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30 CFR Part 57
Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners; Final Rule

DEPARTMENT OF LABOR

Mine Safety and Health Administration

30 CFR Part 57

RIN 1219–AB29

Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners

AGENCY: Mine Safety and Health Administration (MSHA), Labor.

ACTION: Final rule.

SUMMARY: This final rule revises the May 20, 2006 effective date of the diesel particulate matter (DPM) final concentration limit of 160 micrograms of total carbon (TC) per cubic meter of air (160_{TC} µg/m^3) promulgated in the 2001 final rule ''Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners,'' and published in the **Federal Register** on January 19, 2001 (66 FR 5706) and amended on September 19, 2005 (70 FR 55019).

This final rule increases flexibility of compliance for mine operators by allowing staggered effective dates for implementation of the final DPM limit, phased-in over a two-year period, primarily based on feasibility issues which have surfaced since promulgation of the 2001 final rule.

Furthermore this final rule establishes requirements for medical evaluation of miners required to wear respiratory protection and transfer of miners who are medically unable to wear a respirator; deletes the existing provision that restricts newer mines from applying for an extension of time in which to meet the final concentration limit; addresses technological and economic feasibility issues, and the costs and benefits of this rule.

EFFECTIVE DATE: This final rule is effective on May 18, 2006 except for amendments to § 57.5060(d), which is effective August 16, 2006.

FOR FURTHER INFORMATION CONTACT: Patricia W. Silvey, Acting Director, Office of Standards, Regulations, and Variances, MSHA, 1100 Wilson Blvd., Room 2350, Arlington, Virginia 22209–3939; 202–693–9440 (telephone); or 202–693–9441 (facsimile).

You may obtain copies of this final rule and the Regulatory Economic Analysis (REA) in alternative formats by calling 202–693–9440. The alternative formats are either a large print version of these documents or electronic files that can be sent to you either on a computer disk or as an attachment to an e-mail. The documents also are available on the Internet at *http://www.msha.gov/REGSINFO.HTM.*

SUPPLEMENTARY INFORMATION:

Outline of Preamble

This outline will assist the mining community in finding information in this preamble.

I. List of Common Terms

Listed below are the common terms used in the preamble.

31 Mine Study	Joint MSHA/Industry Study: Determinations of DPM levels in Underground Metal and Nonmetal Mines.
Commission	Federal Mine Safety and Health Review Commission.
CV	Coefficient of Variation.
DPF	diesel particulate filter.
DPM	diesel particulate matter.
EC	elemental carbon.
ETS	environmental tobacco smoke.
Filter Selection Guide	Diesel Particulate Filter Selection Guide for Diesel-powered Equipment in Metal and Nonmetal Mines.
First Partial Settlement Agreement	66 FR 35518 (2001) & 66 FR 35521 (2001): basis for July 5, 2001 NPRM.
MARG	Methane Awareness Resource Group.
M/NM	metal/non-metal.
MSHA	Mine Safety and Health Administration.
NIOSH	National Institute for Occupational Safety and Health.
NTP	National Toxicology Program.
OC	organic carbon.
PAPR	powered air-purifying respirator.
PEL	permissible exposure limit.
PPM	parts per million.
QRA	quantitative risk assessment.
REA	Regulatory Economic Analysis.

Second Partial Settlement Agreement	67 FR 47296 (2002): basis for August 14, 2003 NPRM.
SD	standard deviation.
SKC	SKC, Inc.
TC	total carbon (the sum of elemental and organic carbon).
USWA	United Steelworkers of America.
USW	United Steelworkers.
μg/cm²	micrograms per square centimeter.
μg/m³	micrograms per cubic meter.
2001 final rule	January 19, 2001 DPM final rule.
Amended 2001 final rule	2001 final rule amended on February 27, 2002.
2002 final rule	February 27, 2002 final rule.
2002 ANPRM	Advance Notice of Proposed Rulemaking published on September 25, 2002.
2003 NPRM	Notice of Proposed Rulemaking published on August 14, 2003.
2005 final rule	June 6, 2005 final rule.
2005 proposed rule	Notice of Proposed Rulemaking published on September 7, 2005.

II. Background

On January 19, 2001, MSHA published a final rule addressing the health hazards to underground metal and nonmetal miners from exposure to diesel particulate matter (DPM) (66 FR 5706). The rule established new health standards for these miners by requiring, among other things, mine operators to use engineering and work practice controls to reduce DPM to prescribed limits. It set an interim and final DPM concentration limit in the underground metal and nonmetal mining environment with staggered effective dates for implementation of the concentration limits. The interim concentration limit of 400_{TC} μg/m³ was to become effective on July 20, 2002. The final concentration limit of 160_{TC} μg/m³ was scheduled to become effective January 20, 2006. In the 2001 final rule, MSHA projected that the mining industry would meet the final concentration limit in their mines through the use of diesel particulate filtration devices, ventilation changes, and the turnover of equipment and engines to less polluting models (66 FR 5713, 5888).

Several mining trade associations and individual mine operators challenged the final rule and the United Steelworkers of America (USWA) intervened in the case, which is now pending in the United States Court of Appeals for the District of Columbia Circuit. The parties agreed to resolve their differences through settlement negotiations with MSHA and we delayed the effective date of certain provisions of the standard.

A. First Partial Settlement Agreement

On July 5, 2001, as a result of an agreement reached in settlement negotiations, MSHA published two notices in the **Federal Register**. One notice (66 FR 35518) delayed the effective date of § 57.5066(b) related to tagging requirements in the maintenance standard. The second notice (66 FR 35521) proposed a rule to make limited revisions to § 57.5066(b) and added a new paragraph to § 57.5067(b) ''Engines'' regarding the definition of the term ''introduced.'' MSHA published the final rule on February 27, 2002 (67 FR 9180).

B. Second Partial Settlement Agreement

Settlement negotiations continued on the remaining unresolved issues in the litigation, and on July 15, 2002, the parties finalized a written agreement (67 FR 47296, 47297). Under the agreement, the interim concentration limit of 400_{TC} μg/m³ became effective on July 20, 2002, without further legal challenge. MSHA afforded mine operators one year to develop and implement good-faith compliance strategies to meet the interim concentration limit, and MSHA agreed to provide compliance assistance during this one-year period. MSHA also agreed to propose rulemaking on several other disputed provisions of the 2001 final rule. The legal challenge to the rule was stayed pending completion of the additional rulemakings.

On July 20, 2003, MSHA began full enforcement of the interim concentration limit of 400_{TC} μg/m³. MSHA's enforcement policy was also based on the terms of the second partial settlement agreement and includes the use of elemental carbon (EC) as an analyte to ensure that a citation based on the 400 TC concentration limit is valid and not the result of interferences (67 FR 47298). The policy was discussed with the DPM litigants and stakeholders on July 17, 2003.

III. Rulemaking History

A. Advance Notice of Proposed Rulemaking (ANPRM) on the Interim and Final Concentration Limits

On September 25, 2002, MSHA published an Advance Notice of Proposed Rulemaking (ANPRM) (67 FR 60199). MSHA noted in the ANPRM that the scope of the rulemaking was limited to the terms of the Second Partial Settlement Agreement and posed a series of questions to the mining community related to the 2001 final rule. MSHA also stated its intent to propose a rule to revise the surrogate for the interim and final concentration limits and to propose a DPM control scheme similar to that included in our longstanding hierarchy of controls scheme used in MSHA's air quality standards (30 CFR 56.5001 through 56.5005 and 57.5001 through 57.5005) for M/NM mines. In addition, MSHA stated that it would consider technological and economic feasibility for the underground M/NM mining industry to comply with revised interim and final DPM limits. MSHA determined at that time that some mine operators had begun to implement control technology on their underground diesel-powered equipment. Therefore, MSHA requested relevant information on current experiences with availability of control technology, installation of control technology, effectiveness of control technology to reduce DPM levels, and cost implications of compliance with the 2001 final rule.

B. Notice of Proposed Rulemaking (NPRM) on the Interim Limit

In response to our publication of the ANPRM, some commenters recommended that MSHA propose separate rulemakings for revising the interim and final concentration limits to give MSHA an opportunity to gather further information to establish a final DPM limit, particularly regarding feasibility. In the subsequent notice of proposed rulemaking (NPRM) published on August 14, 2003 (68 FR 48668), MSHA concurred with these commenters and notified the public in the NPRM that we would propose a separate rulemaking to amend the existing final concentration limit of 160_{TC} μg/m³. MSHA also requested comments on an appropriate final DPM limit and solicited additional information on feasibility. The proposed rule also addressed the interim concentration limit by proposing a comparable PEL of 308 μg/m³ based on the EC surrogate and included a number of other provisions.

C. Final Rule Revising the Interim Concentration Limit

MSHA published the final rule revising the interim concentration limit on June 6, 2005 (70 FR 32868). This rule changed the interim concentration limit of 400 μg/m³ measured by TC to a comparable PEL of 308 μg/m³ measured by EC. The rule requires MSHA's longstanding hierarchy of controls that is used for other MSHA exposure-based health standards at M/NM mines, but retains the prohibition on rotation of miners for compliance. Furthermore, the rule, among other things, requires MSHA to consider economic as well as technological feasibility in determining if operators qualify for an extension of time in which to meet the final DPM limit, and deletes the requirement for a control plan.

Currently, the following provisions of the DPM standard are effective: § 57.5060(a), establishing the interim PEL of 308 micrograms of EC per cubic meter of air which is comparable in effect to 400 micrograms of TC per cubic meter of air; § 57.5060(d), Addressing control requirements; § 57.5060(e), Prohibiting rotation of miners for compliance with the DPM standard; § 57.5061, Compliance determinations; § 57.5065, Fueling practices; § 57.5066, Maintenance standards; § 57.5067, Engines; § 57.5070, Miner training; § 57.5071, Exposure monitoring; and, § 57.5075, Diesel particulate records.

D. September 2005 Notice of Proposed Rulemaking

On September 7, 2005, (70 FR 53280) MSHA proposed a rule to phase in the final DPM limit because MSHA was concerned that there may be feasibility issues for some mines to meet that limit by January 20, 2006.

Accordingly, the proposed rule considered staggering the effective date for implementation of the final DPM limit, phased in over a five-year period, primarily based on feasibility issues which had surfaced since promulgation of the 2001 final rule. MSHA also proposed to delete existing § 57.5060(c)(3)(i) that restricts new mines from applying for an extension of time for meeting the final concentration limit. MSHA sought comment and data on an appropriate conversion factor for the final DPM limit, technological implementation issues, and the costs and benefits of the final rule. In addition, MSHA requested comments on the appropriateness of including in a final rule a provision for medical evaluation of miners required to wear respiratory protection and transfer of miners who have been determined by a medical professional to be unable to wear a respirator.

MSHA set hearing dates and a deadline for receiving comments on the September 7, 2005 proposed rule with the expectation that MSHA would complete the rulemaking to phase in the final DPM limit before January 20, 2006.

After publication of the September 7, 2005 proposed rule, MSHA received a request from the United Steel, Paper and Forestry, Rubber, Manufacturing, Energy, Allied Industrial and Service Workers International Union (USW) for more time to comment on the proposed rule. The USW explained that Hurricane Katrina had placed demands on their resources that would prevent them from participating effectively in the rulemaking under the current schedule for hearings and comments. MSHA recognized the USW's need to devote resources to respond to the aftermath of Hurricane Katrina and the impact that would have on their participation under the current timetable. MSHA also received a request from the National Stone, Sand and Gravel Association (NSSGA) for additional time to comment on the proposed rule and for an additional public hearing in Arlington, Virginia.

Accordingly, due to requests from the USW and NSSGA, MSHA published a notice on September 19, 2005 (70 FR 55018) that changed the public hearing dates from September 2005 to January 2006. MSHA also extended the public comment period from October 14, 2005 to January 27, 2006. Also on September 19, 2005, MSHA issued a second notice delaying the applicability of the final concentration limit of 160TC μg/m³ until May 20, 2006.

Public hearings were held on the proposed rule in Arlington, Virginia on January 5, 2006; Salt Lake City, Utah on January 9, 2006; Kansas City, Missouri on January 11, 2006; and Louisville, Kentucky on January 13, 2006. The comment period was scheduled to close on January 27, 2006. However, the National Mining Association and the Methane Awareness Resource Group (MARG) Diesel Coalition requested that the comment period be extended an additional 30 days beyond January 27, 2006 to allow for more time to prepare their comments. Additionally, the Agency received a request from the National Institute for Occupational Safety and Health (NIOSH) for a three week extension. On January 26, 2006, MSHA determined that a three week extension of the comment period was sufficient to allow additional public comment on the proposed rule and extended the comment period until February 17, 2006.

What follows is a discussion of the specific revisions to the 2001 DPM standard. The final rule addresses:

- Section 57.5060(b) addressing the final dpm concentration limit;
- Section 57.5060(c)(3)(i) addressing special extensions;
- Section 57.5060(d)addressing medical evaluation and transfer; and
- Section 57.5075 addressing recordkeeping requirements.

IV. Risk Assessment

A. Introduction

We rely on our comprehensive January 2001 risk assessment published at 66 FR 5752–5855 (as corrected at 66 FR 35518–35520) to support this final rule. This risk assessment was updated in the 2005 final rule (70 FR 32868) establishing the 308EC μg/m³ interim permissible exposure limit (PEL). In the following discussion, we will refer to the risk assessment published in the 2001 final rule as the ''2001 risk assessment'' and the updates published in the 2005 final rule as the ''updated 2001 risk assessment.''

The discussion of the 2001 risk assessment in our 2005 final rule presented our evaluation of health risks associated with DPM exposure levels encountered in the mining industry and is based on a review of the scientific literature available through March 31, 2000, along with consideration of all material submitted during the public comment periods for the 2001 and 2005 rulemakings.

The 2001 risk assessment was divided into three main sections. Section 1 (66 FR 5753–5764) contained a discussion of U.S. miner exposures based on field data collected through mid-1998. Section 2 of the 2001 risk assessment (66 FR 5764–5822) reviewed the extensive scientific literature on health effects associated with exposures to DPM. In section 3 of the 2001 risk assessment (66 FR 5822–5855), we evaluated the best available evidence to ascertain whether exposure levels currently existing in mines warranted regulatory action pursuant to the Mine Act. After careful consideration of all the submitted public comments, the 2001 risk assessment established three main conclusions:

1. Exposure to DPM can materially impair miner health or functional capacity. These material impairments include acute sensory irritations and respiratory symptoms (including allergenic responses); premature death from cardiovascular, cardiopulmonary, or respiratory causes; and lung cancer.

2. At DPM levels currently observed in underground mines, many miners are presently at significant risk of incurring these material impairments due to their occupational exposures to DPM over a working lifetime.

3. By reducing DPM concentrations in underground mines, the rule will substantially reduce the risks of material impairment faced by underground miners exposed to DPM at current levels (66 FR 5854–5855).

Exposure to DPM can materially impair miner health or functional capacity. These material impairments include acute sensory irritations and respiratory symptoms (including allergenic responses); premature death from cardiovascular, cardiopulmonary, or respiratory causes; and lung cancer. Scientific evidence gathered after the peer-review of the 2001 risk assessment generally supports our conclusions, and nothing in our reviews suggests that they should be altered.

Some commenters presented critiques challenging the 2001 risk assessment and disputing scientific support for any DPM exposure limit, especially by means of an EC surrogate. Other commenters endorsed the risk assessment and stated that recent scientific publications support our conclusions.

Some commenters continue to question the scientific basis for linking DPM exposures with an increased risk of adverse health effects. Many of these comments are the same as those addressed in the 2005 final rule. We refer the reader to section VI, DPM Exposures and Risk Assessment, in the 2005 final rule (70 FR at 32888) for discussions addressing earlier commenters' positions on the underlying basis of the risk assessment.

After considering the additional peer-reviewed scientific literature submitted in response to the proposed rule, and all of the comments, we did not identify any reason to reduce our concern with regard to adverse health risks associated with DPM exposure as identified in the 2001 risk assessment.

Section IV.B, summarizes the DPM exposure data that became available after publication of the 2001 final rule. Section IV.C, Health Effects, summarizes additional scientific literature pertaining to adverse health effects of DPM and fine particulates submitted to the record since our 2005 final rule. The reader is encouraged to refer to the 2001 quantitative risk assessment (66 FR 5752–5855) that reviewed the health effects associated with exposure to DPM. This discussion evaluates the extent to which literature added to the record changes the conclusions of the 2001 risk assessment. Section IV.D, Significance of Risk, supplements Section 2 of the 2001 risk assessment (66 FR 5764–5822) by addressing comments related to the risk assessment.

We reviewed comments on the potential health effects of substituting EC for TC as a surrogate measure of DPM. We believe that the issue of an appropriate surrogate for a measure of DPM is separate from the issue of determining whether adverse health effects are caused by whole DPM or a specific component of DPM. The 2001 risk assessment is definitive in explaining relevant adverse health effects caused by exposure to DPM. The risk assessment accurately portrays adverse health effects ranging from sensory irritation to lung cancer caused by exposure to DPM. The method by which exposures are measured does not affect the conclusion that exposure to DPM produces serious adverse health effects. Comments concerning the analytical method are addressed in part VIII.A. Section 57.5060(b), addressing the final limits.

B. Exposures to DPM in Underground Metal and Nonmetal Mines

The 2001 risk assessment and the update presented in 2005 used the best available data on exposure to DPM at underground M/NM mines to quantify excess lung cancer risk. "Excess risk" refers to the lifetime probability of dying from lung cancer during or after a 45-year occupational DPM exposure. All of the exposure-response models for lung cancer are monotonic (i.e., increased exposure yields increased excess risk).

We evaluated exposures based on 355 samples collected at 27 underground U.S. M/NM mines prior to promulgating the 2001 rule. Mean DPM concentrations found in the production areas and haulageways at those mines ranged from about 285 $\mu g/m^3$ to about 2000 $\mu g/m^3$, with some individual measurements exceeding 3500 $\mu g/m^3$. The overall mean DPM concentration was 808 $\mu g/m^3$. All of the samples considered in the 2001 risk assessment were collected prior to 1999.

Two sets of DPM exposure data, collected after promulgation of the 2001 final rule, were compiled for underground M/NM mines: (1) data collected in 2001 and 2002 from 31 mines for purposes of the 31-Mine Study (Table IV–1) and (2) data collected between 10/30/2002 and 10/29/2003 from 183 mines to establish a baseline for future sample comparisons (Table IV–2). The mean whole DPM concentration across all 358 valid samples in the 31-Mine Study was 432_{DPM} $\mu g/m^3$. The mean concentration across all valid 1,194 baseline samples was 318_{DPM} $\mu g/m^3$.[1]

TABLE IV–1.—DPM CONCENTRATIONS ($\mu g/m^3$) BY MINE CATEGORY FOR SAMPLES COLLECTED FOR THE 31-MINE STUDY (2001–2002)

[DPM is estimated by TC ÷ 0.8]

	Estimated 8-hour Full Shift Equivalent DPM Concentration ($\mu g/m^3$)			
	Metal	Stone	Trona	Other
No. of samples	116	105	54	83
Minimum	46	16	20	27
Maximum	2,581	1,845	331	1,210
Median	491	331	82	341
Mean	610	465	94	359
Std. Error	45	36	9	27
95% UCL	699	537	113	412
95% LCL	522	394	75	306

[1] The relationship DPM ≈ TC/0.8 is the same as that assumed in the 2001 risk assessment. The relationship TC ≈ 1.3 × EC was formulated under the Second Partial Settlement Agreement, based on TC:EC ratios observed in the joint 31-Mine Study.

TABLE IV–2.—DPM CONCENTRATIONS BY MINE CATEGORY FOR SAMPLES COLLECTED DURING THE BASELINE SAMPLING PERIOD (10/30/2002–10/29/2003)

[DPM is estimated by (1.3 × EC) ÷ 0.8.]

	Estimated 8-hour Full Shift Equivalent DPM Concentration (µg/m³)					
	Metal	Stone	Other N/M	Trona	Total	Total excluding Trona
No. of Samples	284	689	196	25	1,194	1,169
Maximum	2,532	3,724	1,200	509	3,724	3,724
Median	339	186	185	102	218	223
Mean	444	295	243	132	318	322
Std. Error	23	13	15	20	10	10
95% UCL	490	320	272	173	338	342
95% LCL	399	270	214	91	299	303

Thus, despite substantial improvements attained since the 1989–1999 sampling period addressed by the 2001 risk assessment, underground M/NM miners are still faced with an unacceptable risk of lung cancer due to their occupational exposure to DPM. The reader is referred to part D of this section, Significance of Risk, for further discussion of excess risk.

Personal exposure samples taken after October 2003 are collected according to our enforcement sampling policy. These enforcement samples collected after the end of the Baseline Sampling period are not representative of the *average* M/NM miner's exposure to DPM because we collect samples to target the highest risk miner, not the average miner. Therefore, this exposure information is not used to characterize the average miner's exposure to DPM. See section V.B, Economic Feasibility, for a summary of enforcement sampling results. However, our enforcement activities from November 1, 2003 through January 31, 2006 continue to show some miners have experienced exposures substantially greater than 308_{EC} µg/m³. During the time period from November 1, 2003 to January 31, 2006, 1,798 valid personal compliance samples from all mines covered by the regulation were collected. From these samples collected, 18% (324) of samples exceeded 308_{EC} µg/m³, 22% (396) exceeded 350_{TC} µg/m³, and 64% (1,151) exceeded 160_{TC} µg/m³. These percentages show that miners are still being exposed to high levels of DPM.

C. Health Effects

A key conclusion of the 2001 risk assessment was:

Exposure to DPM can materially impair miner health or functional capacity. These material impairments include acute sensory irritations and respiratory symptoms (including allergenic responses); premature death from cardiovascular, cardiopulmonary, or respiratory causes; and lung cancer. [66 FR 5854–5855]

We have reviewed scientific literature pertaining to health effects of fine particulates in general and DPM in particular published later than what was considered in the 2001 risk assessment. This scientific evidence supports the 2001 risk assessment, and nothing in our review suggests that it should be altered.

A number of commenters endorsed the 2001 risk assessment, and suggested that the latest evidence strengthens its conclusions. Some other commenters responding to our 2003 NPRM jointly stated that ''[t]he scientific evidence for the [adverse] health effects of DPM is overwhelming'' and that ''evidence for the carcinogenicity and non-cancer health effects of DPM has grown since 1998.''

A number of commenters contended that all of the evidence to date is insufficient to support limitation of occupational exposure to DPM. We believe that these commenters did not appreciate evidence presented in the 2001 risk assessment and/or mischaracterized its conclusions. For example, a few commenters erroneously stated that promulgation of the 2001 rule was based on only ''two principal health concerns: (1) The transitory, reversible health effects of exposure to DPM; and, (2) the long-term impacts that may result in an excess risk of lung cancer for exposed workers.'' Actually, as shown in the conclusion cited above, the 2001 risk assessment identified three different kinds of material health impairment associated with DPM exposure: (1) Acute sensory irritations and respiratory symptoms (including allergenic responses); (2) premature death from cardiovascular, cardiopulmonary, or respiratory causes; and (3) lung cancer. Although the cardiovascular, cardiopulmonary, and respiratory effects were associated with acute exposure to DPM, commenters presented no evidence that any such effects were ''transitory'' or ''reversible.'' Nor did commenters present evidence that immunological responses associated with either short-term or long-term DPM exposure were ''transitory'' or ''reversible.''

In addition, some commenters erroneously stated that ''no [quantitative] dose/response relationship related to the PELs could be demonstrated by MSHA.'' These commenters apparently did not appreciate the discussion of exposure-response relationships in the 2001 risk assessment (66 FR 5847–54) and failed, specifically, to note the quantitative exposure-response relationships shown for lung cancer in the two tables provided (66 FR 5852–53). Relevant exposure-response relationships were also demonstrated in articles by Pope et al. cited in the 2003 NPRM, which will be discussed further below.

Some commenters objected that the exposure-response relationships presented in the 2001 risk assessment did not justify adoption of the specific DPM exposure limits promulgated. These commenters mistakenly assume the limits set forth in the 2001 final rule were derived from an exposure-response relationship. As explained in 66 FR at 5710–14, the choice of exposure limits, while justified by quantifiable adverse health effects, was actually driven by feasibility concerns. The exposure-response relationships provided clear evidence of significant adverse human health effects (both cancer and non-cancer) at exposure levels far below those determined to be feasible for mining.

The additional scientific literature cited in the 2003 NPRM, the 2005 final rule and this 2006 final rule is meant only to update and supplement the evidence of health effects cited in the 2001 risk assessment. Although the

2001 risk assessment presented ample evidence to justify its conclusions, additional supplemental DPM health effects literature is reviewed in this document that became available after the 2001 risk assessment was published.

The following section summarizes additional studies submitted to the record. Our review focuses on the implications of these study results for the characterization of risk presented in MSHA's 2001 assessment. These study summaries are presented in three tables that correspond to the material health impairments identified in the 2001 risk assessment: (1) Respiratory and immunological effects, including asthma, (2) cardiovascular and cardiopulmonary effects, and (3) cancer. A fourth table focuses on a recent study about potential mechanisms of action for DPM. These tables describe the studies that some commenters and the agency felt were representative of the type of new information available since the completion of the 2001 assessment and the updated 2001 risk assessment, however, these tables are not to represent a comprehensive review of all information published about particulate matter.

(1) Respiratory and Immunological Effects, Including Allergenic Responses

In the 2001 risk assessment, acute sensory irritations with respiratory symptoms, including immunological or allergenic effects such as asthmatic responses, were grouped together. Similar material health impairments likely to be caused or exacerbated by excessive exposures to DPM were identified. This finding was based on human experimental and epidemiological studies and was supported by experimental toxicology. (For an explanation of what type of health effects are considered by us to be material impairments of health, the reader is referred to the 2001 risk assessment (See 66 FR 5766.)

Table IV–3 summarizes five studies dealing with respiratory and immunological effects of DPM and/or fine particulates in general that have been submitted to the record since the 2005 literature update to the 2001 risk assessment. The epidemiological studies by Hoppin (2004) and Pourazar (2004) provide additional support for the association between diesel exhaust exposure and development of asthma. Three of the studies, Gluck (2003), Stenfors (2004), and Behndig (2006), have also shown that exposures of human volunteers to diesel exhaust at levels below 160_{TC} µg/m^3 cause inflammation of the human respiratory tract.

