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February 16, 2006

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VIA COURIER AND US MAIL

Rebecca J. Smith
Acting Director
Office of Standards, Regulations and Variances
Mine Safety and Health Administration
1100 Wilson Blvd.
Arlington, VA 22209-3939

Re: RE: RIN: 1219-AB29
Comments on Proposed Rule: Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Mines 70 FR53279-53293 (September 7, 2005)

Dear Ms. Smith:

The MARG Diesel Coalition[1] welcomes this opportunity to comment on the proposed rule that would impose reduced elemental carbon (EC) particulate limits on underground metal and nonmetal mines. MARG notes with approval that MSHA will include the entire record of the diesel particulate matter (DPM) rules in this proceeding. All prior MARG written comments and testimony[2] on the

[1] The members of the MARG Coalition are Cargil Salt, Detroit Salt, Carmuese Lime, FMC Wyoming, General Chemical, Morton Salt, Mosaic Potash, and Stillwater Mining. MARG notes with appreciation that it has received significant support from a number of other companies and trade associations. Coalition members volunteered their mine sites, records and resources to assist with, and participate in, the ten year, multimillion dollar study of 14,000 miners by NIOSH and NCI to determine if diesel exhaust causes adverse health effects, and if so at what level of exposure (completion expected in 2006-7). The preliminary results of that study were released by NIOSH and NCI and an analysis by Dr. Gerald Chase was entered into the rulemaking record. MARG Members are thankful that the preliminary data did not show any excess lung cancer associated with diesel exhaust exposures and hopeful that the final results of the study will confirm the preliminary results.

[2] The Coalition was formed 15 years ago and has sponsored original, scientific research resulting in peer-reviewed, published literature on diesel exhaust matters, and placed extensive information into the record of this rulemaking. Among the scientific information submitted to the record by the Coalition are the comments by Dr. Jonathan Borak, Yale Medical School, on the analysis of potential health effects of diesel exhaust conducted by MSHA; the industrial hygiene research conducted by Dr. Howard Cohen (University of Connecticut at New Haven, Dr. Jonathan Borak (Yale) and Dr. Thomas Hall (University of Oklahoma) on the MSHA sampling and analytical method; and the engineering and economic feasibility analysis conducted by mining expert, H. John Head.

AB29-COMM-110

MSHA rules should be incorporated into the record of this rulemaking, as if we had repeated them fully herein.

Diesel engines are critical to the viability of the mines operated by MARG Coalition members and to the jobs enjoyed by their employees and communities. Generally, they are the only technology that has the necessary horsepower, durability, duty cycles, efficiencies and flexibility for the rigorous challenges posed by the underground mining environment.

MARG Members are committed to the protection of the workforce and the public from hazards related to diesel exhaust and from all other hazards as well. MARG members are supportive of effective and scientifically sound regulations, but oppose regulations that are counterproductive and have no scientific or engineering basis. MARG members have witnessed the high cost of US regulatory burdens, even when worthy, and have observed that worldwide competition, often from countries with wages and benefits orders of magnitude below the US, results in the loss of thousands of US jobs and significant portions of the nation's production capacity for critical and strategic minerals such as zinc, molybdenum, copper, iron ore, uranium, potash, and others. Today, there are only 170 remaining underground metal and nonmetal mines in the Untied States compared to the 261 mines reported by the 1998 proposed rule 63 F.R. 58104, 58209 (October 29, 1998).

On August 10, 2005, MARG filed a Petition For Expedited Data Quality Act (DQA) Corrections of The Diesel Particulate Matter Rules, issued as Final Rules in June 2005. In violation of the DQA, the Department of Labor and MSHA declined to respond to the detailed Petition, other than to indicate that it would be considered in the record of this rulemaking. MARG respectfully suggests that if DOL had abided by the intent of Congress when it passed the Data Quality Act, rule corrections would have been considered and made prior to this rulemaking, significantly improving the adopted provisions of the MSHA rules, and eliminating the need for this rulemaking. Unfortunately, the DOL/MSHA decision to "side step" the Data Quality Act facilitates the perpetuation of the scientific and engineering errors that result in this proposed rule, which MARG opposes.

MARG notes a fundamental flaw in the proposed rule. It is not a diesel particulate or diesel exhaust rule as originally proposed in 1998, but a rule that expressly proposes to limit elemental carbon (EC), a replacement for a repudiated limit on total carbon (TC). As shown herein, there is no scientific or engineering support for the EC limits and reductions proposed by MSHA, and the TC limit MSHA is abandoning was never feasible or justified either.

The 400 TC limit and the 160 TC Limit were rushed to publication on the last day of the President Clinton's Administration in 2001, as future standards to be applied in 2002 and 2006, but were immediately challenged in court. The 400 TC limit became effective only as an interim, partial "settlement" limit, enforced in 2003. At that time, MSHA was forced to acknowledge its inability to measure TC, and the need to develop potentially feasible sampling and analysis methods, and determine if there were potentially feasible exhaust control methods.

MSHA also was required to determine if there was a relationship between DPM, EC and TC, to permit conversion of the exposure limits from TC to EC, and to review the limits for validity and feasibility. All of this work should have preceded the 2001 rule, if the mandates of the Mine Act and other laws had been followed. However, in agreeing to the interim, partial settlement, MARG agreed to work cooperatively with MSHA to achieve the goals of the settlement, but it retained its full rights to challenge both the 2001 rule, and the anticipated amendments, if the flaws in the rules were not cured. MARG believes that MSHA violated the interim partial settlement agreement and that the flaws in the regulations are compounded, not cured, by the new MSHA proposal.

We enclose as **Exhibit 1** the comments of Dr. Jonathan Borak, Yale University Medical School, and his associates, dated February 6, 2006, that demonstrate: (1) the EC content of DPM is neither stable nor predictable and thus the proposed conversion of TC limits to EC limits is not feasible; (2) measurement of EC is not accurate and the inherent inaccuracies are not accounted for by the MSHA "error factor;" (3) EC is not a constituent of diesel exhaust that is suspected of causing lung cancer, and the MSHA risk analysis of diesel exhaust is inapplicable to the proposed EC limits; (4) there is no National Institute of Standards and Technology (NIST) "standard" for defining EC for analysis and measurement, thus accurate measurement is not feasible (e.g. there is no standard 12" ruler, or one gram weight); and (5) MSHA duplicate analysis of more than 600 EC samples ("punch to punch" comparisons of duplicate analysis for the same sample) show that the results are neither precise or reproducible. Enclosed as **Exhibit 2** is the December 8, 2005, letter of Dr. Borak and associates on the draft report by JD Noll, et al: *The Relationship Between Elemental Carbon, Total Carbon and Diesel Particulate In Several Underground Metal/Non-Metal Mines*. In prior comments contained in the record, Dr. Borak and associates concluded that the diesel exhaust risk analysis conducted by MSHA did not meet basic minimum scientific standards and that there is no dose / response relationship that supports the proposed EC limits.

We enclose as **Exhibit 3** comments by mining engineering expert, H. John Head, that demonstrate that the proposed EC Limits are not feasible. Mr. Head's previous clear and convincing engineering comments and economic analysis contained in the record demonstrate why MSHA was forced to admit the lack of feasible controls, necessitating a stay of the MSHA Limits. Enclosed as **Exhibit 4** is a January 31, 2006, letter from The Lubrizol Corporation stating that they are ceasing production of Purinox, further reducing the potential for feasible DPM controls, and confirming the lack of reliability of alternative fuel supplies testified to by mine operators and MARG.

As shown below, there is overwhelming evidence in the rulemaking record to support Dr. Borak's and H. John Head's comments throughout the rulemaking process, including conclusions reached recently by MSHA itself. Prior attempts by MSHA federal register pronouncements to discredit sound scientific analysis using hypothetical computer models, and misquoted scientific evidence, are shown herein to be spurious.

MARG is hopeful that MSHA will finally correct its flawed rules, by deleting the 160 limit, rather than perpetuate their proven and admitted errors by adopting the new proposals which lack a valid health rational, measurement system, and engineering basis.

Sincerely

Henry Chajet
Counsel to the MARG Coalition

MARG Coalition Comments on DPM Proposed Rule, 70 F.R. 53279 (September 7, 2005)

The Federal Mine Safety and Health Act, Section 101(a)(6)(A) provides:

> The Secretary, in promulgating mandatory standards dealing with toxic materials or harmful physical agents under this subsection, shall set standards which most adequately assure on the basis of the best available evidence that no miner will suffer material impairment of health or functional capacity even if such miner has regular exposure to the hazards dealt with by such standard for the period of his working life. Development of mandatory standards under this subsection shall be based upon research, demonstrations, experiments, and such other information as may be appropriate. In addition to the attainment of the highest degree of health and safety protection for the miner, other considerations shall be the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws. Whenever practicable, the mandatory health or safety standard promulgated shall be expressed in terms of objective criteria and of the performance desired.

30 U.S.C. § 811 (emphasis added).

An examination of the basis and history of the MSHA proposed rule demonstrates that the agency repeatedly ignored its statutory mandates and the facts regarding diesel exhaust and exhaust control technology to issue rules without any scientific or engineering support.

- The questions posed by MSHA in this rulemaking demonstrate that the Agency has neither collected nor analyzed the basic facts necessary to meet its statutory mandates. See infra at 16-29 (responding to MSHA seeking information on the makeup of the diesel fleet, the substance proposed for regulation and the use of control technology).

- No other US or international agency regulates or limits diesel exhaust (a complex and ever changing mixture of gasses and particulates) based on its EC content. OSHA, which has responsibility for regulating diesel exhaust in construction tunneling and diesel engine maintenance facilities, industries with significant exposures, relies on the regulation of diesel exhaust gases for effective employee protection. Neither OSHA, nor the Department of Transportation, nor any US department or agency limits the EC content of diesel exhaust.

- While MSHA has existing regulations that limit diesel exhaust by limiting its constituent gases, MSHA elected to ignore the experience gained under its own law, and the experience under other health and safety laws, and in 2001 undertook a regulatory experiment that led to today's proposed rule, without any of the basic knowledge or scientific evidence needed to support new regulations.

- No study existed or was conducted by MSHA to determine the level of protection offered by existing regulations that limit diesel exhaust gases. Thus, MSHA was unable to and did not compare existing protections to those offered by proposed new limits on a different selected surrogate for diesel exhaust, the carbon content limits adopted in 2001.

- No study existed or was conducted by MSHA to determine if the carbon content of diesel exhaust particulate accurately and consistently represents overall diesel exhaust exposures of miners, so as to render the regulation of this new surrogate feasible and compliant with the Mine Act's limited authority to regulate and prevent material impairment of health resulting from the substance proposed for regulation.

- When the 2001 rule was issued it limited total carbon, based on a supposed MSHA risk analysis for diesel exhaust, that used far broader ambient air research to justify the MSHA selected total carbon limits. Moreover, the MSHA carbon limits were based on a now discredited ACGIH TLV, which was later withdrawn because it was proven to be both invalid and derived from MSHA and ACGIH conflicts of interest now documented in this rulemaking record.

- The MSHA 2001 total carbon limits were pronounced "feasible" in 2001 by MSHA, based on a hypothetical computer model that later proved to be incorrect and unreliable, forcing MSHA to admit a lack of sufficient evidence of feasibility of compliance for the 160 TC limit in 2005 and 2006.

- MSHA concluded that the total carbon limits it selected in 2001 were feasible to measure accurately and reliably, with an MSHA (and NIOSH) developed sampling device and analysis system that at the time was not commercially tested or available. That conclusion has now been rescinded by MSHA (TC incapable of measurement, 70 Fed. Reg. at 32871), forcing the proposal of an elemental carbon limit. However, the new limit suffers from some of the same sampling and analytical flaws as the original limit, and from "conversion" flaws admitted by MSHA to render reliable and accurate conversion from TC to EC impossible.

- Elemental Carbon, the new MSHA proposed regulated substance, is not a suspected carcinogen according to all of the scientific studies that examined this question. Yet, lung cancer was the focus of, and the most important potential adverse health effect, identified by the 2001 MSHA health risk analysis the agency used to justify the total carbon limits. While MSHA continues to defend its diesel exhaust risk analysis, regardless of its inapplicability to the proposed elemental carbon limits, the risk assessment per se was found to use an inadequate methodology by Dr. Jonathan Borak, Yale University Medical School who confirms in new comments that there is no suspected relationship between EC and lung cancer.

- MSHA admits that since: "it is unlikely that EC and OC have identical health effects, it is important to consider the extent to which the ratio of EC to OC (and hence of EC to TC) may vary in different underground mining environments."

- MSHA admits that: "at a confidence level exceeding 99.9%, the data show statistically significant differences in the mean EC: TC ratios between mines and between different sampling days within mines."

- The new MSHA proposed Elemental Carbon limits can not be derived from the MSHA abandoned total carbon limits of 400 Total Carbon or 160 Total Carbon because no stable, reliable relationship exists between TC and EC, and EC does not reliably predict DPM.

- Like its withdrawn total carbon limit that could not be measured without unacceptable interferences, there is no national or accepted "standard" defining the "elemental carbon," to be limited by the proposed rule (e.g. an NIST standard sample), and creating the accepted "ruler" needed to render the MSHA proposed limits feasible for use.

- MSHA data from more than 600 duplicate elemental carbon analytical results, from the same collection filters (analysis results for a "punch and re-punch" from the same filter), described in Dr. Borak's comments, demonstrate an unacceptable level of measurement repeatability for measuring elemental carbon levels, rendering the proposed limits not feasible.

- The 2001 Final Rule predictions that the 160 TC and 400 TC limits were technically and economically feasible for compliance by the mining industry, were proven wrong by actual events. Reality, including extensive experiments with diesel exhaust filters, fuels, and other control mechanisms, and MSHA 2002-2005 industry wide sampling results demonstrating 37% above the 400 TC / 308 EC limit, and 90+% above the Final Limit, caused MSHA to admit a lack of evidence of feasibility when it extended the date for its January, 2006 Final Limit. The late 2005 MSHA admission of a lack of feasible means of compliance remains valid for the predictable future.

- The MSHA analysis of technical and economic feasibility used to support the 2001 and 2005 Final rules was simply wrong. They were based on another MSHA computer model ("The Estimator") and suffered from the many faults described by our prior comments; particularly the engineering analysis provided by H. John Head. The same faulty evidence and hypothetical feasibility predictions underlie the new MSHA prediction that successive, yearly 50 microgram EC reductions are feasible between now and 2011.

- An examination of the testimony submitted by the Stillwater Mine, the site of the most extensive diesel exhaust control testing in the world, demonstrates the lack of feasibility of the proposed limits. Stillwater is not alone and the testimony of MARG and non-MARG members demonstrate the lack of feasibility throughout the mining industry. See e.g. Salt Lake City public hearing transcript.

The best and latest available scientific evidence does not indicate that miners will suffer any risk of or impairment of health or functional capacity if regularly exposed to elemental carbon at the current limit of 308 micrograms per cubic meter. That level is about 1/7 of the MSHA 2 mg / m3 limit for coal dust, before any of the MSHA proposed reductions.

As MSHA acknowledged in the preamble to the 2001 rule, the scientific community has not widely accepted any exposure-response relationship between the amount of DPM exposure and the likelihood of adverse health outcomes. 66 Fed. Reg. 5706, 5708 (Jan 19, 2001). MSHA reviewed and updated its risk assessment in the June 6, 2005 rule amendments and concluded that no change was warranted.

<u>Pending the results of the NIOSH/NCI study, MSHA should not adopt any new standard.</u>

A NIOSH / NCI study is currently underway that was designed to address the question of potential diesel health effects and safe levels of exposure. Any regulatory effort now to adopt a reduced EC limit is not in compliance with the law and the instructions of Congress.

As previously noted, the January 2001 MSHA rule that started this controversy was rushed and premature, published on the last day of President Clinton's Administration. The publication violated specific bipartisan congressional directives mandating that any diesel exhaust rule be informed by the congressionally-funded, multi-million dollar NIOSH NCI Study to determine if diesel exhaust poses potential health effects and if so, safe levels of exposure.

At great expensive and disruption, MARG members and their employees, provided the mine sites, sampling access and extensive records access for the on-going NIOSH / NCI study of 14,000 miners that used diesel equipment since it was originally introduced in mining 30 plus years ago. The NIOSH NCI Study is expected to be complete some time in 2006 - 2007.

As shown by the comments of Dr. Chase, contained in the rulemaking record, the first NIOSH / NCI preliminary data releases thankfully show no excess lung cancer found among the 14,000 studied miners. Dr Chase recited numerous qualifiers when he reached his preliminary conclusions, based on preliminary data, but the study continues to be "good news;" and certainly the 14,000 miners and the MARG Coalition hope and pray that the final results confirm the interim, preliminary results.

It is incredible that the MSHA June 2005 federal register notice seemingly prefers "bad news" from the NIOSH/ NCI study, and is filled with hypothetical reasons why excess lung cancers *should* occur. The MSHA attempt to discredit the report by Dr Chase, who simply reviewed the data provided by NISOH / NCI, and compared it to published and accepted lung cancer death rates, should be withdrawn as an attempt to instill fear, based on wild speculation, into a scientific discussion about the health of the employees included in the NIOSH / NCI study.

MSHA' s continuing defense of its flawed rules, and its lack of willingness to identify, admit and correct fully the errors of these regulations, may lie in their origin. Instead of relying on its diesel exhaust, gaseous component limits until the NIOSH / NCI Study was complete, MSHA permitted a conflicted senior employee to chair the MSHA DPM rule drafting committee. As shown by the deposition transcript of Thomas Tomb, submitted for the record by MARG, Mr. Tomb selected TC as the proposed regulated substance for the ACGIH, selected the ACGIH TLV of 150, and used the ACGIH 150 TC TLV (that he created) to support the MSHA 160 TC PEL proposed and adopted by MSHA. Mr. Tomb concurrently was paid by MSHA to be the MSHA representative to the ACGIH, and the lead author of the now withdrawn ACGIH TC limit for diesel exhaust. While his conflicted dual roles were hidden from the public until discovered in litigation, he successfully "bootstrapped" the dual roles to support each other, producing a regulation that today continues to suffer from the conflict infected flaws. If Mr. Tomb's conduct took place today, and was exposed, DOL and ACGIH policy would prohibit his conduct, rather than award him a bonus for his accomplishments. Yet, there have been no DOL actions to identify, acknowledge and correct the damage created by Mr. Tomb's actions and MSHA and Mr. Tomb's colleagues continue to defend and support an unsupportable result.

The adoption of a rule based on the conflict infected ACGIH TLV, that ignores the NIOSH / NCI study, and the credible scientific research and opinions of Dr. Borak and his associates, violates the Mine Act and Data Quality Act mandates to base rules on the latest scientific evidence, studies and demonstrations and to use only bias free, scientific evidence that is transparent and reproducible.

The 2001 MSHA rule, and the 2005 proposed amendments, are invalid not only because the scientific community has not accepted any exposure-response relationship between the amount of DPM exposure and the likelihood of adverse health outcomes, 66 Fed. Reg. 5706, 5708 (Jan 19, 2001), but because MSHA did not adopt or propose a diesel exhaust limit or DPM limit, but a limit on total carbon, that it abandoned, and now a proposed limit on elemental carbon. MSHA took this action without knowing what diesel exhaust constituent, if any: (a) presents a health risk; (b) represents diesel exhaust reliably and predictably; (c) should be measured; (d) can be feasibly measured with accurate results; (e) should be controlled and limited to an identified, scientifically justifiable level; and (f) can be feasibly limited to that justifiable level.

<u>The Proposed Regulations Are Not Feasible</u>

Nothing can be more telling than MSHA's own admission in the June 6 Federal Register notice at page 32916 (emphasis added):

> **MSHA acknowledges that the current DPM rulemaking record lacks sufficient feasibility documentation to justify lowering the DPM limits below 308EC ug/m3 at this time.**

This admission is in addition to the other, critical MSHA admissions made in June and September, 2005, that it could not accurately and feasibly measure total carbon (70 FR 32867-32968) requiring a rule amendment to "convert" its limits to elemental carbon.

The 2001 MSHA conclusions regarding statutorily mandated determinations of risks, benefits, impacts, and feasibility were all based on the selected regulated substance, total carbon, as a surrogate for diesel exhaust. 66 Fed. Reg. 5706-5755. Yet, MSHA has failed to withdraw the 160 ug/m3 total carbon limit, adopted in 2001, and discredited by its June and September Federal Register notices.

