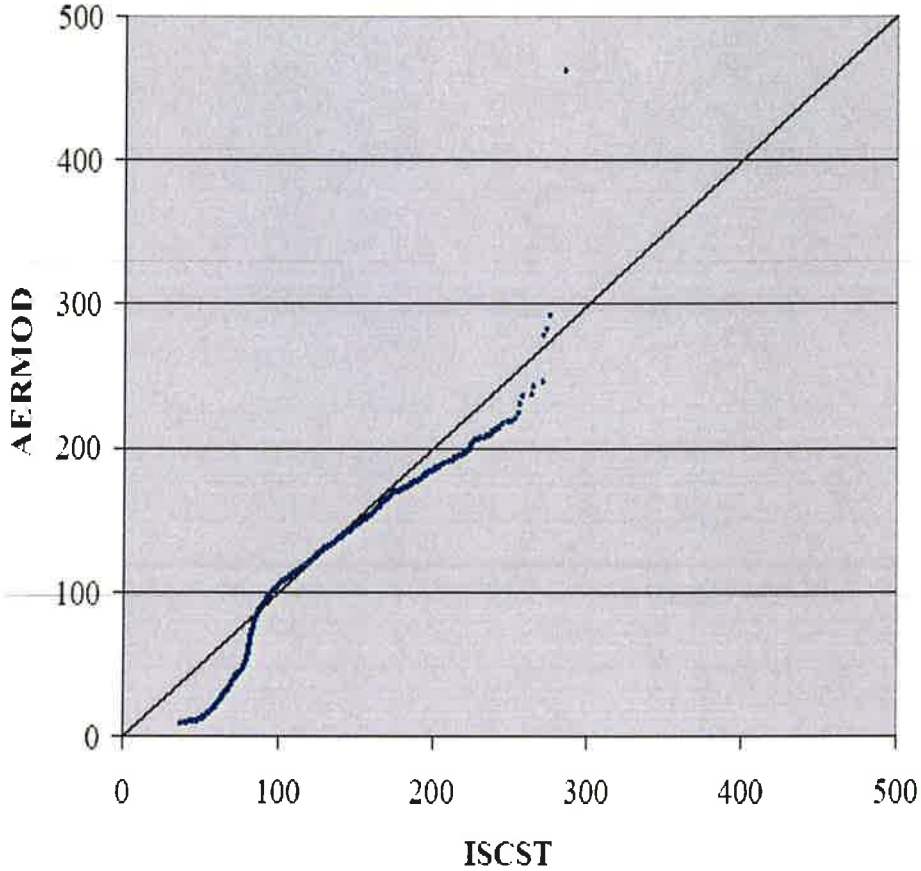

Figure 15. 50 MMTPY Mine Plan, 100-meter Receptors, Concentrations in μg/m^3

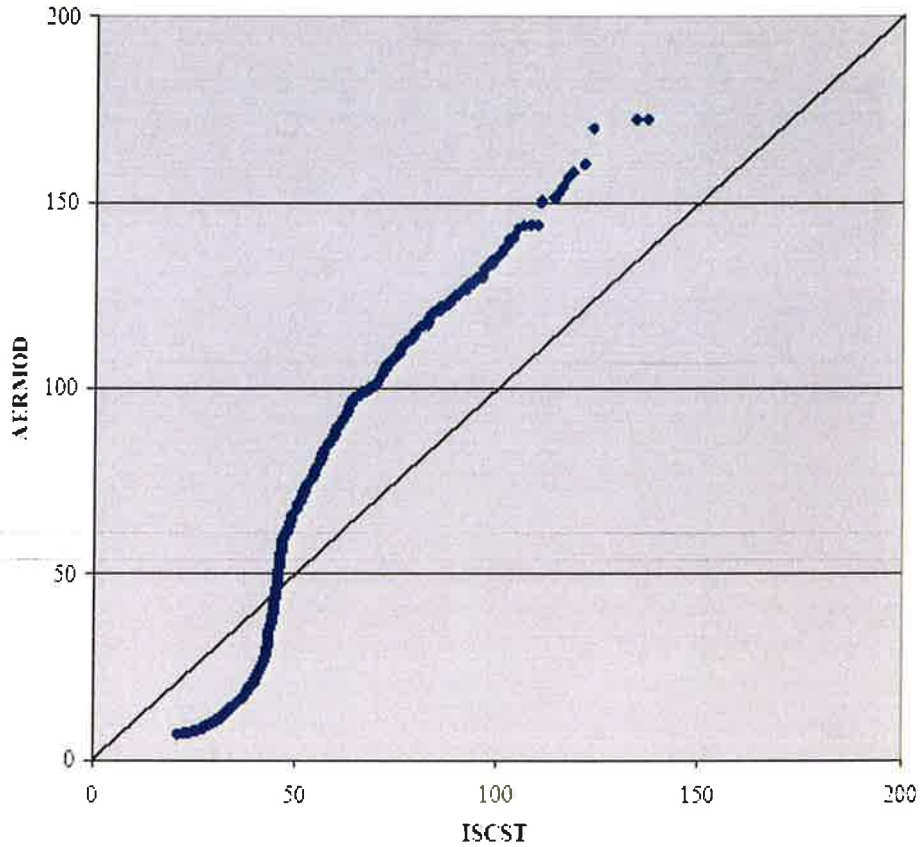

Figure 16. 50 MMTPY Mine Plan, 250-meter Receptors, Concentrations in μg/m^3

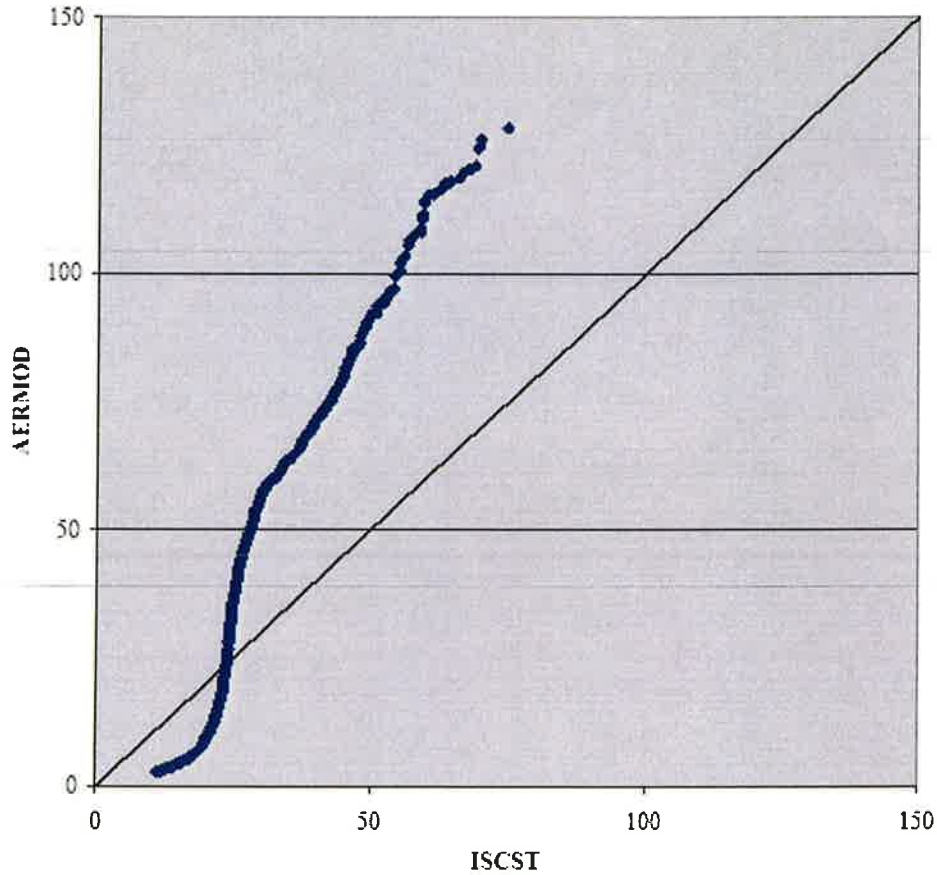

Figure 17. 50 MMTPY Mine Plan, 500-meter Receptors, Concentrations in μg/m^3