TABLE IV–3.—STUDIES OF HUMAN RESPIRATORY AND IMMUNOLOGICAL EFFECTS

Authors, year	Description	Key results
Behndig et al., 2006	15 healthy volunteers exposed to diesel exhaust or air (2 hours, diesel concentration measured as PM_{10}: 100 µg/m^3) Eighteen hours after exposure, the volunteers were assessed using bronchoscopy with bronchoalveolar lavage and endobronchial mucosal biopsy.	Exposure to diesel exhaust at this concentration is sufficient to cause airway inflammation.
Gluck et al., 2003	Comparison of nasal cytological examinations of 136 customs officers involved solely in clearance of heavy-goods vehicles using diesel engines with examinations of 58 officers working only in offices. Examinations were performed twice a year over a period of 5 years. Measured diesel engine emission concentrations for the exposed group varied between 31 and 60 µg/m^3.	The exposed group was found to have chronic inflammatory changes of the nasal mucosa, including goblet cell hyperplasia, increased metaplastic and dysplastic epithelia, and increased leukocytes while the unexposed group did not.
Hoppin et al., 2004	An association between diesel exhaust exposure and development of asthma is explored. The study evaluated the odds of wheeze associated with nonpesticide occupational exposures in a cohort of approximately 21,000 farmers in Iowa and North Carolina. Logistic regression models controlling for age, state, smoking, and history of asthma or atopy were applied to evaluate odds of wheeze in the past year.	Driving diesel tractors was significantly associated with elevated odds of wheeze (odds ratio = 1.31; 95% confidence interval = 1.13, 1.52). The odds ratio for driving gasoline tractors was lower but significant at 1.11 (95% confidence interval = 1.02, 1.21). A duration-response relationship was observed for driving diesel tractors but not for driving gasoline tractors.
Pourazar et al., 2004	15 healthy volunteers were exposed to diesel exhaust or air for 1 hour. Diesel concentration was measured as PM10 at 300 µg/m^3).	This level of diesel exposure caused a significant increase in expression of the cytokine interleukin-13 in the airways of these volunteers. Interleukin-13 is known to play a key role in the pathogenesis of asthma.
Stenfors et al., 2004	25 healthy volunteers and 15 mild asthmatics were exposed to diesel exhaust or air alone for two hours (diesel concentration measured as PM_{10} at 108 µg/m^3). At six hours after exposure, subjects underwent bronchoscopy with bronchoalveolar lavage and mucosal biopsies.	Diesel exhaust exposure was documented to cause airways inflammation in healthy volunteers. Diesel exhaust exposure did not significantly worsen existing airways inflammation in the asthmatics, but did significantly increase airways expression of the important allergy-associated cytokine, interleukin-10.

Review Article on Respiratory and Immunological Effects Considered after the 2005 Final Rule

There is a progressive accumulation of evidence showing the inflammatory and immunologic effects of diesel exhaust particulate exposure plays a role in the development of allergies and asthma. The 2001 risk assessment and the update to the risk assessment describe in detail review articles addressing these effects. The most recent review by Riedl and Diaz-Sanchez (2005), summarized in Table IV–4, provides an overview of observational and experimental studies that link DPM and asthma.

TABLE IV–4.—REVIEW ARTICLES ON RESPIRATORY AND IMMUNOLOGICAL EFFECTS

Authors, year	Description	Key results
Riedl and Diaz-Sanchez, 2005.	Review of evidence-based studies of the health effects of air pollutants on asthma, focusing on diesel exhaust particles (DEP).	Intact DEP and extracts of DEP induce reactive oxygen species production. DEP and particulate matter induce release of Granulocyte Macrophage-Colony Stimulating Factor and increase intracellular peroxide production. The ultrafine particle fraction of diesel exhaust might also exert biologic effects independent of chemical composition through penetration of cellular components, such as mitochondria.

In its 2002 ''Health Assessment Document for Diesel Engine Exhaust,'' the Environmental Protection Agency (EPA) reached the following conclusion with respect to immunological effects of diesel exhaust:

> Recent human and animal studies show that acute DE [diesel exhaust] exposure episodes can exacerbate immunological reactions to other allergens or initiate a DE-specific allergenic reaction. The effects seem to be associated with both the organic and carbon core fraction of DPM. In human subjects, intranasal administration of DPM has resulted in measurable increases of IgE antibody production and increased nasal mRNA for some proinflammatory cytokines. These types of responses also are markers typical of asthma, though for DE, evidence has not been produced in humans that DE exposure results in asthma. The ability of DPM to act as an adjuvant to other allergens also has been demonstrated in human subjects. (EPA, 2002)

Submissions to the rulemaking record since the 2005 final rule support our previous position that exposure to DPM is associated with the development of adverse respiratory and immunological effects.

(2) Cardiovascular and Cardiopulmonary Effects

In the 2001 risk assessment, the evidence presented for DPM's adverse cardiovascular and cardiopulmonary effects relied on data from air pollution studies in the ambient air. This evidence identifies premature death from cardiovascular, cardiopulmonary, or respiratory causes as an endpoint significantly associated with exposures to fine particulates. The 2001 risk assessment found that ''[t]he mortality effects of acute exposures appear to be primarily attributable to combustion-related particles in $PM_{2.5}$ [*i.e.*, fine Particulate Matter] (such as DPM) * * *.''

There are difficulties involved in utilizing the evidence from such studies in assessing risks to miners from occupational exposure to DPM. As noted in the 2001 risk assessment,

> First, although DPM is a fine particulate, ambient air also contains fine particulates other than DPM. Therefore, health effects associated with exposures to fine particulate matter in air pollution studies are not associated specifically with exposures to DPM or any other one kind of fine particulate matter. Second, observations of adverse health effects in segments of the general population do not necessarily apply to the population of miners. Since, due to age and selection factors, the health of miners differs from that of the public as a whole, it is possible that fine particles might not affect miners, as a group, to the same degree as the general population (66 FR 5767).

However,

> Since DPM is a type of respirable particle, information about health effects associated with exposures to respirable particles, and especially to fine particulate matter, is certainly relevant, even if difficult to apply directly to DPM exposures (66 FR 5767).

One new study on cardiovascular and cardiopulmonary effects was added to the record. See Toxicological Effects in this section for a summary of this article.

The EPA concluded in its 2002 Health Assessment Document for Diesel Engine Exhaust that diesel exhaust (as measured by DPM) is ''likely to be a human carcinogen.'' Furthermore, the assessment concluded that ''[s]trong evidence exists for a causal relationship between risk for lung cancer and occupational exposure to D[iesel]E[xhaust] in certain occupational workers'' (Health Assessment Document for Diesel Engine Exhaust, EPA, 2002, Sec. 9, p. 20). The EPA's 2004 Air Quality Criteria Document for particulate matter (EPA, 2004b) describes a number of additional studies related to the cardiopulmonary and cardiovascular effects of $PM_{2.5}$, including work published later than that cited in MSHA's 2003 NPRM (68 FR 48668). One of the summary conclusions presented in that document is:

> Overall, there is strong epidemiological evidence linking (a) short-term (hours, days) exposures to $PM_{2.5}$ with cardiovascular and respiratory mortality and morbidity, and (b) long-term (years, decades) $PM_{2.5}$ exposure with cardiovascular and lung cancer mortality and respiratory morbidity. The associations between $PM_{2.5}$ and these various health endpoints are positive and often statistically significant. [EPA, 2004b, Sec. 9 p. 46]

Submissions to the rulemaking record since the 2001 final rule support our previous position that exposure to DPM is associated with the development of adverse cardiovascular and cardiopulmonary effects.

(3) Cancer Effects

The 2001 risk assessment concluded that DPM exposure, at occupational levels encountered in mining, was likely to increase the risk of lung cancer. The assessment also found that there was insufficient evidence to establish a causal relationship between DPM and other forms of cancer. This update contains a description of three human research studies and a literature review relating DPM and/or other fine particulate exposures to lung cancer.

Lung Cancer

Table IV–5 presents three human studies pertaining to the association between lung cancer and exposures to DPM or fine particulates submitted to the record after the 2005 update of the 2001 risk assessment was done.

TABLE IV–5.—STUDIES ON LUNG CANCER EFFECTS

Authors, year	Description	Key results
Garshick et al., 2004	An evaluation of lung cancer mortality in 54,793 railroad workers ages 40–64 with 10–20 years of service in 1959. Based on evaluation of death certificates, subsequent mortality was assessed through 1996. Diesel-exposed workers such as engineers and conductors were compared to a referent group of less exposed workers such as ticket agents, station agents, signal-maintainers, and clerks.	Railroad workers in jobs associated with operating trains had a relative risk of lung cancer mortality of 1.4 (95% confidence limits = 1.30–1.51). The authors did not think this association was due to uncontrolled confounding. No relationship was found between years of exposure and lung cancer risk. The authors discussed the potential for this to be due to factors such as a healthy worker survivor effect, lack of information on historical changes in exposure, and the potential contribution of coal combustion product before the transition to diesel locomotives.
Guo et al., 2004	Evaluation of lung cancer mortality in all working Finns born between 1906 and 1945 and participating in the national census of December 1970. Based on the reported occupation held for longest time and a national database of exposures for various occupations, a variety of exposures including diesel exhaust were estimated. Information about subsequent diagnosis of lung cancer during the period 1971 to 1995 was obtained from the Finnish Cancer Registry.	After controlling for other exposures such as asbestos and quartz dust, only a slight excess of lung cancer was found in men aged 20–59 associated with diesel exhaust exposure. A parallel, but weaker, association was documented in women. The authors concluded that risk associated with diesel exhaust "was not consistently elevated" and speculated that this was the result of factors such as low exposures or confounding from unmeasured non occupational exposures.
Jarvholm et al., 2003	Mortality study of Swedish construction workers. Information about occupation and smoking was taken from computerized health records available for the period 1971–1992. Workers in two occupations exposed to diesel exhaust, 6,364 truck drivers and 14,364 drivers of heavy construction vehicles were compared to a reference group of 119,984 carpenters and electricians.	Truck drivers had significantly increased risk for cancer of the lung, while heavy construction vehicle operators did not. In heavy construction operators, a significant trend of decreased risk for lung cancer was associated with increasing use of vehicle cabins. The authors explained that there was a difference between truck and heavy equipment operators, but no conclusion could be reached without more detailed information about the duration and concentration of diesel exhaust exposures and smoking habits.

A Cohort Mortality Study With a Nested Case-Control Study of Lung Cancer and Diesel Exhaust Among Nonmetal Miners [NIOSH/NCI 1997]

A number of commenters expressed opinions on the unpublished document authored by Dr. Gerald Chase (2004) entitled *Characterizations of Lung Cancer in Cohort Studies and a NIOSH Study on Health Effects of Diesel Exhaust in Miners.* This document presents an analysis of some very preliminary data provided by NIOSH and the National Cancer Institute at a public stakeholder meeting held on Nov. 5, 2003. These data were taken from unpublished charts that NIOSH and NCI used to inform the public of the status and progress of their ongoing project, *A Cohort Mortality Study with a Nested Case-Control Study of Lung Cancer and Diesel Exhaust Among Nonmetal Miners* (NIOSH/NCI Study 1997). We previously addressed Dr. Chase's analysis in our 2005 final rule (70 FR 32906). NIOSH and NCI researchers involved in that project have not yet published their analyses or conclusions based on these data. When the study is concluded, we will assess the results and their association to our updated 2001 risk assessment findings. Therefore, the Agency believes that the opinions expressed by commenters on Dr. Chase's unpublished analysis of preliminary data are inappropriate for identifying or assessing the relationship between occupational DPM exposure and excess lung cancer mortality in that data set.

Bladder Cancer and Pancreatic Cancer

No additional information was submitted to the rulemaking record that would change our position that bladder cancer is associated with exposure to DPM. The Agency has not received additional information that would change our position that there is insufficient evidence to support a link between exposure to DPM and pancreatic cancer.

(4) Toxicological Effects of DPM Exposure

Table IV–6 presents one new particulate matter toxicity study (Sun et al., 2005) obtained since the 2005 final rule. The table identifies the agent(s) of toxicity investigated and indicates how the results support the risk assessment by categorizing the toxic effects and/or markers of toxicity found in each study.

TABLE IV–6.—STUDY ON TOXICOLOGICAL EFFECTS OF DPM EXPOSURE

Authors, year	Description	Key results	Agent(s) of toxicity	Toxic effect(s)*	Limitations
Sun et al., 2005	Assessment of effects of subchronic exposure to environmentally relevant particulate matter on atherosclerosis and vasomotor tone in a mouse disease model.	Long-term exposure to low concentration of $PM_{2.5}$ altered vasomotor tone, induced vascular inflammation, and potentiated atherosclerosis.	Concentrated $PM_{2.5}$ from northeastern regional background particulate.	Inflammation, Adverse cardiovascular effects.	Exposure not specific to DPM.

No new review articles on various aspects of the scientific literature related to mechanisms of DPM toxicity were submitted to the record since the 2005 final rule. In summary, the peer-reviewed publications submitted to the rulemaking record addressing the health effects of exposure to diesel exhaust support our 2001 risk assessment (66 FR 5526; 30 CFR Part 2005) and nothing in our review suggests that it should be altered.

D. Significance of Risk

Adverse Health Effects

The first principal conclusion of the 2001 risk assessment was:

> Exposure to DPM can materially impair miner health or functional capacity. These material impairments include acute sensory irritations and respiratory symptoms (including allergenic responses); premature death from cardiovascular, cardiopulmonary, or respiratory causes; and lung cancer (66 FR 5854).

We agree with commenters who characterized the weight of evidence from the most recent scientific literature and the comprehensive scientific literature reviews carried out by other institutions and government agencies as supporting and potentially strengthening this conclusion.

In 2002, for example, the U.S. EPA, with the concurrence of its Clean Air Scientific Advisory Committee (CASAC), published its Health Assessment Document for Diesel Engine Exhaust (EPA, 2002). With respect to sensory irritations, respiratory symptoms, and immunological effects, this document concluded that:

> At relatively high acute exposures, DE [diesel exhaust] can cause acute irritation to the eye and upper respiratory airways and symptoms of respiratory irritation which may be temporarily debilitating. Evidence also shows that DE has immunological toxicity that can induce allergic responses (some of which are also typical of asthma) and/or exacerbate existing respiratory allergies. [EPA, 2002]

In 2003, the World Health Organization (WHO) issued a review report on particulate matter air pollution and health. WHO concluded that ‘‘fine particles (commonly measured as $PM_{2.5}$) are strongly associated with mortality and other endpoints such as hospitalization for cardiopulmonary disease, so that it is recommended that air quality guidelines for $PM_{2.5}$ be further developed.’’ (WHO, 2003)

In the 10th edition of its Report on Carcinogens, the National Toxicology Program (NTP) of the National Institutes of Health formally retained its designation of diesel exhaust particulates as ‘‘reasonably anticipated to be a human carcinogen.’’ (U.S. Dept. of Health and Human Services, 2002) The report noted that:

> Diesel exhaust contains identified mutagens and carcinogens both in the vapor phase and associated with respirable particles. Diesel exhaust particles are considered likely to account for the human lung cancer findings because they are almost all of a size small enough to penetrate to the alveolar region.
>
> * * * Because of their high surface area, diesel exhaust particulates are capable of adsorbing relatively large amounts of organic material * * * A variety of mutagens and carcinogens such as PAH and nitro-PAH * * * are adsorbed by the particulates. There is sufficient evidence for the carcinogenicity for 15 PAHs (a number of these PAHs are found in diesel exhaust particulate emissions) in experimental animals. The nitroarenes (five listed) meet the established criteria for listing as ‘‘reasonably anticipated to be a human carcinogen’’ based on carcinogenicity experiments with laboratory animals. [U.S. Dept. of Health and Human Services, 2002]

Although many commenters agreed that the adverse health effects associated with miners' exposure to DPM warranted an exposure limit, commenters from trade associations and industry continued to challenge the conclusions of the 2001 risk assessment. Discussions addressing this issue were summarized in the 2001 risk assessment and the 2005 update. As referenced in this section, the U.S. Environmental Protection Agency, World Health Organization, and the National Toxicology Program regard DPM exposure as adversely affecting human health.

Statement of Excess Lung Cancer Risk

In our 2001 risk assessment, we explained why we focused our quantification of health effects on lung cancer only. We estimated lower bounds on the significance of risks faced by miners occupationally exposed to DPM with respect to (1) acute sensory irritations and respiratory symptoms or (2) premature death from cardiovascular, cardiopulmonary, or respiratory causes. We expect the final rule to significantly and substantially reduce these two kinds of risk as well as (3) lung cancer. However, we were unable, based on available data, to quantify with confidence the reductions expected for the first two kinds and are still unable to do so. Therefore, MSHA's quantitative assessment of the rule's impact on risk is restricted to its expected impact on the third kind of risk—the risk of lung cancer (66 FR 5854).

In the 2001 risk assessment, MSHA assumed that, in the absence of this rule, underground M/NM miners would be occupationally exposed to DPM for 45 years at a mean level of 808 $\mu g/m^3$, and estimated reductions in lifetime risk expected to result from full implementation of the rule, based on the various exposure-response relationships obtained from Säverin *et al.* (1999), Steenland *et al.* (1998), and Johnston *et al.* (1997).

Miner's exposures to DPM levels have declined since 1989–1999. We expect that further improvements will continue to significantly reduce the health risks identified for miners. There is clear evidence of adverse health effects due to exposure to DPM in the rulemaking record, not only at pre-2001 exposure levels but also at the generally lower levels currently observed at many underground mines. The adverse health effects associated with exposure to DPM are material health impairments as specified under section 101(a)(6)(A) of the Mine Act.

Because the exposure-response relationships used in the risk assessment are monotonic, we expect that industry-wide implementation of each final limit will significantly reduce the risk of lung cancer and other adverse health effects among miners. The 2001 risk assessment used the best available data on DPM exposures at underground M/NM mines to quantify excess lung cancer risk. ''Excess risk'' refers to the lifetime probability of dying from lung cancer during or after a 45 year occupational DPM exposure. This probability is expressed as the expected excess number of lung cancer deaths per thousand miners occupationally exposed to DPM at a specified mean DPM concentration. The excess is calculated relative to baseline, age-specific lung cancer mortality rates taken from standard mortality tables. In order to properly estimate this excess, it is necessary to calculate, at each year of life after occupational exposure begins, the expected number of persons surviving to that age with and without DPM exposure at the specified level. At each age, standard actuarial adjustments must be made in the number of survivors to account for the risk of dying from causes other than lung cancer. Occupational exposure is assumed to begin at age 20 and to continue, for surviving miners, until retirement at age 65. The accumulation of lifetime excess risk continues after retirement through the age of 85 years.

Table IV–7, taken from the 2001 risk assessment, shows excess lung cancer estimates at mean exposures equal to the final limit equivalent to 200 micrograms of DPM per cubic meter of air for eight hour shift weighted average. The eight exposure-response models for lung cancer used in the 2001 risk assessment were based on studies by Säverin *et al.* (1999), Johnston *et al.* (1997), and Steenland *et al.* (1998). Assuming that TC is 80 percent of whole DPM, and that the mean ratio of TC to EC is 1.3, the DPM limit of 200 $\mu g/m^3$ shown in Table IV–7 corresponds to the 160 $\mu g/m^3$ TC limit adopted under the present rulemaking.

TABLE IV–7.—EXCESS LUNG CANCER RISK EXPECTED AT SPECIFIED DPM EXPOSURE LEVELS OVER AN OCCUPATIONAL LIFETIME

[Extracted from Table III–7 of the 2001 risk assessment]

Study and statistical model	Excess lung cancer deaths per 1,000 occupationally exposed workers† Final DPM Limit 200 $\mu g/m^3$ (160 $\mu g/m^3$ TC)
Säverin et al. (1999):	
Poisson, full cohort	15
Cox, full cohort	70
Poisson, subcohort	93
Cox, subcohort	182
Steenland et al. (1998):	
5-year lag, log of cumulative exposure	67
5-year lag, simple cumulative exposure	159
Johnston et al. (1997):	
15-year lag, mine-adjusted	313
15-year lag, mine-unadjusted	513

† Assumes 45-year occupational exposure at 1,920 hours per year from age 20 to retirement at age 65. Lifetime risk of lung cancer adjusted for competing risk of death from other causes and calculated through age 85. Baseline lung cancer and overall mortality rates from NCHS (1996).

As explained in the 2005 final rule, the exposure-response models shown are monotonic (i.e., increased exposure yields increased excess risk, though not proportionately so). Therefore, using our estimates of mean exposure levels, they all predict excess lung cancer risks somewhere above the final whole DPM limit of 200 $\mu g/m^3$, or equivalently, 160_{TC} $\mu g/m^3$. Thus, despite substantial improvements apparently attained since the 1989–1999 sampling period addressed by the 2001 risk assessment, underground M/NM miners are still faced with an unacceptable risk of lung cancer due to their occupational exposure to DPM.

V. Feasibility

Section 101(a)(6)(A) of the Mine Act requires the Secretary of Labor, in establishing health standards, to most adequately assure, on the basis of the best available evidence, that no miner will suffer material impairment of health or functional capacity over his or her working life. Standards promulgated under this section must be based upon research, demonstrations, experiments, and such other information as may be appropriate. MSHA, in setting health standards, is required to achieve the highest degree of health and safety protection for the miner, and as stated in the legislative history of the Mine Act, MSHA must consider the latest available scientific data in the field, the feasibility of the standards, and experience gained under this or other health and safety laws.

Though the Mine Act and its legislative history are not specific in defining feasibility, the Supreme Court has clarified the meaning of feasibility in the context of OSHA health standards in *American Textile Manufacturers' Institute* v. *Donovan* (OSHA Cotton Dust), 452 U.S. 490, 508–09 (1981), as ''capable of being done, executed, or effected,'' both technologically and economically.

The legislative history to the Mine Act indicates Congress' intent for MSHA when considering feasibility and states:

While feasibility of the standard may be taken into consideration with respect to engineering controls, this factor should have a substantially less significant role. Thus, the

Secretary may appropriately consider the state of the engineering art in industry at the time the standard is promulgated. However, as the circuit courts of appeals have recognized, occupational safety and health statutes should be viewed as ''technology forcing'' legislation, and a proposed health standard should not be rejected as infeasible ''when the necessary technology looms on today's horizon''. *AFL–CIO* v. *Brennan*, 530 F.2d 109 (3d Cir. 1975); *Society of Plastics Industry* v. *OSHA,* 509 F.2d 1301 (2d Cir. 1975), *cert. denied* 427 U.S. 992 (1975).

Similarly, information on the economic impact of a health standard, which is provided to the Secretary of Labor at a [public] hearing or during the public comment period, may be given weight by the Secretary. In adopting the language of [this section], the Committee wishes to emphasize that it rejects the view that cost benefit ratios alone may be the basis for depriving miners of the health protection which the law was intended to insure. The Committee concurs with the judicial constitution that standards may be economically feasible even though from the standpoint of employers, they are ''financially burdensome and affect profit margins adversely'' (*I.U.D.* v. *Hodgson*, 499 F.2d 6a47 (D.C. Cir. 1974)). Where substantial financial outlays are needed in order to allow industry to reach the permissible limits necessary to protect miners, other regulatory strategies are available to accommodate economic feasibility and health considerations. These strategies could include delaying implementation of certain provisions or requirements of standards in order to allow sufficient time for engineering controls to be put in place or a delay in the effective date of the standard. S. Rep. No. 95–181, 95th Cong. 1st Sess. 21 (1977).

The ''arbitrary and capricious test'' is usually applied to judicial review of rules issued in accordance with the Administrative Procedure Act. The legislative history of the Mine Act further indicates that Congress explicitly intended the ''arbitrary and capricious test'' be applied to judicial review of mandatory MSHA standards. ''This test would require the reviewing court to scrutinize the Secretary's action to determine whether it was rational in light of the evidence before him and reasonably related to the law's purposes.'' S. Rep. No. 95–181, 95th Cong., 1st Sess. 21 (1977). In achieving the Congressional intent of feasibility under the Mine Act, MSHA may also consider reasonable time periods of implementation. *Ibid.* at 21.

In order to establish the economic and technological feasibility of a new rule, an agency is required to produce a reasonable assessment of the likely range of costs that a new standard will have on an industry, and an agency must show that a reasonable probability exists that the typical firm in an industry will be able to develop and install controls that will meet the standard. *United Steelworkers of America, AFL–CIO–CLC* v. *Marshall,* (OSHA Lead) 647 F.2d 1189, 1273 (D.C. Cir. 1980).

Like, the Mine Act, the OSH Act contains the term ''technology-forcing'' with respect to standards setting. The D.C. Circuit Court also determined with respect to technological feasibility under the OSH Act that:

* * * ''technology-forcing'' under the OSH Act, means, at the very least, that OSHA can impose a standard which only the most technologically advanced plants in an industry have been able to achieve-even if only in some of their operations some of the time. *American Iron & Steel Institute* v. *OSHA, supra,* 577 F.2d at 832–835.

Since ''technology-forcing'' assumes that ''an agency will make highly speculative projections about future technology, a standard is obviously not infeasible solely because OSHA has no hard evidence to show that the standard has been met. More to the point here, we cannot require OSHA to prove with any certainty that industry will be able to develop the necessary technology, or even to identify the single technological means by which it expects industry to meet the PEL. OSHA can force employers to invest all reasonable faith in their own capacity for technological innovation. *Society of Plastics Industries, Inc.* v. *OSHA, supra* 509 F.2d at 1309, and can thereby shift to industry some of the burden of choosing the best strategy for compliance. *United Steelworkers of America,* 647 F.2d at 1266.

This same court found that proving economic feasibility presented different issues from that of technological feasibility, where it stated:

But when the agency has proved technological feasibility by making reasonable predictions about experimental means of compliance, the court probably cannot expect hard and precise estimates of costs. Nevertheless, the agency must of course provide a reasonable assessment of the likely range of costs of its standard, and the likely effects of those costs on the industry. *Ibid. at 1266.*

A. Technological Feasibility

Courts have ruled that in order for a standard to be technologically feasible an agency must show that modern technology has at least conceived some industrial strategies or devices that are likely to be capable of meeting the standard, and which industry is generally capable of adopting. *Ibid.* (citing *American Iron and Steel Institute* v. *OSHA,* (AISI–I) 577 F.2d 825 (3d Cir. 1978) at 832–35; and, *Industrial Union Dep't., AFL–CIO* v. *Hodgson,* 499 F.2d 467 (DC Cir.1974)); *American Iron and Steel Institute* v. *OSHA,* (AISI–II) 939 F.2d 975, 980 (DC Cir. 1991). A control may be technologically feasible when ''if through reasonable application of existing products, devices or work methods with human skills and abilities, a workable engineering control can be applied'' to the source of the hazard. It need not be an ''off-the-shelf'' product, but ''it must have a realistic basis in present technical capabilities.'' (*Secretary of Labor* v. *Callanan Industries, Inc.* (Noise), 5 FMSHRC 1900, 1908 (1983)). The Secretary may also impose a standard that requires protective equipment, such as respirators, if technology does not exist to lower exposures to safe levels. See *United Steelworkers of America,* 647 F.2d at 1269.

We have established that it is technologically feasible for the underground M/NM mining industry to reduce miners' exposures to the DPM final limits as prescribed in the final rule. Unlike the 2005 NPRM, we are phasing in the final limit of 160 Total Carbon micrograms per cubic meter of air (160_{TC} µg/m^3) over a two-year period, due to the updated feasibility information in the rulemaking record. This updated feasibility information relates primarily to the wider availability of alternative fuels, and in particular biodiesel, improved filter technology, and the impending availability of EPA compliant 2007 on-road diesel engines. Consequently, on May 20, 2006, the initial final limit will be 308 micrograms of EC per cubic meter of air (308_{EC} µg/m^3), which is the same as the existing interim limit; on January 20, 2007, the final limit will be reduced by 50 micrograms and will be a TC limit of 350_{TC} µg/m^3; and on May 20, 2008, the final limit of 160_{TC} µg/m^3 will become effective. Note that the 350_{TC} µg/m^3 final limit and the 160_{TC} µg/m^3 final limit are established as TC-based limits in this final rule. It is our intention to convert these TC limits to comparable EC limits; however, developing appropriate conversion factors for these limits was beyond the scope of the current rulemaking. These TC limits will be converted to comparable EC limits through a separate rulemaking.