MSHA based its 2001 conclusion of feasibility of the 160 and 400 TC Limits upon predictions that retrofitting diesel equipment with exhaust filters would be the primary method of compliance. As documented by our prior comments, the use by MSHA of its "Estimator" computer model was based on invalid assumption of the availability of filters that would fit the entire varied fleet of equipment in use, and assumptions of perfect ventilation conditions throughout the industry. As established by MARG comments submitted by engineering expert H. John Head, no such filters were available commercially at the time of the MSHA prediction, nor when the 2001 Final Rule was published, nor had any undergone testing. Moreover, as Mr. Head established in his comments, the assumption of "The Estimator" of perfect ventilation in mines did not exist in reality and the rule could not be declared feasible based on these incorrect assumptions.

When filter testing began following the 2001 rule, MSHA and the industry encountered significant problems and hazards.

1. Fire hazards with high temperature disposable diesel particulate filters (Program Information Bulletin No. P04-17)
2. Platinum based catalysts resulted in increased and hazardous nitrogen dioxide exposures (Program Information Bulletin No. P02-4)

See response to question 1 below for further discussion on filters.

After several years and multiple rounds of NIOSH Partnership testing of potential diesel exhaust controls at the Stillwater Mine, a mine with one of the most diverse fleets of diesel engines in the country, and extensive multimillion dollar exhaust control efforts by Stillwater (including major ventilation upgrades, massive equipment modifications, and improved maintenance practices), the mine cannot feasibly comply with the 400 TC (308 EC) interim standard, and can not foresee feasible compliance with any of the reduced limits MSHA proposes to become effective between now and 2011. The Stillwater testing and implementation of controls included every type of control available, including multiple filters and alternative fuels, and experimental controls. *See Testimony and Comments of Stillwater Mining Company submitted for this rulemaking on January 26, 2006.* Similar documented results were reported during the public hearings by many other companies, and their employees who often testified independently or with their union representative to the extensive efforts by their employers to reduce exhaust level.

Accurate measurement is not possible

The June 6, 2005 amendment to the 2001 Total Carbon (TC) Limit admits that a change in the MSHA selected surrogate is needed because accurate measurement of TC, using the NIOSH 5040 Method and the MSHA sample collection system, was not possible, and thus not feasible. Of course, since the 400 TC Interim Limit is not feasible, neither is the 160 TC final limit feasible, because it cannot be accurately measured either.

If a regulated substance cannot be measured, the health effect risks cannot be quantified, feasibility of compliance with a limit cannot be determined, and the rule offers no measurable health protection benefits and thus cannot be promulgated lawfully.

Even if the MSHA total carbon limits were meaningful from a dose / response health risk perspective (which they are not), and could be converted to elemental carbon because the two substances occur in a stable, predictable relationship within diesel exhaust (which they do not), the 160 TC Limit violates the Mine Act because it is not feasible for mine operators to achieve compliance from an engineering perspective, and the limit will cause job loss and mine closure, should it be enforced.

Nothing has changed since MSHA reached its June 6, 2005 lack of feasibility conclusion, yet again invalidating the basis of its 2001 rule , 70 Fed. Reg. at 32916, except that the agency decided to predict, again, that reduced limits are feasible to achieve over yet another future five-year time frame. In so doing the agency ignores its industry wide EC measurement results to the contrary, and the massive testing, experimentation and implementation, which occurred before the MSHA June conclusion.

Amazingly, the rulemaking questions posed by MSHA and detailed below demonstrate that once again MSHA has proposed a rule based on wild speculation and without even the most basic information needed to determine feasibility (e.g. the current inventory of diesel equipment), thereby again violating its statutory mandates and insuring that should the proposed rule go into effect, it will continue the regulatory failures that preceded it, unless the rule is overturned by the Courts.

Failing to delete the infeasible 160 TC limit, and/or adopting whatever proposed EC conversions, and "phase in," MSHA may select, would cause further site-by-site experimentation creating new and unforeseen risks, and further divert limited resources, thereby reducing protections offered under existing standards and violating the Mine Act and the Data Quality Act.

No stable correlation between EC and TC

The June 6, 2005 rule amendments provide additional compelling reasons for the withdrawal of the Final Limit of 160 TC micrograms standard, and any alleged EC "conversion" limit that MSHA may select. MSHA data and admissions alone prove that the 160TC limit cannot be "converted" to EC because there is no stable correlation between them nor in their relationship to diesel exhaust. Moreover, once filters are applied to engines to achieve the 308 EC Limit, exhaust characteristics change and create even further instability and variability in EC/TC predictability, rendering conversion impossible. *See e.g. Comments of Dr. Borak at Exhibit --*. *See also* 70 Fed. Reg. at 32897 concluding "statistically significant differences in the mean EC:TC ratios between mines and between differing sampling days within mines."

Sampling data demonstrates that the proposed standard is not feasible

MSHA sampling data published in its June federal register notice and on its web site demonstrates that 90% or more of the regulated industry cannot comply with the January 19, 2006 limit. See comments of H. John Head at Exhibit 3. This supports the MSHA conclusion that DPM rulemaking record lacks sufficient feasibility documentation to justify lowering the DPM limit below 308EC. The comments of H. John Head, attached as Exhibit 3, present an analysis of the past five years of MSHA sampling data, which demonstrate the infeasible nature of the MSHA proposal and the 160 PEL.

Mr. Head's analysis and the extensive testimony in the record shows that it is not technologically feasible for a significant percentage of the mines to reduce underground miners' exposures to the new permissible exposure limit (PEL) of 308 micrograms of EC per cubic meter of air (308_{EC} $\mu g/m^3$), if it is upheld by the Courts following review. The data establish the need for an effective, timely and clear procedure to obtain repeated extensions for those mines that can not feasibly comply with the 308 EC limit, which the data suggest are between 30 – 50 % of the mines. The data and Mr. Head's comments demonstrate the lack of feasibility for 90% or more of the mines to comply with the MSHA proposed reduced PELs for the foreseeable future.

The information quality underlying the proposed rule does meet DOL and OMB Data Quality Act requirements nor the mandates of the Mine Act.

On August 10, 2005, MARG filed a Petition for Expedited Data Quality Act Corrections in regard to the DPM rulemaking. MSHA's reply states that all of the issues raised in the Petition will be addressed in this rulemaking. Some of its elements are discussed herein, but the entire petition is incorporated into our comments.

MSHA feasibility conclusions for its proposed phased-in limit reductions are contradicted by its own data base and it's acknowledged need for providing mine specific feasibility extensions for the interim standard. (30-37% of the industry is not in compliance with the Interim Standard and 90+% of the industry is not in compliance with the Final Standard). MSHA's incorrect conclusion is based, upon incorrect assumptions, speculation, and inaccurate data disseminated as part of an MSHA designed "31-Mine Study" and an MSHA created computer model ("The Estimator"). The 31-Mine Study and the Estimator (*See* 70 Fed. Reg. at 32919; *see also* 66 Fed. Reg. 5709) fail to meet the "reproducibility" standard required for disseminating influential information. *See* 67 Fed. Reg. at 378; DOL Guidelines, Appendix I at ¶ 10 (reproducibility standard requires an agency to ensure that information disseminated by it is sufficiently transparent in terms of data and methods of analysis that would be feasible for replication). Neither the study nor the Estimator were independently peer reviewed.

Contrary to MSHA's description, a review of the 31-Mine Study by self-selected personnel in its sister agency, NIOSH, is not "independent peer review." Similarly, contrary to MSHA's assertion, a review of the Estimator for publication in a mining magazine does not constitute the needed independent peer review for use of the Estimator to determine feasibility of compliance for a mine or for the industry, due to the incorrect assumptions in the Estimator described herein. The information disseminated also fails to meet the "transparency" and bias free standards required under the guidelines. 67 Fed. Reg. 377; DOL Guidelines, Appendix I at ¶ 12-13. For these reasons, MSHA has violated the Information Quality Guidelines by grounding its conclusions regarding feasibility on the 31-Mine Study and the Estimator, and therefore there can be no valid finding of feasibility by MSHA.

In reaching its conclusion regarding feasibility, MSHA used data that relies on non-representative sampling. First MSHA assumed that sample results in isolated sections of the mines in the 31-Mine Study are representative of DPM and TC exposure levels in hundreds of thousands of locations in all underground mines, resulting from thousands of pieces of diesel equipment. MSHA then voided 25% of the samples collected in the 31-Mine Study "mostly because of potential interferences," and eliminated four mines from the study. 70 Fed. Reg. at 32890. MSHA later admitted that TC sampling did not produce reliable and accurate measurements, and were not representative of EC or DPM levels. Yet, MSHA used this non-representative data throughout its justification for the June 2005 Rule and by extension for the September proposed rule. MSHA's baseline samples reported in the June 6 Federal Register do not cure this defect since they are similarly non-representative and MSHA's conclusions to the contrary have not undergone independent peer review for their statistical validity.

Plainly, this sampling database was not, and is not today representative of the mining industry, which has varied conditions and fleets of diesel equipment (dictated by the uncontrollable variables of the earth's mining conditions and the material being mined), and DPM exposures far different than those speculated by MSHA. Moreover, the highly variable relationship between TC/EC and DPM, admitted by MSHA, does not permit MSHA to use its data to predict feasibility.

Moreover, the mean levels of DPM and TC reported by MSHA to justify the agency rulemaking were based on sampling and analysis that at best is now admitted to be unreliable and inaccurate. Such reports and analysis do not represent hazards, feasibility of achieving reduced DPM levels, or feasibility of compliance with the MSHA rules, and are not acceptable under either the Mine Act or the Data Quality Act as the basis for proposed or final rules.

The MSHA proposed rule would measure compliance based only on one, single sample of EC, regardless of MSHA risk estimates based on hypothetical, long-term exposures to complex diesel exhaust mixtures and other atmospheric contaminates, that MSHA declared to be the risk it sought to regulate. One sample of EC is not representative of an individual, or a population's exposure to diesel exhaust, since both the diesel exhaust and the percentage of the EC component have been proven to be highly variable from day to day, place to place, time to time, and even when measured by attaching two sampling devices on two opposite lapels of the same individual or comparing the results of two analysis of the same collection filter.

Drs. Borak, Hall, and Cohen's peer reviewed and published research articles, Dr. Borak's comments submitted to MSHA, and the peer reviewed and scientific publications of Drs. Morton Corn and Thomas Hall on sampling variability, demonstrate the inherent variability that makes the use of a single EC sample invalid under the Data Quality Act and the Mine Act. The MSHA use of non-representative sampling is pervasive throughout the justification for the rule and the rule itself and constitutes a lack of transparency, and non-reproducible results, based on science that was not subjected to independent peer review, but was used to make major policy decisions impacting diesel engines across the economy.

A sampling-and-analysis method must produce accurate, precise and consistent results to be feasible and acceptable under the statutory mandates that restrict and that authorize MSHA rulemaking. To determine the accuracy of a method, it is first necessary to have a 'standard' against which the method can be compared. (An example is the silica exposure limit, for which a silica standard material of a known quantity is provided by the National Institute of Standards and Technology (NIST), that allows measurements of silica to be compared to a 'true value' in order to determine whether the Permissible Exposure Limit has been exceeded). As concluded by Dr. Borak's comments, no such standard exists for elemental carbon; thus it is not possible to determine or ensure the accuracy of its measurement.

In calculating its Error Factors for this method, MSHA assumes that there are no related methodological inaccuracies, an assumption that is factually unsupported. We are aware of no analytical method that is without some element of inaccuracy and the MSHA assumption defies reason. Thus, the MSHA statements that their method is accurate and feasible cannot be supported scientifically, have not and cannot be tested, and are certainly incorrect. Accordingly, MSHA statements that its method is accurate and feasible must be seen as reflecting unsubstantiated and incorrect conclusions.

An important consideration in evaluating a sampling-and-analysis method is the ability of the method to provide consistent and reproducible results. This concern reflects the concept of 'precision', i.e., the statistical calculation of the repeatability of the measurement, regardless of its relationship to the true value. Precision is generally calculated as the coefficient of variability (CV) of the method. That concept is built into the NIOSH Accuracy Criteria for industrial hygiene measurements: NIOSH defines an accurate method as one which provides results that are within 25% of the true value, 95% of the time. This is a generous definition of accuracy that recognizes the difficulty and substantial variability of industrial hygiene measurements of small quantities of potentially toxic substances that make-up only a small percentage in much larger quantities of air, water or soil.

MSHA's determination that its sampling methodology is sufficient for feasibility finding is erroneous. First, the conclusion must be put into the context of a sampling device designed and redesigned by MSHA repeatedly, and a NIOSH analysis method never used commercially before the 2001 rule was issued. Both were found by MSHA to be feasible in 2001, although fundamental changes were made from 2001 to 2005. 70 Fed. Reg. 32871. As concluded by Dr. Borak and associates, the MSHA approach to defending its feasibility conclusions poses a substantial risk that a sampling-and-analytical method of unacceptable imprecision will be deemed acceptable for other regulatory and enforcement purposes.

The MSHA 2001 and 2005 conclusions that its sampling and analytical method is accurate was not subjected to independent peer review, is not transparent nor free from bias, is not reproducible and is wrong. Compliance with the 160TC Limit or the proposed conversion to an EC Limit is not technologically feasible. It should be withdrawn, not phased in.

The proposed regulations are not economically feasible

MSHA has not supported its conclusion that a PEL of 308 micrograms per cubic meter of air (308_{EC} $\mu g/m^3$) is economically feasible for the M/NM mining industry, let alone its necessary finding of economic feasibility for the 160 Limit. MSHA 's prior economic feasibility conclusion is based on improper sampling and analysis, inaccurate and incomplete data, and incorrect assumptions. For these reasons, and as more fully explained elsewhere in these comments, MSHA's stated economic feasibility conclusion does not meet the mandates of the Mine Act nor the "reproducibility" standard of the Data Quality Act. *See* 67 Fed. Reg. at 378; DOL Guidelines, Appendix I at ¶ 10 (reproducibility standard requires an agency to ensure that information disseminated by it is sufficiently transparent in terms of data and methods of analysis that would be feasible for replication).

MSHA's conclusions regarding the economic feasibility of the 308 and 160 PELs are not based on a representative sampling of all the underground mines affected by this rule. The underground mines impacted by the standard are composed of 24 different major commodities, each of which must be examined from the unique perspective of the market for its products, its existing margins, national and foreign competition, and product commodity market prices. For example, the underground mines in Missouri that produce lead, the underground mines in Montana that produce platinum, and the underground mines in Nevada that produce gold, are each economically viable only when viewed in light of the international price for their commodities, not their gross sales as used by MSHA to determine feasibility.

MSHA's use of the gross revenue as a measure of economic feasibility is invalid and was improperly used to support MSHA's conclusion regarding economic feasibility. This method ignores the fact that international commodity markets determine the viability of mines by setting market prices for their production. For most of the last twenty years, in the mining industry volume and gross sales were an indication of massive losses rather than profitability. For example, gross sales in the hundreds of millions (if not billions of dollars) did not prevent the US underground mining industry today from being a fraction of its size when the MSHA law was passed in 1977 and substantially reduced from the date that MSHA initiated the DPM rulemaking. Competition with unregulated foreign entities, US regulatory costs, and margins have had at least the following effects: 5 zinc mines in Tennessee have closed, 6 out of 7 silver mines in Idaho have closed, at least 2 underground copper mines have closed in Arizona, 3 out of 6 lead mines in Missouri have closed, and 1 of the 2 molybdenum mines in Colorado have closed. The remaining mines in these industries have suffered significant employment cuts, and the many industries that depended on the closed operations, like the metal smelters, refiners, transporters, and service contractors, have closed as well. In addition, there are thousands of service contractors that provided good paying jobs and were regulated by

MSHA, have closed as well. MSHA's analysis is flawed to the extent it fails to examine the impact of the additional cost of its regulations on each industry sector, as well as the entire industry.

Furthermore, in the 31-Mine Study (upon which MSHA now relies to support its economic feasibility study), MSHA used unit prices for commodities that were significantly in error. For example, rock salt for highway de-icing (the primary market for the three rock salt mines included in the study) reportedly sold for about $20 to $25 per ton when the analysis was made. Yet, the estimates for revenues and likely annual production levels for the three salt mines seem to indicate that a price of about $50 to $70 per ton was used in the analysis.

Moreover, because the 31-Mine Study and the Estimator underlying MSHA's economic analysis were flawed from a technical feasibility perspective (see above), their corresponding use for economic analysis is based on non-reproducible data, later proven invalid.

MSHA's economic feasibility analysis incorrectly assumed that none of the 31 mines in the study would need any major changes to its ventilation system. Moreover, only six of the 31 mines in the 31-Mine Study were allocated any funding by MSHA's analysis for minor ventilation upgrades such as auxiliary fans and ducting, for a total capital cost of $234,000. In contrast to MSHA's findings, one mine alone in the 31-Mine Study estimates at least $4.4 million in ventilation changes to achieve compliance. MSHA relied on its erroneous limited ventilation system assumption despite contradictory conclusions by MSHA itself, and NIOSH, that mine ventilation systems throughout the industry need substantial upgrades to comply with the EC limits.

MSHA Selected an Incorrect Exposure Metric for Potential Diesel Exhaust Health Effects

USEPA has published only a weight-of-evidence risk assessment on diesel particulate matter, because they could make no definitive assessment of non-cancer health effects, stating "Information from the available human studies is inadequate for a definitive evaluation of possible non-cancer health effects from chronic exposure to diesel exhaust." See US EPA's Health Assessment Document for Diesel Engine Exhaust. See also Improving Estimates of Diesel and other Emissions for Epidemiologic Studies (Proceedings of an HEI Workshop). Health Effects Institute (ed). Boston: Health Effects Institute, pp. 33-38, 2003. In the comments of Dr Jonathan Borak, MD, submitted in October 2003 in response to the August 14, 2003 proposed rule, Dr. Borak addressed the infeasibility of using the MSHA selected surrogates for any possible cancer agent. He stated:

> If DPM is a human carcinogen, then it should be expected to contain at least one specific carcinogenic agent. For various reasons, it seems almost certain that such a carcinogen would be found in the organic carbon (OC) fraction of DPM, rather than either the elemental carbon (EC) fraction or the gaseous volatiles.... Most studies have not measured the organic fraction (organic carbon or OC) of DPM and none have attempted to measure the potential specific carcinogens. That failure would be of little consequence if OC exposure levels were closely related to levels of EC or total carbon (TC=EC+OC), the DPM measures that are most often reported. But, that

> relationship is not stable; measurements of EC and TC are now recognized as poor predictors of OC exposure.

In defense of its selected limits, MSHA admits that comments "mistakenly assumed the limits... were derived from an exposure response relationship... " 70 Fed. Reg. at 32900. Instead, MSHA states that its limits (both new and old, for both EC and TC) "while justifiable by quantifiable adverse health effects, were actually driven by feasibility concerns." *Id.* citing 66 Fed. Reg. at 5710 - 14. This illogical explanation and conclusion was false, and based on incorrect feasibility assumptions that the June and September Federal Register notices now acknowledge.

Contrary to the MSHA explanation, there are no "quantifiable adverse health effects" presented for total carbon or elemental carbon, but instead extrapolations and speculation from EPA ambient air, total fine particulate rules, and the inconclusive, diesel exhaust studies (which suffered from confounding substances or a lack of statistical significance). These uncertainties and inconclusive scientific background led NIOSH and NCI to conduct their mining industry health effects study to try to resolve them. Since MSHA presents no quantifiable adverse health effects for total carbon or elemental carbon, their risk conclusions are based purely on "less is better" speculation, without the ability to quantify how much "less" diesel exhaust they have mandated by their TC or EC limits, or identify or quantify the risks of the regulated substances, nor the benefits of the mandated reductions for the regulated substances.

Because of significant variations empirically observed for the ratios of OC, EC and TC, Dr. Borak concludes that measurement of either EC or TC can not accurately predict OC and its suspected carcinogenic components, and MSHA agrees. *See* Figure VI-3 at 70 Fed. Reg. at 32895, which presents massive differences in TC/EC ratios and the MSHA admission on the same page that:

> At a confidence level exceeding 95%, the data show statistically significant differences in the mean EC:TC ratios between mines and between differing sampling days within mines."

In other words, neither EC nor TC provides an appropriate basis for measuring exposure to suspected DPM-associated carcinogenic agents, and the very basis of MSHA's risk analysis and resulting limit on its selected diesel exhaust component is wrong and must be corrected. Moreover, MSHA created a Figure VI-3 at 70 Fed. Reg. 32895 that shows a paucity of data at 160 TC and below, and a far greater data spread in this range that in the higher ranges.