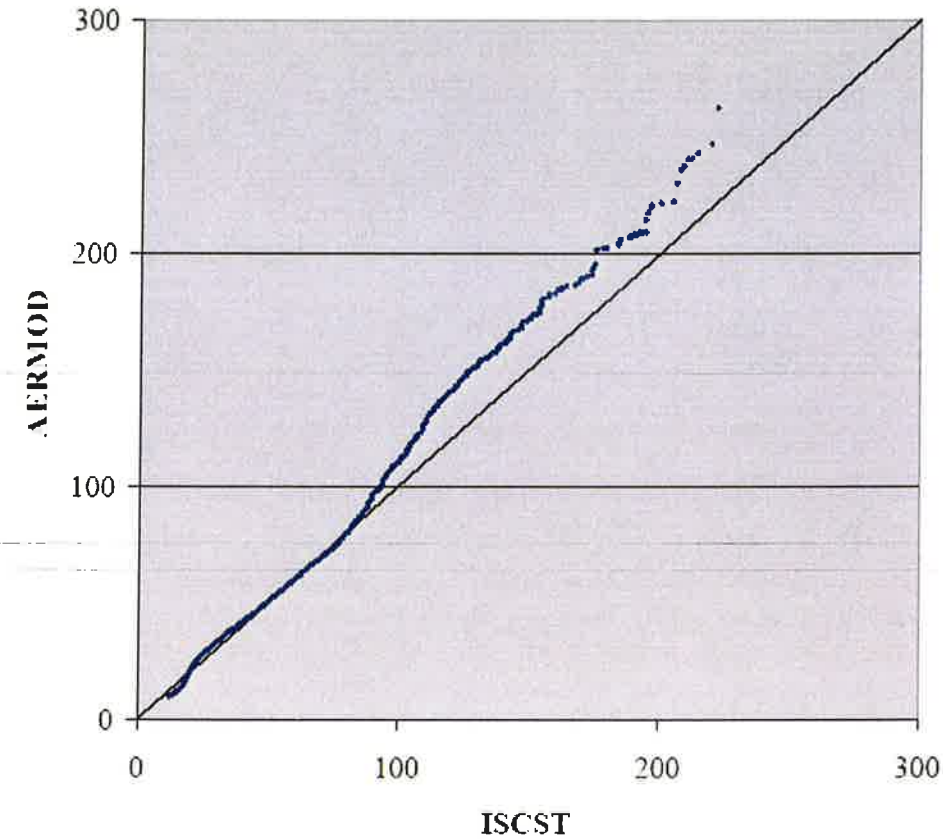

Figure 18. 100 MMTPY Mine Plan, 100-meter Receptors, Concentrations in μg/m^3

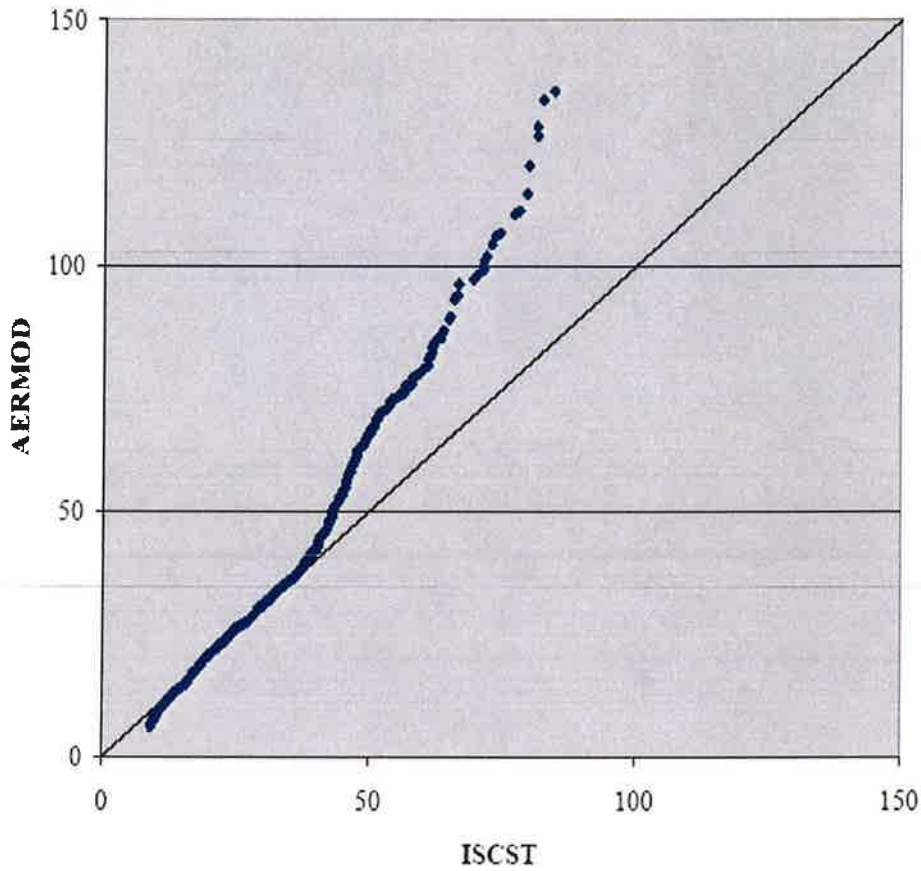

Figure 19. 100 MMTPY Mine Plan, 250-meter Receptors, Concentrations in μg/m^3

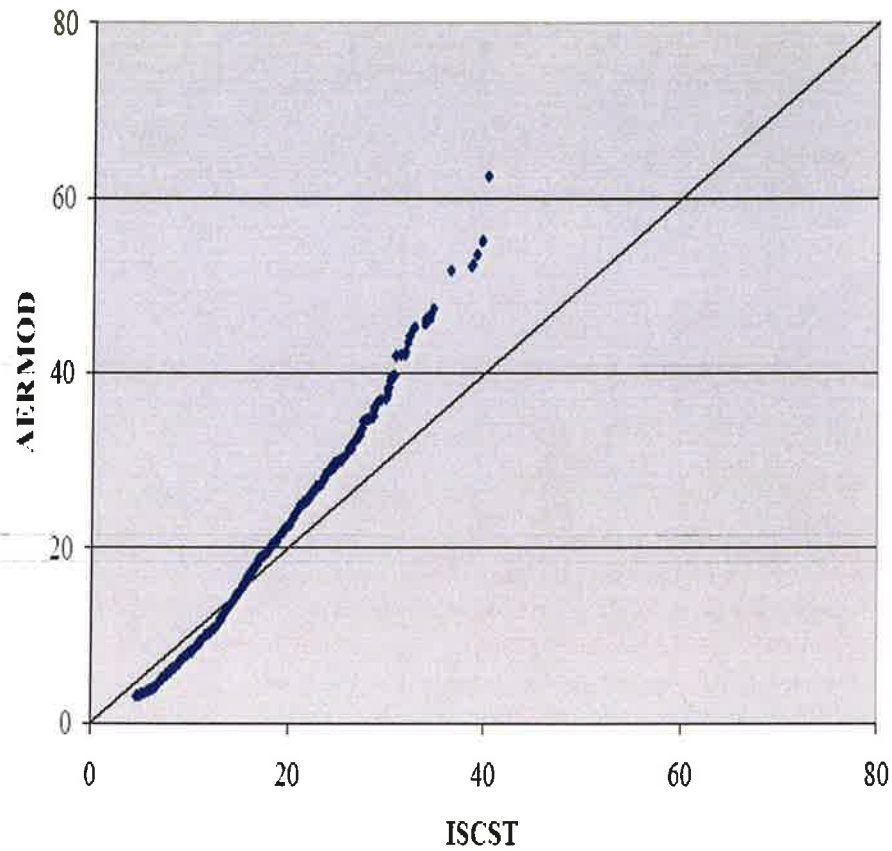

Figure 20. 100 MMTPY Mine Plan, 500-meter Receptors, Concentrations in μg/m^3

10.0 Conclusions

The research done in this report leads to the following simple conclusions:

- The provisions of CAAA Section 234 remain in effect to this date, some 21 years later.
- The technical difficulties with the model and emission factors recognized by Congress in Section 234 remain unresolved.
- EPA's adoption of the AERMOD model, in particular, has not remedied the strong tendency for available air quality tools to excessively over-predict concentrations of PM_{10} for surface coal mines. In fact, AERMOD predicts concentrations that are higher yet than ISC for the maximum predicted impacts that drive permit decisions.

Appendix A

References in Electronic Format