To meet the final DPM limits, mine operators will be able to continue to use existing available engineering control technology and various administrative control methods used in meeting the interim DPM limit. However, we are affording the mining industry the additional time from that provided under the 2001 final rule to work through their remaining implementation issues with DPM control technology and to gain access to alternative fuels and DPFs. The additional time will also allow mine operators, especially small mine operators, time to find effective approaches to utilizing available DPM control technology so that they will be capable of meeting the standard. Altogether, the mining industry will have been afforded over seven years to institute control technology to reduce miners' exposures to the final DPM limit of 160_{TC} µg/m³. Our decisions in the final rule are based on our enforcement experience, along with information and data in the updated DPM rulemaking record, which includes the 2001 and 2005 DPM rulemaking records. The final rulemaking record lacks feasibility documentation to justify lowering the final DPM limit to 160_{TC} µg/m³ at this time.

The existing requirement for methods of compliance will continue to be applicable to the final limits. To attain the final limits, mine operators are required to install, use, and maintain engineering and administrative controls to the extent feasible. When engineering and administrative controls do not reduce a miner's exposure to the DPM limit, the controls are infeasible, or controls do not produce significant reductions (defined in the 2005 rule (70 FR 32868, 32916) as at least 25% reduction in the affected miners' DPM exposures), operators must continue to use all feasible engineering and administrative controls and supplement them with respiratory protection. Though mine operators may choose to use an engineering control or an administrative control to reduce a miner's exposure, or a combination thereof, existing § 57.5060(d) prohibits a mine operator from using respiratory protection in lieu of feasible controls. When respiratory protection is required under the final standard, mine operators must establish a respiratory protection program that meets the specified requirements under existing § 57.5060(d) of the DPM standard.

MSHA emphasizes that DPM engineering and administrative controls may be feasible, and therefore be required by MSHA, even if controls do not reduce a miner's exposure to the DPM limit.

Under this rule, MSHA intends that feasible DPM controls must be capable of achieving a significant reduction in DPM. We also note that most of the practical and effective controls that are currently available, such as DPM filters, enclosed cabs with filtered breathing air, and low-emission engines will achieve at least a 25% reduction. Other controls such as ventilation upgrades or alternative fuel blends may achieve a 25% reduction, depending on exposure circumstances and the specific nature of the subject control. It should also be noted that reductions of less than 25% could be due to normal day-to-day variations in mining operations as opposed to reductions due to implementing a control technology. Thus, for mines that are out of compliance with the DPM final limits, controls would be required that attain compliance, or that achieve at least a 25% reduction in DPM exposure if it is not possible to attain compliance by implementing feasible controls. If engineering and administrative controls are not capable of reducing exposure to the limits in this final rule, and cannot reduce DPM exposures by at least 25%, we would not require the implementation of those controls. In such cases, we will require miners to be protected using appropriate respiratory protective equipment.

If a particular DPM control were capable of achieving at least a 25% reduction all by itself, we would continue to evaluate the costs of that individual control to determine its economic feasibility. If a number of controls could together achieve at least a 25% reduction, but no individual control, if implemented by itself, could achieve a 25% reduction, we will evaluate the total costs of all controls added together to determine their economic feasibility as a group. In determining whether a combination of controls is economically feasible, we will consider whether the total cost of the combination of controls is wholly out of proportion to the expected results. We will not cost the controls individually, but will combine their expected results to determine if the 25% significant reduction criterion can be satisfied. The concept of significant reduction is not new to the M/NM mining industry. MSHA's 2005 Compliance Guide includes the 25% significant reduction for determining feasibility.

At this time, we believe that this compliance approach coupled with the phased-in final limits provides mine operators with flexibility necessary to assure feasible compliance. This current enforcement approach results in feasibility of compliance for the industry as a whole with each of the phased-in limits contained in this final rule while protecting miners' health. However, we continue to acknowledge that compliance difficulties may be encountered at some individual mines, but on a much smaller scale than what we project if the final limit of 160_{TC} µg/m³ became effective in May 2006. This primarily will be due to implementation issues and the cost of purchasing and installing certain types of controls at these mines.

Moreover, pursuant to existing § 57.5060(c), mine operators can apply to the District Manager for a special extension for additional time in which to meet the final limits, including the initial final limit of 308_{EC} µg/m³. Although we anticipate that special extensions and our traditional hierarchy of controls in enforcement will address some compliance issues, we envision that some miners will have to wear respiratory protection under the final limit of 160_{TC} µg/m³.

Based upon a review of enforcement data, we believe that a large portion of the mining industry will initially encounter implementation issues as they attempt to attain compliance with the final limits using engineering and administrative controls. However, we believe that most mine operators will be able to overcome these issues within the two-year period during which the final limits will be phased-in. For example, the wider use of high biodiesel content fuel blends, which can reduce DPM emissions by up to 80% or more, will be greatly facilitated by the significant increases in biodiesel fuel production that will occur in the United States over the next two years. The National Biodiesel Board reports that annual biodiesel production rose from 25 million gallons in 2004 to 75 million gallons in 2005. They also report that biodiesel plants that are either under construction at the present time or in the pre-construction phase will add another 847 million gallons of annual production capacity. A large portion of this added capacity will be on-line by 2008.

Another example of a recent development that will help enable mine operators attain our final DPM limit of 160_{TC} µg/m³ by May 2008 is the impending availability of U.S. EPA 2007 on-road diesel engines. U.S. EPA 2007 on-road diesel engine standards have DPM emission limits that are about 90% lower than the current EPA limits allow. The DPM reduction will be attained through the use of DPFs. The DPFs will be part of the engine and vehicle when sold. For example, a new 2007 on-road pickup truck will have a DPF installed on the vehicle at the time of purchase. The 2007 on-road engines will be commercially available starting in early 2007.

In addition to the EPA 2007 on-road DPM standards, EPA also has new Tier 4 off-road standards that will reduce DPM about 90%. Tier 4 will be phased-in beginning in 2008. Similar to the 2007 on-road engines, a DPF will be installed on the engine and vehicle when purchased. Even though the EPA implementation dates of Tier 4 is after the date of the final limit, the DPF technology is being developed at this time by the engine and filter manufacturers in order to be ready for the tier 4 standards. This current work will enhance the developments and availability of DPF systems that can be retrofitted to mining vehicles.

Although the emission limits for 2007 on-road engines were established some time ago, we had very little insight as to the strategies and technologies that the engine manufacturers would use to meet these limits. For competitive reasons, the engine manufacturers did not publicize their strategies or designs for complying with these EPA regulations. We were therefore uncertain as to whether any 2007 on-road compliant engines would be compatible with typical underground M/NM mine operational and production requirements, duty cycles, and maintenance practices, and thus, whether they could be readily used or adapted for use in underground M/NM mines.

With the first 2007 on-road engines scheduled for release in early 2007, however, we now have a much clearer picture of the technologies that will be incorporated into these engines. The predominant technology will be DPM filters which incorporate some form of active regeneration to accommodate any duty cycle, ranging from constant high-speed over-the-road trucks to light duty delivery vehicles and pickup trucks and SUVs in stop-and-go traffic conditions. As noted later in this section of the preamble, we are confident that such filter technology is suitable for application in underground M/NM mines. Therefore, we expect appropriate 2007 on-road engines to be readily usable or adaptable for use in underground M/NM mining equipment. These engines will begin to become available in early 2007, with more and varied models becoming available in subsequent months and years.

In the future, we project that the number of miners who will need to wear respiratory protection will decrease as mine operators learn more about effectively selecting, retrofitting, and maintaining DPFs, as they begin to use EPA compliant 2007 on-road engines with integral DPFs, and as mine operators in remote locations are able to gain easier access to alternative fuels, primarily biodiesel.

1. MSHA's 2001 Assumptions Regarding Compliance With the Final Concentration Limit

We stated in the proposed rule that the assumptions that we used in 2001 in support of our cost estimates included: (a) Fifty percent of the fleet will have new engines (these new engines do not impact cost of the rule) * * * Moreover, due to EPA [Environmental Protection Agency] regulations, which will limit DPM emissions from engines used in surface construction, surface mining, and over-the-road trucks (the major markets for heavy duty diesel engines), the market for low tech ''dirtier'' engines will dry up * * *; (b) one hundred percent of the production equipment and about fifty percent of the support equipment will be equipped with filters; (c) about thirty percent of all equipment will need to be equipped with environmentally controlled cabs; (d) twenty three percent of the mines would need new ventilation systems (fans and motors); (e) forty percent of the mines will need new motors on these fans; and (f) thirty two percent of the mines will need major ventilation upgrades (66 FR 5889–90).

Furthermore, we concluded that it would not be feasible to require the metal and nonmetal sector, as a whole, to lower DPM concentrations further, or to implement the required controls more swiftly (66 FR 5888).

2. Reasons Why the 2001 Assumptions Were Questioned

Over the five years since the 2001 final rule was promulgated, both MSHA and the mining industry have gained considerable experience with the implementation, use, and cost of DPM control technology. We have reviewed this experience, and our own enforcement data, and other relevant information, and conclude that effective DPM controls sufficient to attain compliance with the DPM limits specified in this final rule will be feasible and commercially available to mine operators by May 2008. For example, in addition to currently available DPM controls such as environmental cabs with filtered breathing air, a variety of DPF systems, low-emission engines, upgraded ventilation, and alternative fuels, by May 2008, we believe mine operators will benefit from wider availability of alternative fuels, particularly biodiesel, improved filter technology, and the availability of EPA compliant 2007 on-road diesel engines and diesel powered equipment. As implementation issues are resolved, the most successful implementation strategies will be adopted by other mine operators, thereby speeding up compliance by the industry as a whole. For example, in 2004, we were aware of only one mine operator that was using a high biodiesel content fuel blend as a DPM compliance method. DPM levels measured in this mine were consistently greater than 200_{EC} μg/m^3 prior to the change to biodiesel fuel, compared to levels less than 100_{EC} μg/m^3 after the change-over. In the most recent enforcement sampling at this mine, all samples were less than 50_{EC} μg/m^3. By late 2005, we were aware of at least four other mine operators that had learned from this experience and adopted this compliance strategy. Another example is the recently developed Diesel Particulate Reactor™ (described later in this section of the preamble). This new technology has been successfully implemented by a large nonmetal mine operator. Reactors are currently installed on about 80% of the mine's fleet of roughly 50 pieces of diesel equipment with no installation, operation, or maintenance problems reported. These experiences demonstrate that even the more complex DPM control technologies can be successfully implemented by mine operators. As these successful experiences are shared throughout the mining industry, compliance by the underground M/NM mining industry as a whole by May 2008 will be greatly facilitated. The extended time specified in this final rule is necessary to address the implementation issues that the industry as a whole must overcome. However, as noted above, we believe these issues can be resolved within the extended compliance timeframes established in the final rule.

Several commenters quoted previous MSHA statements from the rulemaking record they believe support their position that the final DPM limit is technologically infeasible. A few quoted a passage from the 2005 final rule: ''MSHA acknowledges that the current DPM rulemaking record lacks sufficient feasibility documentation to justify lowering the DPM limit below 308_{EC} μg/m^3 at this time'' (70 FR 32916). However, these commenters did not include the statements that followed, which explained that we believed it was feasible for the industry as a whole to fully comply with the interim limit, but that at that time—June of 2005—attaining levels lower than 308_{EC} μg/m^3 was not feasible for the entire industry. In our 2005 NPRM, we indicated that a DPM limit lower than 308_{EC} μg/m^3 should not become effective before January 2007, at the earliest, due to concerns about implementation difficulties. It was our intention that mine operators would use the period of nearly 20 months from June 2005 through January 2007 and the subsequent phased-in timeframes proposed in the NPRM to overcome implementation challenges and attain compliance with the reduced limit.

Some commenters stated that any delay in the effective date for the final DPM limit was unjustified on either technological or economic grounds. A number of commenters said that our 2005 NPRM makes it clear that several technologies are available which, alone or in combination, would permit mines to meet the final limit. Doubts about whether all mines can do so in all operations, or doubts about whether current distribution networks for alternative fuels are as complete as may be necessary under the final rule, do not in these commenters' views detract from the conclusion that the final limit is feasible. According to these commenters, MSHA's search for certainty that all mines can comply at all times in all circumstances is a violation of its technology-forcing mandate. In response, the Mine Act does not mandate that MSHA standards must be technology-forcing.

Another commenter stated that no technological reason exists for granting industry an additional five years, on top of the five years they have already had, to install existing technology to protect workers.

Although technology currently exists for compliance with both the interim and final DPM limits, we conclude that implementation challenges and difficulties with this technology and the costs of implementing it in the M/NM mining industry affect feasibility. We have observed the difficult applications engineering challenges faced by a substantial number of mine operators in implementing these technologies. Consequently, these challenges have led us to determine that additional time is needed by the industry as a whole to feasibly meet the final limit.

Another passage that several commenters in opposition to the 2005 NPRM quoted, stated that:

> 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 (70 FR 53283).

Although we have evidence of successful applications of DPM controls in the rulemaking record and the proven effectiveness of various products, systems, and strategies for controlling DPM emissions and exposures, we believe that the implementation challenges presented by the industry warrant granting some additional time to attain full compliance with the final limit. We intend, however, for the mining industry to utilize this extra time to diligently move forward in achieving compliance with the final limits.

Some commenters quoted the decision of *Secretary of Labor* v. *Callanan Industries, Inc.* (Noise), 5 FMSHRC 1900, 1908 (1983)), which addresses feasibility of an individual mine operator to comply with an MSHA exposure-based health standard. These commenters concluded that based on the current existence of alternative fuels and DPFs, that no delay in the final limit was justified. However, as noted above, based on present implementation issues, we have determined that additional time is needed by the mining industry, as a whole, to meet the final limits.

Some other commenters stated that they do not believe there is a ''realistic basis in present technical capabilities,'' [quoting *Callanan*]. These commenters believe that there is not an adequate array of mine worthy, technically feasible solutions that are readily available for implementation in underground metal and nonmetal mines. They believe that their conclusion is confirmed by MSHA's statement in the 2005 NPRM that, ''effective control technology that will reduce exposures to the final limit is speculative at this time'' (70 FR 53285).

We find these arguments made by some commenters not persuasive, because in the 2005 NPRM, we acknowledged that full compliance with the final DPM limit by the industry as a whole by the original effective date of January 2006 was unlikely to be feasible. Over the past five years, we have been working with all members of the M/NM mining community affected by this final rule. We believe that the industry has made tremendous progress and will continue to work through these feasibility challenges and that it will be feasible for the industry to comply by the dates established in this final rule.

We continue to conclude, based on experience gained under the existing DPM rule, that the applications engineering required to adapt advanced DPM control devices and systems to new and existing mining equipment, to introduce alternative fuels, to train miners on their proper installation, operation, inspection, maintenance, and repair, and to integrate new methods and work practices into complex mining processes will take more time than we originally anticipated. However, we find one commenter's position that suitable DPM controls are not readily available to not be persuasive. The rulemaking record contains evidence that mine worthy control technology is available, and includes a number of examples of the successful implementation of such controls in all types of M/NM underground mines. The preamble to this final rule expands on those available technologies, indicating as we have suggested previously, that as demand for these technologies grows, manufacturers will respond by increasing the availability of feasible control systems for use at underground M/NM mines.

We know that, when properly implemented, DPFs, environmental cabs, alternative diesel fuels, ventilation, and modern low emission engines are effective engineering controls for reducing DPM exposures in underground M/NM mines. They have all been successfully implemented at numerous mining operations to comply with the current interim limit. We know that when properly implemented, various administrative and work practice controls can also effectively reduce DPM exposures. Effective control technology, however, cannot be successful if mine operators are not diligent in resolving their unique implementation issues. Implementation issues vary from mine to mine, and what accounts for some mine operators being successful while others have had only limited success attaining DPM compliance primarily depends on the particular choices of controls selected, and the corresponding implementation strategies employed. Clearly, it is easier and cheaper to obtain compliance at some mines than at other mines, due to factors such as mine size, mining conditions, the amount, type, and age of diesel equipment in use, height and width of roadways, grades that must be traversed, elevation of the workings, remoteness of the mine, and so on.

A commenter expressed the need for DPM controls that are, ''readily available for implementation in underground metal and nonmetal mines.'' Although we believe the rulemaking record supports the conclusion that the required DPM controls are commercially available, as noted above, the additional time offered by this final rule to meet the final limit is necessary for the mining community as a whole to implement these DPM controls.

A commenter observed that ''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 not often achievable.'' This commenter goes on to say ''Therefore, by implication, the compliance model used to estimate compliance feasibility, and costs in the PREA and FREA is suspect.''

Several other commenters also claimed that our technological feasibility determinations were based on predictions that retrofitting diesel equipment with exhaust filters would be the primary means of compliance, but that no such filters were commercially available at the time. We believe these commenters may not fully appreciate our position on technological feasibility in at least two key respects. First, we have never advised the industry that full compliance with either DPM limit would be a simple process of ''[putting] a filter on it.'' Rather, our feasibility determinations were based on the assumption that mine operators would choose the control or combination of controls that best suited the unique circumstances and conditions at their mine. In the preamble to the 2001 final rule (66 FR 5713), we said, ''the best actions for an individual operator to take to come into compliance with the interim and final concentration limits will depend upon an analysis of the unique conditions of the mine.'' In the same preamble (66 FR at 5859), we indicated that,

> The final rule contemplates that an operator of an underground metal or nonmetal mine have considerable discretion over the controls utilized to bring down dpm concentrations to the interim and final concentration limits. For example, an operator could filter the emissions from diesel-powered equipment, install cleaner-burning engines, increase ventilation, improve fleet management, use traffic controls, or use a variety of other readily available controls. A combination of several control measures, including both engineering controls and work practices, may be necessary, depending on site specific conditions.

We expected mine operators would have had less difficulty in appropriately selecting and experimenting with technology applications than we had observed at many mines. Also, we expected mine operators to be able to more effectively address their maintenance and regeneration issues with DPFs, and would have had better access to alternative fuels. Our experience revealed that many mine operators did not fully resolve all the complex implementation issues that were encountered. Some operators simply removed the controls instead of working through these implementation issues.

The other aspect of our position on technological feasibility that these commenters may not fully appreciate is our position on current technological feasibility versus feasibility at a future date. They have assumed that because we acknowledged that it was infeasible to meet the final limit by May 20, 2006, that it is also infeasible to meet the final limit at a future date as required in the final rule. Again, our position is that we believe that additional time will be required for certain key technologies to become sufficiently diffused and available, and that the industry as a whole will require additional time under this final rule to successfully implement the necessary controls to attain compliance with the final phased-in limits.

We believe it will be feasible for the industry as a whole to implement the required controls and attain compliance with the phased-in DPM limits within the timeframes established in the final rule. For example, biodiesel production in the U.S. will increase dramatically over the next two years, making it increasingly easier for mine operators to gain access to a reliable supply of this alternative fuel. Also, EPA compliant 2007 on-road diesel engines will begin to become available in early 2007, and their availability will grow in the months and years to follow. We believe that the industry as a whole will be capable of attaining compliance with the final limits using these and other existing DPM control methods. We also believe that industry-wide compliance within the timeframes established in the final rule will not require the development of new technologies.

We believe that the three-step phase-in approach for establishing the DPM limits and the wider use of alternative fuels, improved filter technology, and EPA compliant 2007 on-road engines along with other engineering and administrative controls, will enable the underground M/NM mining industry as a whole to resolve lingering implementation challenges and difficulties relating to the 160_{TC} µg/m³ final limit.

In our 2005 NPRM, we proposed that the final DPM limit be phased-in in five steps over a five-year period. The choice of five-years for the length of the phase-in period was based on our compliance assistance and enforcement experience that indicated that mine operators were encountering more significant implementation issues than originally anticipated. These issues affected a greater portion of the industry and presented greater challenges to resolve than we anticipated in the 2001 final rule. The five-year phase-in period was proposed based on the rate at which we observed these implementation issues being successfully addressed at that time by the industry as a whole. We believed this five-year timetable for phasing-in the final limit was reasonable, providing for feasible compliance by the industry as a whole while insuring substantial annual reductions in DPM exposure of miners. However, we asked for comments on whether this proposed five-year phase-in would be the appropriate timeframe for mine operators to attain the final DPM limit of 160_{TC} µg/m³. Some commenters provided information opposing the five-year phase-in, saying any delay was unjustified. Other commenters supported the five-year phase-in as an improvement from the original January 2006 deadline, but suggested that due to feasibility concerns, even more time would be needed to attain compliance. Other commenters have consistently maintained that controls sufficient to attain the final limit do not exist, so the timeframe for compliance is irrelevant. Other commenters provided information supporting a shorter phase-in of the final limit.

We now believe that the three step phase-in of the final limit over two years that is incorporated into this final rule is the most appropriate approach and phase-in time period that both provides for maximum protection of miners and is also technologically and economically feasible for the industry to achieve. This determination was based on our enforcement experience, the comments in the rulemaking record addressing feasibility, and other relevant technical information we have obtained since we issued the 2005 NPRM.

The key information that we relied on to reduce the timeframe from the originally proposed five-year phase-in of the final limit to the two-year phase-in incorporated into the final rule included wider availability of alternative fuels, particularly biodiesel, improved filter technology, and the impending availability of EPA compliant 2007 on-road diesel engines. As previously discussed, we were also encouraged by the accelerating rate at which effective DPM control technologies were being implemented by mine operators, for example, high temperature disposable diesel particulate filter (HTDPF) systems. We believed the development of these systems would fill a critical gap in available filter technology, as they are particularly well suited to filter the exhaust from small and mid-sized equipment having low to medium duty cycles that were not good candidates for passive regeneration filter systems, and on which mine operators did not wish to implement active filter systems. These systems demonstrated high filtration efficiency for EC, and did not increase NO_2 emissions. However, when used in underground M/NM mines, these systems were subject to filter element damage due to occasional high temperature exhaust exposures. We are now confident that these systems can be used successfully in mining applications if a heat exchanger is placed upstream from the filter element in the vehicle's exhaust system. We have recently learned that purpose-built heat exchangers are now commercially available, either as separate units that can be retrofitted to an existing HTDPF system or as an integrated unit that combines a heat exchanger with a filter.

Another example is the impending availability of EPA compliant 2007 on-road diesel engines. As noted earlier in this section, these engines must reduce DPM emissions by about 90% compared to current models, and also must meet strict NOX standards. As recently as the fall of 2005, we could not be certain these new engines would be fully compatible with underground M/NM mine operational and production requirements, duty cycles, and maintenance practices. With the introduction of EPA compliant 2007 on-road engines less than 8 months away, we are now aware that the predominant technology that will be used by the engine manufacturers to comply with these requirements will be DPFs with provision for continuous or automatic active filter regeneration regardless of equipment duty cycle. As noted later in this section of the preamble, we are confident such DPFs can be implemented by mine operators. These DPFs typically have very high EC filtration efficiency approaching 99% or more, and the method of filter regeneration eliminates implementation issues relating to whether a particular machine's duty cycle is sufficiently severe to enable passive regeneration and the perceived logistical complications associated with active on-board or active off-board filter regeneration.

These recent developments and technologies, along with increased utilization of the other engineering and administrative controls that we have discussed throughout the remaking record, such as environmental cabs with filtered breathing air, ventilation upgrades, and a host of administrative control options, will enable the underground M/NM mining industry as a whole to resolve lingering implementation challenges and difficulties relating to compliance with the 160_{TC} µg/m^3 final limit by May 2008. We are confident compliance under the final rule can be attained by most mines regardless of size or the commodity produced, because none of these technologies are mine size or commodity dependent.

Regarding biodiesel, the National Biodiesel Board noted in their comments that the domestic annual production capacity of biodiesel fuel would increase by at least 100 million gallons between May 2005 and May 2006. Based on production statistics released on November 8, 2005 by the National Biodiesel Board (*http://www.nbb.org/resources/pressreleases/gen/20051108_ productionvolumes 05nr.pdf*) we also learned that biodiesel production and consumption in the United States grew 300% in one year, from 25 million gallons per year in 2004 to an estimated 75 million gallons per year by the end of 2005. Biodiesel plants currently under construction will add 329 million gallons of annual production capacity (*http://www.nbb.org/buyingbiodiesel/producers_marketers/ProducersMap-Construction.pdf*), and plants in the pre-construction phase will add another 518 million gallons of annual production capacity (*http://www.nbb.org/buyingbiodiesel/producers_marketers/ProducersMap-Pre-Construction.pdf*). Much of this added production capacity is expected to be on-line by 2008, and some of these plants are being, or will be built in areas of the country that are currently underserved by biodiesel production facilities, such as Wyoming, Montana, Washington, California, Colorado, and Texas in the west, and Tennessee, Kentucky, Pennsylvania, Virginia, North Carolina, and New York in the east. This expected increased availability of biodiesel fuel by 2008 supports our decision to phase-in the final DPM limits in three steps from 308_{EC} µg/m^3 in May 2006 to 350_{TC} µg/m^3 in January 2007 to 160_{TC} µg/m^3 in May 2008.

Increased use of these fuels is consistent with and in support of recent U.S. initiatives towards greater energy independence. On October 22, 2004, President Bush approved a tax credit for blenders of biodiesel as part of H.R. 4520, also known as the American Jobs Creation Act of 2004 (Pub. L. 108–357). The tax credit for biodiesel produced from agricultural feedstocks is equal to $0.01 per gallon per percentage biodiesel in the blended product, essentially erasing the price difference between biodiesel and standard petroleum-based diesel fuel. In the late summer and fall of 2005 and again in the spring of 2006, due to price swings in the market, the net cost of biodiesel, when the tax credit is applied, was less than the cost of standard #2 diesel fuel in many parts of the country. As noted in more detail later in this section of the preamble, biodiesel consumption is expected to grow as more product is produced, as its availability increases in presently underserved parts of the country, and as the price gap between biodiesel and standard diesel closes, or as has recently occurred, when biodiesel becomes cheaper than standard diesel.

Retrofit options for self-cleaning DPFs should increase as the manufacturers of these filter systems become assured of a reliable market both in underground mining and on diesel-powered equipment intended for surface applications. In addition, two manufacturers of synthetic high temperature disposable filters have updated their specification sheets (discussed further in this section) to advise mine operators of the exhaust gas temperature limitations when using these filters. In order to meet these exhaust gas temperature limits, mine operators can purchase commercially available heat exchanger systems that can lower the exhaust gas temperature before contact with the filter. This can allow application of this type filter to be expanded to a wider variety of machines, especially ones that have low to medium duty cycle.

The more stringent EPA 2007 on-road exhaust emission standards (*http://yosemite.epa. gov/opa/admpress.nsf/b1ab9f485b098972852562e7004dc686/f20d2478833ea3bd85256e91004d8f90?OpenDocument*) that begin in 2007 for on-road diesel engines (*http://www.epa.gov/otaq/diesel.htm*) will lead to an additional 90 percent reduction in particulate emissions when fully implemented. In addition, the EPA is mandating a reduction of the sulfur content of diesel fuel to no more than 15 ppm beginning in mid year of 2006 for on highway diesel engines and 2010 for nonroad diesel engines. Use of this fuel will enable advanced DPM control technology that would otherwise have been inhibited by the use of higher sulfur content fuel. Note that biodiesel fuel already meets this 15 ppm sulfur content requirement. Use of newer equipment with cleaner engines will also increase as older equipment is retired from service.

We anticipate that the three-step two year phased-in approach to establishing the final DPM limit that is incorporated in this final rule will provide the needed time to resolve the logistical, operational, and market-based factors that make implementation of the final limit infeasible at this time for the industry as a whole. In addition, this delay may decrease our 2001 projection of the cost of compliance with the rule. During this phase-in, we will continue to work with the Diesel Partnership (discussed below) and the mining industry to help facilitate resolution of DPF selection and implementation problems for the diverse metal and nonmetal mining environment.