It is impossible to convert TC to EC to support the MSHA proposal due to the wide variability in ratios reported, and the increase in sampling and analytic error expected as the quantity being measured decreases.

MSHA incorrectly concludes that the potential carcinogenic role of OC, as described by Dr Borak, was "speculative." 30 Fed. Reg. at 32988. MSHA based its conclusion on an inaccurate understanding of a publication by Ichinoses et al. *Id.* However the report by Ichinoses actually supports Dr Borak's conclusion, and rebuts MSHA. Ichinoses explains his findings as follows:

> The mechanism of lung carcinogenesis induced by diesel exhaust is not fully understood. However, it is thought that the carcinogenic compounds present in DEP may contribute to the development of lung cancer induced by diesel exhaust since carcinogenic compounds such as benzo[a]pyrene and nitro-polyaromatic hydrocarbons could form DNA adducts which are involved in carcinogenesis... We have recently found that O_2^- and $\cdot OH$ were enzymatically generated from DEP by the following process: soot-associated quinone-like compounds are reduced to the semiquinone radical by cytochrome P450 reductase, and these semiquinone radials reduce O_2 to O_2^- ... which causes DNA damage *in vitro*[3]

Thus, Ichinoses proposed that the carcinogenic agent might be "carcinogenic compounds present in DPM" such as PAHs and nitro-PAHs or "soot-associated quinone - like compounds"; both types of compounds are found in the OC fraction of DPM. These authors, incorrectly cited by MSHA, directly contradict the MSHA conclusion, and demonstrate why the MSHA selected surrogates are the wrong substances to regulate and do not relate to the risk, if any, of lung cancer. The comments of Dr. Borak submitted with these MARG comments again explain this scientific fact to MSHA.

The MSHA Final Rule, 790 Fed. Reg. at 32911, quotes at length from the National Toxicology Program (NTP) *Tenth Report on Carcinogens*.[4] The NTP statement indicates agreement with Dr Borak's comments, i.e., that if diesel exhaust is a carcinogen, the most likely human carcinogenic agents in DPM are organic compounds (e.g., PAHs and nitro-PAHs) that would be measured as OC, but not as EC. The more recent NTP *Eleventh Report on Carcinogens, 2005,* affirms that view.[5] It is noteworthy that neither proposes inflammation-induced reactive oxygen species as the cause of lung cancer in humans. Thus, the MSHA defense of its selection of the wrong substance to undergo risk assessment, and be regulated, is incorrect, "speculative," and lacks transparency.

Because there essentially are no epidemiological data correlated to OC levels, and because EC and/or TC levels in studies can not accurately predict OC, there are large and important uncertainties in the exposure assessments that MSHA uses to support its risk conclusions. This can be restated simply: Even if MSHA's speculative interpretation of non-statistically significant historical studies were appropriate, which it is not, MSHA has used the wrong exposure metric for predicting lung cancer risks.

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[3] Ichinose T, Yajima Y, Nagashima M, et al: Lung carcinogenesis and formation of 8-hydroxy-deoxyguanosine in mice by diesel exhaust particles. *Carcinogenesis* 18:185-192, 1997.

[4] National Toxicology Program: *Tenth Report on Carcinogens*. Research Triangle Park, NC: US Department of Health and Human Services, 2003.

[5] National Toxicology Program: *11th Report on Carcinogens*. Research Triangle Park, NC: US Department of Health and Human Services, 2005.

Specific MSHA Requests for Comment, 70 Fed. Reg. 53279-53293
Each numbered paragraph is extracted from the Notice of Proposed rulemaking. Where there are comments, they follow the question, in larger type and different font. Paragraph numbering tracks the Federal Register notice, but not all paragraphs contained specific requests, and as a result, there are gaps in the sequence.

Technological Feasibility

A. Introduction

1. **We seek additional information regarding technological difficulties and whether they will increase the cost to comply with the final concentration limit above that estimated in the 2001 final rule. We are particularly interested in whether mine operators have attempted to institute DPF systems that are impractical or have failed to work for their mining operations. We wish to know what types and sizes of DPFs have been evaluated, what types of equipment have been fitted with DPFs, what types of horsepower of engines were installed in the equipment, details concerning monitoring of equipment exhaust temperatures prior to specifying a DPF for a given application, whether DPF installations include a provision for backpressure monitoring, DPF maintenance intervals, DPF life, the results of any DPF failure mode analysis, DPM reductions obtained, and any other data related to in-mine experiences with DPFs on underground metal and nonmetal mining equipment.**

RESPONSE: Retrofitting diesel particulate filters onto the existing fleet of diesel equipment, originally anticipated as the primary control method to achieve the Interim and Final Limits, has proven difficult or impossible for a significant percentage of the diesel fleet. As a result, NIOSH has, and continues to conduct studies on control technologies. See attached comments of H. John Head regarding the latest NIOSH studies at the Stillwater Mine and their conclusion that a significant percentage of the fleet cannot feasibly be retrofitted with control technology.

An example of the problems with DPF's is shown by the results of testing performed at the Stillwater Mine in partnership with NIOSH, MARG, and others, described in the June 6 Federal Register notice. MSHA speculates, without actual evidence, expertise, or experience that there are feasible filters for equipment that could not be retrofitted in the NIOSH sponsored testing (due to the size of the filters, the equipment's horsepower, and/or the duty cycle of the equipment that was not compatible with the filters). MSHA further speculates that it can obtain feasible compliance at substantial cost savings to Stillwater's carefully calculated costs, which were based on actual testing, operating experience and expertise.

The MSHA explanation for the many filter failures reported by the industry and NIOSH, was both wrong, and identical: it was the fault of the user or the manufacturer and MSHA would have selected or used them differently (70 Fed. Reg. at 32924-26). When installed filters undergoing NIOSH sponsored testing and oversight released dangerous levels of Nitrogen Dioxide, causing mine evacuations under the watchful eye of NIOSH researchers, MSHA blamed the mine operator, without any proof or substance, and disagreed with NIOSH, which carefully documented that the filters caused NO2 hazards (compare 70 Fed. Reg. at 32928 reporting the NIOSH cause to 70 Fed. Reg. at 32929 speculating— "it is likely"— that company conditions caused the event). The extensive MSHA speculations for filter failures are neither transparent, nor have they undergone independent peer review.

These control experiment failures provide another reason that the 160 PEL should be withdrawn. MSHA agrees that there is insufficient evidence of feasible control technology to achieve the 160 PEL. The result of adopting the PEL reductions would be continued and expanded experimentation, most likely without the careful oversight of NIOSH, which does not have the resources to be at each mine. Previously untested and unproven controls likely will fail with increasing frequency and miners will be exposed to hazards that would not have been created were it not for the new Limits. Adoption of such a standard, without a proper basis to conclude feasibility before adoption and implementation, would thus be a violation of the Data Quality Act, the Mine Act and the particularly the provisions of Section 101(a)(6) of the Mine Act.

2. **We seek data on alternative fuel distribution systems.**

RESPONSE: The comments of MARG members and H. John Head demonstrate that while alternate fuels offered exhaust reductions for some mines, they do not present a feasible means of compliance with the proposed rule because: (1) there is not a reliable supply and distribution system to service the industry and the often remote mine sites; (2) the use of alternative fuels is not feasible at many mine sites because it poses transportation, storage, freezing and reheating problems and hazards; (3) the economic feasibility of alternative fuels depends upon uncertain government price supports that are due to expire in the near future; (4), the duty cycle and horse power demands of many mines could not be met by alternate fuels; and (5) even if these feasibility problems could be overcome, mines like Stillwater have tested alternative fuels in combination with many other control technologies and found that they could still not feasibly meet the proposed PEL reductions.

Attached as Exhibit 4, is a letter from the Lubrizol Company that demonstrates the supply problems of alternative fuels, Purinox, an alternative fuel tested by MARG members and encouraged by MSHA, will no longer be produced following 2006.

3. **We request comments on the percentage of diesel equipment, by mine size, in metal and nonmetal mines that currently have newer, low DPM emitting engines such as EPA Tier I and Tier 2 compliance engines.**

RESPONSE: We do not have the requested information. We note, however, that there is no evidence in the record that replacing engines is feasible for existing equipment, nor that new engines, when available, achieve compliance with the proposed EC limits. In fact the evidence is to the contrary, with operators testifying that they have replaced significant numbers of primary exhaust producing units of their fleet, on an accelerated basis without being able to achieve compliance with either the interim or proposed final limits.

Moreover, operators should be allowed to continue operating currently used diesel equipment and to replace, as well as repair, existing engines with the same type and model refurbished engine. A recent experience at one MARG member company demonstrates that new replacement engines would not fit on a major piece of in-use production equipment, and that the cost for replacement of the entire machine was prohibitive. Yet, the operator was prohibited by the MSHA rule from purchasing an exact duplicate, but fully refurbished engine, that would fit on the machine and likely would have reduced emissions from the level of the original repaired unit.

Most importantly, we are disappointed by the lack of MSHA information and data to support its feasibility conclusions for the proposed rule. MSHA is the only entity with full access to every mine site's inventory of diesel powered equipment, based on its inspector presence at each mine for at least four full inspections each year. Yet, MSHA has not collected or analyzed the basic information needed to conduct a feasibility analysis for the proposed rule.

4. **Our 2001 cost estimates were based, in part, on the assumption that by the effective date of the final limit, 50% of the diesel equipment fleet would have new engines. We are interested in whether our 2001 assumption was accurate.**

RESPONSE: Information submitted in the public hearings again demonstrates that the MSHA assumptions were wrong. However, we have no compilation of data regarding engine purchases throughout the industry. During the Salt Lake City public hearing on this rulemaking, it was pointed out that the industry uses diesel equipment for many years and that repairs are much more common than replacements for these durable engines.

We again note that MSHA has not collected or analyzed the most basic information needed to conduct a valid feasibility assessment for its proposed rule: the diesel equipment list of the current fleet of engines, the age of those engines, their horsepower and performance characteristics, their diesel exhaust levels, and their potential for exhaust controls. Given the last five years of ongoing rulemaking and the multiple mine inspections per year conducted by MSHA, it is incredible that these critical data would not have been collected for analysis, leaving MSHA's feasibility analysis again to the speculation and assumption that proved invalid for the 2001 rule.

C. Remaining Technological Feasibility Issues

5. **We request comments on whether compliance is technologically feasible by January 2006 and the appropriateness of a multi-year phase-in of the final limit.**

RESPONSE: The 160 final limit should be withdrawn since it was not feasible by January 2006 (nor will it be by the current published extension in May, 2006), nor by 2011, as assumed by the phase in proposal (without any reliable and reproducible evidence to support the assumption).

The question of whether there should be a multi-year phase-in of a reduced limit is moot. The 308 EC Limit is not feasible for a substantial segment of the industry as demonstrated by: the reported MSHA sampling results, the public hearing testimony of mine operators, the need for respirators recognized by MSHA, and the MSHA proposal for a needed process to permit operators to request yearly, renewable extensions from the 306 EC Limit. MSHA's own attempts to deal with its incorrect prior feasibility determinations alone proves the lack of any basis to determine the phase in or the 160 Limit feasible, for the foreseeable future. Moreover, a phase in period does not render the proposed lower Limits valid or feasible, and its adoption would be in contravention of Section 101(a)(6)(A) of the Mine Act and the Data Quality Act.

6. **We also request comments and data on when the technology will be feasible.**

RESPONSE: Predictions of the pace of future, feasible diesel exhaust technology, and EC or TC or exhaust reductions are highly complex and dependent on mine-specific conditions and equipment, and the availability of control technology applicable to the specific site, and the selection of scientifically supportable exhaust surrogates that can be feasibly measured to which applicable and feasible technology can be applied. It is futile to continue attempts to force reductions in emissions of EC or TC, when there is inadequate information on the potential health effects of the selected portion of the emission, and no valid way to measure the constituent or its relationship to the whole exhaust that is addressed by the standard. Repeated site-by-site experimentation of unproven and untested controls is a counterproductive use of resources and dangerous. Completion of NIOSH research and testing is far preferable and consistent with Mine Act mandates for standards to be based on research and demonstrations.

7. **We also request comments on whether compliance difficulties may lead to another problem by requiring a large number of miners to wear respirators until feasible controls are fully implemented.**

RESPONSE: The MSHA 2005 Federal Register publications indicate that 30-37% of the industry is not in compliance with the 308 EC Limit and 90% or more of the industry is not in compliance with the 160 PEL. H. John Head's analysis in his attached comments show that the percentages of out of compliance mines has not changed dramatically over the last five years of extensive experimentation and implementation of controls. Implementation of the proposed Limit or phase in would undoubtedly result in requiring far more than "a large number of miners" to wear respirators, nearly all miners would be required to wear respirators.

The use of respirators on a wide spread basis will lead to a discontent workforce, and difficulties in retaining employees and attracting new workers. It will add significant costs to an already infeasible proposed standard, costs that have not been calculated properly by MSHA. More importantly, the mandated use of respirators (to prevent against assumed, but unknown risks of EC) will itself create health risks resulting from breathing resistance and dermatology risks from the respirators themselves, and from combinations of mine dust and respirator material at the respirator / face skin interface. These risks should not be created without a detailed MSHA analysis of the risks and benefits, as mandated by the provisions of the Mine Act and applicable law.

8. **We are interested in public comment on how many miners would need to wear respirators to comply with the 2001 final limit and proposed multi-year phase-in of the final limit, and whether in each case they would need to wear respirators for their entire work shift, whether this amount of respirator usage is practical, and any other comments or observations concerning this issue.**

RESPONSE: Only MSHA has access to the mine by mine database, and the individual sample and citation information needed to determine the number of miners and the percentage of the shift they were exposed.

Again, we are disappointed that MSHA did not collect this data and make it available for public review and comment, nor use it for a risk/benefit and feasibility analysis of the proposed regulations.

C.1. Implementation of Available DPF's

9. **We request information on the number of currently installed passive regeneration DPF filters.**

Please see individual responses of MARG Member Companies for these mine specific questions and our above stated concerns that MSHA has not collected industry wide information available to the agency to conduct its mandated analysis of the regulatory proposal.

10. **We are interested in the methods used by the industry to match a passive regeneration DPF to a machine.**

Please see individual responses of MARG Member Companies for these mine specific questions and our above stated concerns that MSHA has not collected industry wide information available to the agency to conduct its mandated analysis of the regulatory proposal.

11. **We are aware that two identical machines operating in two different mines may not both be able to use passive regeneration. We would be interested in comments about practical experience with these implementation issues.**

While we appreciate the late realization by MSHA that its prior simplistic and invalid assumption approach to feasibility determinations was wrong, we do not have the industry-wide information available to MSHA. Please see the individual responses of MARG Member Companies for these mine specific questions and our above stated concerns that MSHA has not collected information available to the agency to conduct its mandated analysis of the regulatory proposal.

12. **We request that commenters submit information from the mines that are utilizing active regeneration including data regarding the benefits and the practicability of active regenerating filters.**

Please see individual responses of MARG Member Companies for these mine specific questions and our above stated concerns that MSHA has not collected information available to the agency to conduct its mandated analysis of the regulatory proposal.

As a general comment we note the concerns identified by the Partnership tests at Stillwater about: the infeasible logistics of creating regeneration stations in narrow underground tunnels; the potential ground control hazards of widening exiting openings; the infeasible logistics of moving a large fleet of equipment (and personnel) to regeneration stations at the start of , during or at the end of a shift; and the lack of space for installation to install active (and inactive) filter systems for a large percentage of the fleet.

13. **We seek further comment regarding these technological implementation issues as they affect feasibility of compliance with the final concentration limit including the practicality of available DPM control technology.**

Please see individual responses of MARG Member Companies for these mine specific questions and our above stated concerns that MSHA has not collected industry wide information available to the agency to conduct its mandated analysis of the regulatory proposal.

14. **We request that the mining community specifically address issues surrounding off-board regeneration; back pressure build up; frequency of the necessity to clean DPFs; the difficulty of placement of regeneration stations; and information on the extent to which diesel powered equipment accommodates a retrofit of the DPF.**

Please see the comments of H. John Head, and the individual responses of MARG Member Companies, including Stillwater, for these mine specific and experiment specific questions, and our above stated concerns that MSHA has not collected industry wide information available to the agency to conduct its mandated analysis of the regulatory proposal.

C.2. Benefits of On-Board Regeneration

15. **We request comments from the mining community regarding the foreseeable utility of these and other new control technologies for reducing DPM levels in underground metal and**

nonmetal mines. (Referencing: a. ArvinMeritor [supreg] System; b. Johnson Matthey's CRT [supereg] System)

Please see the comments of H. John Head, and the individual responses of MARG Member Companies, including Stillwater, for these mine specific and experiment specific questions, and our above stated concerns that MSHA has not collected industry wide information available to the agency to conduct its mandated analysis of the regulatory proposal.

C.3. Operators' Limited Access to Alternative Fuels and Ultra Low-Sulphur Fuels

C.3.a. Water Emulsion Fuels

16. We request any information that would help a mine operator determine if certain machines in a fleet cannot run efficiently on this type of fuel.

Please see the comments of H. John Head, and the individual responses of MARG Member Companies, including Stillwater, for these mine specific and experiment specific questions, and our above stated concerns that MSHA has not collected industry wide information available to the agency to conduct its mandated analysis of the regulatory proposal. We note, however, that mine operator testimony reported a lack of feasibility due to a reduction in the horsepower of equipment needed for high horsepower tasks.

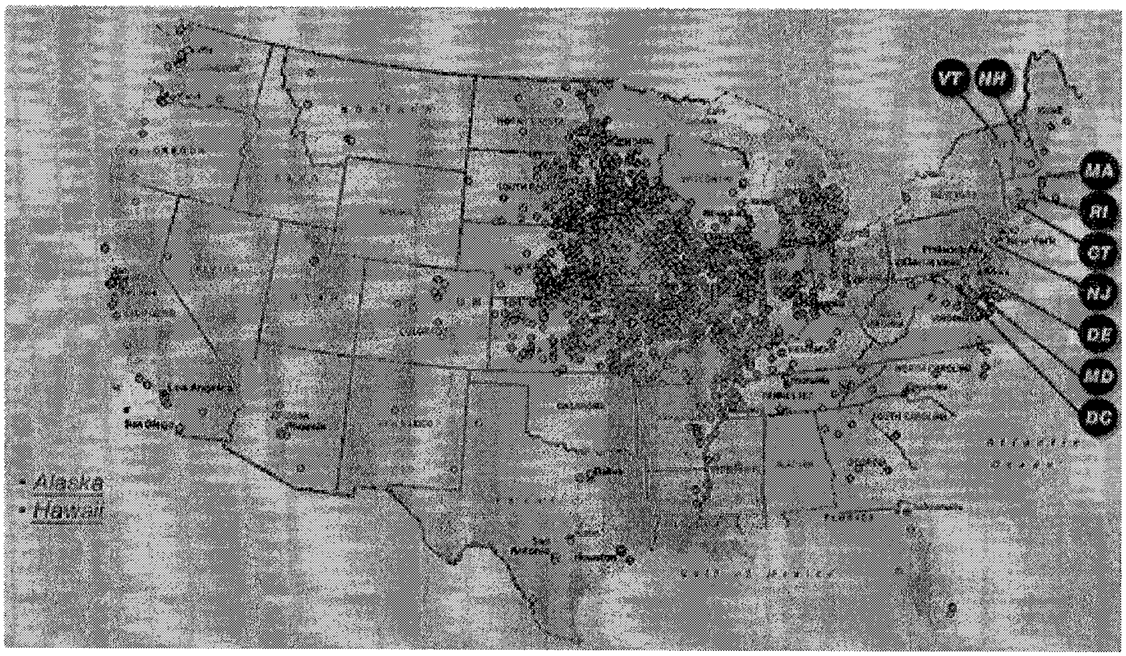
17. We request comments on the mining industry's experience with using water emulsion fuels to reduce DPM exposures.

Please see the comments of H. John Head, and the individual responses of MARG Member Companies, including Stillwater, for these mine specific and experiment specific questions, and our above stated concerns that MSHA has not collected industry wide information available to the agency to conduct its mandated analysis of the regulatory proposal. We note, however, that mine operator testimony reported a lack of feasibility due to a reduction in the horsepower of equipment needed for high horsepower tasks. Please see individual responses of MARG Member Companies for these mine specific questions. We also note the lack of availability of water emulsion fuels that will result from the closure of the Purinox supplier (Exhibit 4)

C.3.b. Bio-Diesel Fuels

18. We request comments on the mining industry's experience with using bio-diesel fuels to reduce DPM exposures.

RESPONSE: While the use of biodiesel showed some promise in reducing EC at some mines, biodiesel caused reduced horsepower problems described by mine operators and is not widely distributed nor accessible at a reasonable cost to many mining operations. The map below is from the website of the National Biodiesel Board (www.biodiesel.org) and shows that there is very little availability of biodiesel in the Eastern or Western United States, where many of the mining operations are located that will be impacted by the proposed rule.



C.4. Installation of Environmental Cabs

19. **We request comments on the mining industry's experience with using environmental cabs to reduce DPM exposures.**

RESPONSE: Environmental cabs, while they may be effective in reducing exposures to a single individual while he or she is using the equipment, are not feasible for the overall reduction of exposure of all miners to the proposed PEL or phase in of the PEL. MSHA bases compliance determinations on a single sample result, and many miners do not use equipment with cabs or have the potential to work from an enclosed location or cab. We note again that MSHA does not seem to have collected the industry wide information available to it that would permit it to properly analyze the feasibility of cabs in achieving compliance.

V. Complexity of Developing an Appropriate Conversion Factor for the Final Concentration Limit

20. **We welcome comments regarding the types of data we should request from NIOSH to assist us in developing an appropriate conversion factor for converting the TC limits of this proposed rule to EC limits.**

RESPONSE: See earlier sections of these comments, and the December 8, 2005, letter from Dr. Borak and associates (Exhibit 2) submitted to MSHA on the draft NIOSH report by JD Noll, et al. *The Relationship between Elemental Carbon, Total Carbon, and DPM in Several Underground Metal/NonMetal Mines.*

The question is moot because there is no reliable, accurate conversion factor, and neither the measurements nor the conversion are feasible.

21. **We are interested in receiving comments on whether the record supports an EC PEL without regard to any conversion factor, the appropriate conversion factor if one is used, and any other scientific approaches for converting the existing TC limit to an appropriate EC limit.**

RESPONSE: See information submitted above and the comments of Dr. Borak and associates.

22. **We are considering using the current 1.3 conversion factor to convert the phased-in final TC limits to EC equivalents. We would use the EC equivalents as a check to validate that an overexposure is not the result of interferences. We are interested in receiving comments on this approach to enforcement of the 2007 PEL, assuming the conversion factor rulemaking is not completed before January 20, 2007.**

RESPONSE: It is impossible to convert TC to EC with any degree of reliability and accuracy, and neither represents diesel exhaust or DPM, in a reliable, accurate and feasible manner. This conclusion is reached when the science and sampling and collection data base for TC and EC is examined from the various perspectives needed to promulgate a feasible and supportable standard: the collection and measurement perspective, the risk analysis perspective, and the feasibility perspective.

Neither measurement has a "standard" issued by the National Institute of Standards and Technology by which to judge accuracy, and both measurements are subject to such high errors and wide variability in results that neither is precise, repeatable nor feasible. As Dr. Borak concluded, MSHA has selected the wrong exposure matrix for its intended purpose of regulating diesel exhaust or DPM.

We again note that MSHA has agreed with Dr Borak and published a series of significant admissions regarding the lack of a reliable relationship between DPM, TC and EC, from mine to mine, and within mines, stating: "The EC:TC ratio ranged from 23% to 100%, with a mean of 75.7% and a median of 78.2%." 70 FR at 32895 (June 6, 2005). After presenting a number of graphs and tables demonstrating the vastly different TC/EC ratios between commodities and mines, MSHA concluded: "At a confidence level exceeding 99.9% the data show statistically significant differences in the mean EC/TC ratios between mines and between different sampling days within mines." Id. at 32897.

The interim partial settlement agreement postponed this issue, to permit continued settlement discussions, and the temporary application of the challenged rules, based on an assumed EC/TC ratio, but only "for the purpose of temporarily converting EC measurements to TC measurements." Id. at 32895. No such assumption on the ratios of EC / TC / DPM/ Diesel Exhaust are supported by the science, nor the record, nor enforceable, given the challenge to the June Final Rule, the invalidity of the proposed rule, and the lack of meaningful settlement negotiations to produce an agreed to result, regardless of the lack of supporting science.

VI. Economic Feasibility

23. We request comments on the economic feasibility of the final concentration limit of 160TC micrograms and implications of the proposed phase-in approach on the economic feasibility.

RESPONSE: It is economically not feasible to comply with a standard that is not technically feasible of compliance nor measurement. Moreover, as shown by the comments of H. John Head, the MSHA economic feasibility analysis is wrong from every perspective (e.g. applying the wrong economic analysis, to inapplicable or incorrect economic facts, based on incorrect determinations of exposure levels, and incorrect assumptions of applicable and feasible controls). The phased in approach can only repeat the same errors for each phased reduction, not validate the prior errors and flaws in the MSHA hypothetical and speculative analysis.

VII. Section 101(a)(9) of the Mine Act

24. We request comments on whether a five-year phase-in period for lowering the final concentration limit to 160TC $\mu g/m^3$ complies with Section 101(a)(9) of the Mine Act.

RESPONSE: One cannot even speculate on the protection afforded by an invalid standard based on the wrong exposure matrix, or a standard that is not feasible, except to conclude that it offers no protection. Withdrawal of the standard is the only action that could comply with the mandates of the Mine Act.

The discussion above, of filter failures, fire hazards, and increases in hazardous gases that resulted from control experiments, even under the watchful eye of NIOSH, indicates that implementation of the 160 limit would result in wide spread experimentation, with unproven and untested control technology, that presents new and potentially significant risks to miners. Such a result would violate the Mine Act and should not be permitted, or even risked by MSHA without undertaking a complete risk analysis that the Agency has not performed.

VIII. Section-by-Section Discussion of the Proposed Rule
VIII.A Section 57.5060(b)

25. MSHA is interested in whether the mining community believes at this time that a reduction, after that (January 20, 2007) date, of the PEL equivalent by 50TC [mų]g/m³ each year from 400TC [mų]g/m³, is feasible and will provide additional time for the implementation of controls and development of distribution systems for alternative fuels.

RESPONSE: As demonstrated throughout these comments, even the current 308 standard is infeasible for many mines and the proposed reductions are not feasible for 90% of the industry, for the foreseeable future, even if they were scientifically justified or feasible to measure, which they are not.

26. We also request information and comments on mining industry current experiences with feasibility of compliance with a limit lower than the current interim PEL of 308 [mų]g/m³ of elemental carbon (EC).

RESPONSE: Please see the comments of H. John Head, and the individual responses of MARG Member Companies, including Stillwater, for mine specific and experiment specific facts. Also see our above stated concerns that MSHA has not collected industry wide information available to the agency to conduct its mandated analysis of the regulatory proposal.

27. We request comments on whether five years is the correct timeframe for reducing miners' exposures to the 160 micrograms of TC as originally established in the 2001 standard and to have been effective in January 2006.

SEE RESPONSES ABOVE.

We request information on whether the proposed annual 50 microgram reductions of the final DPM limit are appropriate or, in the alternative, should the final rule include an approach such as one or two reductions.

SEE RESPONSES ABOVE

28. We request your comments on the impact of granting extensions for compliance with the exposure limits that are greater than the 160 TC final limit.

RESPONSE: The availability and grant of repeat extensions might be an acceptable means of applying the 308 EC limit, if it is not overturned by the Courts, for those mines that can not feasibly comply. However, the extension process is not a feasible means of salvaging the infeasible 160 PEL, or the unworkable and unsupported yearly "phase in" proposal.

We suggest that extensions for the 308 PEL be available on a mine wide or section basis, for 5-year time frames, since technology generally does not make major leaps each year, and experiments with controls is safer and more effective if centralized under the NIOSH partnership organization than conducted haphazardly mine by mine. Moreover, the experience gained under the Petition for Modification process demonstrates that requests for extensions, like PFMs, are likely to take many months and perhaps years for MSHA to investigate and approve. Thus, the one year, renewable extension process is not likely to provide timely relief for the mines that can not feasibly comply with the 308 EC Limit, for many years in the future.

VIII.B. Effect of Eliminating Sec. 57.5060(c)(3)(i)

29. **We request comments on the benefits of current Sec. 57.5060(c)(3)(i), and the effects of deleting the requirement, along with the number of miners that would be affected if Sec. 57.5060(c)(3)(i) were eliminated.**

RESPONSE: As MSHA points out in the Federal Register notice, there is no reason to retain the rule that special extensions should be limited to those who were operating diesel equipment prior to the arbitrary date of October 29, 1998.

30. **We also request comments on whether the elimination of Sec. 57.5060(c)(3)(i) would result in a reduction in the current level of health protection afforded to miners.**

RESPONSE: For the reasons set forth above, there would be no reduction in the level of health protection from a standard that is not feasible, nor with which health risks were never associated.

IX. Medical Evaluation and Transfer

31. **We are interested in comments from the mining community on whether we should include in the final rule, pursuant to Section 101(a)(7) of the Mine Act, a provision requiring a medical evaluation to determine a miner's ability to use a respirator before the miner is fit tested or required to work in an area of the mine where respiratory protection must be used under the final limits.**

RESPONSE: MARG opposes a provision for respirator mandates in the diesel exposure rule, since there are existing respirator standards and the issues raised are generic to all respirator uses. The issues also are complex and require a separate and complete rulemaking meeting all MSHA statutory mandates. Such a rulemaking proceeding has not been initiated here and the necessary analysis and findings by MSHA have not been made. In fact, MSHA has not even collected the data available to it to determine how many miners such a rule would require receive evaluation for respirator use.

Previously, MARG raised the problem of the MSHA rule being enforced with an unrepresentative single sample and MARG suggests that such a result should not be permitted to adversely impact miners and mine operators. Instead, if MSHA promulgates such a rule, which MARG opposes, MARG suggests that at a minimum MSHA use the average of three samples to demonstrate overexposure for more than one month in any year to trigger respirator mandates for this rule.

Moreover, when MSHA makes a determination that all feasible controls have not been used, or that PPE should be made available as the result of diesel exhaust exposure, MSHA should issue a written Notice and detailed Finding to the Mine Operator, reviewable by the Federal Mine Safety and Health Review Commission.

32. **We are seeking comments on whether the final rule should contain a requirement for transfer of a miner to an area of the mine where respiratory protection is not required if a medical professional has determined in the medical evaluation that the miner is unable to wear a respirator for medical reasons.**

RESPONSE: If respirator rules are adopted in the diesel exhaust rule, which MARG opposes, the current DPM regulation should be amended so that the Mine Operator can rotate personnel to reduce individual exposures, and reduce the time that any particular miner must wear PPE, or prevent the need for any particular miner to wear PPE. Such a result is consistent with Dr Borak's finding that the MSHA rules address the wrong exposure matrix from a health perspective, and would help prevent the risks and discomfort that respirators pose.

33. **We are interested in whether the public believes that we should amend the existing respiratory protection requirement at Sec. 57.5060(d) by adding new paragraphs (d)(3) and (d)(4) that would address medical evaluation and transfer rights for miners.**

MSHA should not issue any regulations dealing with employee transfers or pay issues since those matters are generic to any respirator use, and require extensive analysis of scientific support, risks, benefits, and feasibility, before adoption.

We particularly want to know if the final rule should include the following language.

(3) **The mine operator must provide a medical evaluation, at no cost to the miner, to determine the miner's ability to use a respirator before the miner is fit tested or required to use the respirator to work at the mine.**

(4) **Upon notification from the medical professional that a miner's medical examination shows evidence that the miner is unable to wear a respirator, the miner must be transferred to work in an existing position in an area of the same mine where respiratory protection is not required.**

(i) **The miner must continue to receive compensation at no less than the regular rate of pay in the classification held by that miner immediately prior to the transfer.**

(ii) **The miner must receive wage increases based upon the new work classification.**

MSHA should not issue any regulations dealing with employee transfers or pay issues since those matters are generic to any respirator use, and require extensive analysis of scientific support, risks, benefits, and feasibility, before adoption.

34. We also solicit comments from the public as to whether a transfer provision in the final rule should address issues of notification to the District Manager of the health professional's evaluation and the fact that a miner will be transferred; the appropriate timeframe within which the transfer must be made; whether a record of the medical evaluation conducted for each miner should be maintained along with the correct retention period; medical confidentiality; and any other relevant issues such as costs to mine operators for implementing a rule requiring medical evaluations and transfer of miners.

RESPONSE: MSHA should not issue any regulations dealing with employee transfers or pay issues since those matters are generic to any respirator use, and require extensive analysis of scientific support, risks, benefits, and feasibility, before adoption. There should be no required notification to the District Manager for anything related to the diesel rules since such notifications would not serve the interests of safety and health and could run afoul of various state and federal privacy laws regarding health records.

X. Regulatory Impact Analysis

B. Costs

35. We solicit public comment concerning the cost of compliance, including any changes in cost that may have occurred since the 2001 REA.

RESPONSE: See earlier discussion on economic feasibility.

C. Benefits

36. You are encouraged to submit additional evidence of new scientific data related to the health risk to underground metal and nonmetal miners from exposure to DPM.

RESPONSE: See discussion above and Dr Borak's comments

XI. Regulatory Flexibility Act Certification

37. We solicit public comment concerning the accuracy of these cost estimates. (Data from 2001 showing cost savings)

RESPONSE: See discussion above and comments by H. John Head and MARG members.

XIII. Other Regulatory Considerations

XIII.A. National Environmental Policy Act of 1969

38. The rule would have no significant impact on the human environment. We solicit public comment concerning the accuracy and completeness of this environmental assessment.

MARG believes that the proposed rule, if adopted, will have an adverse impact on the environment by: (1) encouraging the purchase of new, unneeded and unjustified equipment, whose production and delivery will use scarce resources and emit potential contaminates into the earth, water and air; (2) causing each mine to experiment with untested and unproven equipment that has not been identified nor analyzed by MSHA for adverse environmental impact; and (3) causing additional ventilation to be installed that will exhaust mine dusts and other substances needlessly into the atmosphere; all without MSHA analyzing the adverse environmental impact of its proposed rule as required by law, and the actual benefits of the proposed rule required by the Mine Act.

EXHIBIT INDEX

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MSHA/OSRV

JONATHAN BORAK & COMPANY, INC.

Specialists in Occupational & Environmental Health

February 6, 2006

Mr. Henry Chajet
Patton Boggs, LLP
2550 M Street, NW
Washington, DC 20037

Dear Mr. Chajet:

As you requested, we reviewed the MSHA Final Rule establishing an exposure limit for the elemental carbon component of diesel exhaust, published June 6, 2005 (*Fed Reg* 70:32868-32968), and the related MSHA Proposed Rule to reduce the exposure limit, published on September 19, 2005 (*Fed Reg* 70:55019). We prepared the following comments on the scientific issues and methodological concerns raised by these rules with the understanding that you intend to append our comments to others that you may submit to MSHA, and that our prior comments on earlier stages of the MSHA diesel particulate rulemaking are a part of the record on this new, proposed MSHA rule.

1. <u>MSHA Relies on the Wrong Exposure Metric</u>

The following point was made in our previous comments, but it has not been adequately addressed in the Final Rule or in the Proposed Rule:

> MSHA relies on the wrong exposure metric for diesel exhaust particulate matter (DPM).

MSHA states that its Proposed and Final Rules were "supported primarily by a quantitative risk assessment for lung cancer" (*Fed Reg* 70:32889, 2005). However, EC, the exposure metric addressed by the MSHA exposure limit, is not appropriate for quantitative prediction of human lung cancer risks. Accordingly, the quantitative risk assessment that provided primary support for the Proposed Rule can not justify the regulation of EC as a surrogate measure for DPM:

a) If DPM causes human lung cancer, then the carcinogenic agent would likely be found in the OC fraction, not the EC fraction. The OC fraction

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contains a number of organic compounds (e.g., benzo[a]pyrene and nitro-polyaromatic hydrocarbons) that react directly with DNA and thereby form DNA-adducts that lead to mutations and cancer. By contrast, the EC fraction does not contain such carcinogenic compounds. Accordingly for considerations of carcinogenicity, it is important to distinguish between exposures to EC vs. OC.

b) In the Final Rule, MSHA presents EC as an appropriate surrogate measure of DPM and TC. But, empirical studies have documented significant variations in the proportion of TC attributable to EC in diesel exhaust. In other words, the EC:TC ratio in diesel exhaust is highly variable.

Moreover, because TC = EC + OC, "variability in the EC:TC ratio corresponds to variability in the ratio of either EC or TC to OC" (*Fed Reg* 70:32898, 2005). In other words, if the ratio of EC and OC varies significantly, then EC cannot be used to accurately predict the expected levels of either OC or TC.

In the Final Rule, MSHA documents significant variability of the relationships between EC, OC and TC. For example:

> In Figure VI-3 of the Final Rule, MSHA shows that for TC values >100 $\mu g/m^3$, the EC:TC ratio varies between 46% and 97% (*Fed Reg* 70:32895, 2005).
>
> In Figure VI-4 of the Final Rule, MSHA presents the same data after arcsin transformation; the same large variability is again demonstrated (*Fed Reg* 70:32895, 2005).

In the text that accompanies these Figures, MSHA makes this point emphatically:

> "It is clear from Figures VI-3 and VI-4 that individual samples in the 31-Mine Study exhibited <u>considerable variation</u> in their EC:TC ratios".
>
> (*Fed Reg* 70:32897, 2005; <u>emphasis</u> added)

MSHA then describes additional statistical analyses of these data which reached a similar conclusion:

> "At a confidence level exceeding 99.9%, the data show statistically significant differences in the mean EC:TC ratios between mines and between different sampling days within mines".
>
> (*Fed Reg* 70:32897, 2005; emphasis added)

Thus it seems apparent that MSHA recognized and agrees that because of "considerable variation in the EC:TC ratios", the 31-Mine Study results indicate that EC is not a statistically appropriate predictor of OC or TC. Moreover, MSHA apparently agrees that relationships proposed between EC, OC and TC vary significantly between mines and between sampling days within the same mine.

c) Based on the facts that OC, not EC, is the DPM fraction more likely to contain a lung carcinogen (if DPM causes human lung cancer) and also that EC is not a statistically appropriate predictor of OC or TC, it follows logically that the use of EC as a surrogate measure of DPM exposure can not be justified by the quantitative risk assessment for lung cancer.

In its response to this argument, as presented in my earlier comments, MSHA described our views on diesel exhaust carcinogenicity as "speculative" and contradicted by findings reported in a study by Ichinose et al (1). In particular, MSHA said that we had not taken into account data presented by Ichinose et al. that MSHA described as suggesting that "active oxygen radicals induced by the inorganic carbon core of DPM" might have contributed to the "promoting" of lung cancers (*Fed Reg* 70:32898, 2005).

These comments are factually incorrect; the paper by Ichinose et al. actually agrees with our analysis, not with MSHA. Note the following statement from the report by Ichinose et al.:

> "The mechanism of lung carcinogenesis induced by diesel exhaust is not fully understood. However, it is thought that the carcinogenic compounds present in DEP may contribute to the development of lung cancer induced by diesel exhaust since carcinogenic compounds such as benzo[a]pyrene and nitro-polyaromatic hydrocarbons could form DNA adducts which are involved in carcinogenesis...
>
> We have recently found that O_2^- and $\cdot OH$ were enzymatically generated from DEP by the following process: soot-associated quinone-like compounds are reduced to the semiquinone radical by cytochrome P450 reductase, and these semiquinone radials reduce O_2 to O_2^- ... which causes DNA damage *in vitro*...

> DNA adducts formation by metabolites of soot-associated organic compounds may be one step in the initiation of diesel exhaust-induced pulmonary carcinogenesis."
>
> (1), p. 189-190, emphasis added)

Thus, Ichinose et al. actually presented data and concluded that the potential carcinogenic compounds in diesel exhaust include "benzo[a]pyrene and nitro-polyaromatic hydrocarbons" and other "soot-associated organic compounds". That is entirely consistent with our comments to MSHA; the compounds referred to by Ichinose et al. are found in the OC fraction of DPM, not the EC fraction.

Ichinose et al. also proposed that DNA damage and lung cancer resulted from the formation of active oxygen radicals; their studies indicated that such radicals were formed by a process involving "soot-associated quinone-like compounds ... reduced to the semiquinone radical by cytochrome P450 reductase". Such "soot-associated quinone-like compounds" are found in the OC fraction, not the EC of DPM.