3. Diversity of Underground Mines Affected by the 2001 Final DPM Concentration Limit

The M/NM mining industry has approximately 168 underground mines that use numerous pieces of diesel powered equipment, widely distributed throughout each mining operation. These mines employ an array of mining methods to produce commodities including metals such as lead, zinc, platinum, gold, silver, etc. Also, there are different types of nonmetal mines that produce stone products such as limestone, dolomite, sandstone, and marble. Other underground nonmetal mines produce clay, potash, trona, and salt. Not only do these mines vary in the commodities that they produce, but they also use different mine designs and mining techniques such as room and pillar mining and stope mining. Some of these mines are large, complex multilevel mines, while others are small adit-type mines.

Ventilation levels in these mines also vary widely. Many limestone mines have only natural ventilation with variable air movement, whereas trona mines have high ventilation rates to dilute and remove methane gas released during the mining process. There are also deep metal mines with multiple levels that have far less ventilation than that found in underground trona mines. Furthermore, many metal and nonmetal mines are located in remote areas of the country, at high altitudes, or are subject to extremely hot or cold environments.

Considering these factors as a whole, we have found that there is no *single* control technology that would be suitable and effective for all M/NM mines in significantly reducing current DPM levels to or below the 2001 final DPM concentration limit of 160_{TC} µg/m³ by May 2006.

4. Work of the M/NM Diesel Partnership (The Partnership)

Since promulgation of the 2005 final rule, the Partnership has been engaged in on-going NIOSH diesel research. One project involves a contract issued to Johnson Matthey Catalyst to develop a system to control nitrogen dioxide (NO_2) emissions from diesel-powered underground mining vehicles equipped with Johnson Matthey's Continuously Regenerating Trap (CRT®) system. This system promotes regeneration at lower temperatures and is widely used in urban bus applications. If the results of laboratory evaluations show that a system is suitable for use in underground mining, NIOSH would continue studying this control technology with a long-term field evaluation in an underground mine. The M/NM Diesel Partnership is continuing to investigate this and other DPF applications.

5. Remaining Technological Feasibility Issues

In January 2001, we concluded that technology existed to accurately sample for DPM with a TC method and to reduce DPM levels to the 160_{TC} µg/m³ limit by January 2006 (66 FR 5889). In June 2005, we concluded that it was technologically feasible to reduce M/NM underground miners' exposures to the interim PEL of 308_{EC} µg/m³ by using available engineering control technology and various administrative control methods. However, we acknowledged that compliance difficulties may be encountered at some mines due to implementation issues and the cost of purchasing and installing certain types of controls. Specifically, we indicated that implementation issues may adversely affect the use of DPFs to reduce exposures despite the results reported in NIOSH's Phase I Isozone Study.

A number of commenters expressed the view that our enforcement sampling experience demonstrates that both the interim DPM limit, and especially the final DPM limit are technologically infeasible. Some of these commenters stated that our sampling data published in our June final rule and on our web site demonstrates that 90% or more of the regulated industry cannot comply with the January 19, 2006 limit of 160_{TC} µg/m³.

We have carefully examined these comments, the data in the June final rule, and our more recent enforcement sampling data. We note first that the commenters were not questioning the validity of the sampling method or whether our sampling data are complete and representative. Our sampling and analytical methods have been validated by NIOSH, and our longstanding sampling strategy that focuses on miners we believe will experience the greatest exposures is fully consistent with good industrial hygiene practice. Second, in evaluating the sampling data we recognize that current DPM levels at many mines exceed the final limit. In the 2005 NPRM, we pointed out that, ''* * * in 2002 and 2003, we found that over 75% of the underground mines covered by the 2001 final rule have levels that would exceed the final concentration limit of 160_{TC} µg/m³.'' We are encouraged, nevertheless, that DPM levels across the industry have been steadily and significantly reduced from the levels observed prior to the promulgation of the 2001 rule, and they are continuing to go down. As we stated in the 2005 NPRM (70 FR 53283), DPM exposures in affected mines have declined from a mean of 808 DPM µg/m³ (646_{TC} µg/m³ equivalent) prior to the implementation of the standard, to a mean of 233_{TC} µg/m³ based on current enforcement sampling. During the time period from November 1, 2003 to January 31, 2006, 1798 valid personal compliance samples from all mines covered by the regulation were collected. From these samples collected, 18% of samples exceeded the 308_{EC} µg/m³ interim limit, and 64% exceeded the 160_{TC} µg/m³ final limit. The fact that 64% of the enforcement samples collected from November 1, 2003 to January 31, 2006 are above 160TC µg/m³ does not establish infeasibility of the standard. We expect that overexposures will continue to decline as operators install new equipment, address implementation issues with DPFs, make use of biodiesel fuel, and install cleaner engines. Thus by May 2008, we would expect operators to achieve full compliance.

Our experience reveals that little progress was made in reducing DPM levels across the industry until the interim DPM limit became effective. Once the interim limit became effective, mine operators implemented the controls they believed were necessary to attain compliance. Based on our experience with other health standards, we would not have expected the industry as a whole to have achieved compliance with the final limit before the compliance deadline. Further, as discussed throughout this section of the preamble, we believe sufficient technologically feasible DPM controls exist for the industry as a whole to comply with the final DPM limit within the prescribed regulatory timeframe in this final rule.

Commenters, acknowledging that some DPM levels at some mines currently exceed both the interim and final DPM limits, indicated that the existence of such overexposures was the primary justification for the rule. These commenters observed that the rulemaking process is long, cumbersome and costly and that there ''would be little point in invoking it to require the industry to do something it is already doing on its own.''

These commenters continued, ''It is settled law that MSHA 'can impose a standard which only the most technologically advanced [mines] have been able to achieve even if only in some of their operations some of the time.' '' *United Steelworkers,* 647 F.2d at 1264.

We realize that some commenters will disagree with our decision not to presently implement the final limit. However, we have carefully reviewed all comments and data and believe that a number of mines have made good faith attempts to implement control technology but need more time to make such technology work. It is not our intent to have a majority of the mining industry apply for special extensions, or for a significant number of miners to be overexposed to DPM and have to wear respirators. We stated in the 2005 NPRM that a significant number of overexposures may:

> * * * lead to another problem by requiring a large number of miners to wear respirators until feasible controls are fully implemented. We have never had a standard that resulted in a significant percentage of the workforce being required to wear respiratory protection, and we are concerned about the impact on worker acceptance of the rule and about mine operators' ability to remain productive. 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 (70 FR 53285)

The commenters that referenced the OSHA *Lead* decision also presented the results of an extensive analysis of our DPM sampling and enforcement actions at 11 selected mines. According to these commenters, these data show that we are not adequately enforcing the interim DPM limit because there were 56 sample results that exceeded the interim DPM limit, but we issued only 24 DPM citations. These commenters further assert that our failure to enforce the interim limit provides encouragement for mine operators who have delayed the implementation of controls that are necessary to attain both the interim and final DPM limit.

These commenters did not provide information that indicated which mines were included in the commenter's analysis. However, assuming the commenters' numbers are accurate, there are three plausible reasons for the discrepancy between the number of samples exceeding the enforceable limit and the number of citations. First, the commenters indicate that the data for their analysis were gathered from the MSHA Data Retrieval System, which can be accessed from a link on the MSHA internet home page. The DPM sampling data contained in this database includes DPM samples obtained by our inspectors during the ''baseline'' sampling period prior to July 20, 2003. In accordance with provisions of the Second Partial Settlement Agreement, samples that exceeded the enforceable limit during the baseline sampling period were not subject to citation as long as the subject mine operator was exercising good faith efforts toward developing a DPM compliance strategy. Thus, the Data Retrieval System includes numerous overexposure sample results that were not citable because they pre-dated our full enforcement of the interim limit.

Second, our enforcement policy for DPM, which is posted on our M/NM DPM Single Source page, identifies certain situations where a normally citable overexposure to DPM will not prompt a citation. In one case, a citation will not be issued if the mine operator can demonstrate that controls that would normally be effective in attaining compliance with the limit have been ordered, and the affected miner is wearing a suitable respirator in the context of a compliant respiratory protection program. This situation is covered in question 24 in the enforcement policy:

> 24. If MSHA finds a miner overexposed to DPM and I have a valid purchase order for controls that have not been delivered to my mine site, will I be cited for a violation? No. If you can demonstrate to MSHA, through appropriate documentation such as purchase orders, that you are making reasonable progress toward implementing feasible engineering and/or administrative controls that have a reasonable likelihood of achieving compliance with the interim DPM limit within a reasonable timeframe, and you have implemented a respiratory protection program meeting the requirements of ANSI Z88.2–1969 that covers all affected miners, MSHA will not conduct compliance sampling of affected miners at that time. The inspector will return to the mine to verify that adequate progress is being made toward full implementation of controls and/or to conduct DPM sampling based on the completion timeframe established by the mine operator.

In the other case, if the mine operator has fully implemented all feasible engineering and administrative controls and the affected miner is wearing a suitable respirator in the context of a compliant respiratory protection program, no citation will be issued even if an exposure exceeding the limit is measured. This situation is covered in question 29 in the enforcement policy:

> 29. How will MSHA determine if a citation is warranted when evaluating whether I have implemented all feasible controls? Once you use and maintain all feasible engineering and administrative controls to reduce a miner's exposure, implement the required respiratory protection program and require the miner to use a respirator, you will be in compliance with § 57.5060(a), even though a miner's DPM exposure may continue to exceed the limit and a citation will not be issued. Keep in mind that feasibility is an MSHA determination. If the agency finds that you failed to install, use and maintain all feasible controls, or you failed to establish an appropriate respiratory protection program, you will be out of compliance.

Third, some samples that exceed the interim DPM limit may be resamples of previously cited overexposures. Our enforcement sampling practice requires that after an overexposure is cited, the mine operator is given the opportunity to implement engineering and/or administrative controls to reduce the subject miner's exposure to or below the enforceable limit. Once these steps have been taken, we resample the miner to confirm that controls have been successful in lowering the miner's exposure to or below the limit. On occasion, the resample is still over the limit, in which case, if the operator has made good faith efforts to apply normally effective controls, the citation will be extended so that additional controls can be implemented, followed by another resample.

Thus, due either to controls being on order, to issues relating to feasibility, or to resample that continues to exceed the DPM limit, and depending on other factors, we may not issue a citation even though a sample result represents a DPM overexposure. We intend to continue this enforcement practice under this final rule and will issue necessary compliance guidance.

Several commenters repeated earlier public comments regarding their views that previous technological and economic feasibility determinations are invalid because they were based partially on analyses conducted using a ''flawed'' computer simulation program. The economic feasibility issues are addressed latter in this section. The computer program in question, referred to as the DPM Estimator, is a Microsoft® Excel spreadsheet program that calculates the reduction in DPM concentration that can be obtained within an area of a mine by implementing individual, or combinations of engineering controls. This program was the subject of a Preprint published for the 1998 Society of Mining Engineers Annual Meeting

(Preprint 98–146, March 1998), and it was fully described in a peer reviewed article in a professional journal (Haney and Saseen, Mining Engineering, April 2000). Its algorithm is accurate, and we have not received comments that challenged the mathematical basis for its calculation.

Although this program was criticized as ''flawed'' by several commenters, few specific errors in the design or utilization of the program were offered. One commenter indicated that the

> * * * computer model was based on invalid assumptions of the availability of filters that would fit the entire fleet of equipment in use, and assumptions of perfect ventilation conditions throughout the industry.

This commenter continues,

> * * * no such filters were available commercially at the time of the MSHA prediction, nor when the 2001 rule was published, nor had any undergone testing.''

Regarding the issue of ventilation, this commenter stated that,

> * * * 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.

This same commenter goes on to say that our technological feasibility determinations for all of our DPM rulemakings, from the original 2001 final rule to this rulemaking, are invalid because they are founded on analytical results obtained from the Estimator.

We have responded previously to both of these comments, and to many other criticisms of the Estimator. Regarding the availability of DPFs, we must emphasize that our DPM rules have always been performance oriented, and that mine operators have been given wide latitude to select DPM controls that were best suited to their unique circumstances and conditions. Neither the original 2001 rule nor this current final rule requires DPFs as the exclusive means of compliance with the DPM limit. The Estimator contains provisions for estimating the effect of applying DPFs, ventilation upgrades, low DPM engines, and other DPM controls on DPM levels in an area of a mine. At the time that we promulgated our 2001 final rule, however, we acknowledged our limited in-mine documentation on implementation of DPM control technology with issues such as retrofitting and regeneration of filters. Consequently, we committed to continue to consult with NIOSH, industry and labor representatives on the availability of practical mine worthy filter technology.

Regarding the same commenter's concerns that ventilation issues were handled inappropriately in the 31 Mine Study, we believe the commenter used the term ''perfect ventilation,'' when they may have meant perfect mixing of ventilation airflows. ''Perfect ventilation'' is a term with which we are unfamiliar. We have never used this term in this or any other rulemaking, and are unfamiliar with it in the context of mine ventilation engineering. ''Perfect mixing,'' in the context of ventilation systems, is a common technical term that refers to an idealized process in which two or more airflows of dissimilar composition join, and in which the composition of the composite airflow is an instant and homogonous mix of the input airflows. The issue of perfect mixing was raised by one of the same commenters in their public comments on the August 14, 2003 proposed rule on the interim DPM limit, and we responded in detail to these comments in the preamble to the 2005 final rule (70 FR 32920–32921).

The commenters believe that the Estimator's computations of DPM concentrations are valid only if engine emissions are perfectly mixed with the air flow, which they suggest does not occur in an actual mine. As discussed in the 2005 final rule preamble, these commenters make an erroneous assumption with respect to our utilization of the Estimator. The Estimator actually incorporates two independent means of calculating DPM levels: one based on DPM sampling data for the subject mine, and one based on the absence of such sampling data. Where no sampling data exist, the Estimator calculates DPM levels based on a straightforward mathematical ratio of DPM emitted from the tailpipe (or DPF, in the case of filtered exhaust) per volume of ventilation air flow over that piece of equipment. This is referred to in the Estimator as the ''Column B'' option for calculating DPM concentrations. The commenters'' observation that the Estimator fails to account for imperfect mixing between DPM emissions and ventilating air flows is a valid criticism of the ''Column B'' option. For this and other reasons, the Estimator's instructions urge users to utilize the ''Column A'' option whenever sampling data are available.

In the ''Column A'' option, the Estimator's calculations are ''calibrated'' to actual sampling data. Whatever complex mixing between DPM emissions and ventilating air flows existed when DPM samples were obtained, are assumed to prevail after implementation of a DPM control. This is an entirely reasonable assumption, and in fact, there is no engineering basis to assume otherwise. Indeed, comparisons of ''Column A'' Estimator calculations and actual DPM measurements taken in mines before and after implementation of DPM controls have shown good agreement, indicating that Estimator calculations do adequately incorporate consideration for complex mixing of DPM and air flows when the ''Column A'' option is used.

The Estimator was originally developed with both the Column A and Column B options because at the time it was developed (1997), the specialized equipment required for reliable and accurate in-mine DPM sampling, such as the submicron impactor, was not widely available. Consequently, few mine operators were able to obtain the in-mine DPM sample data required for utilizing the Column A option. Though mine operators may continue to use the Estimator, we rely more on our in-mine documentation and enforcement experience on the feasibility of DPFs.

This background and detailed explanation on perfect mixing was provided in the preamble to the 2005 final rule (70 FR 32920). However, the comments we received on this subject for the instant rulemaking do not acknowledge or respond to the background and explanation we provided in the earlier preamble. The commenters simply restate their previous assertion that the Estimator is flawed because it assumes perfect ventilation, which as noted above, we believe was meant to refer to perfect mixing.

As we have maintained throughout this rulemaking, mine operators should determine the control or combination of controls that will be best suited to their mine-specific circumstances and conditions, and that controls need to be evaluated, selected, and implemented on a case-by-case and application-by-application basis. Nonetheless, based on our experience, observations, and the comments received from mine operators, we believe to attain the final DPM limit, many mine operators that are not yet using DPFs will have to start using them, and most mine operators that are already using DPFs to attain the interim limit will have to continue or increase their use to attain the final limit. The mining industry maintains that while some operators are using DPFs to control miners' exposures to the interim PEL, it is infeasible for them to further reduce miners' exposures through expanded use of DPFs. However, we maintain that feasibility difficulties encountered with the use of DPFs can be resolved within the prescribed timeframe offered in this final rule, and that the greatest impediment to more widespread use of DPFs throughout the industry is the need to overcome implementation challenges and difficulties relating to specific pieces of mining equipment. For example, as the final limits become effective, some mines that were possibly using one or two DPFs on large horsepower haul trucks may have to install more DPF systems on other types of machines, such as loaders or support and utility equipment, in order to attain the final limit.

As discussed extensively throughout the rulemaking record and as we explained in detail in the 2005 NPRM, mine operators continue to prefer passive DPF regeneration systems over active regeneration systems. Passive regeneration is the process where the temperature of the exhaust gas produced by the engine is sufficiently high for a sufficient percentage of the working shift to burn off the collected DPM on the DPF. In order for passive regeneration to be a viable option, filter regeneration has to occur frequently enough to prevent the DPM that accumulates in the filter from causing backpressure on the engine that exceeds the engine manufacturer's backpressure specification. Passive regeneration is normally preferred by mine operators because the DPF will regenerate in the normal course of equipment operation, with no interruption to mine production activities and no equipment downtime required for filter regeneration. Also, passive regeneration occurs without the need for intervention by the equipment operator, and it does not require any special external equipment or facilities. However, many pieces of mining equipment do not have engine duty cycles that will presently support consistent passive regeneration. This problem will take more time for individual mine operators to resolve.

If a passive DPF loads up with DPM, but the exhaust temperature is not sufficient to ignite and burn off the accumulated DPM, the backpressure on the engine will increase. Prolonged engine operation in excess of the manufacturer's backpressure specifications can cause engine and DPF damage. Therefore, it is strongly recommended that when passive regeneration DPF systems are installed, a means for the machine operator to monitor the engine's exhaust backpressure should be included. Such a provision is important even on equipment where the normal duty cycle easily supports passive regeneration. For example, if a piece of equipment on which a filter normally passively regenerates is used temporarily for some other activity having a less severe duty cycle, the filter may not passively regenerate, and backpressure could build up. Likewise, if the subject equipment experiences a maintenance related problem that causes an increase in the level of ''engine out'' DPM emissions, the rate of DPM buildup in the filter could exceed the capacity of the filter to passively regenerate. In such cases, excessive engine backpressure could build up in less than a working shift. If the equipment is provided with a means for monitoring backpressure, and the equipment operator observes engine backpressure rising to excessive levels, corrective action can be taken before engine or filter damage occurs. Successful implementation of passive DPF systems has been reported where the mine operators have determined that a machine has sufficient exhaust gas temperature for passive regeneration and exhaust backpressure is being monitored.

If passive regeneration is infeasible due to an insufficient duty cycle, active regeneration may be a feasible alternative. Active regeneration depends on an external heat source for burning off the DPM collected in a filter. Some mine operators commented that it is not feasible for them to utilize active regeneration due to the physical size of filters, machine downtime, and/or the cost associated with building and equipping underground regeneration stations required for active DPF regeneration. We disagree that these factors render active regenerating DPF systems infeasible. As discussed throughout the rulemaking record, and later in this section of the preamble, filter size and machine downtime issues relate to implementation challenges and difficulties which can impact feasibility of compliance with the final limits. We believe these factors can usually be effectively addressed through proper system selection and deployment, as described below, which take time to effect. We also believe the deployment of an active DPF system is economically feasible under the prescribed time frames for the final limit. Economic feasibility is discussed in detail later in this section in this preamble.

Engine emissions and exhaust flows affect the size of the DPF that needs to be installed. These factors are important considerations for both passive and active regeneration. If the DPF is undersized for a particular application due to high DPM emissions or high exhaust flows, a passive or active DPF system may become overloaded, requiring the filter to be removed from service for regeneration. If such an interruption occurred mid-shift, it would typically have a greater negative effect on production than if it occurred at the end of a shift. Active regeneration DPF systems are normally sized so that the filter has sufficient capacity for the host vehicle to operate over its normal duty cycle for at least a full shift or longer. In some cases, especially when a machine with an older, high emission engine needs to be filtered, a filter having sufficient capacity to allow for a full shift of machine operation may be too large to fit in the available space on the machine. For this reason, most DPF manufacturers do not recommend DPF installation on older high emission engines. Some mine operators who have faced this dilemma have opted to compromise by installing a smaller filter. The result is DPM overloading. DPM overloading leading to excessive backpressure on the engine is the main problem that mine operators experience when the DPF installation is not correct for the application and duty cycle. Possible feasible corrective actions include utilizing a larger DPF or a lower DPM emission engine, or both. As noted later in this section of the preamble, installation of a new, low-emission engine, in addition to facilitating use of a reasonably sized DPF, can cut DPM emissions by up to 90% or more, and their greater operating efficiencies can reduce maintenance costs and lower fuel usage by 10% to 15% compared to older technology high emission engines.

Regarding commenters' concern about the physical size of DPFs, if the DPF for a particular piece of equipment is too large to handle or too large to fit in the space available on the equipment, the exhaust could be divided into two branches fitted with smaller sized filters on each branch, or as noted above, the engine could be replaced by one with lower DPM emissions that can be effectively filtered by a correspondingly smaller DPF.

Since 2001, a number of older, high DPM emitting engines have been replaced with new, low DPM emitting engines, either through direct engine replacement into existing equipment or through the acquisition of new equipment, but not as many as we predicted in 2001. From our enforcement experience, we believe this has occurred in mostly the larger horsepower engines, greater than 150 hp, in production equipment. This equipment is typically turned over more frequently because it has more severe duty cycles, is worked harder, and typically has a shorter life than smaller, lower horsepower support equipment. High horsepower production equipment also typically accounts for the greatest proportion of DPM produced in the mine, so replacing these engines was the highest priority at most mines. Thus, the smaller engines normally found in support equipment often have older engines with higher DPM emissions per horsepower than the newer and larger production equipment.

We estimated in the 2001 final rule that 50% of the support equipment would probably need DPFs for compliance with the final limit (66 FR 5889–90). The higher DPM emissions from these engines, however, can complicate the expanded use of DPFs on this equipment. It is our belief that the mining industry will need additional time to further evaluate the proper sizing of both passive and active regeneration DPF systems on this equipment. Consequently, we expect the implementation issues relating to DPFs, particularly the selection of appropriate DPFs for a given application, regeneration issues, filter maintenance, etc. may extend over a larger portion of the mining industry as operators work toward compliance with the final limit.

Although we believe these implementation issues are sufficient to warrant the additional time offered in this final rule, we are nonetheless confident these issues can be effectively resolved within the compliance timeframes established in the final rule. For example, EPA compliant 2007 on-road engines will be provided with engine manufacturer supplied DPF systems that will regenerate continuously or automatically regardless of duty cycle, thereby greatly reducing implementation issues for the owner. Another example is the HTDPF with integral heat exchanger. This recently commercialized technology will enable filtering the exhaust from small to mid-size equipment with low to medium duty cycles. In addition to these and other new developments, competitive pressures will force the manufacturers of existing DPF systems to make incremental product improvements over time.

Note that high engine exhaust temperatures are an implementation issue only for disposal particulate filter element type DPFs. Ceramic and metallic filter element type DPFs can tolerate the normal range of exhaust temperatures from any diesel engine. In fact, passive regenerating DPFs depend on high exhaust temperatures to initiate the regeneration process. Where high exhaust temperatures could potentially occur, but where the user wishes to implement a disposal particulate filter element system, the use of a heat exchanger upstream from the filter element is required to lower the exhaust gas temperature and prevent filter element damage. For ceramic and metallic filter element type DPFs, heat exchangers are neither required nor desired.

Several commenters stated that we admitted to implementation problems with DPF systems in the preamble to the proposed rule. We agree with these commenters that we did express concerns about implementation issues with DPFs, and that these concerns, along with concerns about implementation issues with other DPM engineering controls led to our decision to propose delaying the effective date of the final limit of 160_{TC} µg/m^3 until January 2011. We continue to believe that a delay to the effective date for the final limit is necessary due to feasibility considerations. However, as we explained earlier in this section of the preamble, based on our enforcement experience and comments and other data in the rulemaking record addressing feasibility since we issued the 2005 NPRM, we have subsequently determined that delaying the final limit until 2011 is not justified. Primarily due to wider availability of alternative fuels, particularly biodiesel, improved filter technology, and the impending availability of EPA compliant 2007 on-road diesel engines, we believe the rulemaking record supports the three step phase-in of the final limit over two years, with the final limit of 160_{TC} µg/m^3 becoming effective in May 2008. This is the approach that is incorporated into this final rule, and we believe it provides for the maximum protection of miners that is technologically and economically feasible for the industry to achieve.

As discussed earlier in this section of the preamble, recent developments in the three key areas of biodiesel, improved filters, and EPA compliant 2007 engines, along with the application of a variety of other existing DPM controls, will enable compliance by the industry as a whole significantly sooner than was proposed in the September 2005 NPRM. Biodiesel, improved filters, and EPA compliant 2007 engines can be used by any size mine producing any M/NM commodity, and these technologies are not subject to many of the difficult implementation issues that have slowed the adoption of some DPM controls. For example, biodiesel can be used in any diesel engine with elastomeric fuel system components that are biodiesel compatible, and any non-compatible components can be easily replaced. No other engine or equipment modifications of any kind are required. Improved diesel particulate filters are commercially available for retrofit to any size diesel engine, and systems like the HTDPF and diesel particulate Reactor™ are particularly well suited to installation on small and medium sized production and support equipment that had been problematic for some mine operators. No implementation issues in regards to selection of the DPF media, sizing, or regeneration type are expected for EPA compliant 2007 on-road engines. As discussed previously in this section, the engine will have a DPF installed in the vehicle when purchased by the mine operator.

DPF systems are a more effective control technology for reducing EC than TC. In order to comply with the final limit, we expected that most mine operators would need to add to the DPM controls they had previously implemented for compliance with the interim limit. We also anticipated that many mine operators that had successfully attained compliance with the interim limit without DPFs would need to utilize DPFs to obtain compliance with the final limit.

We acknowledged in previous preambles that DPFs may not be the optimal solution for all machines, especially machines equipped with dirtier engines. But we have also advised that machines with older, dirtier engines should be replaced or re-powered with cleaner engines, and then if necessary, be equipped with DPF systems.

We continue to emphasize to the mining industry to utilize our DPM Single Source Page to obtain information to assist with installation of DPF systems. This information stresses that DPFs require the engine to be maintained through a good maintenance program and to monitor the exhaust backpressure in order to prevent the DPF system from becoming overloaded with DPM. Minimizing these problems can help prevent premature DPF or engine failure, which affect feasibility.

NIOSH commented that

> Although adverse health effects occur at the proposed concentration limits and below, NIOSH recognizes that all factors, including technical and economic feasibility must be considered by MSHA in developing an exposure standard. NIOSH is aware of the 'implementation and operational difficulties' currently facing the metal and nonmetal mining industry presented in MSHA's preamble, Section IV. Technological Feasibility (page 53282). A phase-in period may provide time to resolve such issues. Requiring control technologies before mine operators have had sufficient time to work through selection and implementation problems may create hazards and adverse health effects, such as the elevated levels of NO2 experienced when some PT-catalyzed

diesel particulate filters (DPFs) have been used in poorly or marginally ventilated areas.