Beyond their text description, that specific mechanism was also presented schematically in their Figure 3 (page 189): "proposed mechanism for oxygen radical induction of lung carcinogenesis" [1].

In summary, the MSHA argument is in error and demonstrates an apparent misunderstanding of the underlying science. The reference upon which they rely to rebut our statements is actually supportive of our analysis and conclusion that the EC fraction of DPM is not likely to contain those agents likely to cause lung cancer (if DPM causes human lung cancer). Ironically, it is the MSHA argument that is "speculative".

2. Concerns about Sampling Variability and Errors

That sampling and analytical method proposed in the Final Rule, collection and measurement of submicron elemental carbon (EC) samples, is unique. It has not been used previously in any regulatory programs. Since the 2001 Final Rule, the specific sampling and analytical methods proposed by MSHA have undergone various changes in response to identified failings. For example, the filter system used for sample collection was redesigned, the sampling cassette was redesigned, and the size distribution of collected particles was changed by the use of a "sub-micron impactor". In addition, MSHA concluded that the DPM

[1] It is also notable that Ichinose et al do not suggest that active oxygen radicals "promote" lung cancers as stated by MSHA.

surrogate initially proposed in the 2001 Final Rule, total carbon (TC), could not be measured without significant interference from non-DPM sources, such as oil mist and certain mine dusts. Accordingly, MSHA changed its initial approach, instead selecting elemental carbon (EC) as the critical exposure metric for its 2005 Final Rule. However, MSHA has not adequately addressed continuing concerns raised by us and others regarding the method.

In our previous comments, we described concerns about the accuracy and precision of the analytical methods adopted in the Final Rules and presented again in the Proposed Rule. We documented our concerns by reference to published data from our own study of seven non-metal mines with results determined using the NIOSH 5040 Method (2). We also documented our concerns by reference to two MSHA data sets, the Compliance Assistance Database (containing 223 pairs of punch-repunch data from samples collecting using an older version of the SKC impactor) and data that had been provided to us from the MSHA 31-Mine Study.

In the Final Rule, MSHA pointed out that we had used only a subset of the 31-Mine Study database that had been made available to us:

> "No explanation was provided as to why these particular 63 pairs were included … while about 750 other paired punch results available from the 31-Mine Study were excluded." (*Fed Reg* 70:32950)

Subsequently, we submitted to MSHA a FOIA request and obtained "a partial response" in a letter dated December 30, 2005 (see Appendix I), which provided spreadsheets said to contain the complete database of paired punch results from the 31-Mine Study. We analyzed those data in a manner similar to that which we had earlier used for what we now recognize to have been a subset of the data.

1). First, we determined the amount of data provided in the 31-Mine Study punch-repunch database.

> a) Contrary to MSHA statements in the Final Rule, that database does not contain "about" 813 pairs of data (i.e., 63 pairs described in our earlier comments plus "about 750 other paired punch results from the 31-Mine Study"). The actual total number of pairs is <u>626</u> [2].

[2] We did not include pairs in which the second punch was acidified.

b) The 626 pairs of punch-repunch data were derived from a heterogeneous group of sample filters. Among that total of 626 filters were the following [3]:

- 64 static (i.e., unexposed) blank filters;
- 126 dynamic (i.e., back-up) blank filters;
- 60 primary filters from samplers that were VOIDED and not otherwise analyzed as part of the 31-Mine Study;
- 34 primary filters for which the corresponding dynamic blank was greater than the 95% upper confidence limit for the dynamic blanks at each of the respective labs (>0.14 $\mu g/cm^2$ for the MSHA lab and >0.27 $\mu g/cm^2$ for Clayton, NATLASCO and NIOSH). Such findings on dynamic blanks indicate sampler malfunction;
- 354 primary filters suitable for analysis.
- 22 of the 354 primary filters otherwise suitable for analysis lacked sample times.

Note that the above numbers do not correspond exactly to those summarized by MSHA in the 31-Mine Study Report. Table II-1 of that report described a total of 620 filters including 181 blanks. That Report does not contain raw data, while the raw data provided to us electronically by MSHA were not labeled to correspond to data summarized in the 31-Mine Study Report. Thus, we are unable to explain this apparent difference in the MSHA data.

2). We then determined "analytical uncertainty" by comparing punch-repunch results from the same filters. We compared punch-repunch results only for EC analyses. In the 31-Mine Study, MSHA compared punch-repunch results for TC = EC + OC. Because the Final Rule includes only the EC measure, comparisons of punch-repunch differences for TC and OC are not relevant.

In our comments to MSHA submitted 10/23/03, we discussed our concerns and our approach in detail. Therefore, we will only summarize them here; our more detailed comments are attached to this letter as Appendix I.

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[3] A small number of pairs were included in two or more categories.

a) NIOSH and MSHA have independently published methods by which they determine acceptable parameters for the application of analytical methods.

b) NIOSH considers both the accuracy and the precision of a test when considering its acceptability as an analytical method. Accuracy refers to the difference between a measured concentration and the 'true' concentration of the sample that has been measured. For EC, there is no standard reference material against which analytical results can be compared. Thus, it is not possible to determine analytical 'accuracy' for MSHA sampling results.

Instead, MSHA has accepted its analytical method in consideration of only an assessment of the method's 'precision'. Precision is a measure of a method's ability to produce the same result, repeatedly, regardless of the true value or accuracy of the result. NIOSH evaluates the 'precision' of analytical methods in terms of its coefficient of variation (CV) which is described in the attachment:

> "Specifically, the goal of this evaluation is to determine whether, on average, over a concentration range of 0.1 to 2 times the exposure limit, the method can provide a result that is within ±25% of the true concentration 95% of the time." (3)

The NIOSH documentation for the 5040 Method, which MSHA adopted to measure TC and EC, indicates that NIOSH determined the method's precision in two ways (4): 1) in an exposure box on a truck loading dock ventilated with truck exhaust at an exposure level equivalent to about 250 $\mu g/m^3$; and 2) in a laboratory with precision described at levels of 23 $\mu g/m^3$ and 240 $\mu g/m^3$.

Thus, neither of the NIOSH determinations of precision was performed in a mining environment, neither considered exposure levels corresponding to the proposed MSHA exposure limits, and neither utilized the sub-micron impactor adopted in the Final Rule. Each of these factors has potentially significant impact on precision.

c) MSHA uses a related, but different approach than NIOSH for considering the acceptability of an analytical method's precision:

> "MSHA would issue a citation only if a measurement demonstrated noncompliance with at least a 95-percent confidence. We would achieve this 95-percent confidence by comparing each EC

measurement to the limit multiplied by an appropriate "Error Factor" (5).

The DPM Error Factor is comprised of three components: 1) Variability in volume of air pumped through the filter; 2) Variability in area of dust deposited on filter; 3) Analytical measurement imprecision. In its technical documents (6), MSHA derives values for those three component errors. The MSHA Error Factor calculated for exposures ≥123 $\mu g/m^3$ is 1.15.

It is important to note that the MSHA Error Factor neglects all concerns about accuracy, i.e., the 'true' value of EC or DPM being measured. Despite the total absence of data to support its approach, MSHA has developed this Error Factor as though the NIOSH 5040 method were perfectly accurate for measurements of EC. This is speculative and almost certainly wrong.

Also, MSHA has not calculated the precision or CV of the NIOSH 5040 Method using data actually derived from studies of mining environments or any other real world exposure setting. As described above, the two settings in which NIOSH evaluated the method, a laboratory and a fabricated exposure chamber, have little semblance to an underground mine. Our published exposure data (described above and in Appendix I), which were obtained in underground mining settings (2), suggest that data obtained in real mining settings can be expected to differ from those calculated by NIOSH for different conditions and collection methods. Accordingly, it is not possible to directly evaluate the MSHA Error Factor for the use of the NIOSH 5040 Method in underground mines using the mines outlined in the Proposed and Final rules.

MSHA regards the analytical differences between punches taken from the same sample filter as one component of "analytical measurement Imprecision". The 31-Mine Study punch-repunch database provides some mine-derived data with which it is possible to evaluate the adequacy of that component of the MSHA Error Factor, but not the total Error Factor.

We evaluated the 'analytical measurement imprecision' of the method as reflected by the observed variance between paired punches from the same filters. By this approach, we were able to estimate the magnitude of that component of 'analytical measurement imprecision'.

In response to MSHA comments in the 2005 Final Rule, we compared the difference between punches, to the average of the two punch results, and we included the data contained in the larger datasets recently made available to us by MSHA. In our previous comments we had compared the difference between punches to the lower of the two punch results because the MSHA lab was nearly always the lower value. Comparing the difference between punches to the average of the two punches decreases the estimate of imprecision.

As shown in Table 1, we first analyzed all 626 pairs of punch-repunch data as presented in the MSHA data tables provided to us.

Table 1: Summary of Punch-Repunch Data for <u>626</u> EC Samples from the 31-Mine Study

% Difference ($\mu g/m^3$)	0-4.99%	5-9.99%	>10	>15%
# of Pairs	294/626	104/626	228/626	194/626
% of Total Pairs	47.0%	16.6%	36.4%	31.0%

Table 1 indicates that for all of the 626 pairs of punch-repunch data provided by MSHA, 194 pairs (31.0%) had punch-repunch differences that were greater than the total MSHA Error Factor of 15%. Said differently, when filters were analyzed twice, 194 of 626 (31.0%) produced results that differed by more than 15%.

Table 2 indicates the result of a similar analysis that focused only on the 354 primary filters (of the 626 total) that were suitable for analysis; we excluded all blanks, all voided samples and those for which sampler malfunction was likely.

Table 2: Summary of Punch-Repunch Data for <u>354</u> EC Samples of "Suitable Primary Filters" from the 31-Mine Study

% Difference ($\mu g/m^3$)	0-4.99%	5-9.99%	>10	>15%
# of Pairs	227/354	75/354	52/354	30/354
% of Total Pairs	64.1%	21.2%	14.7%	8.5%

In the 31-Mine Study, 31.2% of punch-repunch pairs differed by >15%. Even among the subset of 354 primary filters suitable for analysis, 14.7% had punch-repunch differences >10% and 8.5% had differences >15%.

These findings indicate that punch-repunch differences, only one component of precision and the total Error Factor, often exceed the total Error Factor for the analytical Method.

It is thus apparent that the formula-derived Error Factor underestimates the actual imprecision of the MSHA method. Accordingly, we conclude that the MSHA Error Factor described in the proposed Final Rule is too small to meet the statistical goals (i.e., "95-percent confidence") adopted by the Agency.

3. Further Concerns about Sampling Variability

In the Final Rule, MSHA raised another set of issues in responding to our earlier comments about the apparent variability and error of EC sampling method.

Our previous comments were based on real-world data generated using baskets of side-by-side samplers. The data that we evaluated derived from a published peer-reviewed study performed in seven non-metal mines with EC results determined by means of the NIOSH 5040 Method (2). Based on those data, we concluded that because an excessively large proportion of the baskets (i.e., ~32%) had a CV >12.5% (i.e., the level used by NIOSH to determine the acceptability of an analytical method), that the method was not acceptable. This conclusion is supported by the more extensive analysis in this letter of the full MSHA data set; i.e., an excessively large proportion of the punch-repunch samples demonstrate unacceptably large analytical variability.

In response, MSHA presented a "Monte Carlo" computer model simulation and claimed that the simulation of 10,000 hypothetical sampling results demonstrated the adequate precision of its method (*Fed Reg* 70:32946-7). On the basis of that simulation, MSHA argued that our data were actually "consistent with meeting the NIOSH Accuracy Criterion". MSHA further attributed our findings to "statistical instability" due to small sample size (i.e., too few side-by-side samplers), but failed to indicate the number of samples that would be acceptable to determine the precision and adequacy of their method [4].

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4 MSHA also failed to observe that the NIOSH "Coefficients of Variation and Accuracy Criteria Requirements" do not specify a necessary minimum number of samples. Also, documentation of the NIOSH 5040 Method, adopted by MSHA in this Final Rule, was based on only two 'baskets', one with only seven 'measurement' and the other containing an undefined number of 'measurements' (4).

The MSHA response based on that theoretical, computer model argument is not valid. To demonstrate the invalid nature of the MSHA response, we emulated their Monte Carlo simulation [5]; results are presented in Appendix III.

We first used the Monte Carlo simulation to address the MSHA comment that our analytical results suffered from "statistical instability" due to a small sample size. For the hypothetical example used by MSHA ('true' coefficient of variation = 12%), we determined that the proportion of 'baskets' with CV >12.5% ranged from ~26.53-36.33% as the number of measurements in each basket ranged from 2-100. Our field data fall around the midpoint of this range. In other words, MSHA is wrong in its assertion that our results from the underground mine survey reflected "statistical instability" due to sample size.

We then utilized the Monte Carlo simulation to demonstrate that the MSHA computer model approach would allow otherwise unacceptable analytical methods to be judged appropriate for compliance and enforcement purposes.

We asked the following question:

> What is the likelihood, based on the MSHA computer simulation, that a basket containing specific numbers of samplers would be found to have a CV ≤12.5%, even when the true CV of the method was known to be greater than 12.5%?

Such a result would wrongly indicate that the method was acceptable according to NIOSH Criteria.

Graphical analyses of the results are presented in Appendix IV. The figures demonstrate the proportion of baskets, each containing between 2 and 100 samplers that would be judged to meet the NIOSH criteria (i.e., CV ≤12.5%) as the 'true" CV of the analytical method increases from 10-20%.

This analysis shows that although the proportion of baskets that are wrongly judged adequate by the NIOSH criteria declines as the 'true CV' increases, there remains a large proportion of baskets that would wrongly be judged as "acceptable" even though the 'true CV' exceeded the acceptable limit.

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[5] Using SAS release 8.02, we generated datasets of simulated measurements from a log normal distribution with mean = 126 and a variety of predetermined CV values. For each predetermined CV value, we randomly drew 100,000 'baskets' each containing a predetermined number of 'measurements'. The CVs for those individual 'baskets' were then determined, allowing the number of 'measurements' in each basket to increase from 2 to 100. The results of these analyses are presented in Appendix II.

In other words, if such a simulation were adopted as the basis for MSHA policy making, a significant number of unacceptably imprecise analytical methods (i.e., with 'true CV' greater than 12.5%) would be wrongly judged acceptable for enforcement purposes.

> Consider for example an analytical method with 'true CV' of 16%. If that method were evaluated using baskets with 10 side-by-side samplers, the simulation model predicts that it would wrongly be judged "acceptable" 20% of the time.
>
> Or, consider an analytical method with 'true CV' of 20%. If that method were evaluated using baskets containing four side-by-side samplers, the simulation model predicts that it would wrongly be judged "acceptable" 25% of the time.

MSHA employed its Monte Carlo simulation to support the conclusion that their sampling and analytical method was adequately precise and therefore feasible. However, in adopting that approach, MSHA has apparently embraced a theoretical model that would lead it to wrongly conclude that unacceptable analytical methods were acceptable for enforcement purposes. We are concerned that this approach does not illuminate the question or advance the issue. To the contrary, reliance on such hypothetically generated data seems only to obscure the real-world data that document analytical imprecision.

4. Summary

We are concerned that the MSHA DPM Final Rule is not based on sound science. As described above, it is our opinion that EC is not the correct exposure metric for evaluating the risks of DPM, and therefore the Proposed Rule is not supported by the quantitative cancer risk assessment presented by MSHA.

We also find evidence that the analytical method is less precise than is acceptable to either NIOSH or MSHA. In addition, we find evidence that the MSHA Error Factor is too small to achieve the MSHA goal of reliable enforcement feasibility. We also conclude that the MSHA argument justifying its method, which relies on a theoretical Monte Carlo computer simulation, would lead the agency to wrongly accept unacceptable analytical methods with potentially large imprecision.

The latter concern points to a fundamental deficiency in the MSHA regulation. The agency apparently lacks established criteria for determining both an acceptable "standard" for analytical procedures, and the number and types of samples required to determine that an analytical method is precise, accurate, feasible, and "acceptable".

In this case, MSHA has not actually determined its Error Factor in underground mines and did not address the lack of a 'suitable reference material' against which analytical results can be compared. Because it has not been possible to document accuracy, MSHA developed an error factor that ignores potential inaccuracy. This is not scientifically appropriate.

Yours truly,

Jonathan Borak, MD, DABT — Yale University

Greg Sirianni, MS, CIH — University of New Haven

Reference List

1. Ichinose T, Yajima Y, Nagashima M, et al: Lung carcinogenesis and formation of 8-hydroxy-deoxyguanosine in mice by diesel exhaust particles. Carcinogenesis 18:185-192, 1997.

2. Cohen HJ, Borak J, Hall T, et al: Exposure of miners to diesel exhaust particulates in Underground Nonmetal Mines. Am Ind Hyg Assoc J 63:651-658, 2002.

3. National Institute for Occupational Safety and Health: Occupational Exposure Sampling Strategy Manual (NIOSH Publication No. 77-173). Washington, DC: U.S. Department of Health, Education and Welfare, 1977.

4. National Institute for Occupational Safety and Health. Elemental Carbon (Diesel Particulate) (5040) (Issue 3). In: NIOSH Manual of Analytical Methods, Cincinnati: National Institute for Occupational Safety and Health, 1999.

5. Mine Safety and Health Administration: 30 CFR Part 57: Diesel particulate matter exposure of underground metal and nonmetal miners; Proposed rule. Fed Reg 67:48668-48721, 2003.

6. Mine Safety and Health Administration: Metal and Nonmetal Diesel Particulate Matter (DPM) Standard Error Factor for TC Analysis. 2003. (http://www.msha.gov/01%2D995/dieselerrorfactor.doc; accessed 1/06).

Appendix I

Letter of December 30, 2005:
Felix Quintana to Jonathan Borak

U.S. Department of Labor

Mine Safety and Health Administration
1100 Wilson Boulevard
Arlington, Virginia 22209-3939

DEC 30 2005

Dr. Jonathan Borak
Jonathan Borak & Company, Inc.
234 Church Street
Suite 1100
New Haven, CT 06510

Dear Dr. Borak:

This is a partial response to your December 14, 2005, Freedom of Information Act (FOIA) request. Your request concerns our Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners published in the *Federal Register* on June 6, 2005 (70 FR 32868-32916). You requested "all documents referring to or relating to the 'about 750 other paired punch results' as referenced in the *Federal Register* notice." You also requested "the actual sampling data from all of those 'about 750 other paired punch results', including data describing the sampling flow rates, filter loads and calculated air concentrations for each of the sample punches." You requested "all documents referring to or relating to the 'about' 813 paired punch results as referenced in the *Federal Register* notice." and "the actual sampling data from all of those 'about' 813 sets of paired punch results, including data describing the sampling flow rates, filter loads and calculated air concentrations for each of the sample punches." You requested "all documents referring to or relating to the 702 samples from the 31-Mine Study included in the punch-repunch analysis, as referenced in the Final Report of that Study " and " the actual sampling data from all of those 702 sets of paired punch results, including data describing the sampling flow rates, filter loads and calculated air concentrations for each of the sample punches." You requested "all documents referring to or relating to the 620 samples from the 31-Mine Study included in the punch-repunch analysis, as referenced in Table II-1 of the Final Report of that Study " and " the actual sampling data from all 620 sets of paired punch results, including data describing the sampling flow rates, filter loads and calculated air concentrations from each of the sample punches."

We conducted a thorough search in an effort to identify records responsive to your request. Listed below are the records that we located:

ANFO dpm2.xls	77 KB	3/29/2002	2:26 PM
dpm2.xls	4,673 KB	3/29/2002	2:26 PM
dpminterference2.xls	249 KB	3/29/2002	2:25 PM

oil mist dpm2.xls	87 KB	3/29/2002	2:26 PM
acidification.xls	72 KB	12/28/2005	10:08 AM
Msha_all.xls	234 KB	12/28/2005	10:14 AM

Information, including dates and identifying information, has been redacted under Exemption 6, which protects information that would clearly be an unwarranted invasion of personal privacy if released. The redactions include information about the Federal Inspector, actual sampling date, mine name and MSHA mine identification number. Coded data is included in the records provided allowing analysis of information about the inspector, sampling date and mine as if the original information was included.

We anticipate providing the final response to your request shortly. We are reviewing other documents that may be responsive to your request.

Should you have any questions concerning this matter, please contact the MSHA Office of Metal and Nonmetal Mine Safety and Health at 202-693-9630.

Sincerely,

Felix Quintana
Acting Administrator for Metal and Nonmetal
Mine Safety and Health

Enclosure

Appendix II

Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners: Final Rule
Federal Register 66:5706-5910, 2001

Comments on Sampling Variability and Errors

Jonathan Borak, MD, DABT
Greg Sirianni, MS

October 13, 2003

Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners: Final Rule *Federal Register* 66:5706-5910, 2001

Comments on Sampling Variability and Errors

Jonathan Borak, MD, DABT
Greg Sirianni, MS

October 13, 2003

NIOSH and MSHA have independently published methods by which they determine acceptable parameters for the application of analytical methods for compliance purposes. Their respective approaches are discussed below, followed by the findings of our reanalyses of MSHA and MARG DPM data in light of those two methods for determining acceptability of analytical methods.

1. NIOSH Method and the 5040 Method

NIOSH considers both the accuracy and the precision of a test when considering its acceptability as an analytical method.

> Accuracy refers to the difference between a measured concentration and the 'true' concentration of the sample that has been measured. The difference between the average of measured values and the 'true' value is sometimes referred to as bias.
>
> Precision refers to the amount of random variation of the method about its own mean, i.e. the "tightness" of the clustering of results.

For EC measurements using the NIOSH 5040 Method, there is no 'suitable reference material' against which analytical results can be compared. Thus, it is not possible to determine analytical 'accuracy'. Accordingly, acceptability of the method has rested only on an assessment of its 'precision'.

NIOSH evaluates the 'precision' of analytical methods in terms of its coefficient of variation (CV). The CV, a widely used index of the dispersion of distribution of data, is calculated as the standard deviation of a distribution divided by the distribution mean: CV = SD ÷ mean. The CV is usually reported as a percentage: CV (%) = [SD ÷ mean] x 100. With relation to the mean of a distribution, 95% of the distribution is expected to be found within the range defined as ±1.96 CV.

NIOSH Guideline for evaluating an analytical method state that the CV of an analytical method must be ≤12.76% (i.e., 25% ÷ 1.96 = 12.76)"

"Specifically, the goal of this evaluation is to determine whether, on average, over a concentration range of 0.1 to 2 times the exposure limit, the method can provide a result that is within ±25% of the true concentration 95% of the time." (1)

Implicit in this criterion is the assumption that the mean of the distribution of analytical results will coincide with the "true concentration ... represented by an independent method" (1), but there is no "independent method" for measurement of EC and there is no suitable reference material.

The NIOSH documentation for the 5040 Method indicates that precision was determined in two ways (2):

1) Precision was determined in the field setting of a loading dock where a diesel truck was operating. There were 14 short-duration, low-volume samples (30 min x 2 L/min = 60 L; two each of seven different sampler types) with a CV of 5.6% calculated on the basis of the mean of those samples (i.e., not an independently determined "true concentration"). The amount of EC collected (240 μg/sample = 28.1 $\mu g/cm^2$) was calculated by NIOSH as equivalent to sampling an EC level of 250 $\mu g/m^3$ for 8 hours at 2 L/min.

2) Precision was also determined in a laboratory where diesel particles were generated with a dilution tunnel and a dynamometer. Four EC concentrations, from 23 to 240 $\mu g/m^3$ were generated (the intermediate levels were not described). The numbers of samples at each concentration were not described. Variance was proportional to concentration, thus precision increased with increasing concentration. "Pointwise accuracy" was ± 16.7% at the lowest loading (23 $\mu g/m^3$), while the overall precision (CV) was 8.5%. Precision at exposures of 100-150 $\mu g/m^3$ was not reported.

It is notable that neither of these determinations of precision was performed in a mining environment and neither utilized the proposed sampling method using a sub-micron impactor.

2. MSHA Method and the 5040 Method

MSHA uses a related, but different approach for considering the acceptability of an analytical method. With respect to the Proposed Final Rule for DPM, it states:

"MSHA would issue a citation only if measurement demonstrated noncompliance with at least a 95-percent confidence. We would achieve this 95-percent confidence by comparing each EC measurement to the limit multiplied by an appropriate "error factor... The formula for the error factor was based on three factors included in the DPM settlement agreement…" (3).

The MSHA website provides a technical document describing the Standard Error Factor for TC Analysis (4) which states:

> "As with all other exposure-based M/NM compliance determinations, MSHA will address uncontrollable sampling and analytical errors (SAE) by allowing a margin of error before issuing a citation for exceeding the total carbon (TC) limit".

The DPM error factor is comprised of three components.

CV_P = Variability in volume of air pumped through the filter

CV_D = Variability in area of dust deposited on filter

CV_A = Analytical measurement imprecision

The Standard Error Factor (EF) is then calculated as:

$$EF = 1 + [1.645 \times (CV_P^2 + CV_D^2 + CV_A^2)^{0.5}]$$

The numerical value "1.645" corresponds to the number of standard deviations (SD) above the mean of a normal distribution that defines that point in the distribution above which there is 5% of the distribution. In statistical terms, the value "1.645 x SD" defines the upper bound for a 95-percent confidence range ("95-percent 1-tailed confidence coefficient") using a one-tailed statistical test.

By means of calculations detailed in the technical document, MSHA presents the following values for the three components of its EF:

CV_P = 0.042

CV_D = 0.031

CV_A = 0.046 (for EC ≥ 308 $\mu g/m^3$).

CV_A = 0.072 (for EC ≥ 123 $\mu g/m^3$)

By substituting those components into the equation, MSHA calculates the following two EF, one appropriate for the interim PEL:

$$EF = 1 + [1.645 \times (0.042^2 + 0.031^2 + 0.046^2)^{0.5}]$$

$$EF = 1 + (1.645 \times 0.0696)$$

EF = 1.12

For the final PEL, the calculated EF is **1.15**.

3. MARG Study Data

In the MARG DPM study, we obtained personal and area samples from seven non-metal mines with results determined using the NIOSH 5040 Method (5). There were 25 area baskets (4 or 5 samplers per basket) for which at least one EC measurement was in the range 75-200 $\mu g/m^3$. Analytical data from those baskets are shown in Appendix Table 1, which presents the range, mean, standard deviation and CV for each of the baskets. Those data are summarized in Table 1a, which indicates the number and proportion of baskets corresponding to CV ranges of 0-4.99, 5-9.99, >10 and >12.5%.

Table 1a: Summary of Coefficient of Variation Data for 25 Area Baskets - 4 or 5 samplers per basket - at least one sample in 75-200 $\mu g/m^3$ range - MARG Diesel Study

CV	0-4.99	5-9.99	>10	>12.5
# of Samples	5/25	7/25	13/25	8/25
% of Samples	20%	28%	52%	32%

4. MSHA Sampling Data

MSHA has apparently not published data that independently calculates the CV of the NIOSH 5040 Method as used in mines. However, two sampling data sets have been provided to the public that allow a comparison of the results when two punches are taken from the same filter (although not necessarily measured by the same laboratory). In its technical document (discussed above), MSHA indicates that analytical differences between punches taken from the same sample filter are a component of Analytical Measurement Imprecision (CV_A).

One data set, the Compliance Assistance Database, contained 223 pairs of punch-repunch data from samples collecting using an older version of the SKC impactor that differs from the impactor proscribed in the proposed Final Rule. The data are presented in Appendix Table 2. The table columns indicate: Sample ID #, EC in punch 1, EC in punch 2, Absolute Difference (Absolute Δ) and Percentage Difference (% Δ). Most of the samples with punch-repunch data had EC values >300 $\mu g/m^3$, but there were 22 samples (9.9%) with values <200 $\mu g/m^3$.

Table 2a summarizes the data set, indicating the number and proportion of samples with punch-repunch differences corresponding to 0-4.99, 5-9.99, >10 %.

Table 2a: Summary of Punch-Repunch Data for 223 EC Samples - Compliance Assistance Database

% Difference ($\mu g/m^3$)	0-4.99%	5-9.99%	>10
# of Samples	190/223	20/223	13/223
% of Samples	85.2%	9.9%	5.8%

Table 2b summarizes the data for samples <200 $\mu g/m^3$.

Table 2b: Summary of Punch-Repunch Data for 22 EC Samples < 200 μg/m3 -- Compliance Assistance Database

% Difference ($\mu g/m^3$)	0-4.99%	5-9.99%	>10
# of Samples	17/22	3/22	2/22
% of Samples	77.3%	13.6%	9.1%

A second set of sampling data were provided to us and identified as from the 31-Mine study. That database contained 63 samples for which there were punch-repunch analytical differences. Those data are presented in Appendix Table 3. The table columns indicate: Sample ID #, EC in punch 1, EC in punch 2, Absolute Difference (Absolute Δ) and Percentage Difference (% Δ). We understand that the punch-repunch samples were analyzed at different labs.

Table 3a summarizes the data set, indicating the number and proportion of samples with punch-repunch differences corresponding to 0-4.99, 5-9.99, >10 %.

Table 3a: Summary of Punch-Repunch Data for 63 EC Samples - (Identified as '31-Mine Study')

% Difference ($\mu g/m^3$)	0-4.99%	5-9.99%	>10
# of Samples	36/63	17/63	10/63
% of Samples	57.1%	27.%	15.8%

Table 3b summarizes the data for samples <200 $\mu g/m^3$.

Table 3b: Summary of Punch-Repunch Data for 52 EC Samples <200 μg/m^3 - (Identified as '31-Mine Study')

% Difference (μg/m^3)	0-4.99%	5-9.99%	>10
# of Samples	27/52	15/52	10/52
% of Samples	51.9%	28.8%	19.2%

5. Discussion

Based on the data analyzed above, we conclude that that the Error Factor (EF) presented in the proposed Final Rule is too small. In the MARG study, 32% of baskets containing at least one sample in the 75-200 μg/m^3 range had a CV ≥12.5 %. That finding is inconsistent with the NIOSH criteria for appropriateness of analytical methods and does not meet guidelines presented in the proposed Final Rule.

With respect to MSHA, its EF is calculated on the assumption that CV_A, of which one component is punch-repunch differences, will be less than 4.6% for samples in which EC ≥308 μg/m^3 and less than 7.2% for samples in which EC ≥123 μg/m^3. But data from the two MSHA databases indicate that punch-repunch differences often exceed the total value of CV_A, thus indicating that the formula for EF underestimates the actual imprecision of the MSA method. Moreover, the punch-repunch differences were greater than the total EF in 4.5% of the samples with punch-repunch data in the Compliance Assistance database and 9.5% of such samples in the 31-Mine database. Accordingly, it is almost certain that both of those databases document failure to meet the NIOSH and MSHA acceptability criteria.

It is unfortunate that MSHA has not evaluated its proposed method by means of systematic determinations of the CV for samples obtained under real mining settings. Lacking such data, it does not seem possible to conclude whether the proposed sampling methods and their related PELs meet the NIOSH and MSHA appropriateness criteria discussed above. As a result, there is an apparent failure to demonstrate feasibility of the proposed method despite the Agency's two databases, which raise significant concerns about the methods proposed in the Final Rule.

6. References

1. National Institute for Occupational Safety and Health: Occupational Exposure Sampling Strategy Manual (NIOSH Publication No. 77-173). Washington, DC: U.S. Department of Health, Education and Welfare, 1977.

2. National Institute for Occupational Safety and Health. Elemental Carbon (Diesel Particulate) (5040) (Issue 3). In: NIOSH Manual of Analytical Methods, Cincinnati: National Institute for Occupational Safety and Health, 1999.

3. Mine Safety and Health Administration: 30 CFR Part 57: Diesel particulate matter exposure of underground metal and nonmetal miners; Proposed rule. Fed Reg 67:48668-48721, 2003.

4. Mine Safety and Health Administration: Metal and Nonmetal Diesel Particulate Matter (DPM) Standard Error Factor for TC Analysis. available at: http://www.msha.gov/01%2D995/dieselerrorfactor.doc, 2003.

5. Cohen HJ, Borak J, Hall T, et al: Exposure of miners to diesel exhaust particulates in Underground Nonmetal Mines. Am Ind Hyg Assoc J 63:651-658, 2002.

Appendix III

Monte Carlo Simulation Data Tables

Measurement of Diesel Particulate Matter

Monte Carlo Simulation of 100,000 Samples

CV	Mean	Standard Deviation	Number of Measurements Averaged per Sample	Percent of Sample Means within Range (+/- 25% of 'True' Mean)	Percent of Sample Means Outside Range (Greater the +/1 25% of 'True' Mean)	Percent of Sample CV's Less than or Equal to 12.5%	Percent of Sample CV's Greater than 12.5%
10%	126	12.60	1	98.69%	1.31%	n/a	n/a
10%	126	12.60	2	99.94%	0.06%	79.09%	20.91%
10%	126	12.60	3	100.00%	0.00%	79.35%	20.65%
10%	126	12.60	4	100.00%	0.00%	80.91%	19.09%
10%	126	12.60	5	100.00%	0.00%	82.26%	17.74%
10%	126	12.60	6	100.00%	0.00%	83.65%	16.35%
10%	126	12.60	7	100.00%	0.00%	84.96%	15.04%
10%	126	12.60	8	100.00%	0.00%	86.20%	13.80%
10%	126	12.60	9	100.00%	0.00%	87.27%	12.73%
10%	126	12.60	10	100.00%	0.00%	88.12%	11.88%
10%	126	12.60	100	100.00%	0.00%	99.95%	0.05%
11%	126	13.86	1	97.73%	2.27%	n/a	n/a
11%	126	13.86	2	99.83%	0.17%	74.65%	25.35%
11%	126	13.86	3	99.97%	0.03%	73.01%	26.99%
11%	126	13.86	4	100.00%	0.00%	73.02%	26.98%
11%	126	13.86	5	100.00%	0.00%	73.41%	26.59%
11%	126	13.86	6	100.00%	0.00%	74.15%	25.85%
11%	126	13.86	7	100.00%	0.00%	74.94%	25.06%
11%	126	13.86	8	100.00%	0.00%	75.47%	24.53%
11%	126	13.86	9	100.00%	0.00%	76.18%	23.82%
11%	126	13.86	10	100.00%	0.00%	76.96%	23.04%
11%	126	13.86	100	100.00%	0.00%	96.89%	3.11%
12%	126	15.12	1	96.39%	3.61%	n/a	n/a
12%	126	15.12	2	99.61%	0.39%	70.56%	29.44%
12%	126	15.12	3	99.93%	0.07%	66.84%	33.16%
12%	126	15.12	4	99.99%	0.01%	65.17%	34.83%
12%	126	15.12	5	100.00%	0.00%	64.41%	35.59%
12%	126	15.12	6	100.00%	0.00%	64.31%	35.69%
12%	126	15.12	7	100.00%	0.00%	64.05%	35.95%
12%	126	15.12	8	100.00%	0.00%	63.79%	36.21%
12%	126	15.12	9	100.00%	0.00%	63.72%	36.28%
12%	126	15.12	10	100.00%	0.00%	63.67%	36.33%
12%	126	15.12	100	100.00%	0.00%	73.47%	26.53%
13%	126	16.38	1	94.85%	5.15%	n/a	n/a
13%	126	16.38	2	99.23%	0.77%	66.83%	33.17%
13%	126	16.38	3	99.87%	0.13%	61.08%	38.92%
13%	126	16.38	4	99.97%	0.03%	57.83%	42.17%
13%	126	16.38	5	99.99%	0.01%	55.92%	44.08%
13%	126	16.38	6	100.00%	0.00%	54.62%	45.38%
13%	126	16.38	7	100.00%	0.00%	53.50%	46.50%
13%	126	16.38	8	100.00%	0.00%	52.41%	47.59%
13%	126	16.38	9	100.00%	0.00%	51.50%	48.50%
13%	126	16.38	10	100.00%	0.00%	50.69%	49.31%
13%	126	16.38	100	100.00%	0.00%	31.97%	68.03%
14%	126	17.64	1	93.01%	6.99%	n/a	n/a

Measurement of Diesel Particulate Matter

Monte Carlo Simulation of 100,000 Samples

CV	Mean	Standard Deviation	Number of Measurements Averaged per Sample	Percent of Sample Means within Range (+/- 25% of 'True' Mean)	Percent of Sample Means Outside Range (Greater the +/1 25% of 'True' Mean)	Percent of Sample CV's Less than or Equal to 12.5%	Percent of Sample CV's Greater than 12.5%
14%	126	17.64	2	98.72%	1.28%	63.19%	36.81%
14%	126	17.64	3	99.73%	0.27%	55.65%	44.35%
14%	126	17.64	4	99.93%	0.07%	51.27%	48.73%
14%	126	17.64	5	99.98%	0.02%	48.09%	51.91%
14%	126	17.64	6	99.99%	0.01%	45.84%	54.16%
14%	126	17.64	7	100.00%	0.00%	43.78%	56.22%
14%	126	17.64	8	100.00%	0.00%	42.15%	57.85%
14%	126	17.64	9	100.00%	0.00%	40.54%	59.46%
14%	126	17.64	10	100.00%	0.00%	39.24%	60.76%
14%	126	17.64	100	100.00%	0.00%	7.46%	92.54%
15%	126	18.90	1	91.01%	8.99%	n/a	n/a
15%	126	18.90	2	98.06%	1.94%	59.93%	40.07%
15%	126	18.90	3	99.52%	0.48%	50.83%	49.17%
15%	126	18.90	4	99.85%	0.15%	45.32%	54.68%
15%	126	18.90	5	99.96%	0.04%	41.35%	58.65%
15%	126	18.90	6	99.99%	0.01%	38.20%	61.80%
15%	126	18.90	7	100.00%	0.00%	35.70%	64.30%
15%	126	18.90	8	100.00%	0.00%	33.34%	66.66%
15%	126	18.90	9	100.00%	0.00%	31.38%	68.62%
15%	126	18.90	10	100.00%	0.00%	29.64%	70.36%
15%	126	18.90	100	100.00%	0.00%	1.06%	98.94%
16%	126	20.16	1	88.99%	11.01%	n/a	n/a
16%	126	20.16	2	97.25%	2.75%	57.00%	43.00%
16%	126	20.16	3	99.22%	0.78%	46.43%	53.57%
16%	126	20.16	4	99.74%	0.26%	40.09%	59.91%
16%	126	20.16	5	99.92%	0.08%	35.41%	64.59%
16%	126	20.16	6	99.97%	0.03%	31.94%	68.06%
16%	126	20.16	7	99.99%	0.01%	28.89%	71.11%
16%	126	20.16	8	100.00%	0.00%	26.31%	73.69%
16%	126	20.16	9	100.00%	0.00%	23.97%	76.03%
16%	126	20.16	10	100.00%	0.00%	22.00%	78.00%
16%	126	20.16	100	100.00%	0.00%	0.10%	99.90%
17%	126	21.42	1	86.84%	13.16%	n/a	n/a
17%	126	21.42	2	96.30%	3.70%	54.27%	45.73%
17%	126	21.42	3	98.80%	1.20%	42.53%	57.47%
17%	126	21.42	4	99.59%	0.41%	35.51%	64.49%
17%	126	21.42	5	99.84%	0.16%	30.33%	69.67%
17%	126	21.42	6	99.94%	0.06%	26.59%	73.41%
17%	126	21.42	7	99.97%	0.03%	23.36%	76.64%
17%	126	21.42	8	99.99%	0.01%	20.58%	79.42%
17%	126	21.42	9	100.00%	0.00%	18.28%	81.72%
17%	126	21.42	10	100.00%	0.00%	16.18%	83.82%
17%	126	21.42	100	100.00%	0.00%	0.01%	99.99%
18%	126	22.68	1	84.68%	15.32%	n/a	n/a
18%	126	22.68	2	95.19%	4.81%	51.70%	48.30%