NIOSH also recognizes that the mines covered by this proposed standard have unique designs and operational differences presenting unique challenges in controlling and reducing diesel emissions. For some metal and nonmetal mines, targeted reductions in exposures of underground miners to DPM below the 400 μg/m³ TC or 308 μg/m³ elemental carbon (EC) current limit may be achieved only through implementation of complex, integrated strategies and state-of-the-art control technologies.

The first steps to control diesel emissions are fundamental changes to improve mine ventilation and diesel engine maintenance practices, along with the introduction of cleaner engines or the use of alternative fuels, such as biodiesel, when practical. When these are insufficient to achieve compliance, more advanced diesel emission control technologies, such as DPF systems, may be necessary to achieve compliance.

We have considered the technological and economic feasibility of achieving the final limits specified in this final rule as discussed throughout this preamble. The three step phase-in approach allows mine operators more time to work towards implementation of DPM control technologies. We agree with NIOSH that the first steps that the mine operators took to lower DPM levels were changes to engines, maintenance practices, ventilation systems, and to a lesser extent, alternative fuels. As we have discussed in this preamble, these efforts have lowered miners' exposure to DPM as our enforcement sampling has shown.

Even though NIOSH refers to DPFs as ''more advanced diesel emission control technologies,'' some mines have already implemented DPFs in order to comply with the interim standard. These same mines will most likely continue using DPFs, plus add additional DPFs or other DPM controls such as biodiesel, to meet the final limits. However, we agree that the final limits will require a larger segment of the mining industry to implement DPFs and alternative fuels. We agree that underground metal and nonmetal mines present unique designs and operational differences which affect the application of DPM controls. This three step phase-in approach provides the time for mine operators to learn more about advanced control technologies with regards to implementation issues.

NIOSH further referenced a June 25, 2003 letter to the Assistant Secretary from Dr. John Howard, Director, NIOSH, relating to DPFs. NIOSH stated that although DPFs ''* * * are commercially available, the successful application of these systems is predicated on solving technical and operational issues associated with the circumstances unique to each mine.'' This three step phase-in of the final limits will provide the necessary time for mine operators to overcome these technical and operational issues, since we believe that DPFs are now more readily available and DPF implementation issues can be resolved.

This commenter also agreed with us that mine ventilation, maintenance, cleaner engines or use of alternative fuels, such as biodiesel were effective DPM control measures. However, the commenter stated that when these methods are insufficient to achieve compliance, more advanced control technologies would be needed, such as DPF systems. Gaining extensive experience with implementation and operation of DPF systems on production vehicles would greatly assist in resolving some of these issues. The commenter further stated that to ensure success of the phase-in period, individual mine operators or a consortium of mine operators or other partnerships should have compliance plans detailing their integrated approach to reducing DPM levels in terms of maintenance, ventilation, fuels, control technologies, retrofitting, and monitoring.

We agree with the commenter that the final limit does require mine operators to continue implementing the current controls needed to meet the interim concentration limit, however, in order to meet the final limit, more controls may need to be implemented. If DPF systems are needed, then the mine operator will need to continue work to properly install and maintain DPF systems to manufacturers' specifications.

Some commenters referred to the NIOSH Phase I and II studies, stating that they were successful in showing that the DPM controls, especially DPF systems, work in reducing DPM. However, these commenters believed that NIOSH did not provide reliable data to indicate that the selected filter technology would provide the necessary reductions of DPM in actual mining applications. We responded to the NIOSH Phase I and II studies in the 2005 final rule. We noted the successful DPM reductions that were achieved from the DPM controls, especially DPF, in the Isozone study of Phase I. We further reviewed the work done by NIOSH in the production area of the mine in Phase II. We maintain as we did in the preamble to the 2005 final rule that ''the Phase II study helped to confirm existing agency data that shows that it is technologically feasible to reduce miners' exposures to DPM to 308 μg/m³ interim PEL.'' (70 FR 32928) The NIOSH work confirmed that DPFs can reduce DPM to MSHA's DPM limits. As stated previously, as the final limit is reduced over the time frame specified in this final rule, the mine operator can implement additional DPF systems (or other DPM control technologies) to further reduce the DPM exposure. The NIOSH Phase II study and MSHA's Greens Creek study as discussed in the June 6 preamble (70 FR 32928—32929) showed reductions in EC.

The same commenters stated that the Phase II study showed that the efficiencies of the DPF did not always agree with laboratory studies. However, the commenters failed to acknowledge that the comment was directed towards the DPF systems performing better than laboratory data, especially for EC reductions. We highlighted this finding from NIOSH's Phase II study in the preamble to our 2005 final rule (70 FR 32928).

Several commenters continued to state concerns with the use of catalyzed ceramic DPF systems due to increased NO_2 levels. We discussed this issue thoroughly in the preamble to the 2005 final rule (70 FR 32928–32929). We concluded then, and we believe the evidence is still persuasive, that the NO_2 issues discussed in the NIOSH Phase II studies were related to deficient ventilation in the areas where the testing occurred. The results of the Greens Creek study, which also evaluated heavily platinum catalyzed DPFs, showed a possible rise in NO_2; however the small increase detected made it unclear as to the cause (preamble to the 2005 final rule, (70 FR 32884 and 32921)). Even if the NO_2 increases at Greens Creek were caused entirely by the catalyzed DPFs, the rise, which was about 1 ppm downstream from stopping operations involving one loader and two or three haulage trucks totaling over 1,000 horsepower, was manageable due to effective auxiliary ventilation. We continue to acknowledge that highly catalyzed platinum ceramic DPFs have the potential to generate higher levels of NO_2 than the baseline emissions from the subject diesel engine. However, when such DPFs are used in conjunction with proper ventilation, NO_2 has not increased to hazardous levels. As discussed previously in this section, NIOSH commented that increased NO_2 levels occurred in poorly or marginally ventilated areas with the use of some catalyzed DPFs.

Several commenters agree that progress has been made with the application of ceramic DPF systems that regenerate passively on larger horsepower production machines. The DPF systems have been shown to be highly efficient in collecting DPM and mine operators have reported that they do passively regenerate on the larger horsepower, production machines. The production machines operate at a heavy duty cycle that corresponds to high exhaust gas temperatures for a sufficient portion of the shift. This allows the DPF to regenerate passively and burn off the collected DPM, thus keeping the DPF below the engine manufacturers' maximum allowable exhaust backpressure.

One mine operator provided a list of their DPF systems that have been in operation up to 9000 hours. The DPF systems were supplied by two different DPF manufacturers, but were both designed for passive regeneration. This commenter stated that 13 of their 17 haul trucks were equipped with passive regeneration DPFs and they are currently evaluating 4 more units on their haul trucks. According to the information submitted by this commenter, they have plans for installation of DPFs on 6 of their loaders. The commenter stated that the process of achieving DPF reliability has been arduous, and required much discussion and work with the DPF manufacturer.

Another mine operator also stated that 32 passive regeneration DPF systems have been installed with an average life of the DPF system from 3000–4000 hours. The operator stated that the success has been with haul trucks and they are working on evaluating the installation of this type DPF on LHD's.

Yet another mine reported installing four passive DPF systems on machines and the exhaust backpressure quickly exceeded the manufacturer's specification for exhaust backpressure. The commenter stated that the DPF would not passively regenerate, requiring the mine to remove them for cleaning.

The experiences described by these three mine operators continue to show that DPF system selection and installation must be carefully evaluated. However, overall it appears that a number of mine operators have been successful in installing passive regeneration DPF systems on machines that have high duty cycles and are therefore acceptable for passive regeneration, particularly haulage trucks and some loaders. We continue to advise mine operators that DPF systems that utilize passive regeneration must be carefully evaluated and well-maintained for their successful operation. Both MSHA and NIOSH continue to post extensive information on DPF systems on our respective Web sites. The Filter Selection Guide (detailed in the preamble to the 2005 final rule (70 FR 32922)) that was designed by NIOSH and MSHA continues to be an important tool for understanding the steps that must be taken to evaluate, select, and install a DPF system, especially one that depends on passive regeneration.

The same commenters also stated that when passive DPF systems were not feasible for some types of machines, especially those with medium to low duty cycles, they began evaluating active regeneration systems. In contrast to passive regeneration systems that depend on the high temperature of the engine's exhaust for burning off the DPM collected in the DPF, active systems use an external heat source to initiate the burning process for DPM. These commenters stated they have purchased some active systems for evaluation. However, they question the feasibility of utilizing active DPF systems in their mines due to a variety of logistical and operational concerns. For example, they point out that the mining production cycle at many mines does not provide for sufficient machine downtime to stop the machine and take it out of service in order to ''plug'' the machine into a regeneration station for regeneration of the DPF to occur. These commenters also stated that if they tried to change out DPFs, then the number of DPFs they would need to maintain on hand to store and rotate would be both cost prohibitive and storage space consuming. These commenters indicated that machines that return to the surface at the end of the shift would be candidates for active regeneration.

We agree that using active systems that require prolonged machine downtime for regeneration may not be feasible at all mines. However, at mines that only operate for a single shift or have a gap between shifts for blasting gases to clear, for example, regenerating active filters between shifts would be more feasible. For mines that operate around the clock, shutting down a key piece of production equipment for filter regeneration may present a problem. While such an implementation scheme would undoubtedly adversely affect mine production, the commenters did not provide information or data sufficient to establish the significance of the effect to determine the feasibility of the method.

More importantly, however, we have continued to recommend alternatives to this implementation scheme for active DPFs. For example, the fuel burner system regenerates the filter during normal equipment operations, without intervention by the equipment operator, and regardless of equipment duty cycle. Another option is to swap out filters instead of regenerating them on-board the equipment. Between shifts, a used filter can be removed from a piece of equipment and swapped for a regenerated filter. The used filter can then be placed in a regenerating appliance so it will be ready by the beginning of the next shift, and the equipment can be returned to duty without further delay. Using this implementation method, equipment downtime to accommodate DPF regeneration is measured in minutes rather than hours.

The technology for a variety of active systems continues to be commercially available. Implementation of active regeneration systems does require the mine operator to look at the logistics of time, place, and manpower to successfully perform the task. Those logistical decisions have been outlined in the NIOSH Filter Selection Guide. However, the mechanism for installation of a DPF system with active regeneration is less complex than passive regeneration because the location of the DPF on the machine, distance of the DPF from the exhaust manifold or turbocharger, and the orientation of the DPF are less important. On passive regeneration systems, the DPF must be as close as possible to the outlet of the exhaust manifold or turbocharger to utilize the maximum exhaust gas temperature. On active regeneration systems, this is not an installation requirement.

We continue to believe that for installation of either type of regeneration system, engine maintenance is vital. The engine must be maintained in good working condition. The engine must be maintained to limit excess DPM being emitted from unburned fuels or oil. Intake filters must be maintained and the engine's intake air restrictions and exhaust backpressure must be maintained to the manufacturer's specifications.

In addition, the exhaust gas backpressure measurement provides critical information on the amount of DPM loading on the DPF. Engine manufacturers and DPF manufacturers provide maximum limits that should not be exceeded to ensure proper engine and DPF operation. The exhaust backpressure ports and devices must be maintained. This has become a special concern in the underground coal sector, prompting the Coal DPM Partnership to form a Subcommittee to investigate the proper procedures to monitor backpressure and the proper type of equipment to use. MSHA and NIOSH are working with labor and industry on this issue. Recommendations from this subcommittee will be shared with both coal and M/NM industry personnel since the information will be pertinent to both mining sectors involved with DPF systems. These recommendations will cover all types of DPF systems.

We believe that in place of ceramic DPF systems that require passive or active regeneration, machines could be installed with disposal DPF technology. These systems are commercially available and include exhaust heat exchangers to limit the exhaust gas temperature at the DPM media. These systems are available for all horsepower ranges typically found in M/NM mines.

From the comments received to the proposed rule, mine operators have installed synthetic high temperature disposable particulate filters (HTDPFs) as a means for DPM control. HTDPFs were initially used on permissible machines in underground coal mines to further reduce the chance of a filter fire that could occur more easily with paper filter media. Since that first introduction on permissible machines, manufacturers have developed systems to use HTDPFs on non-permissible machines in underground coal mines and on machines in underground M/NM mines. The HTDPFs were tested by NIOSH in the Isozone studies and shown to be effective in DPM EC reductions.

One commenter stated that they estimated the DPM reduction to be about 60–65% with the use of HTDPFs. We would consider that reduction estimate to be low (assuming the data the commenter was referring to was EC) when compared to our laboratory test that showed up to 80–83% percent reduction of whole DPM and higher efficiencies for EC.

However, several commenters stated that the synthetic HTDPF systems were removed from the machines that they were originally installed on when the DPF ''burned out'' and melted. The commenters stated that the backpressure would rise quickly when the DPF loading exceeded the specified loading capacity of the DPF media size. When this occurred, there was the potential for a DPF ignition.

One of these commenters also stated that the use of HTDPF was discouraging because the DPFs were only lasting 4–10 hours, requiring filters to be discarded and replaced every two shifts or less. It is well known that the operating life of a disposable DPF is mainly due to the size of the DPF installed, the amount of DPM that the engine emits, and the condition of the engine. Any one of these parameters can affect DPF life. The size of the DPF should be evaluated and engineered into the machine prior to installation. The DPM output of the engine should also be known prior to installation, and the condition of the engine is an important factor that can change and can severely affect DPF life. However, the engine DPM output and the condition of the engine can be altered. If DPF life is too short due to an older engine, then an engine replacement with a newer, cleaner engine can usually be done. Engine maintenance can increase DPF life by minimizing burning oil or unburned fuels.

Underground coal mine operators faced these same implementation issues when they began using disposable DPFs to comply with the coal DPM rule. They resolved these issues by replacing high DPM emitting engines and improving engine maintenance procedures. The same methods for extending DPF operating life are applicable to M/NM machines and are discussed in the DPF Selection Guide.

The DPM overloading issue also led to DPF ignition events. These concerns were raised by the underground coal mine operators. In response to this, we performed an extensive investigation on the causes of DPF ignitions. We determined that when the DPF collected the DPM, oils and unburned fuels were also collected on the media. When the DPF was exposed to exhaust gas temperatures that were in excess of 650 °F, the DPM, oils, and unburned fuels ignited, but not the DPF media. However, when the burning occurred, temperatures were high enough to melt the DPF media. When paper filter media was involved, the paper filter media also caught fire.

To help resolve this issue and to provide the mine operators with more awareness of the potential for an ignition of a DPF, we worked with DPF manufacturers that produce synthetic HTDPF systems. The DPF manufacturers agreed with us to update their DPF system specifications to specifically advise their customers that the synthetic HTDPF cannot be used where the exhaust gas temperature at the filter media exceeds 650 °F. We posted on the internet links to these updated specification sheets from the manufacturers.

To help further resolve this issue, manufacturers have developed exhaust gas heat exchangers, both air to air and air to water type heat exchangers that can either be installed in the exhaust prior to the DPF media or be built in as part of the DPF canister to maintain the exhaust gas temperature at or below 650 °F. The addition of a heat exchanger makes the use of the HTDPF feasible on a wider variety of vehicles that have duty cycles that could create exhaust gas temperatures at the DPF media in excess of 650 °F. Instead of the machine manufacturer or mine operator being concerned that the engine's duty cycle does not exceed 650 °F, a heat exchanger system can be built in to the exhaust system prior to the DPF to limit the exhaust gas temperature at the filter media to 650 °F.

Several commenters made reference to a joint NIOSH Partnership study at the Stillwater Mine. This study did a paper analysis of the equipment and based on some basic information, assigned each piece of equipment into a category to describe the potential for DPF application. The rulemaking record does not include the results of this study, and it is our understanding from NIOSH that this study is incomplete at this time. Therefore, this study was not considered by us in reaching our determination in this final rule.

However, we do believe that the type of approach used by NIOSH is a good beginning step that each mine should take when considering the use of DPF control technology. Once a mine operator categorizes its equipment based on general assumptions, they could then begin a more in-depth study of each piece of equipment that may need a DPF system installed, and finally, determine which system or systems could be feasible. Again, the NIOSH Filter Selection Guide provides mine operators with a step by step approach to determine the best ''fit'' for a machine to reduce the DPM emissions.

One commenter discussed feasibility issues with applying DPF systems to their mine's equipment which included Schedule 31 equipment. The commenter stated

> FMC's fleet falls into the category that does not support DPF's due to duty-cycle and manufacturers specifications. To date, FMC has found only one filter manufacturer that is willing to try their disposable filters on our fleet. Specific challenges/concerns include flammability of disposable filters, low engine duty cycle, and Schedule 31 hurdles that have yet to be addressed.

The commenter referenced the NIOSH work conducted at the Stillwater Mine where NIOSH categorized equipment for DPF application as was discussed above.

We believe that the issues raised by the commenter have been fully addressed in this preamble and in previous preambles which include flammability of disposable filters and the types of DPFs that can be used based on an engine's duty cycle.

The commenter references his Schedule 31 equipment. Schedule 31 is terminology used to refer to permissible equipment approved by us for use in gassy mines. Similar types of diesel powered equipment that are used in this mine are also used in underground coal mines in areas where methane gas may be present. We do not agree with the commenter that DPF systems are not available for permissible equipment. Underground coal mines have been retrofitting similar permissible equipment since 2001 to reduce DPM emissions from this type of equipment. To date, approximately 300–400 disposable type DPF systems have been installed on permissible equipment in coal underground. We believe that the equipment referred to by the commenter can be installed with a DPF system. We have information posted on our Web site on retrofitting permissible equipment. Companies such as Dry Systems Technologies (DST), DBT Australia Pty Limited, and EJC Mining Equipment have been supplying this type of DPF system to the underground coal permissible fleet. In addition, mine operators can contact our Technical Support Approval and Certification Center for information related to retrofitting permissible equipment.

One manufacturer testified at the public hearings that the DPF systems that they supply to the underground coal permissible machines are available in non-permissible (non explosion proof) configurations for machines in M/NM mines. They stated that the technology can be configured for all horsepower machines and be designed for numerous machine configurations.

Another area of DPF systems that we have been investigating is the use of on-board regeneration. On-board regeneration normally operates in principle between a passive system and an active system. In this type of DPF system, some passive regeneration occurs depending on duty cycle, however there is a mechanism for active regeneration when the duty cycles are not sufficient. The active regeneration may be in the form of catalyst, electrical system, or fuel burner type system. Several of these systems were discussed in the preamble to the 2005 NPRM such as the ArvinMeritor. Other systems are discussed below that we have become aware of since the preamble to the proposed rule.

DPF systems using this type of technology are becoming more readily available and feasible due to the upcoming EPA 2007 on-highway emission standards. We are aware the EPA emission standards are more stringent for reducing both DPM and NO_X. Information on systems being designed for 2007 on-highway machines will include DPF filters and NO_X catalysts. These systems will most likely require some type of active regeneration systems to account for low duty cycle on-highway vehicles. However, at this time, most engine manufacturers have not released the technical details of their systems since they are still in on-going developments to prepare for the 2007 model year. A combination of passive and active regeneration will most likely be used to account for the various duty cycles of non-road equipment. The EPA DPM standards will be forcing more DPF technologies to the commercial market starting in 2007 which will be available to the mine operators during the extension of time allowed for in this final rule.

Recently, MSHA and NIOSH have been in discussions with an automotive manufacturer of a commercial pickup truck and the diesel engine manufacturer that supplies the diesel engine for the pickup truck. Currently, many underground coal mines and some M/NM mines use commercially available automotive type pickup trucks. In 2007 model year, the new trucks will be sold with DPF systems in order to comply with the EPA on-highway standards. However, some underground coal operators became concerned with the new DPF systems on these pickup trucks. The concern relates to regeneration based on a mining duty cycle. The manufacturers also have not yet released all the details on the DPF systems. Engine and machine manufacturers are doing extensive testing for on-highway applications. MSHA and NIOSH have agreed with the manufacturers to perform laboratory and field test on the new pickup trucks once the trucks are available for mining. This work will be done during the extension of time allowed for in this final rule.

This type of technology will become more widespread, even in the mining industry, as the EPA DPM emission standards become effective. In addition, the California Air Resources Board (CARB) continues work with their ''Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines''. This program verifies DPF systems for installation on machines in California. CARB maintains a Web site at: *http://arb.ca.gov/diesel/verdev/home/home.htm.*

Most of the systems being developed for EPA have also been developed for California's program. Some commenters stated that we should wait till the EPA standards and technology becomes available. However, we believe that the delayed timeframe of the final limit will permit the DPF technology to become more universal in the mining industry. The mining industry should use its resources during this delay to resolve implementation issues on mining vehicles to meet the final limit.

We are aware of the following DPF technologies that are either commercially available or being further investigated by MSHA and NIOSH. Many of these systems have been discussed by us in preambles for the 2005 Final Rule (70 FR 32935) and the 2005 NPRM (70 FR 53284) and we are updating the discussions to include the new information that we have. The extension of time offered by this final rule will allow for more work to be done on these promising systems for implementation into the mining industry market.

a. *ArvinMeritor System.* In the 2005 proposed rule, we noted that the ArvinMeritor system, which utilizes active regeneration of the DPF, offers great potential for underground mines in further reducing DPM exposures. The ArvinMeritor system utilizes an on-board fuel burner system to regenerate DPFs. This system actively regenerates the filter media during normal equipment operations by causing the fuel to ignite the burner and thereby increase the exhaust temperature in the filter system. Consequently, this system does not require the host vehicle to travel to a regeneration station to regenerate the DPF. The condition of the DPF is monitored via sensors. We also stated that while this product was successfully evaluated at Stillwater's Nye Mine, we recently learned that the manufacturer had decided to concentrate on working with Original Equipment Manufacturers (OEMs) where they would be selling 50 units or more to one customer rather than selling one or two units to individual customers for retrofit application. It is our current understanding that this system is still commercially available for purchase in smaller quantities from ArvinMeritor distributors and local dealers.

b. *Johnson Matthey's CRT System. The Johnson Matthey CRT System is a DPF utilizing passive regeneration.* As stated above, passive regeneration works by using the exhaust gas generated by the engine to burn the DPM. Normally, DPF manufacturers utilize catalyst technology to lower the temperature needed for successful passive regeneration. By lowering the exhaust gas temperature needed for passive regeneration, a broader range of machines will have the necessary duty cycle to generate the exhaust gas temperature needed to burn the DPM. However, when a platinum coating is used as the catalyst, it can also increase the nitrogen dioxide (NO_2) emissions from the engine exhaust. In mines with low ventilation rates, the increased NO_2 emissions can also result in increased NO_2 exposures to potentially dangerous levels for miners. We discussed this issue in the 2005 final rule (70 FR 32924–26).

In 2004, the NIOSH Pittsburgh Research Laboratory issued a contract to Johnson Matthey to develop a system that can regenerate at lower exhaust gas temperatures and control NO_2 emissions. The system is based on Johnson Matthey's CRT system and promotes regeneration at lower temperatures. Such DPFs are widely used in urban bus applications and are capable of passively regenerating DPFs at the temperatures commonly seen in the exhausts of underground mining equipment (above 250 °C for at least 40% of the operation time).

The laboratory evaluation of the systems continues under NIOSH contract by the Center for Diesel Research (CDR) at the University of Minnesota. The objective is to examine performance and suitability of the systems relative to heavy-duty diesel engines in underground mining applications, with specific focus on the effectiveness of controlling NO_2. If the results of laboratory evaluations show that the system is suitable for use in underground applications, NIOSH would continue to study this DPM control with a field evaluation in an underground mine. However, at this time the laboratory data is still incomplete, and NIOSH continues to work with the lab and Johnson Matthey on this promising technology.

c. *Diesel Particulate Reactor*™. We have begun testing in our diesel laboratory a high performance DOC that contains a substrate which is a catalyst treated, woven stainless steel alloy fabric cartridge. This Reactor is being tested as a stand alone unit, in combination with a HTDPF, and with a synthetic fuel called Synpar 200. Our preliminary laboratory data using the Reactor and the Synpar 200 synthetic diesel fuel has shown an effective whole DPM removal efficiency approaching 50 percent without any adverse changes in other engine emissions. We are aware that several mines are planning on trying one or several of the combinations listed. One underground nonmetal mine has equipped about 80% of its fleet of about 50 pieces of diesel equipment with the Reactor, and reports no operational or maintenance problems. We will include on our DPM Single Source Page our efficiency numbers for DPM removal when they become available. NIOSH has also contracted with the Center for Diesel Research to do additional testing on the Reactor and the Synpar 200 synthetic diesel fuel at this time.

d. *Fleetguard*. This company has partnered with other DPF companies that market such products as a Longview Lean NO_X Catalyst DPF. The Longview Lean NO_X Catalyst combines NO_X reduction plus a DPM reduction system.

One underground coal mine operator is planning on receiving a unit to investigate and install on a piece of mobile equipment. The system specifies a minimum exhaust gas temperature of 260°C at least 25 percent of operating time in order for regeneration to occur. We also understand that this device may have the ability for active regeneration. MSHA and NIOSH plan to work with the coal mine operator to monitor the device once it is installed.

Since the system utilizes NO_X reduction, we are planning on testing this device in our diesel laboratory to determine the amount of NO_X reduction and to determine if there would be any adverse effects on engine emissions from this control scheme. NIOSH is also planning on testing this device at a M/NM mine, that is, if the work at the underground coal mine proves promising for application in the mining industry.

e. *Rypos*. Rypos utilizes a sintered metal filter media for DPM filtration. The system uses electrical current for active regeneration. Initially, the system was used on stationary generator systems. Rypos has successfully tested a prototype system on a surface grader. Electrical power for filter regeneration was obtained from a second alternator on the grader that was dedicated exclusively to the DPF. At this time, Rypos is discussing with us and NIOSH development of a system for mobile mining equipment. We will update the mining community on our work with this device.

f. *Huss*. We are aware that a M/NM mine operator has purchased a Huss system with a ceramic DPF using active regeneration. However, we have not received any information on the application of this DPF to the machine at the mine or its performance. If and when we do, we will inform the mining community through the DPM Single Source Page.

g. *Other DPF Systems*. We continue to work with DPF manufacturers that are listed on our Web site at: *http://www.msha.gov/01-995/Coal/DPM-FilterEfflist.pdf*. The DPF manufacturers that have submitted data to us and are listed on our Web site are: CleanAir Systems, DCL International, Engine Control Systems, Catalytic Exhaust Products, Nett Technologies, Donaldson Company, and Filter Services and Testing Corporation. We understand that there are other DPM control technologies that could be available but the other manufacturers have not contacted us. We continue to discuss and evaluate the latest DPM control technologies for applicability with the mining market through this Technical Support Directorate.

h. *Diesel Engine Replacements*. Several commenters stated that the mines have been replacing older, dirtier engines with newer, EPA Tier engines. The EPA Tier engine requirements force engine manufacturers to build engines that comply with more stringent emission standards for NO_X, DPM, and CO over a time period. The Tier schedule normally requires the larger horsepower engines to meet more stringent emission standards first, then the smaller horsepower engines. At this time, all new engines being sold in the United States in all horsepower ranges are meeting a minimum of a Tier 2 EPA emission standard.

We agree that this trend which the mine operators are following to replace older engines has been a feasible approach to reduce DPM exposure to meet the interim limit. However, in order to meet the final limit, mine operators must continue to evaluate their engine inventories to determine which engines need to be replaced as they become older, and new cleaner engines are available.

In addition, if mine operators are considering adding a DPF system to a machine that is equipped with a high DPM emitting engine, they may first need to repower the machine with an engine having lower DPM emissions. In some cases, a Tier 1 engine may need to be replaced with a Tier 2 engine to allow for a successful application of the DPF. A lower DPM emitting engine would enable the machine to operate for a longer period between regenerations, or before a disposable DPF would need to be replaced. Interruptions to mine production activities to accommodate regeneration or to replace a disposable filter can be avoided when the engine and DPF are properly matched to each other.

To further emphasize this point, one commenter discussed the application of installing disposable DPF systems on Toyota pickup trucks. The mine operator stated that the cost of replacing the disposable DPF is cost prohibitive. However, we are aware that the engine model used in that Toyota truck is an old model that may be out of production at this time. The truck engine described is a 128 hp engine. Based on information gathered by us, we believe that this engine may have a DPM emissions output of between 0.8 and 0.9 g/bhp-hr. This is considered a dirty engine and is higher than a Tier 2 engine standard. This would require more frequent DPF replacements when using disposable filters, or more frequent active regenerations, or the use of two DPFs as was discussed by the commenter, thus increasing the cost. A current Tier 2 engine in this horsepower range has a maximum DPM emission rate of 0.22 g/bhp-hr. An engine replacement or vehicle replacement could reduce the DPM output from each engine by up to 90 percent.

We believe that there are engines that could be used to repower the truck. As further discussed later in this section on Economic Feasibility, based on the cost estimates that the commenter presented, the cost savings of switching engines or even purchasing newer pickup trucks with cleaner engines could pay for the engine or truck in a minimal time frame.

In addition, more stringent EPA on-highway emission standards come into effect with on-highway vehicle models starting in 2007. The more stringent standards will require engine manufacturers to install a DPF system on all on-highway diesel powered vehicles. The 2007 model pickups that will be sold in the United States will then have DPF systems installed at the factory.

As discussed previously in this section, we are working with an engine manufacturer and a pickup manufacturer, NIOSH, and a coal mine operator to evaluate the technology being incorporated. We plan on testing the new engine/DPF system in our Diesel laboratory as soon as an engine/DPF system can be made available. The coal mine operator is concerned about the ability of the DPF system to regenerate. MSHA and NIOSH will be conducting in-mine studies to determine the feasibility of the regeneration process on the pickup trucks in both coal and M/NM mines. The extended period of time allowed for in this final rule should provide the additional time needed for this evaluation.

i. *Alternative Fuels and Ultra Low-Sulfur Fuels*. In our 2005 NPRM, we stated that during our compliance assistance efforts, we observed several mines using alternative fuels, including water emulsion fuels and biodiesel fuels, both of which are EPA approved fuels. We subsequently tested these alternative fuels to determine if they could decrease tailpipe DPM emissions. In each application the change to an alternative fuel had a positive impact on reducing engine emissions and miners' exposures to DPM. In some cases, reductions of 50 to 80+ percent were measured. While we found notable benefits, the use of alternative fuels can also cause equipment operation issues for mine operators. These operational issues have included initial clogging of the fuel filters when biodiesel is used, reduction of horsepower with the use of water emulsion fuels, and management of proper fueling of the correct fuel into specific machines. While these operational issues could be overcome, we believe that the mining industry needs the additional time offered by this final rule to work through implementation issues on a case-by-case basis.

The most common problem with alternative fuels is lack of geographic proximity of most mines to a fuel distributor. There are only three cities that are served by a water-emulsion fuel blender/distributor: Cleveland, Ohio, Houston, Texas, and Los Angeles, California. Biodiesel fuel is more widely available throughout the country than water-emulsion fuel, but some mines, particularly in the intermountain west and the west coast, may be 200 miles or more from the nearest biodiesel producer or distributor. Thus, mine operators in these isolated areas could incur significantly increased fuel transportation costs if they utilized biodiesel fuel at their mines.

Fuel manufacturers are building distribution centers near mining areas to reduce the transportation costs, but these centers will take some additional time to complete. Limited distribution is also a feasibility issue for metal and nonmetal mine operators who seek to obtain ultra low sulfur fuel. However, as discussed elsewhere in this preamble, the commercial availability of ultra low sulfur fuel (less than 15 ppm sulfur content) will increase during 2006 and beyond when on-road vehicles, and shortly after that, nonroad diesel engines in the United States will be required by the EPA to use only this type of diesel fuel. For these reasons, we believe the additional time provided in this final rule will allow mine operators the additional time they will need to comply is warranted.

j. *Water Emulsion Fuels*. In the 2005 NPRM, we explained that water emulsion fuels, such as PuriNox®, are blends of diesel fuels and water. The water is held in suspension with a surfactant. The water in the fuel reduces the engine combustion temperature resulting in reduced NO_2 and reduced DPM emissions. However, the added water also reduces the engine's horsepower. While the per gallon price of the water emulsion fuel is the same as standard fuel, we are aware of increases in engine consumption of these fuels by as much as 15 percent. However, continued increased use in mines is currently limited due to lack of fuel availability in most mining regions. Manufacturers of this fuel must install centralized blender facilities in order to make the fuel more available and economically feasible for use by the metal and nonmetal mining industry.

We also stated that we had observed some engines using water emulsion fuels. One issue appears to be with the use of very efficient water separators used on engine fuel systems to remove water from the fuel lines. We advised that a very efficient water separator will actually remove the water from the emulsion, thus affecting the engine's performance. An engine manufacturer that has experienced this with its engines has recommended replacing the more efficient water separator with a less efficient one.

Another issue identified by some mine operators is that some small machines cannot run, or run poorly, on this fuel. We are not aware of any testing that has been done to prove or disprove this. This may or may not be due to less complex fuel systems that cannot handle a change in fuel properties.

Since water emulsion fuels have been associated with horsepower loss, mines will have to determine through their own in-mine testing if their machines can continue to operate efficiently even with the power loss. Some situations where the power loss could affect a machine's productivity occur at multilevel underground mines at high elevations. Also, mines that require the use of permissible engines with pre-chamber combustion, such as the metal and nonmetal gassy mines, may need to determine any additional effects on these types of engines.

Several commenters noted that PuriNox®, a proprietary diesel fuel water emulsion product manufactured by the Lubrizol Corporation, will no longer be available in North America after calendar 2006. We regret this decision by Lubrizol, as we have documented very significant DPM reductions at mines that have experimented with, or permanently switched to PuriNox® fuel. Since most mines have been successful in attaining the interim limit using low DPM emission engines, environmental cabs, and upgraded ventilation, very few mines have switched to PuriNox® fuel, thus limiting demand for this product.

It's very limited geographic available in the three cities identified above also limited demand. It is possible that more mines might have switched to PuriNox® to attain the final DPM limit, if it were still available when the final limit becomes effective. However, as noted below, many of the DPM reduction benefits we have observed at mines using a water-emulsion fuel can also be achieved using high biodiesel content fuel blends.

k. *Biodiesel Fuels.* As noted above, the use of high biodiesel content fuel blends has resulted in significant DPM reductions of up to 80% or more at mines that have experimented with or switched entirely to such fuel blends. Even in blends as low as 20%, DPM reductions of nearly 40% have been documented. Actual DPM reductions depend on engines, duty cycles, etc., but reductions of at least 60% would be expected when fuel blends of B90 to B100 are used.

Biodiesel fuels are more readily available than water emulsion fuels. As noted below, biodiesel is currently available in every state except Alaska. The costs and therefore the demand for biodiesel have been related primarily to federal excise tax credits that have been available since 2004 to blenders of this fuel. The tax credits are passed along from the fuel blender to the purchaser in the form of reduced fuel costs. With current tax credits, biodiesel can be an attractive fuel alternative for the mining industry. In the late summer and fall of 2005, and again in the spring of 2006, due to market induced price swings for standard #2 diesel fuel, the price of biodiesel in many parts of the country, with the tax credit applied, was lower than standard diesel.

Several commenters expressed general agreement with our statements in the 2005 NPRM regarding the use of biodiesel fuel as an effective means of reducing DPM emissions (70 FR 53287). One commenter listed various other advantages of biodiesel, including reduced emissions of carbon monoxide, carbon dioxide, polycyclic aromatic hydrocarbon (PAH) compounds, oxides of sulfur, and total hydrocarbons, as well as better lubricity, higher flash point for increased fuel handling safety, and higher cetane number for better cold starts. However, some commenters asserted that biodiesel fuel is not a technologically feasible engineering control because it is not widely available in the eastern and western states, it causes unacceptable power loss, it is subject to gelling in cold weather, and it causes engine maintenance problems. These commenters also mentioned higher fuel costs as an impediment to increased usage of biodiesel. Technological feasibility issues relating to biodiesel fuel and economic feasibility issues are discussed in this section.

Examples of the specific concerns expressed by commenters who doubt the technological feasibility of biodiesel fuel included a mining industry organization that stated, ''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.'' This commenter went on to say, ''* * * 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.'' A large Montana platinum mining company that consumes about 1,000,000 gallons of diesel fuel per year commented that, ''* * * cold weather concerns were evaluated to determine the necessary storage requirements to reduce the potential for the fuel to gel.'' This commenter continued by stating that biodiesel cold flow properties in 100% form is not good below 45 degrees and would require some type of heating to make it flow. The regional supplier does not have the infrastructure to support this product due to the current low demand and newness of the product. This mine operator also evaluated the requirements for storing biodiesel on-site at the mine, and indicated that a 10,000 gallon tank would be needed for diesel, a 15,000 gallon tank would be needed for biodiesel, and a 10,000 gallon tank would be needed for the blended product, at a combined cost of over $250,000.

Another commenter stated that, ''There may be adverse effects on engine performance and maintenance that need careful consideration before selecting biodiesel as an alternative technology.'' Another commenter stated that, ''Cummins recommends a biodiesel fuel mix of no greater than 5%, but that mixture does not result in a significant DPM reduction.''

We agree that these commenters have concerns based on their current assessments of the biodiesel fuel. The extension of time allowed for in this final rule for meeting the final limit will assist mine operators in working through these operational issues if they decide to use biodiesel. Many of the biodiesel issues when resolved will apply to the entire mining industry. One example of this would be the logistics for transferring biodiesel fuel during the winter. Once the logistics for transferring the biodiesel in winter are resolved, all mines can use the information. This may be as simple as locating one or more companies that can ship biodiesel using insulated rail cars or tankers, or provide a service for warming up the fuel prior to delivery at the mine. We can provide these vendors on our Web site for the entire mining community for their use.

We are aware of several mines that are using very high biodiesel content blended fuels (near 100% biodiesel), and they have reported no operational or maintenance issues that were unanticipated or presented any difficulty for the respective mine. B100 has approximately 5%–7% less energy content than standard #2 petroleum diesel, and this difference is reflected in correspondingly lower horsepower output of an engine running on B100. Mine operators that are using high biodiesel fuel blends report that this horsepower loss is noticeable on some equipment, but manageable, and the power difference has not impacted production.

Biodiesel fuel acts as a solvent, and can loosen sediment in the fuel tanks and fueling systems of equipment that has run previously on standard diesel. This sediment can clog fuel filters for a period of time until the fuel system is fully cleaned, which typically takes a few weeks. During this period, fuel filters need to be changed more frequently than normal to avoid loss of engine power or stalling. This solvent effect has a long lasting benefit, however, in that the fuel system and injectors run cleaner as long as biodiesel fuel is used. One mine operator reported that their diesel engines have never run as well as they are now that the mine switched to a high biodiesel content blended fuel. He attributed the better performance to the higher lubricity of biodiesel and the cleaning effect on the fuel injectors.

The solvent properties of high biodiesel content fuel blends may adversely affect certain elastomeric components associated with an engine's fueling system, such as hoses and gaskets. Users need to contact the respective engine manufacturer to find out which components, if any, need to be replaced with their biodiesel-compatible counterparts. The extension of time allowed for under this final rule will provide the necessary time to make these contacts.

The solvent properties of the fuel may also remove certain types of paint if the fuel remains in contact with a painted surface for a prolonged period. This property of biodiesel does not render the fuel infeasible. It is simply an attribute of the fuel of which users need to be aware and take appropriate precautions. Likewise, because of its somewhat higher viscosity, a property related to its better lubricity, high biodiesel fuel blends may tend to more easily pass over the rings and dilute the engine oil. For this reason, it may be advisable when using high biodiesel fuel blends to shorten engine oil change intervals.

Biodiesel is subject to oxidation, microbial growth, and other conditions during long term storage. Manufacturers typically recommend precautions be taken such as fuel turnover, tank mixing, and anti-oxidant treatments if fuel is to be stored for longer than 6 months. Prior to use, biodiesel fuels stored for longer than 6 months should also be tested for acid number, sediment, and viscosity to insure it remains within specifications. In its publication, ''Biodiesel Handling and Use Guidelines, DOE–GO–102006–2288. Second Edition, March 2006,'' the U.S. Department of Energy indicates that, ''the least stable B100 could be stored for up to 8 months, while the most stable could be stored for a year or more.'' Nonetheless, the National Biodiesel Board recommends biodiesel fuels be used within 6 months of purchase. Instituting these precautions in using biodiesel may take mine operators some additional time to implement thus justifying the delay allowed for in this final rule. For mining operations that consume large amounts of diesel fuel and receive fresh fuel shipments from reputable suppliers on a frequent basis, long term storage issues are not a major concern.

We agree with the comments regarding the cold flow properties of biodiesel presenting storage and handling challenges. Neat soy-diesel (a 100% biodiesel fuel made from soybean feedstock) has a cloud point of 32 degrees Fahrenheit, and a pour point of 28 degrees Fahrenheit. The cloud point is the temperature at which crystals begin to form in the fuel, causing the potential for clogged fuel filters. The pour point is the temperature at which the fuel begins to gel and becomes difficult to pump. At temperatures approaching the cloud point, neat soy-diesel needs to be heated to prevent handling difficulties.

Many industrial chemicals have similar cold weather handling properties, and practical means have been developed to enable routine storage and transfer of these chemicals at any temperature. The most common method for off-loading such materials from transportation vessels is to heat the tank. For example, steam can be applied at the railhead to rail tank cars that are specially designed to facilitate this process. Transportation vessels, either rail or truck, can also be moved into a heated building for unloading. Fixed storage tanks can be heated, placed inside a heated building, or in the case of underground mines, storage tanks can be placed underground. To prevent fuel from gelling during equipment operations, the equipment's fuel tanks, fuel lines, and fuel filters can be heated, either using recycled engine heat, or using an external heating source, as might be required if equipment is parked outside the mine overnight. Such provisions are common in some parts of the world for all diesel equipment.

Although the properties of biodiesel may necessitate special transportation, storage, and handling procedures by mine operators, the precautions that would need to be taken to address these properties are straightforward and technologically unsophisticated, such as more frequent fuel filter changes during the initial change-over period, heating transportation and storage tanks, etc. The process of mixing standard diesel and biodiesel to achieve a particular biodiesel blend, such as B20, B35, or B50 (20%, 35%, and 50% biodiesel with the remainder standard diesel, respectively), though not technologically challenging, would normally be done by the fuel distributor.

It is also significant that biodiesel is a ''drop in'' replacement for standard diesel in any diesel engine. The only engine modification that may be necessary in some engines is to insure that all elastomeric fuel system components (hoses, gaskets) are biodiesel compatible, however, any components that are not compatible can be easily replaced. For these reasons, of the many DPM controls that are available to underground M/NM mine operators, switching to biodiesel fuel may involve the fewest difficult implementation issues. The consequences of failing to implement the precautions listed above could be quite significant. But information regarding these implementation issues is well defined and widely distributed (MSHA will include this important information on its DPM Single Source Page), and fully addressing them would be technologically and economically feasible for most, if not all mine operators.

We agree with comments that the availability of biodiesel fuel is more limited than standard diesel, especially in the eastern and western states. However, we believe that biodiesel will be more readily available in more areas of the country by the effective date of this final rule, even though its use may increase fuel transportation costs for some mines. Biodiesel is available from over 1,400 commercial petroleum distributors and over 750 retail stations across the country. The only state without in-state access to biodiesel is Alaska. The operator of a large underground metal mine in Alaska, however, reported that their fuel is shipped from Seattle, and their supplier has access to biodiesel.

Regarding the availability of biodiesel in the eastern and western states, we acknowledge that most biodiesel production is concentrated in the Midwest, however as noted above, it is available in the contiguous 48 states, and Hawaii and biodiesel production and availability nationally is growing rapidly. Production of biodiesel in the U.S. grew from about 25 millions gallons in 2004 to about 75 million gallons in 2005, and significant further production growth is expected in the future, including plants in currently underserved areas like Wyoming, Montana, Washington, California, Colorado, and Texas in the western part of the U.S., and Tennessee, Kentucky, Pennsylvania, Virginia, North Carolina, and New York in the east. This expected increased availability of biodiesel fuel by 2008 in currently underserved areas of the country supports our decision to phase-in the final DPM limits in three steps from 308_{EC} $\mu g/m^3$ in May 2006 to 350_{TC} $\mu g/m^3$ in January 2007 to 160_{TC} $\mu g/m^3$ in May 2008. Biodiesel plants currently under construction are rated at 329 million gallons of annual production capacity, and plants in the pre-construction phase will add an additional 518 million gallons of annual production capacity.

The Montana platinum mining company referenced above stated that, ''No manufacturers of biodiesel have been located in the proximity of the mine, making availability and delivery a significant concern.'' While there may be no biodiesel manufacturers in proximity to the mine at the present time, a 15,000,000 gallon annual capacity biodiesel plant is scheduled to go online in Culbertson, MT in March 2007, and there is currently a commercial biodiesel distributor about 140 miles from the mine site in Bozeman, MT. This distributor, which receives its supply of biodiesel via rail cars, has the capability to supply the mine's required 1,000,000 gallons per year, and it is equipped to use steam to heat the cars for off-loading during the winter months.

Another commenter that expressed concern about the lack of biodiesel availability was a gold mine operator in the Elko, Nevada area. This operator said, ''B20 is available in Salt Lake City, approximately 300 miles away.'' While this is undoubtedly true, there is also a commercial biodiesel distributor at Battle Mountain, Nevada, about 120 miles from the mine that can supply any grade of biodiesel from B2 to B100. This distributor also receives its biodiesel via rail cars. It does not currently have the capability to apply steam to cars in the winter months to facilitate cold weather off-loading. However, a representative for the distributor indicated that such a capability would be provided if a customer entered into a supply contract providing for sufficient fuel volumes; a requirement that this mine should be able to satisfy within the time prescribed for the effective date of the final limit.

A trona mine operator also expressed concern over the availability of biodiesel fuel near the mine in southwestern Wyoming. However, there is a commercial distributor of all grades of biodiesel fuel in Jackson, WY approximately 185 miles from the mine, and another commercial distributor in Richmond, UT approximately 180 miles from the mine. These fuel distributors are likely farther from the mine than the mine's current distributor, and shipments of fuel from these distributors would be subject to higher transportation costs. Although the mine operator would have to determine the feasibility of receiving biodiesel from such distance, we believe that the biodiesel industry will resolve these logistic problems in time for the effectiveness of the final limit in May 2008. The Biodiesel Board included comments to the 2005 NPRM stating how distribution of biodiesel fuel is expanding throughout the United States, which helps to make the final limit feasible as prescribed in the final rule.

In response to a commenter's concerns about engine warranties, the engine manufacturers do not warrant their engines against fuel related problems, either biodiesel or standard petroleum diesel. Regarding the commenter's concern relating to their Cummins engines, the Cummins on-line customer assistance fact sheet on biodiesel states that,

Given the current understanding of bio fuels and blending with quality diesel fuel, it would be expected that blending up to a 5% volume concentration should not cause serious problems. For customer's intent on blending bio fuels above 5% volume concentration, the following concerns represent what is currently known in the industry.

This on-line fact sheet goes on to identify specific areas of concern, including possible adverse effects on engine performance and fuel system integrity/durability, low temperature operability, heat content, oil change intervals, effects on elastomeric fuel system components, and a variety of issues related to long term storage, such as fuel stability, oxidation, corrosion, microbial growth, and fuel acid content. These issues are potentially significant, and if not appropriately addressed, could result in serious operational problems and engine damage. However, as noted above, we believe that solutions to these issues could be implemented by the extension of time offered by this final rule, so mine operators should not be impeded from utilizing high biodiesel content fuel blends.

Regarding engine warranties, the Cummins on-line fact sheet states that,

Cummins neither approves or disapproves of the use of biodiesel fuel. Cummins is not in a position to evaluate the many variations of biodiesel fuels or other additives, and their long-term effects on performance, durability or emissions compliance of Cummins products. The use of biodiesel fuel does not affect Cummins Material and Workmanship warranty. Failures caused by the use of biodiesel fuels or other fuel additives are NOT defects of workmanship and/or materials as supplied by Cummins Inc. and CANNOT be compensated under the Cummins' warranty.

With respect to engine warranties, Cummins treats biodiesel no differently than it treats standard petroleum-based diesel. Most of the engine manufacturers have similar warranty positions.

A trona mine operator reported that they had obtained DPM sample results for their mine that exceeded the 160_{TC} $\mu g/m^3$ final DPM limit despite using a B20 biodiesel fuel blend (20% biodiesel mixed with 80% standard petroleum diesel fuel). A stone mine operator reported similar results with B20 fuel. These commenters question whether biodiesel is a feasible control, since they were not able to attain compliance with the 160_{TC} $\mu g/m^3$ final DPM limit using this fuel.

Based on extensive in-mine testing and both personal and area sampling at mines that have either experimented with, or switched permanently to biodiesel fuel blends, we believe significant DPM reductions would not have been expected with biodiesel blends as low as B20. In our evaluations, we only began to see significant DPM reductions at B35 or higher, with higher biodiesel content producing lower DPM levels. The DPM reductions of 60% to 80% that we have documented were achieved with fuel blends of 98% to 99% biodiesel. Thus, we continue to believe that biodiesel is a feasible DPM control that is capable of achieving significant reductions (as defined in the 2005 rule (70 FR 32868, 32916)) in DPM exposure when this fuel is used in neat form (100% biodiesel) or in sufficiently high blends with standard petroleum diesel fuel.

Several commenters also mentioned that they were considering, or had switched to ultra low sulfur (15 ppm) diesel fuel. As expected, these commenters did not report significant DPM reductions after the switch to this fuel. The primary benefit of ultralow sulfur diesel is to enable advanced emission reduction technologies that utilize catalysts that would be poisoned by higher sulfur content fuel.

l. *Installation of Environmental Cabs*. Environmental cabs are a proven means to reduce worker exposure to DPM. While much of the construction-type equipment used in underground stone mines comes equipped with environmental cabs, the cabs on specialty mining equipment used in underground hard rock mining are less common, particularly in mines with narrow drifts or low seam heights. As mine operators realize the benefits of cabs, more and more pieces of equipment are being purchased or retrofitted with environmental cabs. These cabs provide protection for workers not only from diesel particulate but also from noise and dust.

Only a few comments were received on the subject of environmental cabs. These comments typically agree that environmental cabs can be effective in reducing the occupant's DPM exposures, but applications may be limited by three factors: retrofitting cabs is not always possible, especially on some older machines, there may not be adequate clearance for cabs in certain confined areas of some mines, and cabs offer no protection for miners who must work outside a cab. A comment received from a mining industry organization was typical:

Environmental cabs are effective. However, they can not be retrofitted to all mining equipment. Further, there are some jobs in underground mines where miners work outside of equipment and cabs would provide them no protection.

Another industry organization stated,

Simply put, fully enclosed environmental cabs provide superb protection to equipment operators from exposure to DPM. However, they provide no protection to miners working alongside such equipment. Furthermore, installation of fully enclosed environmental cabs can only be accomplished where the resulting larger profile of the equipment fits properly within the heading size in the mine where such equipment is operated.

We agree in general with these comments and we believe that a cab's feasibility needs to be evaluated on a case-by-case basis as to exactly which equipment is suitable for retrofit of a cab, or whether space limitations in certain areas at a particular mine would prevent utilization of equipment with cabs. In these respects, questions regarding the feasibility of using cabs as an engineering control to prevent DPM exposure are no different than questions regarding the feasibility of using cabs for control of dust or noise exposures.

m. *Ventilation*. All underground M/NM mines rely on ventilation to dilute and carry away diesel particulate matter and toxic gases as well as to provide fresh air to the miners. Based on the comments received from mine operators and from our own observations during mine inspections and compliance assistance mine visits, it is clear that ventilation is a key component of nearly every mine's DPM control strategy.

However, the extent to which it is feasible for ventilation system performance to be improved or upgraded, either to obtain compliance with the final DPM limit or to obtain compliance in combination with other controls, is disputed by some commenters. One commenter from a gold mine in Nevada stated that, ''Ventilation is near its capacity. Further increases are likely to create fugitive dust problems from haulage vehicles.'' Another commenter addressing conditions at a different multilevel metal mine indicated that increasing airflows in that mine's small and widely distributed working places would be difficult. This commenter also disputed our observation in the preamble to the 2005 final rule that a major multi-million dollar ventilation upgrade at that mine was not a DPM compliance related expense (70 FR 32934–32936). Another commenter from a mining industry organization stated that a notable characteristic of underground stone mines is their large open spaces (room and pillar mining) that are ventilated naturally. To introduce forced ventilation in mines presently ventilated naturally would entail enormous costs in mine structures that would be needed to direct the ventilation inside the mine.

These comments represent the extremes in ventilation practice in the underground M/NM mining industry. Deep multilevel mines, due to a variety of factors, typically have complex, costly, and sophisticated ventilation systems, often designed by a professional mine ventilation engineer, and usually operated and managed by engineers with specific mine ventilation training and experience. These systems normally consist of a network of main, booster and auxiliary fans, and a complex array of interconnected shafts, raises, and ventilation control structures. In contrast, room and pillar stone mines typically have very simple ventilation systems which may not have been designed at all. Such systems may rely entirely on natural ventilation alone, and those that do incorporate forced ventilation are often simple blowing or exhausting systems, or may consist of nothing more than one or a few free standing booster fans underground. They are normally operated or managed by the mine foreman or manager, and it is rare for such individuals to have had any professional training in mine ventilation engineering.

At most multilevel metal mines, high ventilation system costs provide a major economic incentive to operators to optimize system design and performance, and therefore, there are typically few if any feasible upgrades to main ventilation system elements that these mines haven't already implemented, or would have implemented anyway, whether or not the DPM rule existed. Accordingly, and though it remains an option that might be attractive in new development, we expect very few mines of this type to implement major ventilation system upgrades to achieve compliance with this rule.

Despite the built-in incentives to design and operate efficient ventilation systems, however, we have observed aspects of ventilation system operation at such mines that can be improved, usually relating to auxiliary ventilation in stopes. Auxiliary fans are sometimes sized inappropriately for a given application, being either too small (not enough air flow) or too large (causing recirculation). Auxiliary fans are sometimes poorly positioned, so that they draw a mixture of fresh and recirculated air into a stope. Auxiliary fans are sometimes connected to multiple branching ventilation ducts, so that the air volume reaching a particular stope face may be considerably less than the fan is capable of delivering. Perhaps most often, the ventilation duct is in poor repair, was installed improperly, or has been damaged by blasting or passing equipment to the extent that the volume of air reaching the face is only a tiny fraction of that supplied by the fan. We believe that these and similar problems exist at many mines, even if the main ventilation system is well designed and efficiently operated.

Without extensive on-site study, we are unable to assess the validity of the commenter's assertion that the mine's ventilation is near its capacity, but such a condition would not be unusual, at least with respect to major ventilation system elements like shafts and main fans. Short of a major ventilation system upgrade such as a new shaft sinking or main fan installation or repowering, it would be more likely that auxiliary ventilation system performance could be improved.