Measurement of Diesel Particulate Matter

Monte Carlo Simulation of 100,000 Samples

CV	Mean	Standard Deviation	Number of Measurements Averaged per Sample	Percent of Sample Means within Range (+/- 25% of 'True' Mean)	Percent of Sample Means Outside Range (Greater the +/1 25% of 'True' Mean)	Percent of Sample CV's Less than or Equal to 12.5%	Percent of Sample CV's Greater than 12.5%
18%	126	22.68	3	98.30%	1.70%	39.01%	60.99%
18%	126	22.68	4	99.36%	0.64%	31.46%	68.54%
18%	126	22.68	5	99.73%	0.27%	26.03%	73.97%
18%	126	22.68	6	99.89%	0.11%	22.00%	78.00%
18%	126	22.68	7	99.95%	0.05%	18.84%	81.16%
18%	126	22.68	8	99.98%	0.02%	16.11%	83.89%
18%	126	22.68	9	99.99%	0.01%	13.90%	86.10%
18%	126	22.68	10	100.00%	0.00%	11.96%	88.04%
18%	126	22.68	100	100.00%	0.00%	0.00%	100.00%
19%	126	23.94	1	82.46%	17.54%	n/a	n/a
19%	126	23.94	2	93.98%	6.02%	49.40%	50.60%
19%	126	23.94	3	97.68%	2.32%	35.81%	64.19%
19%	126	23.94	4	99.04%	0.96%	27.88%	72.12%
19%	126	23.94	5	99.56%	0.44%	22.47%	77.53%
19%	126	23.94	6	99.79%	0.21%	18.25%	81.75%
19%	126	23.94	7	99.91%	0.09%	15.06%	84.94%
19%	126	23.94	8	99.97%	0.03%	12.59%	87.41%
19%	126	23.94	9	99.98%	0.02%	10.56%	89.44%
19%	126	23.94	10	99.99%	0.01%	8.85%	91.15%
19%	126	23.94	100	100.00%	0.00%	0.00%	100.00%
20%	126	25.20	1	80.28%	19.72%	n/a	n/a
20%	126	25.20	2	92.65%	7.35%	47.26%	52.74%
20%	126	25.20	3	97.00%	3.00%	33.08%	66.92%
20%	126	25.20	4	98.64%	1.36%	24.80%	75.20%
20%	126	25.20	5	99.34%	0.66%	19.35%	80.65%
20%	126	25.20	6	99.68%	0.32%	15.31%	84.69%
20%	126	25.20	7	99.87%	0.13%	12.16%	87.84%
20%	126	25.20	8	99.93%	0.07%	9.81%	90.19%
20%	126	25.20	9	99.97%	0.03%	7.98%	92.02%
20%	126	25.20	10	99.98%	0.02%	6.56%	93.44%
20%	126	25.20	100	100.00%	0.00%	0.00%	100.00%
25%	126	31.50	1	70.18%	29.82%	n/a	n/a
25%	126	31.50	2	85.28%	14.72%	39.01%	60.99%
25%	126	31.50	3	92.09%	7.91%	22.93%	77.07%
25%	126	31.50	4	95.59%	4.41%	14.58%	85.42%
25%	126	31.50	5	97.43%	2.57%	9.59%	90.41%
25%	126	31.50	6	98.43%	1.57%	6.53%	93.47%
25%	126	31.50	7	99.07%	0.93%	4.45%	95.55%
25%	126	31.50	8	99.46%	0.54%	3.09%	96.91%
25%	126	31.50	9	99.64%	0.36%	2.18%	97.82%
25%	126	31.50	10	99.77%	0.23%	1.52%	98.48%
25%	126	31.50	100	100.00%	0.00%	0.00%	100.00%
50%	126	63.00	1	40.53%	59.47%	n/a	n/a
50%	126	63.00	2	54.34%	45.66%	20.89%	79.11%
50%	126	63.00	3	63.74%	36.26%	6.86%	93.14%

Measurement of Diesel Particulate Matter

Monte Carlo Simulation of 100,000 Samples

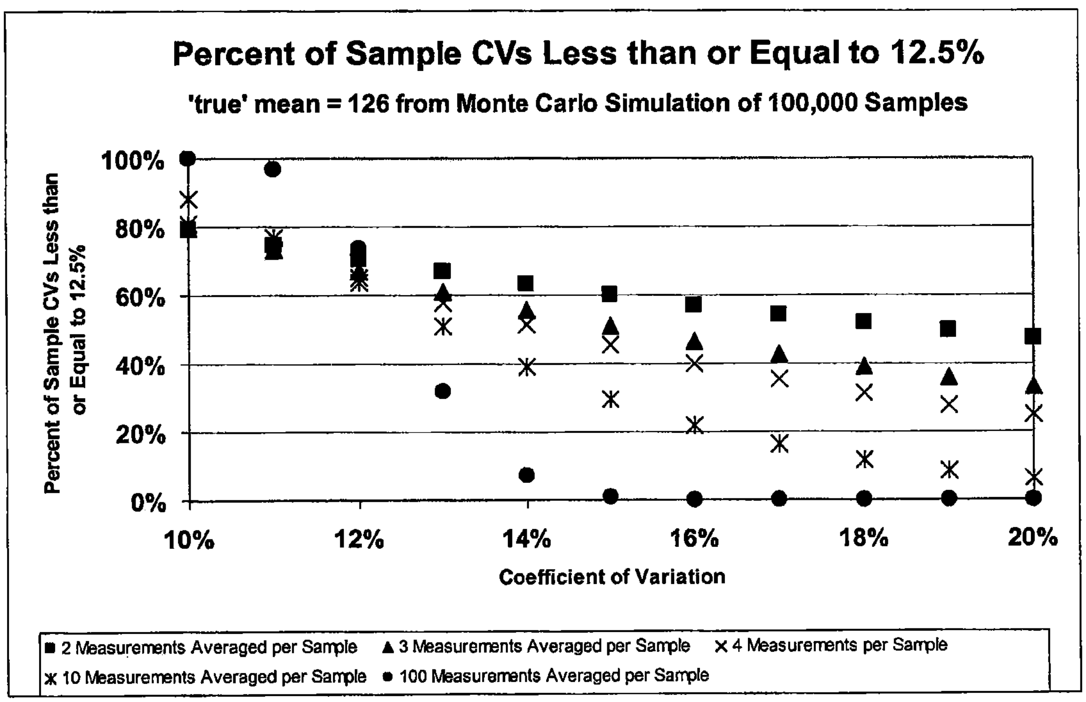
CV	Mean	Standard Deviation	Number of Measurements Averaged per Sample	Percent of Sample Means within Range (+/- 25% of 'True' Mean)	Percent of Sample Means Outside Range (Greater the +/1 25% of 'True' Mean)	Percent of Sample CV's Less than or Equal to 12.5%	Percent of Sample CV's Greater than 12.5%
50%	126	63.00	4	70.55%	29.45%	2.47%	97.53%
50%	126	63.00	5	75.68%	24.32%	0.86%	99.14%
50%	126	63.00	6	79.67%	20.33%	0.33%	99.67%
50%	126	63.00	7	82.85%	17.15%	0.12%	99.88%
50%	126	63.00	8	85.52%	14.48%	0.05%	99.95%
50%	126	63.00	9	87.53%	12.47%	0.02%	99.98%
50%	126	63.00	10	89.33%	10.67%	0.01%	99.99%
50%	126	63.00	100	100.00%	0.00%	0.00%	100.00%
75%	126	94.50	1	28.56%	71.44%	n/a	n/a
75%	126	94.50	2	39.05%	60.95%	14.80%	85.20%
75%	126	94.50	3	46.63%	53.37%	3.54%	96.46%
75%	126	94.50	4	52.42%	47.58%	0.88%	99.12%
75%	126	94.50	5	57.33%	42.67%	0.23%	99.77%
75%	126	94.50	6	61.57%	38.43%	0.08%	99.92%
75%	126	94.50	7	64.98%	35.02%	0.02%	99.98%
75%	126	94.50	8	67.95%	32.05%	0.01%	99.99%
75%	126	94.50	9	70.69%	29.31%	0.00%	100.00%
75%	126	94.50	10	73.11%	26.89%	0.00%	100.00%
75%	126	94.50	100	99.84%	0.16%	0.00%	100.00%
100%	126	126.00	1	22.39%	77.61%	n/a	n/a
100%	126	126.00	2	30.80%	69.20%	11.94%	88.06%
100%	126	126.00	3	37.00%	63.00%	2.32%	97.68%
100%	126	126.00	4	41.92%	58.08%	0.48%	99.52%
100%	126	126.00	5	46.16%	53.84%	0.11%	99.89%
100%	126	126.00	6	49.79%	50.21%	0.03%	99.97%
100%	126	126.00	7	52.81%	47.19%	0.01%	99.99%
100%	126	126.00	8	55.56%	44.44%	0.01%	99.99%
100%	126	126.00	9	58.26%	41.74%	0.00%	100.00%
100%	126	126.00	10	60.59%	39.41%	0.00%	100.00%
100%	126	126.00	100	98.50%	1.50%	0.00%	100.00%

Appendix IV

Graphical Results of Monte Carlo Simulation

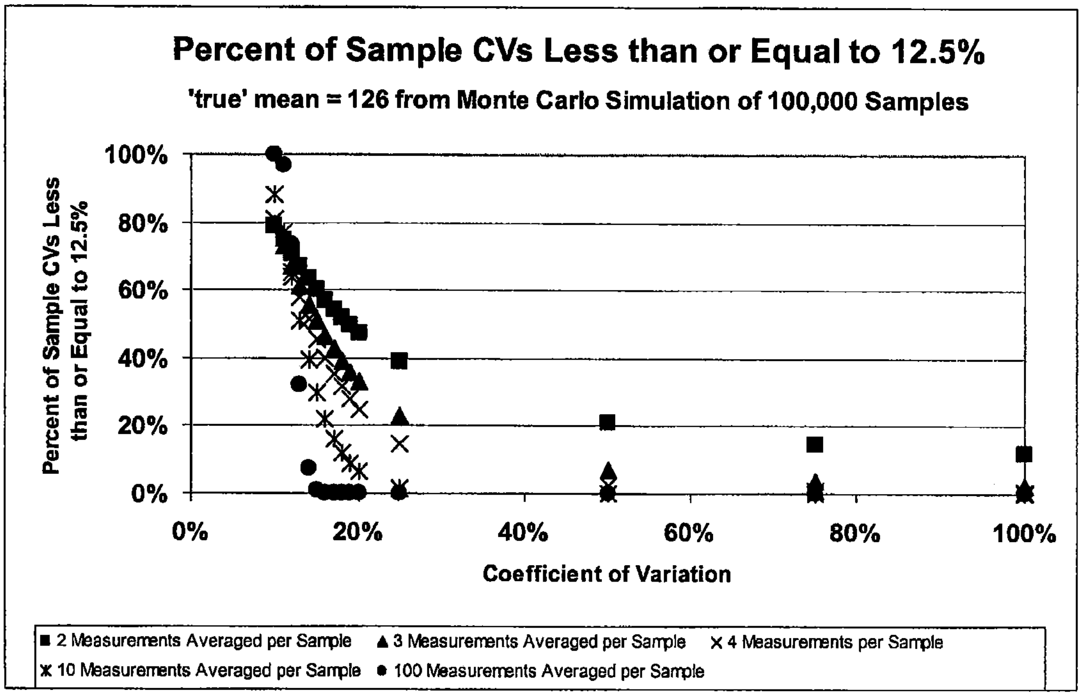
Monte Carlo Results I:

Proportion of sample baskets with varying numbers of samplers (1-100) with sample CV≤12.5% as 'true' CV increases from 10-20%



Monte Carlo Results II:

Proportion of sample baskets with varying numbers of samplers (1-100) with sample CV≤12.5% as 'true' CV increases from 0-100%



Received 2/17/06
MSHA/OSRV

JONATHAN BORAK & COMPANY, INC.

Specialists in Occupational & Environmental Health

December 8, 2005

MARG DIESEL COALITION EXHIBIT 2

Mr. Henry Chajet
Patton Boggs, L.L.P.
2550 M Street, NW
Washington, DC 20037

Dear Mr. Chajet:

I am writing in response to your request that I review and comment upon the undated draft report by JD Noll et al: *The Relationship between Elemental Carbon, Total Carbon, and Diesel Particulate Matter in Several Underground Metal/Non-metal Mines.* In addition to me, the reviewers included a biostatistician and an industrial hygienist.

I am surprised that the authors found relatively little variability in the EC:TC and EC:DPM relationships across mines and across engine technologies. As you are aware, we performed extensive industrial hygiene surveys in a number of underground mines (Cohen H et al: Exposure of miners to diesel exhaust particulates in Underground Nonmetal Mines. *Am Ind Hyg Assoc J*, 63:651-658, 2002). Table 2 of that report documents large variability in EC:TC ratios in underground samples both within and across mines. Briefly summarized, the EC:TC ratio varied from 0.36-0.75. Differences between underground and surface samples were still greater.

Similar findings from the MSHA 31-Mine Study were recently published by MSHA (*Federal Register* 70:32895-32897, June 6, 2005). For example, Figure VI-3 (p. 32895) documents a wide range of EC:TC ratios. The text indicates that "EC:TC ratio ranged from 23% to 100%". Moreover, the majority of points were in the relevant range of measured TC: 100-400 $\mu g/m^3$. MSHA concluded: "It is clear from Figures VI-3 and VI-4 that individual samples from the 31-Mine Study exhibited considerable variation in their EC:TC ratios" (p. 32897).

This difference between our published findings, the findings of the MSHA 31-Mine Study, and those contained in the draft report might be explained by the fact that our analysis and the MSHA analysis included a substantially larger dataset from samples collected in a greater variety of underground settings. It seems likely that the current draft report reflects a survey that included too few samples from only a small number of relatively similar mining environments.

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There are also several methodological issues in the draft report that raise concerns.

1. Samples were obtained in two settings. The first was an "isolated zone" designed so that "the only source of diesel particulate matter and gases ... was the vehicle being tested." The second was "mine surveys" during normal production. Samples were collected "at the exhausts of the mines away from any potential sources [of potential interferences]". But by sampling near the exhausts, which are downwind from mining operations and where air contaminants are most likely to be present and mixed, the study maximized the likelihood that the unique contributions of the tested diesel engines would be obscured by an admixture of background interferences. Like 'white noise' which conceals the details of point sources of noise, such a background mixture of dusts, tobacco smoke, engine oils and other contaminants would conceal the details of engine emissions without regards to the specific contributions of the individual engines.

By contrast, sampling engines that are operating in the areas where fresh air enters the mine and, therefore, where background contamination is minimized, would have been the appropriate way to evaluate exhaust from the tested diesel engines.

Thus, it seems that the design of this study may have biased the results in a way that concealed differences in the EC:TC ratio across engines and operating conditions in the mine survey. In other words, the design of this study likely biased the results towards the null, i.e., it favored a finding of no differences between mines and engines.

2. It is also striking that "isolation zone" tests indicated that diesel particulate filters (DPF) altered the relationship between EC and TC:

> "When DPFs were used, the results start to deviate from this line and seem to form another trend. This is confirmed by the high percent deviation between TC calculated by EC ... and TC measured when DPFs are used... This would indicate that the TC to EC relationship might be changing when DPFs are used... A linear relationship between DPM and EC was shown in the isolated zone study, except when non-catalyzed DPFs were used."

I would have expected these researchers to have pursued that point, because such deviations would be critical to evaluating the feasibility of the conversion factor that MSHA proposed as the basis for monitoring underground mines. But they did not.

The "mine survey tests" included eleven sets of data representing findings at four mines under a variety of engine conditions. Only one set contained data relevant to DPFs, the set labeled "Metal Mine 1 with some DPFs". Note that the number of samples from engines with DPF is not indicated in the report and cannot be determined from the Excel table provided with the report. I assume that these data reflected a mixture of engine conditions, some with and others without DPF; the latter would have been equivalent to the engines sampled and reported separately as "Metal Mine 1 baseline".

By pooling sampling data from engines with and without DPFs, rather than analyzing them separately, the likelihood of detecting the effects of DPFs was reduced.

In summary, evidence from the "isolation zone" tests suggests that the proposed MSHA method relating EC and TC may not be valid when DPFs are used to control diesel emissions. Although the draft report authors recognized that possibility, it seems that they have not yet tested it. Accordingly, the "mine survey" component of this the study is disappointing and incomplete.

3. Finally, I am struck by the distribution and magnitude of the residuals seen in Figure 3b: "Percent deviation of the measured TC values from the calculated TC from EC using the equation of the line on Figure 3a". The authors justify their use of linear regression for this data set by reference to a very high correlation ($R^2 = 0.99$). Notwithstanding that high correlation, Figure 3b demonstrates that variances were highly inconstant across the dataset, a finding that challenges use of linear regression for these data. It is surprising that the authors ignored that concern.

In conclusion, this is a flawed and incomplete study. I am concerned that the "mine surveys" results were biased by specifically obtaining samples near exhausts, where background air contaminants were most likely to be found. The "mine survey" also ignored the implications of the "isolation zone" tests, which suggested that DPF influenced the EC:TC relationship. I am also concerned that linear regression is not appropriate for the EC:TC data.

Yours truly,

Jonathan Borak, MD, DABT

Associate Clinical Professor of Medicine and Epidemiology
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Received 2/17/06
MSHA/OSRV

CONTINENTAL PLACER INC.

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February 8, 2006

Henry Chajet, Esq.
Patton Boggs LLP
2550 M St NW
Washington, DC 20037

Subject: RIN 1219-AB29 : Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Mines; Proposed Rule
Federal Register: September 7, 2005 (Volume 70, Number 172
Comments on Technical and Economic Feasibility Issues

Dear Mr. Chajet:

Continental Placer Inc. (CPI) was requested by the MARG Diesel Coalition (MARG) to prepare comments on the technical and economic feasibility of the above proposed rule.

I understand that you will be filing these comments with MSHA and that they will become as part of the rulemaking record.

Sincerely,
Continental Placer Inc.

H. John Head, P.E
Senior Principal Engineer

Attachments

RIN 1219-AB29

Technical and Economic Feasibility of Proposed DPM Rule

In my numerous comments to the Mine Safety and Health Administration (MSHA) on the DPM standard since the 1990s, I have carefully reviewed the agency's presentations of engineering information, diesel exhaust sampling data, equipment information and performance data, and computer models. I also have served as a member of the NIOSH Partnership, diesel exhaust testing group, as the MARG diesel coalition representative. I repeatedly stated in my comments to MSHA that the agency did not adequately support its conclusion that the exposure limits were technically feasible. I also commented to MSHA repeatedly that they had not properly calculated the compliance costs and that their determination that the exposure limits were economically feasible was incorrect. In fact, I stated that the 160 TC micro-g/m^3 exposure limit was not technically feasible for the foreseeable future, and that as a result, its economic feasibility could not be determined.

MSHA has just as consistently denied any validity to my concerns and opinions in its response to comments, until it recently admitted that there is insufficient evidence of the feasibility of its 160 TC micro-g/m^3 exposure limit in the June and September 2005 Federal Register notices. This admission, and shocking reversal of the MSHA 2001 conclusion, validates my previous observations and opinions.

In my comments[1] on the validity of the Proposed Regulatory Economic Analysis (PREA) to the proposed rule, I commented that the likely cost of compliance was understated, even using MSHA's compliance model of:

- reducing DPM emissions, by using
  - low emission engines,

[1] Head, H. John, 1999, "Review of Economic and Technical Feasibility of Compliance Issues Related to: Department of Labor - MSHA 30 CFR Part 57 - Proposed Rule for Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners" Harding Lawson Associates, 1420 Kensington Road, Suite 213, Oak Brook, Illinois 60523, July 21, 1999, pages iv-v

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Technical and Economic Feasibility of Proposed DPM Rule

  - particulate filters or traps, and/or
  - oxidation catalytic converters,
- reducing operator exposure to DPM, by installing
  - cabs, and
- diluting DPM, by increasing
  - ventilation airflow in sections where diesel powered equipment is working.

I stated that the costs were likely to be in the order of $60 million in annualized costs, or a total of $424 million. This is contrasted with the MSHA Preliminary Regulatory Economic Analysis (PREA) of some $19.2 million in annualized costs [or a total of $135 million, at 7 percent and using a factor of 7.024].

Almost all of the rationales for my cost estimates were dismissed out of hand in the MSHA Final Regulatory Economic Analysis (FREA). The FREA, however, did increase the compliance costs slightly to $25.1 million in annualized costs [or a total of $176 million].

This same rigid posture was taken by the agency in its 31-Mine Study, where compliance feasibility and costs were estimated based on hypothetical computer models that made incorrect assumptions in a manner approximately similar to those in the FREA. Suggestions by me and others in the industry that technical feasibility determinations and compliance cost estimates needed to recognize complex, real world conditions that rendered the 160 PEL infeasible, and created compliance costs significantly higher than the FREA, and the agency's 31-Mine Study report were similarly dismissed by MSHA.

The same rigid posture was taken by the agency in its response to comments on its proposed rule in 2004, where repeated suggestions by me and others in the industry that

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Technical and Economic Feasibility of Proposed DPM Rule

the question of technical feasibility of compliance with the 160 PEL was far more complex than represented by the incorrect MSHA analysis, and that compliance costs were significantly higher than the FREA were similarly dismissed.