Regarding the issue of fugitive dust, which is mineral dust that is entrained in and carried by the ventilation air stream, if ventilation increases are required to reduce DPM levels, but such increased ventilation would be so great as to pick up dust from the mine floor or muck piles, it may be necessary for the mine operator to apply water more frequently to haul roads and working places, or use dust control chemicals to manage corresponding fugitive dust levels. Mine operators frequently face trade-offs like this, and we are confident this problem can be successfully handled within the prescribed time frames of this final rule. For example, mines that currently water their haul roads once a shift, may need to water their haul roads twice a shift.

Regarding the comment relating to the difficulty of increasing ventilation in small and widely distributed working places, we conducted an extensive study of the auxiliary ventilation systems at this mine. The company ventilation engineer stated that the stope ventilation systems were designed to deliver a minimum of 12,000 cfm to the faces. The 12,000 cfm airflow would dilute emissions for a 100 hp loader (PI − 5000 cfm) to 321_{EC} µg/m^3. This value would increase by the level of DPM in the stope intake. During this survey, several of the stope ventilation systems failed to provide that level of airflow to the faces, and in fact, some systems lost over 90% of their air volume before reaching the end of the vent duct. This was primarily due to long ventilation tubing lines and poor maintenance of the ventilation tubing. Also, it was noted during the survey that improper fan placement at the mouth of the stopes allowed exhaust air to be recirculated back to the face before being diluted by the footwall lateral airflow.

This commenter also responded to our analysis of a major ventilation upgrade at this mine, characterizing it as ''suspect,'' but offering no specific comments or corrections. The mine in question had instituted a major upgrade of the ventilation system including new aircourses, new vent raises, and new and redeployed main and booster ventilation fans. The $9,000,000 upgrade increased total mine airflow by 34% to 840,000 cfm while reducing total fan power requirements by 1,000 hp through more efficient deployment of booster fans.

As a result of further discussions with personnel at the mine, we had determined that the upgrade had several objectives in addition to DPM control, including greater system efficiency such as eliminating an excessive number of booster fans (some competing with each other for air), the need to accommodate increased production, the need to ventilate a ramp used by trucks to haul ore upgrade from the levels below the bottom of the shaft, and the desire to increase the number of ventilation intakes into the mine, thereby providing more fresh air emergency escape routes and reducing intake aircourse air velocities (for reduced dust entrainment and enhanced miner comfort). We were told that the mine had ''overreached'' the existing ventilation system, and that the upgrade was overdue, even without consideration for DPM levels in the mine. Based on this information, and in response to comments from this mine operator addressing the August 14, 2003 proposed rule on the interim DPM limit, we had suggested that the total cost of the ventilation upgrade should be only partially DPM-related. We also pointed out that the cost of the upgrade needed to be annualized because the asset had an expected useful life of many years, resulting in a yearly cost that was a small fraction of the $9,000,000 expense. We disagree with the characterization of our analysis as ''suspect,'' because we believe it is fully supported by the facts, and because the commenter provided no explanations or corrections regarding our data or methods.

Room and pillar stone mine ventilation is entirely different than multilevel metal mine ventilation. Ventilation at stone mines was addressed extensively in the preamble to the 2005 final rule (70 FR 32931–32932). We agree that ventilation system upgrades may not be the most cost effective DPM control for many mines, and for others, ventilation upgrades may be entirely impractical. However, at many other mines, perhaps the majority of mines affected by this rule, ventilation improvements would be an attractive DPM control option, either implemented by itself or in combination with other controls. The additional time provided under this final rule will provide mine operators more time to explore these options.

Indeed, during our DPM compliance assistance visits, we have observed that ventilation upgrades have been implemented at many mines in the stone sector for DPM control. Nearly every stone mine visited by us had completed, had begun, or was planning to implement ventilation system upgrades.

At many high-back room-and-pillar stone mines, we observed ventilation systems that were characterized by (1) inadequate main fan capacity (or no main fan at all), (2) ventilation control structures (air walls, stoppings, curtains, regulators, air doors, brattices, etc.) that are poorly positioned, in poor condition, or altogether absent, (3) free standing booster fans that are too few in number, too small in capacity, and located inappropriately, and (4) no auxiliary ventilation for development ends (working faces). At some mines, the ''piston effect'' of trucks traveling along haul roads underground, along with natural ventilation pressure, provide the primary or only driving forces to move air.

In naturally ventilated mines, temperature-induced differences in air density between the surface and underground result in natural air flows through mine openings at different elevations. Warmer and lighter mine air rises up out of a mine during the colder winter months, which draws in cooler and heavier air at lower elevation mine openings. In the summer, cooler and denser mine air flows out of lower elevation openings, which draws warmer less dense air into higher elevation openings. Under the right conditions, such air flows can be significant, but they are usually inadequate by themselves to dilute and carry away DPM sufficiently to reduce miners' exposures to the interim limit.

The other principal shortcoming of natural ventilation is the inherent lack of a method of controlling air flow quantity and direction. Ventilation air flows can slow or stop when temperature differences between the surface and underground are small (common in the spring and fall), and the flow direction reverses between summer and winter, and sometimes even between morning and afternoon.

Mine operators normally supplement natural ventilation with booster fans underground. However, if overall air flow is inadequate, as is usually the case with naturally ventilated mines, and when mine elevation differences or surface and underground temperature differences are small, booster fans are largely ineffective.

The all too frequent result of these deficiencies is a ventilation system that is plagued by insufficient dilution of airborne contaminants, short circuiting, recirculation, and airflow direction and volume that are not controllable by the mine operator. Mines experiencing these problems could benefit greatly from upgrading main, booster, and/or auxiliary fans, along with the construction and maintenance of effective ventilation control structures. Consequently, we have urged the mining industry to utilize mechanical ventilation to improve overall air flows and to enable better control of ventilating air.

Ventilation fan upgrades for the stone mining sector are usually relatively inexpensive due to the low mine resistance associated with large openings. In many of these mines, a 250,000 cfm air flow can be obtained at less than 1 inch of water gage pressure. This air flow can be provided by a 50 horsepower motor.

We agree with the commenter that the major cost in these applications is usually distribution of the air flow underground to insure that adequate air quantities reach the working faces rather than short-circuiting to a return or recirculating around free-standing booster fans. Good air flow distribution requires such practices as installing or repairing ventilation control structures (brattice line, air curtains, etc.) or changes in mine design to incorporate unmined pillars as air walls. Such ventilation control structures are not complex to install, and since they usually have a very long useful life, when the cost of such controls is annualized, the yearly cost is only a fraction of the initial acquisition and installation costs.

Despite the commenter's suggestion to the contrary, a great many underground stone mines are currently ventilated with main and booster fan systems. The necessary ventilation control structures have also been installed in a great many such mines to facilitate the efficient and effective distribution of ventilation air underground. One commenter, a stone producer with seven underground mines, reported that, ''All of [their] mines have performed major ventilation upgrades,'' including ventilation surveys by an outside contractor, installation of larger main fans, installation of new and larger portable fans that are used at active headings, use of larger booster fans, and the installation of ''new ventilation stoppings and curtains at various locations throughout the mine at all mines.'' Clearly, based on this company's experiences and our observations at many other mines, the technological feasibility of this type of DPM engineering control is well established for the stone sector of the underground M/NM mining industry, although it may take some time for mines to make the necessary changes.

n. *DPM Sampling Issues*. A trona mine operator, in reporting their DPM sampling results in their comments, indicated that these samples were analyzed using the NIOSH 5040 method and calculated using the MSHA Sampling Method to determine exposure, which does not take into account significant IH factors such as shift length over 480 minutes, average pump flow rates using pre-sample calibration and post-sample calibration figures, and other environmental factors such as temperature and pressure. We disagree that the MSHA Sampling Method fails to account for these industrial hygiene (IH) factors.

Our DPM sampling procedures are posted on the M/NM DPM Single Source Page, which is linked to our internet home page. Exposures are determined from the sampling data in accordance with the formula on page T–7 of the sampling procedures, as shown below:

$$\text{Carbon Concentration } (\mu g/m^3) = \frac{C\ (\mu g/cm^2) * A\ (cm^2) * 1{,}000\ L/m^3}{1.7\ \text{Lpm} * 480\ \text{min}}$$

Where:

C is the mass of carbon, expressed in micrograms, deposited on the filter per square centimeter of filter surface

A is the area of the filter onto which DPM is deposited, expressed in square centimeters

1,000 L/m^3 is a unit conversion factor to convert liters to cubic meters (the pump flow rate is expressed in liters per minute, whereas the DPM concentration is expressed in micrograms per cubic meter)

1.7 Lpm is the pump flow rate, expressed in liters per minute

480 min is the number of minutes in an 8-hour work shift

We account for work shifts longer or shorter than 8 hours (480 minutes) by shift-weighting all sample results. The shift-weighting process is explained in the DPM Compliance Guide, which is also posted on the M/NM DPM Single Source Page and is summarized below:

> ''Average full shift airborne concentration'' means that a miner's exposure is determined by measuring the average concentration of airborne DPM to which the miner is exposed over a full work shift, regardless of shift length. Temporary excursions above a limit are permitted from time to time during the shift, as long as the average over the entire shift is within the limit. The term, ''average eight hour equivalent full shift airborne concentration,'' refers to our longstanding practice of ''shift-weighting'' when applying compliance limits for airborne contaminants to exposures that occur over a time period that is different from a standard 8-hour shift. Our compliance limits are normally based on 8 hours of workplace exposure to a contaminant and 16 hours of recovery time in the absence of the contaminant. The workplace 8-hour shift weighted average (SWA) exposure is computed as the mass of DPM on the filter divided by the 8-hour sample volume, which is 0.816 cubic meter for a sample flow rate of 1.7 liters per minute.

Thus, our DPM sampling and analytical procedures do account for work shifts that are longer than 8 hours. Regarding the other industrial hygiene factors which the commenter claims are not addressed, our sampling procedures on p. T–3 requires pre-sample calibration of the sampling pump, and on p. T–6, requires post-sample calibration of the sampling pump. The pre-sample and post-sample calibrations are required to be performed in accordance with the procedures outlined in Chapter C of the M/NM Health Inspection Procedures Handbook. Since our pump calibration devices measure true volumetric flow, day to day variations in atmospheric pressure due to weather changes are irrelevant. However, pressure effects from calibrating a pump at one elevation and sampling at a significantly different elevation can be important. Accordingly, among the many requirements relating to the use of sample pumps contained in the M/NM Health Inspection Procedures Handbook is one specifying that pump calibrations must be performed within 1,000 feet of the elevation where sampling will be conducted, or if not, that the specified procedures for adjusting pump flow rate for elevation must be followed. Our inspectors are also required to measure and record the temperature where sampling occurs. Our DPM sampling field notes form has a space for temperature that must be filled in for every sample taken.

B. Economic Feasibility

We have determined that phasing in the final DPM limit of 160_{TC} $\mu g/m^3$ as prescribed in the final rule is economically feasible for the M/NM mining industry. Economic feasibility does not guarantee the continued viability of individual employers, but instead, considers the industry in its entirety. In *United Steelworkers of America* v. *Marshall, 647 F.2d 1189, 1265 (1980)* regarding OSHA's statutory criteria for establishing economic feasibility, the Court recognized that:

> The most useful general judicial criteria for economic feasibility comes from Judge McGowan's opinion in *Industrial Union Dep't, AFL–CIO* v. *Hodgson, supra.* A standard is not infeasible simply because it is financially burdensome, *499 F.2d at 478*, or even because it threatens the survival of some companies within an industry:
>
> Nor does the concept of economic feasibility necessarily guarantee the continued existence of individual employers. It would appear to be consistent with the purposes of the Act to envisage the economic demise of an employer who has lagged behind the rest of the industry in protecting the health and safety of employees and is consequently financially unable to comply with new standards as quickly as other employers. * * *
>
> Id. (footnote omitted). A standard is feasible if it does not threaten ''massive dislocation'' to, *AFL–CIO* v. *Brennan*, supra, *530 F.2d at 123*, or imperil the existence of, *American Iron & Steel Institute* v. *OSHA*, supra, *577 F.2d at 836*, the industry. No matter how initially frightening the projected total or annual costs of compliance appear, a court must examine those costs in relation to the financial health and profitability of the industry and the likely effect of such costs on unit consumer prices. Id. More specifically, *Industrial Union Dep't, AFL–CIO* v. *Hodgson*, supra, teaches us that the practical question is whether the standard threatens the competitive stability of an industry, *499 F.2d at 478*, or whether any intra-industry or inter-industry discrimination in the standard might wreck such stability or lead to undue concentration. *Id. at 478, 481*. Granting companies reasonable time to comply with new PEL's might not only enhance economic feasibility generally, but, where the agency makes compliance deadlines uniform for competing segments of industry, can also prevent such injury to competition. *Id. at 479–481. United Steelworkers of America, AFL–CIO–CLC* v. *Marshall*, (OSHA Lead) 647 F.2d 1189, 1265 (D.C. Cir. 1980). *To prove economic feasibility, ''OSHA must construct a reasonable estimate of compliance costs and demonstrate a reasonable likelihood that these costs will not threaten the existence or competitive structure of an industry, even if it does portend disaster for some marginal firms.'' Steelworkers, 647 F.2d at 1272. As with technological feasibility, OSHA is not*

*required to prove economic feasibility with certainty, but is *981 **153* required to use the best available evidence and to support its conclusions with substantial evidence. *See id. at 1267.*

In a separate case involving review of an OSHA standard, the D.C. Circuit Court stated that:

''Congress does not appear to have intended to protect employees by putting their employers out of business—either by requiring protective devices unavailable under existing technology or by making financial viability generally impossible.'' See *Industrial Union Dep't., 499 F.2d at 467 (D.C. Circuit 1974).*

A standard would not be considered economically feasible if an entire industry's competitive structure were threatened. *Id.* at 478; *See also, AISI–II, 939 F.2d 975, 980 (DC Cir. 1991); United Steelworkers, 647 F.2d at 1264–65; AISI–I, 577 F.2d 825, 835–36 (1978).* This would be of particular concern in the case of foreign competition, if American companies were unable to compete with imports or substitute products. The cost to government and the public, adequacy of supply, questions of employment, and utilization of energy may all be considered when analyzing feasibility.

In determining whether these factors might reasonably be significant in analyzing the economic feasibility of a rule, MSHA has relied on a 1% ''screen'' of the yearly costs industry is estimated to incur to comply with a rule relative to annual industry revenues. When yearly costs are less than 1% of annual revenues, MSHA views that the costs of the rule are below the threshold necessary to conclude that such an extensive analysis is necessary to establish the economic feasibility of the rule. In that case, MSHA presumptively concludes that the rule is economically feasible.

This final rule will continue to require mine operators to establish, use and maintain all feasible engineering and administrative control methods to reduce a miner's exposure to the applicable final limit. It affords mine operators the flexibility to choose engineering and administrative controls, or a combination of controls to reduce a miner's exposure to DPM. When engineering and administrative controls do not reduce a miner's exposure to the DPM limit, the controls are infeasible, or controls do not produce significant reductions (as defined in the 2005 rule (70 FR 32868, 32916)) in DPM exposures, operators must continue to use all feasible engineering and administrative controls and supplement them with respiratory protection. Though mine operators may choose to use an engineering control or an administrative control to reduce a miner's exposure, or a combination thereof, existing § 57.5060(d) prohibits a mine operator from using respiratory protection in lieu of feasible controls. Mine operators must establish a respiratory protection program when controls are infeasible. Section 57.5060(d), as promulgated under the 2005 rule, incorporates by reference MSHA's current respiratory protection program requirements for metal and nonmetal mines at §§ 56.5005(a) and (b) and 57.5005(a) and (b). These provisions include requirements for selection, fit-testing, and maintenance of respirators. In addition, mine operators must follow the requirements under paragraphs (d)(1) and (d)(2) of the 2005 rule for appropriate filters for respirators. If we confirm that mine operators have met all of the abovementioned requirements for addressing a miner's overexposure, and the miner's exposure continues to exceed the final limit (not counting respirators), we will not issue a citation for an overexposure. Instead, we will continue to monitor the circumstances leading to the miner's overexposure, and as controls become feasible, we will require the mine operator to install and maintain them to reduce the miner's exposure to the final limit. We believe that existing controls used to reduce miners' exposures to the current interim limit can be used in helping mine operators achieve compliance with the final limits. Therefore, in determining the economic feasibility of engineering and administrative controls that the M/NM underground industry will have to use under this final rule and using the 2001 REA as a basis, we compared the cost of controls that are used to comply with the existing DPM limit of 308_{EC} μg/m³ to that of the newly promulgated final limits. These controls include diesel particulate filters (DPFs), ventilation upgrades, oxidation catalytic converters, alternative fuels, fuel additives, enclosures such as cabs and booths, improved maintenance procedures, newer engines, various work practices and administrative controls. Our comparison included costs of retrofitting existing diesel-powered equipment and regeneration of DPFs.

On the basis of information in the rulemaking record, including our current enforcement experience, we have determined that the final rule is economically feasible for the underground M/NM mining industry as a whole, as was the 2005 final rule. In the 2005 final rule, we determined that the 308_{EC} μg/m³ interim limit is economically feasible. To determine whether this final rule is economically feasible, we analyze economic feasibility from two different perspectives. First, we analyze whether the new requirements of the final rule (medical evaluation and transfer) are economically feasible. Second, we analyze whether the additional cost of moving from the interim limit of 308_{EC} μg/m³ to the final limit of 160_{TC} μg/m³ is economically feasible.

Analyzed from the first perspective, the additional yearly costs of the final rule are $69,170. The derivation of the costs of medical evaluation and transfer provisions of the final rule are explained in Section IX.A of this preamble. The total yearly compliance cost of these new provisions for the underground M/NM mines that use diesel equipment is only 0.001% of the annual revenues for these mines, well below the 1% ''screen'' that we use as a presumptive benchmark of economic feasibility. Hence, we conclude that this final rule is economically feasible for underground M/NM mines that use diesel equipment. Table V–1 shows these calculations.

Table V-1. Estimated Yearly Costs of Final Rule Relative to Yearly Revenues For Underground M/NM Mines That Use Diesel-Powered Equipment

Mine Size	Yearly Costs of Final Rule[1]	Yearly Revenues[2]	Costs as Percentage of Revenues[3]
1-19 Employees	$9,968	$222,357,776	0.004%
20-500 Employees	$54,225	$3,653,028,457	0.001%
Over 500 Employees	$4,977	$960,859,144	0.001%
All Mines	$69,170	$4,836,245,377	0.001%

[1]Table IX-1, Total Yearly Costs of the final rule for given mine size categories.

[2]Yearly revenues for underground metal/nonmetal mines were obtained by multiplying price and production figures from Mining & Quarrying Trends, 2004 (Tables 1 and 3). These revenues were then prorated by hours of employment to obtain an estimate of revenues only for mines that use diesel equipment. Data for mine hours and employment are from MSHA's Directorate of Program Evaluation and Information Resources, 2004 calendar year data. Diesel mines are identified based on DPM sampling data.

[3](Costs as Percentage of Revenues) = (Yearly Costs of Final Rule) / (Yearly Revenues).

Analyzed from the second perspective, the additional yearly costs for underground M/NM mines to move from the interim limit to the final limit of 160_{TC} µg/m^3 are $8,454,853. The derivation of these costs of achieving the 160_{TC} µg/m^3 final limit, given that the 308_{EC} µg/m^3 interim limit is in effect, are provided in Section IX.B of this preamble. The total yearly cost of meeting the final limit for the underground M/NM mines that use diesel equipment is only 0.175% of the annual revenues for these mines, well below the 1% "screen" that we use as a presumptive benchmark of economic feasibility. Hence, we conclude that the final limit is economically feasible for underground M/NM mines that use diesel equipment. Table V–2 shows these calculations.

Table V-2. Estimated Yearly Cost of Implementing the 160_{TC} µg/m³ Final Limit Given 400_{TC} (308_{EC}) µg/m³ Interim Limit in Effect Relative to Yearly Revenues For Underground M/NM Mines That Use Diesel-Powered Equipment

Mine Size	Yearly Cost of Implementing the 160_{TC} µg/m³ Final Limit[1]	Yearly Revenues[2]	Costs as Percentage of Revenues[3]
1-19 Employees	$1,917,604	$222,357,776	0.862%
20-500 Employees	$6,019,259	$3,653,028,457	0.165%
Over 500 Employees	$517,991	$960,859,144	0.054%
All Mines	$8,454,853	$4,836,245,377	0.175%

[1]Table IX-5, Yearly Cost Adjusted for Several Factors of implementing the 160_{TC} µg/m³ final limit for given mine size categories.

[2]Yearly revenues for underground metal/nonmetal mines were obtained by multiplying price and production figures from Mining & Quarrying Trends, 2004 (Tables 1 and 3). These revenues were then prorated by hours of employment to obtain an estimate of revenues only for mines that use diesel equipment. Data for mine hours and employment are from MSHA's Directorate of Program Evaluation and Information Resources, 2004 calendar year data. Diesel mines are identified based on DPM sampling data.

[3](Costs as Percentage of Revenues) = (Yearly Costs of Final Rule) / (Yearly Revenues).

In circumstances where the use of further controls may not be economically viable, the standard provides for a hierarchy of control strategy that allows specifically for the cost impact to be considered on a case-by-case basis. Our DPM enforcement policy, therefore, takes into account the financial hardship on a mine-by-mine basis, which we believe effectively accommodates mine operators' economic concerns, particularly those of small mine operators.

Whether controls are feasible for individual mine operators is based in part upon legal guidance from decisions of the independent Federal Mine Safety and Health Review Commission (Commission) involving enforcement of MSHA's noise standards for M/NM mines, 30 CFR 56.5–50 (revised and recodified at 30 CFR 62.130). According to the Commission, a control is feasible when it: (1) Reduces exposure; (2) is economically achievable; and (3) is technologically achievable. See *Secretary of Labor* v. *A.H. Smith,* 6 FMSHRC 199, 201–02 (1984); *Secretary of Labor* v. *Callanan Industries, Inc.,* 5 FMSHRC 1900, 1907–09 (1983).

In determining the economic feasibility of an engineering control, the Commission has ruled that we must assess whether the costs of the control are disproportionate to the ''expected benefits,'' and whether the costs are so great that it is irrational to require implementation of the control to achieve those results. The Commission has expressly stated that cost-benefit analysis is unnecessary to determine whether a control is feasible.

Consistent with Commission case law, we consider three factors in determining whether engineering controls are feasible at a particular mine: (1) The nature and extent of the overexposure; (2) the demonstrated effectiveness of available technology; and (3) whether the committed resources are wholly out of proportion to the expected results. A violation under the final standard will entail an agency determination that a miner was overexposed, that controls are feasible, and that the mine operator failed to install or maintain such controls. According to the Commission, an engineering control may be feasible even though it fails to reduce exposure to permissible levels contained in the standard, as long as there is a significant reduction in a miner's exposure. *Todilto Exploration and Development Corporation* v. *Secretary of Labor,* 5 FMSHRC 1894, 1897 (1983).

We will consistently utilize our longstanding enforcement procedures that we currently use for enforcement of our interim DPM limit and for our other exposure-based standards at M/NM mines. As a result, we will consider the total cost of the control or combination of controls relative to the expected benefits from implementation of the control or combination of controls when determining whether the costs are wholly out of proportion to results. If controls are capable of achieving a 25% reduction criterion, we will evaluate the cost of controls and determine whether their costs would be a rational expenditure to achieve the expected results.

We continue to emphasize that the concept of ''a combination of controls'' is not new to the mining industry. It is our consistent practice not to cost controls individually, but rather to combine their expected results to determine if the 25% significant reduction criterion, as discussed earlier in this section, can be satisfied. We heavily weigh the potential benefits to miners' health when considering economic feasibility and do not conclude economic infeasibility merely because controls are expensive. Mine operators have the responsibility for demonstrating to us that the costs of technologically feasible controls are wholly out of proportion to their expected benefits.

In situations where we find that the mine operator has not installed all feasible controls, we will issue a citation and establish a reasonable abatement date. Based on a mine's technological or economic circumstances, the standard gives us the flexibility to extend the period within which a violation must be corrected. If a particular mine operator is cited for violating the DPM final limit, but that operator believes that the standard is technologically or economically infeasible for that operation, the operator ultimately can challenge the citation in an enforcement proceeding before the Commission.

We have found that most of the practical and effective DPM controls that are available, such as DPFs, ventilation upgrades, enclosed cabs with filtered breathing air, alternative diesel fuels, low-emission engines, and various work practice and administrative controls, have the potential to achieve a 25% reduction in DPM exposure. The actual percentage reduction obtained varies from application to application depending on the nature of the exposure and the specific choice of control or controls applied. For example, a DPF might reduce DPM tailpipe emissions from a piece of diesel-powered equipment by 95%. However, the equipment operator's actual exposure could be reduced by more than 95% if an enclosed cab with filtered breathing air is also provided, or the reduction could be less than 95% if other diesel-powered equipment without filtered exhaust is operated in the same area.

We have consistently advised the industry that DPM controls should be selected based on a thorough analysis of the circumstances and conditions at each mine. This final rule affords each mine operator the flexibility to select the DPM controls that are appropriate for their site-specific conditions. We have also advised that similar equipment may require different DPM controls due to different duty cycles or operating conditions. For example, a platinum-catalyzed passively-regenerating DPF might be successfully applied on one piece of equipment, but it may fail on a similar piece of equipment owing to different duty cycles. Even if applied on similar machines with similar duty cycles, such a DPF might be successfully applied on one machine but be unsuitable for the other because it is operated in an area of the mine having marginal ventilation, which could result in elevated NO_2 exposures.

Our compliance cost estimates from the 2001 final rule (not adjusted for inflation) ranged from $31,373 per year for the smallest nonmetal mines (based on fewer than 20 miners and 2.2 pieces of diesel-powered equipment per mine) to $659,987 for the largest precious metals mines (based on over 500 miners and 133 pieces of diesel-powered equipment per mine). Our average estimated compliance cost for the industry as a whole to achieve the interim and final limits was about $128,000 per year per mine in 1998 dollars, or about 0.68 percent of the mine's annual revenues, on average. Of that amount, about $90,000 per mine, on average, was our estimated yearly compliance cost to meet the interim limit of 400_{TC} $\mu g/m^3$. These estimates were reduced by a negligible amount in the 2005 final rule, due largely to the elimination of the provisions on DPM control plan and required approval from the Secretary to use respiratory protection. As shown in Table IX.5 of this preamble, the estimated compliance cost to move from the interim limit to the final limit of 160_{TC} $\mu g/m^3$ is about $50,000 per mine in 2004 dollars.

The 2001 final rule established DPM limits that were to be phased-in in two steps over five years, starting with 308_{EC} $\mu g/m^3$, which is comparable to the 400_{TC} $\mu g/m^3$ that became effective July 20, 2002, 18 months after promulgation, followed by a final limit of 160_{TC} $\mu g/m^3$ that was to become effective three-and-one-half years later. Our intent with respect to the phased-in DPM limits in the 2001 rule and in subsequent rulemaking was to provide the industry with adequate time to familiarize itself with DPM control technology so mine operators could make informed decisions regarding selection and implementation of controls, train miners properly on the use and maintenance of the controls before the limits became effective, and spread the cost of controls over a multi-year period. As noted above, our Regulatory Economic Analysis (REA) for the 2001 final rule determined that total annual compliance costs would average $128,000 per mine for the industry as a whole, primarily for DPM controls. These costs represented about 0.68% of annual industry revenue. We believed that the multi-year phase-in of the DPM limits would serve to reduce the economic impact on affected mines by encouraging purchases of controls gradually over several years.