MSHA, in the final rule in June 2005, and in its proposed rule in September 2005, finally acknowledged that technical feasibility of compliance is not as straightforward as it originally assumed and that there is insufficient evidence of the industry wide feasibility of the 160 PEL. The "put a filter on it" solution, suggested in prior MSHA analysis as the primary mode of compliance, is now acknowledged to be a very goal that is often not achievable. Therefore, by implication, the compliance model used to estimate compliance feasibility, and costs in the PREA and FREA is suspect. Yet , instead of revisiting the compliance model and developing appropriate compliance costs to examine economic feasibility properly, – in a step that is almost beyond reason – MSHA predicted compliance cost reductions, because of the proposed delay in the phasing in of the final standard. This is like saying that "Well, I'm on the wrong train, but at least I won't get to the wrong destination until later, so I'll stay on the train. And, because I'll not be completely lost until later, I'm actually better off than if I had got onto the right train."

It is imperative that MSHA acknowledge that the compliance model for the rule was seriously flawed from the first and correct its faulty analysis of technical and economic feasibility.

Excerpt from the Executive Summary of H. John Head comments to Proposed Rule Dated __________,

"The costs of compliance with the proposed rule on DPM exposure limits for underground M&NM miners will be significantly higher than MSHA has estimated in its PREA. The cost analysis presented in this report was developed using the same basis as in the PREA, namely the compliance strategy was assumed to be the same and the financial model was identical.

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Technical and Economic Feasibility of Proposed DPM Rule

However, as discussed in this report, the compliance strategy is inappropriate for the underground M&NM mining industry as a whole and additional costs will almost certainly be incurred by individual mine operators and by the industry. Thus the revised cost estimates in Table 3.7 must be considered to be the minimum that will need be spent to achieve compliance. **The true number will be substantially larger, as the assumptions made by MSHA are incorrect and additional compliance items and costs must be factored into the analysis.** [Emphasis added]

The initial compliance cost of the total annualized costs (based on MSHA's assumptions as presented in the PREA) is obtained by taking the present value of a 10 year stream of annual costs and discounting them by a rate of return of 7 percent (a factor of 7.024).

TOTAL ANNUAL COMPLIANCE COSTS
for Underground Metal and Nonmetal Mine Operators (Dollars X 1,000)

	Large Mines (>= 20)		Small Mines (< 20)		Total Mines	
	PREA	REVISED*	PREA	REVISED*	PREA	REVISED*
Exposure limits and engines *	$14,010	$49,565	$4,425	$10,045	$18,435	$59,610
Other standards	$610	$610	$139	$139	$749	$749
Total	$14,620	$50,175	$4,564	$10,184	$19,184	$60,359

* Revised compliance costs for only the exposure limits and diesel engine standards were estimated as part of this report. The costs of compliance with the other standards were not changed.

TOTAL PRESENT VALUE COMPLIANCE COSTS
for Underground Metal and Nonmetal Mine Operators (Dollars X 1,000)

	Large Mines (>= 20)		Small Mines (< 20)		Total Mines	
	PREA	REVISED	PREA	REVISED	PREA	REVISED
Exposure limits and engines	$98,406	$348,145	$31,081	$70,556	$129,487	$418,701
Other standards	$4,285	$4,285	$976	$976	$5,261	$5,261
Total	$102,691	$352,430	$32,057	$71,532	$134,748	$423,962

The technical feasibility of compliance with the proposed interim and final DPM exposure limits cannot be definitively determined by us and was not determined or even examined by MSHA. The first reason for the uncertainty is the inability to measure the present exposure levels. The second reason is the lack of a reasonable and accurate assessment by MSHA of the number, types and uses of the diesel equipment used in the mines."

Excerpt from MARG comments on "31-Mine Study" May 2002

"MSHA [has calculated in its cost analysis of the 31-Mine Study that the] [t]otal annual operating and annualized capital costs to achieve:

- interim concentration limit $2.09 million or $67,500 per mine
- final concentration limit $1.44 million or $46,600 per mine
- both concentration limits $3.53 million or $114,100 per mine

If these MSHA costs could be extrapolated to the 196 underground mines operating in the U.S., this would equate to:

Total extrapolated annual operating and annualized capital costs to achieve (compared to the Final Rule FREA):

- interim concentration limit$13.23 million ($17.58 million)
- final concentration limit $9.13 million ($6.61 million)
- both concentration limits $22.36 million ($24.19 million)

These costs were derived using similar compliance strategies for the 31 mines as in the original PREA and FREA, namely filters, engines, ventilation revisions, in that order."

In the 31 Mine Study, "Mine S, Stillwater Nye Mine, was allocated the almost inconceivably low estimate for compliance of about $933,000 in first year costs for the interim and final PEL and ongoing annual costs of about $108,000. This total cost equates approximately to $2.44 million (using a 7.024 multiplier)."

In contrast, the mine recently testified in detail about the millions of dollars spent in improved diesel engine maintenance, new mobile equipment, replacement and upgraded engines, diesel particulate control technology, and improved ventilation systems, yet still cannot meet the interim PEL, let alone the final PEL. Comments by MSHA that some of the expense was a necessary part of the upgrading of the mine facilities are suspect.

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Technical and Economic Feasibility of Proposed DPM Rule

Excerpt from Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Mines; Proposed Rule (Federal Register, September 7, 2005) (page 53283)

"2. Reasons Why the 2001 Assumptions Are Now Being Questioned.

During the 4-1/2 years since the 2001 final rule was promulgated, the mining industry and MSHA have gained considerable experience with the implementation, use, and cost of DPM control technology. Miners' DPM exposures have also have declined significantly from a mean of 808 DPM micro-g/m^3 (646 TC micro-g/m^3 equivalent) prior to the implementation of the standard, to a mean of 233TC micro-g/m^3 based on current enforcement sampling. The industry, however, is encountering economic and technological feasibility issues with DPM controls as they strive to reduce levels below the interim limit. When we established the 2001 final limit, we were expecting some mine operators to encounter difficulties implementing control technology because the rule was technology forcing. We projected that by this time, practical and effective filter technology would be available that could be retrofitted onto most underground diesel powered equipment. However, as a result of our compliance assistance efforts and through our enforcement of the interim limit, we have become aware that this assumption may not be valid. The applications, engineering and related technological implementation issues that we believed would have been easily solved by now are more complex and extensive than previously thought.

Although DPF systems have been proven to be highly effective in reducing elemental carbon, mines are currently experiencing problems with selection and implementation of DPF systems for complying with the interim limit. Since the final limit will require mines to install more DPF systems, these selection and implementation problems will extend over a large portion of the mining industry. At this time we believe that solutions to the problems of selection and implementation have not proceeded as quickly as anticipated since promulgation of the 2001 final rule and many mines will not be able to achieve the final limit by January 20, 2006. Some of the implementation and operational difficulties encountered with the controls are discussed in the sections below."

Excerpt from Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Mines; Proposed Rule (Federal Register, September 7, 2005) (page 53290)

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"X. Regulatory Impact Analysis

B. Costs

In Chapter IV of the Regulatory Economic Analysis in support of the January 19, 2001 final rule (2001 REA), we estimated total yearly costs to underground M/NM mines for the DPM final rule of $25,149,179 (p. 106). Of this amount, $6,612,464 was the discounted incremental yearly cost of compliance with the final limit. The undiscounted incremental yearly cost for compliance with the final limit was estimated as $9,274,325 (p. 58).

This proposed rule would amend the January 19, 2001 final DPM rule by phasing in the 160TC micro-g/m^3 final limit over a five-year period to address technological feasibility constraints that have arisen. The discounted present value of **the cost saving from this five-year phase-in** period would be $25,512,045, if compliance with the 160TC micro-g/m^3 final limit were technologically feasible in 2006. The annualized value of this cost saving, using a discount rate of 7%, would be $1,785,843. Table X–1 shows these calculations and also shows the breakdown of these cost savings by mine size.

During the 41⁄2 years since the 2001 final rule was promulgated, the mining industry and MSHA have gained considerable experience with the implementation, use, and cost of DPM control technology, which could result in cost changes. Therefore, we solicit public comment concerning the cost of compliance, including any changes in costs that may have occurred since the 2001 REA."

Finally the agency is starting to acknowledge that filters are not the universal, simple solution it once thought. However, there is no more justification for assuming that the answer will be found in the proposed extended period for compliance than there was when the rule was first promulgated. It was a flawed leap of logic then, it remains so now, based on my personal observations, review of the testing conducted as the MARG representative to the NIOSH Partnership, and review of the available evidence regarding all types of potential controls for diesel exhaust.

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The response to the MSHA request for economic costs information lies in the testimony of Stillwater, Barrick and other operators that have testified to detailed costs for their compliance efforts to date, that far exceed the MSHA estimates, even though they could not achieve compliance due to technical infeasibility. MSHA should extrapolate those detailed costs as accurately as possible to a detailed mine by mine inventory of current diesel equipment, its horsepower, performance and use, and an evaluation of each mine site's conditions, based on inspector collected ventilation information and available sampling results. Only by collecting and analyzing the industry wide data available to MSHA, for the less than 200 mines covered by this rule, can MSHA make a realistic determination of economic feasibility by using this data to evaluate the rule's cost impact on each industry segment's economic condition using the factors I discussed in my previous comments .

Diesel Particulate Filter Studies

In the draft of a paper to be presented to the 11th U.S./North American Mine Ventilation Symposium later this year, Dr. Aleksandar Bugarski and his colleagues at NIOSH's Pittsburgh Research Laboratory present a coherent summary of the state of the art of the use of diesel particulate filters in underground mines[2].

This experience has been gained in many years of attempting to make diesel particulate filters work in underground mines. The NIOSH group working on this problem has developed tools for assisting mines select, install and operate filters. The results of the work has been published in numerous articles and papers, the most notable of which are the reports on the studies done at Stillwater's Nye Mine in Montana. Most recently the Phase III report[3] concluded that

> This study did not address the important critical path of economic and technical aspects relating to implementation of the studied technologies into underground mines. The successful implementation of control technologies is predicated on addressing issues which are relatively unique to each mine and even to individual applications within a given mine. Most of these technical and operational issues could be investigated through a series of long-term field studies where control technologies would be wisely selected and optimized for the applications, performance of the technologies would be continuously monitored and the effects of the controls on concentrations of diesel pollutants in the mine air would be periodically assessed. The findings of such studies would allow operators to make informed decisions regarding the selection, optimization and implementation of control technologies for its applications and maximize the benefits of using those technologies. It is recommended that these studies be designed and undertaken under the leadership of the Metal/Nonmetal Diesel Partnership.

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2 Aleksandar D. Bugarski, George H. Schnakenberg Jr., and Larry D. Patts, 2006, "Implementation of Diesel Particulate Filter Technology in Underground Metal and Nonmetal Mines – Unpublished Draft" Paper to be presented at Proceedings of 11th U.S./North American Mine Ventilation Symposium, State College, Pennsylvania, June 5-7, 2006

3 Aleksandar Bugarski, George Schnakenberg, Steven Mischler, James Noll, Larry Patts, and Jon Hummer (all of NIOSH), and Richard Anderson (of Stillwater Mine)"The Effectiveness of Reformulated Fuels and Aftertreatment Technologies in Controlling Diesel Emissions A Study in an Isolated Zone at Stillwater Mining Company's Nye Mine, August 31 – September 11, 2004" Report to the NIOSH Metal/Nonmetal Partnership dated May 2005; also cited in the Federal Register / Vol. 70, No. 172 / Wednesday, September 7, 2005, page 53284

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In the unpublished paper Dr. Bugarski also mentions two new technologies. The Arvin Meritor system injects fuel into the exhaust stream, the burning fuel then elevates the filter core temperature, leading to filter regeneration. The Johnson Mathey system uses platinum catalyst upstream of the filter to promote conversion of NO to NO2. The exhaust gases, enriched with NO2, pass to the filter element where they oxidize the collected particulate matter, thereby regenerating the filter. It was hoped that both these systems would allow for passive (i.e. transparent to the operator) regeneration at low duty cycles and low operating temperatures. However both systems are complex and still in the experimental stage and many other promising technologies that preceded them have suffered unfortunate failures. Until field tests prove the technology effective, safe, and mine worthy, they can not be considered feasible controls.

Mines repeatedly have attempted to use filter technologies, especially at large mines such as Stillwater, Kennecott, Newmont, and Barrick.[4] The technology, while promising in many regards, is far from the universal fix anticipated by MSHA in the early stages of the rulemaking, and is certainly not as widely applicable, mine worthy and safe as anticipated in MSHA's feasibility analysis and various cost analyses. In fact reports of unexpected filter "burn through" and NO_2 hazards have made many mine operators leery of wide-spread experimentation until NIOSH conducts supervised and successful tests.

In another project carried out jointly by the NIOSH Partnership at the Stillwater Mine, the application of filters to the entire fleet of 286 diesel-powered units was evaluated[5] (Appendix A). This was a "paper study" to place the units in one of three categories for the use of filters: "Likely", "Not Likely" or "Potential". The "Likely" category is for

[4] Numerous comments to the RIN 1219–AB29 rulemaking record, January and February 2006.
[5] Floyd Varley, H. Buck Chamberlain, H. John Head, 2005, "Draft - Estimation of the Applicability of Available Diesel Exhaust After-treatment Controls to the Equipment Fleet at the Stillwater Mine – November 2005" Draft report to the NIOSH Metal/Nonmetal Partnership

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those vehicles where filters had already been proven or sufficient data existed to make a reasonable assumption that filters would work. The "Not Likely" category was for those vehicles where filters had been tried and failed, whose engines or duty cycles were unlikely to allow for the practical use of filters. The "Potential" category was reserved for vehicles where there was insufficient information to make a positive decision either way and which for purposes of these comments I prefer to call the "unknown" category. .

Two of the authors, H. Buck Chamberlain, the Industrial Hygienist for the mine, H. John Head, acting as a representative of MARG, disagreed with Floyd Varely, the primary author, regarding the original draft. The draft was to have been discussed and finalized at the now-postponed January 19-20, 2006, meeting of the NIOSH Partnership. However, for the sake of fairness, the tables below, which present the crux of the argument, will include the original table as drafted by Mr. Varley. The rationale for the revisions is given and the implication of them presented in the discussion.

Comments on and Revisons to the Draft Paper Study

Messrs Chamberlain and Head are in general agreement with the much of the work that Mr. Varley presented in his draft paper. However, we have several specific concerns about the selection and category placement for several types of equipment. This questioned equipment has been placed in the "Potential" or "Unknown" category by Mr. Varley, when the actual usage of that equipment and the experience with filters on the units argue that they more properly fit in the "Not Likely" category.

Specifically, the 36 Toyota pick ups (pages 4 and 5 of the report) and 23 of the face drills and two of the bolters (page 9 of the report) marked as "Potential" or "Unknown" should be in the "Not Likely" category.

Rationale:

The Toyotas simply do not have the duty to allow them to generate the load profile to allow them to use even the active filters as Mr. Varley suggests. They have intermittent duty cycles, with periods of soot accumulation, without the ability to store the soot prior to being actively regenerated at the end of the shift. The temperature profile at the filter itself will be further compromised by the long exhaust pipe to the filter installation in the bed of the pick up at the rear of the vehicle. Experience has shown that filters can become overloaded on these vehicles. Plus the mobility and unpredictable use of these units makes them poor candidates for routine marshalling at regeneration stations.

The 7 MTI drills and bolter with a 114 hp Deutz BF4M1013C engine and the Tamrock bolter with a 74 hp Deutz BF4M1011F engine and the 17 MTI and Atlas Copco drills using the 45 to 52 horsepower F3 and F4 -912 series engines similarly have intermittent duty cycles. The likelihood of them being successfully fitted with filters, either active or passive, as Mr. Varley suggests, is remote. The argument against the application of active filters is also that these units are not very mobile and cannot be mustered at "regeneration stations" to burn off the soot in the filter elements.

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Tables:

Table 1 Original Draft Report

	Units	% Units	K hp-hr	% K hp-hr	kg/yr	% kg/yr
Not Likely	65	23%	3,158	7%	1,203	21%
Potential	139	49%	9,760	21%	2,288	40%
Likely	82	29%	32,782	72%	2,783 *	40%
Total	286		45,700		6,174	

Table 1 Revised (a): Moving Toyotas and Drills to "Not Likely" from "Potential"/ Unknown

	Units	% Units	K hp-hr	% K hp-hr	kg/yr	% kg/yr
Not Likely	126	44%	8,199	18%	2,263	37%
Unknown	78	27%	4,720	10%	1,128	18%
Likely	82	29%	32,782	72%	2,783	45%
Total	286		45,701		6,174	

Table 1 Revised (b): Moving Toyotas to "Not Likely" from "Potential"/ Unknown

	Units	% Units	K hp-hr	% K hp-hr	kg/yr	% kg/yr
Not Likely	101	35%	7,886	17%	2,243	36%
Unknown	103	36%	5,032	11%	1,248	20%
Likely	82	29%	32,782	72%	2,783	44%
Total	286		45,700		6,274	

* Typo in original corrected in this table.

Discussion:

Note that if all 61 units are placed in the "Not Likely" category (Table 1 Revised (a)), the percentage of vehicles in that category rises to 44% of Stillwater's fleet of 286 vehicles. If only the 36 Toyotas are placed in the "Not Likely" category (Table 1 Revised (b)), the percentage of vehicles in that category falls from 44 to 31% of the fleet.

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> The potential particulate load column (kilograms of particulate per year, or kg/yr), which is based on the hours of use in the past year and the estimated engine out particulate loading rate, may have the most relevance when determining the ability to control levels in the mine atmosphere. In the revised cases with the Toyotas and the drills in the "Not Likely" category the particulate load column rises from 21 to 37% (Toyotas only) or 36% (Toyotas and drills).
>
> The horsepower-hour criteria demonstrate that most (72%) of the larger, high use units (Haul Trucks, larger LHD's and 20 ton Locomotives) are amenable to control. However, as demonstrated by the particulate load criteria, these larger engines are generally newer, cleaner engines as compared to the small engines that may produce more particulate per hour of use.

Thus it can be seen that approximately 36% of the particulate loading in the Stillwater Mine simply not amenable to the use of filters. Much of this equipment runs in small stopes with limited airflow. It will be difficult to increase airflows significantly in these small and widely distributed working places. If diesel-powered equipment cannot be used miner productively will cease or decrease and costs will increase and safety decrease, as labor intensive methods are reintroduced. These labor intensive methods include using jack legs to drill in the stopes – a noisy alternative – and pneumatic slushers to muck them out – a dangerous alternative. Thus, even if the mine can remain economic, miner health and safety – from known sources – will be compromised.

While the fleet of diesel-powered Stillwater Mine may not be representative of the underground metal/nonmetal mines because of its large size , it is probably representative of many metal mines, with small openings and widely-dispersed working places, and the variety of the Stillwater poses a likelihood that most types of equipment in use in the US are represented at Stillwater. This sector of the industry is struggling, even at times of relatively high metal prices, in the face of competition from overseas. If the mines are compelled to either revert to labor intensive pneumatic systems or invest huge sums on further experiments attempts to come into compliance with the reduced PELs, they will be at a further disadvantage in the global market place.

CONCLUSION

Even if the mines that undertook massive control efforts and experimental testing, and the industry as a whole, could spend unlimited resources in attempting to comply with the 160 PEL, over the next six to ten years, my review of the developing technology and the testing to date, and that on the foreseeable horizon, leads me to the opinion that they still could not feasibly comply with the 160 PEL.

LUBRIZOL

Received 2/17/06
MSHA/OSRV

Fluid technologies for a better world™

January 31, 2006

Carmeuse North America
11 Stanwix Street, 11th Floor
Pittsburgh, PA 15222
Attention: Bob Mondron

Dear Bob,

Early last year, we set in motion a plan to continue supporting our PuriNOx™ product while streamlining our business to move away from equipment and asset ownership, specifically PuriNOx blender units. Early this year, we made a further business decision about our PuriNOx direction.

We will be closing down our U.S. PuriNOx business by year end 2006. Although this business has grown, financial returns have not reached expectations.

Until that time, Lubrizol is committed to serve your business. PuriNOx fuel will be available to you through December 2006 from our Painesville facility blender.

I will be working with you to ensure a smooth transition from PuriNOx to diesel fuel. Final orders for PuriNOx fuel should be placed by November 15.

Thank you for your leadership in reducing diesel emissions.

Sincerely,

Steve Blashka
The Lubrizol Corporation

cc: TRWE, file

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