At the time the 2001 final rule was issued, based on the availability of controls we understood could be implemented by mine operators to attain compliance with the respective limits, we believed the phase-in schedule of 18 months to reach the interim limit and five years to reach the final limit would provide sufficient time for the entire industry to attain compliance. However, based on the comments received from the mining industry, other data in the DPM rulemaking record, information received from NIOSH, our compliance assistance reports and activities, and our experience with enforcing the interim limit, we began to question whether it was feasible for the industry to attain compliance with the final limit by January 20, 2006. As we discussed in the preamble to the 2005 NPRM, the applications engineering and related technological and economic implementation issues that we believed would have been easily resolved by then were more complex and extensive than previously thought. We still believed the mining industry could reach compliance with the 160_{TC} $\mu g/m^3$ final limit; however, we had determined that the original schedule for attaining the final limit was too ambitious for a significant portion of this industry.

In the 2005 NPRM, we acknowledged the implementation issues and proposed modifying our phase-in schedule with the intention of establishing a more realistic regulatory timetable for reaching the final limit. Rather than requiring compliance with the 160_{TC} $\mu g/m^3$ final limit by January 20, 2006, we proposed phasing-in the final limit in five steps over a five year period, and in 50_{TC} $\mu g/m^3$ reductions for each year. The initial final limit would have been 308_{EC} $\mu g/m^3$ on January 20, 2006; 350_{TC} $\mu g/m^3$ on January 20, 2007; 300_{TC} $\mu g/m^3$ on January 20, 2008; 250_{TC} $\mu g/m^3$ on January 20, 2009; 200_{TC} $\mu g/m^3$ on January 20, 2010; and finally 160_{TC} $\mu g/m^3$ on January 20, 2011. Our goal in proposing this five-year phase in was to provide the additional time we believed the industry needed to attain the final 160_{TC} $\mu g/m^3$ limit, while at the same time, assuring steady progress would be made during that period to reduce miner exposures to DPM. In the NPRM, we asked for comments on this schedule for phasing in the final limit, and on other issues.

After analyzing the information and data obtained from the comments we received on the 2005 NPRM, we have extended the amount of time we believe the industry will need to attain compliance with the 160_{TC} $\mu g/m^3$ final limit beyond what was promulgated in the 2001 final rule. Based on this new information and data, we now believe that requiring compliance with the final limit in three steps over two years, namely 308_{EC} $\mu g/m^3$ by May 20, 2006, 350_{TC} $\mu g/m^3$ by January 20, 2007, and 160_{TC} $\mu g/m^3$ by May 20, 2008, is feasible. This timeframe for implementing the final limits will produce the maximum degree of miner protection from DPM exposure that is both technologically and economically feasible for the M/NM underground mining industry, as a whole, to achieve.

We continue to believe that establishing a final limit lower than 160_{TC} µg/m^3 is not economically feasible for the industry. Reducing the final limit below 160_{TC} µg/m^3 would require costly ventilation upgrades, replacement of most older mining equipment, and considerably increased use of DPFs on large numbers of, if not on all, underground diesel powered equipment.

In our 2005 NPRM, where we proposed our five-year phase in of the final limit, we tentatively concluded that the 2001 160_{TC} µg/m^3 final concentration limit presented a significant challenge to a large portion of the underground M/NM mining industry and that compliance may not be feasible by January 2006. We also stated that:

> Our experience since January 2001 has raised questions on technological feasibility for the mining industry as a whole, rather than for a small number of individual mines, to meet the 160 TC concentration limit by January 20, 2006.

We specifically requested comments on the economic feasibility of the final concentration limit of 160_{TC} µg/m^3 and our proposed phase-in approach.

We also acknowledged in the 2005 NPRM that significant compliance difficulties may be encountered at some mines due to implementation issues and the cost of purchasing and installing certain types of controls. We requested additional information regarding these technological difficulties and whether they would increase the cost to comply with the final concentration limit above that estimated in the 2001 final rule.

In addition, we proposed to eliminate § 57.5060(c)(3)(i) which prohibits new mines from applying for special extensions and requested comments on the benefits (including cost savings) of doing so. Lastly, we requested comments on the costs to mine operators for implementing a rule requiring medical evaluation and transfer of miners. In response to these requests, we received numerous comments on the economic feasibility of meeting a final limit of 160_{TC} µg/m^3 within the proposed phase-in timeframes, as well as on other provisions of the proposed rule, which we discuss in detail below.

We believe that the reduction from 308_{EC} µg/m^3 to 350_{TC} µg/m^3 in January 2007 will provide necessary incentive and experience for mine operators to continue to work out their remaining feasibility issues and not to delay implementation of further engineering and administrative controls until the final 160_{TC} µg/m^3 limit becomes effective in May 2008.

We believe that the current rulemaking record fully supports the economic feasibility of the initial phase-in final limit of 308_{EC} µg/m^3, and the final limit of 160_{TC} µg/m^3. We have no new data or information in the rulemaking record justifying change to our 2005 cost estimates for the interim limit of 308_{EC} µg/m^3. We stated in our 2005 final rule that a PEL of 308_{EC} µg/m^3 was economically feasible for the M/NM mining industry and provided considerable discussion in support of our position.

Regarding the 2001 final limit of 160_{TC} µg/m^3, we stated in the 2005 final rule that the evidence in the current DPM rulemaking record was inadequate for us to make determinations regarding revision of the final DPM limit at that time. We requested comments on the feasibility of the mining industry to comply with a final limit of less than 308_{EC} µg/m^3.

Although we did not revise the final limit in the 2005 final rule, we did revise the special extension requirement to provide one year, renewable, extensions of time for mine operators in which to comply with the final limit, based on either economic or technological constraints, but continued to prohibit newer mines from applying for extensions (70 FR 32966). Additionally, in this 2006 final rule, we have removed the prohibition on newer mines from applying for a special extension. Consequently, all mine operators will be able to apply for a one-year, renewable special extension of time to comply with each of the final limits, including the final limit of 308_{EC} µg/m^3, 350_{TC} µg/m^3, and 160_{TC} µg/m^3.

The rulemaking record provides numerous examples of successful use of effective DPM controls. Our enforcement sampling record from November 2003 to January 2006 shows that 82% of the 1,798 samples we collected were below the 308_{EC} µg/m^3 interim limit, 78% were below the January 2007 final limit of 350_{TC} µg/m^3, and 46% were below the May 2008 final limit of 160_{TC} µg/m^3. Additionally, 46% of the mines sampled had at least one sample over 308_{EC} µg/m^3, 55% over 350_{TC} µg/m^3, and 82% of the mines had at least one sample over 160_{TC} µg/m^3. It should be noted that we do not consider these sample results to necessarily represent typical or average exposures for the industry as a whole because we do not randomly select the miners to be sampled. Following good industrial hygiene practice, our sampling procedures dictate that when we conduct enforcement sampling, we sample those miners whom we believe will have the highest exposures. Thus, typical or average exposures for the industry as a whole would likely be lower than these values. We have determined that the degree of compliance demonstrated in our enforcement sampling and the cost of available control technology support our conclusion that the final limits are economically feasible for the industry as a whole within the prescribed timeframes. Our enforcement sampling results also demonstrate the magnitude of the compliance difficulties the M/NM mining industry would have experienced in meeting the 160_{TC} µg/m^3 final limit by the May 2006 effective date.

We provide for consideration of compliance difficulties on a mine-by-mine basis in our existing use of hierarchy of controls and provisions on special extensions, which apply to the final limits. We are satisfied that the rule itself and our DPM enforcement policy take into account the financial difficulties on an individualized basis, which we believe will effectively accommodate an individual mine operator's economic concerns, particularly those of small mine operators.

We further recognize that there currently are significant implementation issues, both economic and technological, that would make it infeasible for the industry to comply with the existing 160_{TC} µg/m^3 final limit by May 2006. In our 2005 NPRM, we proposed a five-year phase in of the final limit to address the remaining feasibility issues and asked for comments on the technological and economic feasibility of this approach. Based on our analysis of the comments received, the entire rulemaking record, our current enforcement strategy for enforcing the final limits, and our experience with DPM control technology and costs, we believe that compliance with the 160_{TC} µg/m^3 final limit can be achieved in a shorter timeframe than the five years that we proposed. We are encouraged by the considerable progress we have seen to date in reducing DPM levels and in the many successful implementations of DPM controls addressed in the following discussion.

As stated in our 2005 final rule, ''The trends in DPM control technology development, especially DPFs, indicate that manufacturers are creating more innovative designs. MSHA believes that more cost effective control methods are on the horizon.'' Another new development that supports reducing the proposed five year phase-in of the final limit to the two year phase-in established in this rule is the significant DPM emission reductions achieved through the use of high biodiesel content fuel blends, coupled with the federal excise tax credit for biodiesel, and the rapidly growing availability of this alternative diesel fuel throughout the country. Although we acknowledge the high cost of some DPM controls, we do not believe they are significantly different from our estimated compliance costs in the 2001 final rule, and we have identified many lower cost options.

In the 2001 final rule, we estimated that the yearly cost of the rule would be about 0.68% of annual industry revenues, which was less than the 1% ''screen'' for costs relative to revenues that we use as a presumptive benchmark of economic feasibility (66 FR 5889). In the 2005 final rule, we determined that the 308_{EC} µg/m^3 interim limit was economically feasible for the M/NM mining industry. In Table IX.5 of this preamble, we estimate that the total yearly costs for the underground M/NM mines using diesel equipment to move from the current 308_{EC} µg/m^3 interim limit to the 350_{TC} µg/m^3 and 160_{TC} µg/m^3 final limits contained in this rule are $8,454,853. As previously shown in Table V–2 of this preamble, these yearly costs are less than 0.2% of annual industry revenues, well below our 1% ''screen'' that we use as a presumptive benchmark of economic feasibility.

In this rulemaking to consider a phased-in approach to the final exposure limit of 160_{TC} µg/m^3, we used economic feasibility information from the entire rulemaking record supporting the 2001 final rule, the 2005 final rule, comments in response to the 2005 NPRM, and our experience gained with control technology since 2001. We also used information obtained subsequently and entered into the rulemaking record, including data from the published literature, data developed by us through MSHA Technical Support investigations, public comments and testimony, and our enforcement experience relating to the interim PEL of 308_{EC} µg/m^3.

As stated above, we received numerous comments on the economic feasibility of the 2005 NPRM. Some commenters disagreed with our analytical method and the data we used to estimate compliance costs, and suggested that actual compliance costs will be much higher than our estimates. Consequently, they disputed our tentative conclusion that compliance with the phased-in final limits as proposed will be economically feasible for the industry as a whole. Other commenters stated that no delay is justified because there is strong evidence in the rulemaking record that full compliance with the 160_{TC} µg/m^3 final limit is both technologically and economically feasible at this time for the industry as a whole. Still other commenters indicated that it was impossible to estimate the industry's compliance costs for attaining the final exposure limit at this time. This is because they contend that feasible technology for complying with this limit is not yet available and will not be available in the foreseeable future. Comments relating to our economic feasibility determinations regarding the final limit are discussed in this section. Comments addressing technological feasibility were discussed previously in this section.

A few commenters stated that compliance with the final DPM limit would be cost prohibitive for their mines, and that business failure could result from their attempt to comply. Our technological and economic feasibility assessments of the final rule lead us to a different conclusion with respect to the possibility that business failures will occur as a result of implementing the final DPM limit.

Several commenters suggested that our ''prior economic feasibility conclusion is based on improper sampling and analysis, inaccurate and incomplete data, and incorrect assumptions.'' Regarding the issue of sampling and analysis, our economic feasibility assessment for the 2001 final rule was based on personal, occupational, or area sampling using a respirable dust sampler equipped with a submicron impactor, and analysis of samples for TC (EC plus OC) in accordance with NIOSH Analytical Method 5040. The DPM rulemaking record contains evidence supporting the positions of both MSHA and NIOSH regarding the performance of the SKC sampler. Among the conclusions drawn from the 31-Mine Study and included in the preamble to the 2005 final rule were the following (70 FR 32871):

• The analytical method specified by the diesel standard gives an accurate measure of the TC content of a filter sample and the analytical method is appropriate for making compliance determinations of DPM exposures of underground metal and nonmetal miners.

• SKC satisfactorily addressed concerns over defects in the DPM sampling cassettes and availability of cassettes to both MSHA and mine operators * * *

• The submicron impactor was effective in removing the mineral dust, and therefore its potential interference, from DPM samples. Remaining interference from carbonate is removed by subtracting the 4th organic peak from the analysis. No reasonable method of sampling was found to eliminate interferences from oil mist or that would effectively measure DPM levels in the presence of environmental tobacco smoke (ETS) with TC as the surrogate * * *

MSHA has found that the use of EC eliminates potential sampling interference from drill oil mist, tobacco smoke, and organic solvents, and that EC consistently represents DPM. In comparison to using TC as the DPM surrogate, using EC would impose fewer restrictions or caveats on sampling strategy (locations and durations), would produce a measurement much less subject to questions, and inherently would be more precise. Furthermore, NIOSH, the scientific literature, and the MSHA laboratory tests indicate that DPM, on average, is approximately 60 to 80% elemental carbon, firmly establishing EC as a valid surrogate for DPM.

Some industry comments contained in Section VII of the 31-Mine Study final report state that, ''Fears about using Method 5040 have been allayed, but potential interference from ETS, oil mist, and ANFO are too great to permit using TC as a measure of DPM. Single samples and area samples are inappropriate.'' As noted below, our enforcement sampling procedures were subsequently changed to incorporate personal sampling only, and the DPM surrogate was changed to EC to eliminate potential non-DPM sources of OC from interfering with DPM determinations based on TC.

Regarding the effectiveness of the SKC DPM sampler with integral submicron impactor in the presence of ore dust, the industry comments contained in Section III–B of the 31-Mine Study final report state that, ''The impactor works in most applications.'' The industry comments on this section also stated that, ''The industry is perplexed about possible continued interference in gold mines with graphitic ores.'' However, the 31-Mine Study final report states that, ''For typical samples collected in gold mines, the interference from elemental carbon from gold ore would be less than 1.5 µg/m^3.''

In the 2005 final rule, we modified our compliance sampling strategy to utilize personal sampling only, which is the sampling strategy used by us for determining compliance with our other full-shift exposure-based standards for airborne contaminants, and we changed the DPM surrogate from TC to EC for the interim limit. The change to EC as the DPM surrogate was made to eliminate the potential for sampling interferences from non-diesel sources of OC, such as drill oil mist or tobacco smoke, from causing erroneous TC analytical results. Our 2005 final rule on the interim DPM exposure limit incorporated these changes, as does the current rulemaking, with the exception that we will undertake a separate rulemaking to convert from TC limits to EC limits for the 350_{TC} µg/m³ and 160_{TC} µg/m³ final limits.

Regarding the use of inaccurate or incomplete data for determining economic feasibility, some commenters suggested that the 2001 economic feasibility assessment should have been based on a representative sampling of all the underground mines affected by the rule. These commenters take the position that since the standard affects mines producing 24 different major commodities, our 2001 assessment should have included consideration for the impact of the standard on a representative sample of mines producing each commodity. The commenters also suggest that our practice of comparing the industry-wide cost of compliance to the industry's annual revenue is inappropriate. They indicate that this method ignores the fact that international commodity markets determine the viability of mines by setting market prices for their production, and that annual revenues of hundreds of millions, if not billions, of dollars have not prevented the domestic underground M/NM mining industry from shrinking in recent years.

We believe that the method we used to determine economic feasibility is valid. In the 2001 final rule, we subdivided the industry both by mine size class and commodity sector. The mine size classes were under 20 employees, 20 to 500 employees, and over 500 employees. The commodity sectors grouped mines according to the commodity produced. The commodity sectors were stone, precious metals, other metals, evaporates, and other. The resulting matrix comprised the five commodity groups with three mine size classes within each commodity group. Compliance costs were estimated for mines within each size class and commodity group based on mining methods and equipment common for those specific types and sizes of mines. Using this methodology, all underground M/NM mines were included in our economic analysis, even though compliance costs were not necessarily determined on a mine by mine or individual commodity by individual commodity basis. Compliance cost estimates were included for each of the major provisions of the standard, such as DPM controls to attain the DPM limit (DPM filters, equipment cabs, and ventilation), newly introduced engines, paperwork costs associated with applying for a special extension, tagging and examination of equipment suspected of needed emissions maintenance, training, etc.

Some commenters believe that we made incorrect assumptions in performing our economic feasibility assessments. The Regulatory Economic Analysis (REA) for the 2001 final rule was based on our determination that the most significant compliance cost component would be the cost of DPM controls to meet the respective DPM limits, accounting for 96% of the total cost of compliance. Our cost estimates for these controls were originally based on a compliance strategy that assumed that the interim limit would be attained primarily by replacing engines, installing oxidation catalytic converters, and ventilation improvements. We further assumed that the final limit would be attained primarily by adding environmental cabs with filtered breathing air and installing DPM filters. We recognized that mine operators had the flexibility to choose the engineering and administrative controls that best suited their mine-specific circumstances and conditions. However, for costing purposes, the above compliance strategies were assumed. Based on extensive industry comments on the Preliminary Regulatory Economic Analysis (PREA) for our 1998 proposed rule, we modified our cost estimates to favor diesel particulate filter systems and cabs for compliance with the interim limit, and more filters, ventilation and the turnover of engines for compliance with the final limit. Our 2001 REA was based on this modified compliance strategy.

The modified compliance strategy results in estimated industry-wide compliance costs that we believed were economically feasible for the industry as a whole. The original estimate of $19.2 million in annual compliance costs was revised upward to $25.1 million as a result of the comments received on the 1998 proposed rule. Our economic analysis for the 2005 final rule on the interim limit actually showed a slight decrease in compliance costs of $3,634 annually, primarily due to reduced recordkeeping requirements from elimination of the DPM control plan and required approval from the Secretary to use respiratory protection (70 FR 32944). The 2005 final rule analysis, however, did not address the economic impact of the final DPM limit of 160_{TC} µg/m³.

The commenters further stated that the compliance strategy used for developing compliance cost estimates was based on, ''incorrect assumptions of applicable and feasible controls.'' However, as discussed extensively in the technological feasibility section of this preamble and throughout the rulemaking record, we have established the feasibility of the various controls that are required to attain compliance with the new final limits in accordance with the phased-in dates.

Through the comments received during our DPM rulemakings, compliance assistance visits to mines, and our enforcement experience with the 2001 and 2005 final rules, we have learned that the vast majority of mine operators have acquired at least a few EPA Tier 1 and Tier 2 engines, and many have fleets that are comprised of 40% to 50% or more of such engines. Despite disagreeing with our proposed rule, a stone mining operator with seven underground mines commented that all new equipment purchased at two of their mines were supplied with EPA Tier 3 engines, and they have plans to similarly upgrade the remaining equipment at those mines. Three other stone mining operators who also disagreed with our proposed rule, nonetheless, volunteered similar information. One reported they had recently acquired a new loader, drill, and scaler, all with EPA Tier 2 engines. Another reported acquiring two new haulage trucks in 2005 at a cost of over $600,000. The third operator indicated that,

> Before the initial inventory was even required, we immediately replaced our 1970's haul trucks with trucks built in the 1990's. Later we removed a 1992 loader for a 1999 loader with a Tier 2 engine. We have recently purchased a newer roof-scaler with a Tier 2 engine. We have retrofitted one of our drills with a Tier 2 engine, and are looking at buying a new drill to replace our second drill.''

Use of low emission engines has also been common in the western multilevel metal mines. Despite opposing our proposed rule, one mine operator said that replacement of old engines with new cleaner engines, where practicable, began in 2003. Such engine replacements have now become a primary focus of our efforts to control DPM. Another operator who opposed our proposed rule indicated they have conducted a proactive engine campaign to replace higher DPM emitting engines with newer EPA Tier 1 and Tier 2 rated engines. To date, 68% of the underground equipment is powered by EPA Tier 2 rated engines. A third operator who also disagreed with our proposed rule reported they have repowered eight pieces of equipment at their mine. A mining industry organization commented that, ''* * * as our members replace their old engines with new cleaner engines, that effort will reduce the DPM exposures of miners.'' A comment from another mine operator indicated that during the last two years, they had, ''purchased fifteen Tier 2 engines that, along with thirty Tier 1 engines, constitute 42% of the current underground fleet and 54% of the total horsepower.''

Some commenters noted they have also made improvements to their ventilation systems, such as upgraded auxiliary ventilation systems, more booster fans, and better maintenance of ventilation control structures. Examples include a mining company that operates several underground stone mines, which commented,

All [of our] mines have performed major ventilation upgrades, which include installation of new larger portable fans that are used at active headings to help direct air flow, installation of larger main ventilation fans at two mines, installed larger booster fans in the duct tubing at three mines, installed new ventilation stoppings and curtains at various locations throughout the mine at all mines, [and] replaced less efficient ventilation fans with high volume/low pressure fans.

Another stone mine operator reported they had, ''installed a third vertical air shaft in our mine, we have added brattice cloth for over 25 rooms and adjusted brattice cloth throughout our mine, changed traffic patterns, and utilized portable fans.''

Western multilevel metal mine operators also upgraded ventilation systems. One operator of several underground gold mines reported upgrading a spray chamber, developing a new entrance drift and mine portal, and using large auxiliary fans to increase heading ventilation. A large base metal mine operator reported purchasing 17 new auxiliary fans that were one-third more powerful than the existing fans and also upgrading ventilation system maintenance.

A few mine operators have completed major ventilation system upgrades, including new ventilation shafts and fan installations. However, it is not clear whether all operators that reported such upgrades did so entirely to attain compliance with the DPM interim or final limit. For example, despite the mine operator's claims to the contrary, our detailed analysis of a ventilation system improvement project costing over $9,000,000 at a western multilevel metal mine indicated that some or most of these upgrades would have been necessary anyway to accommodate planned production increases and other non-DPM related purposes. One outcome of this ventilation upgrade was a 1,000 horsepower reduction in the ventilation system's total electrical power requirements, achieved through more efficient deployment of booster fans. Over 60% of the overall $9,000,000 project cost, when annualized, was offset by this electrical power cost savings.

Through the comments submitted to the rulemaking record, the NISOH DPM workshops in 2003, and our compliance assistance visits to mines affected by the rule, we have learned that, although many of the metal mines have experimented with DPM filters, comparatively few are relying on filters as their primary means of complying with the interim limit. Also, environmental cabs are in widespread use throughout the industry; however, comparatively few such cabs have been retrofitted to existing equipment as a primary means of compliance with the interim limit. Indeed, several commenters provided information on the high cost of retrofitting cabs to existing equipment, indicating why cab retrofits were not the first option for attaining compliance. Since the final rule is performance-oriented and gives mine operators flexibility to choose the DPM engineering and administrative controls that are best suited to their unique circumstances and conditions, it is not surprising that other compliance strategies have also been employed, such as utilization of alternative diesel fuel (high biodiesel content blends and diesel-water emulsions) and implementation of a wide array of work practice and administrative controls. But by far the most common strategies employed throughout the industry to attain compliance with the interim limit have been low DPM emitting engines and ventilation improvements, which were the basis for our original compliance cost estimates.

One commenter suggested that we conduct a full regulatory impact analysis to assess the true economic cost of our proposal. This commenter disagreed with the manner in which we updated the 2001 REA, since significant changes have occurred since then in the American economy, namely changes in fuel prices due to war and natural disasters. This commenter also believes that DPM controls are more costly than we projected and questioned whether these controls are effective. Overall, this commenter believes that we grossly underestimated compliance costs in our 2001 final rule. We are unaware of a change in the American economy presented by the commenter other than the price of fuel, which we agree has gone up since 2001. However, the commenter did not relate a rise in fuel prices with the economic feasibility of industry compliance with the subject rule. The recent rise in diesel fuel prices does not affect the 1% ''screen'' for compliance costs relative to industry annual revenue that we use as a presumptive benchmark of economic feasibility. Higher fuel prices would actually make the purchase of low DPM-emitting engines more attractive because they also have better fuel economy compared to the older technology high DPM emission engines. More importantly, we also note that the prices of the various commodities that are produced in underground M/NM mines have also gone up since 2001. For example, between 2001 and 2005, the price of gold increased 108%, zinc 53%, platinum 64%, crushed stone 11%, lead 40%, and rock salt 19%. The commenter has not established that the industry's relative financial position compared to 2001, if it has changed at all, has been so altered by a general rise in prices that compliance with the final rule is economically infeasible.

In responding to the commenter's second point, the technological feasibility of DPM controls was discussed in detail previously in this section of the preamble. In the 2005 NPRM, we proposed a five year phase-in of the final DPM limit to allow mine operators the extra time they would need to overcome technological and economic implementation issues with DPM controls. Based on new information, primarily relating to DPM filters and biodiesel fuel, we have shortened the final limit phase-in period from five to two years. However, we believe this compliance schedule, coupled with provisions in the final rule relating to special extensions of time in which to meet the final limit, will enable the entire industry to attain compliance.

Regarding the comments concerning the role of international commodity markets in determining the viability of mines by setting market prices for their production, our use of industry annual revenue tacitly incorporates the effects of ever-changing commodity prices. As prices rise, industry annual revenue rises, and as prices fall, industry annual revenue falls. Although commodity prices are indirectly incorporated into our analysis, however, for purposes of determining the economic feasibility of a rule, the dollar amount of the industry's annual revenue is not by itself determinative. Both prices and production determine industry annual revenue. Compliance costs that are only a small percentage of industry revenue help to establish economic feasibility.

We have customarily used yearly compliance costs of greater than 1% of annual industry revenue as our screening benchmark for determining whether a more detailed economic feasibility analysis is required. The commenters correctly point out that despite hundreds of millions, if not billions, of dollars of industry annual revenue, business failures can and do occur, and over a period of decades, the characteristics of an industry can change markedly. However, by utilizing the 1% of annual revenue screening benchmark, we assure that a new MSHA rule will not significantly affect the viability of an industry.

While it is true that individual business failures can and do occur, and that over a period of many years, substantial portions of a domestic industry can be adversely affected by, for example, international competition, MSHA believes it is highly improbable that such events would be set into motion by a rule imposing costs equal to or less than 1% of industry annual revenue. Threats to an entire industry's competitive structure and resulting large scale dislocations within an industry sector are typically caused by fundamental changes in technology, permanent downward pressure on demand for a commodity due, for example, to the introduction of a superior substitute material, world-wide or regional business cycles, etc.

A commenter suggested that the economic feasibility analysis in the 31-Mine Study was flawed because our unit prices for commodities 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–$25 per ton when the analysis was made. Yet, this commenter went on to say that our estimates for revenues and likely annual production levels for the three salt mines appeared to indicate that a price of about $50–$70 per ton was used in our analysis.

We are not persuaded by commenter's view that the economic feasibility analysis for the 31-Mine Study is invalid because we used erroneous commodity prices. For the 31-Mine Study, we did not have access to actual annual revenue data for the 31 mines in the study, so we indirectly estimated annual revenues using our data on the number of employee work hours in 2000 for each mine, the total number of employee work hours reported to us in 2000 by all mines producing that commodity, and data from the U.S. Geological Survey on the industry-wide value of mineral production by commodity for the year 2000. We estimated annual revenues for a particular mine by determining the industry-wide production value per employee hour for the specific commodity each mine produced, and multiplying that amount by the number of annual employee work hours reported to us for that mine. This methodology assumes that each mine's annual revenues would be roughly proportional to each mine's share of the industry's total employee work hours. Thus, our estimates, while not necessarily exact for each mine, were a reasonable approximation for those mines based on industry averages. This methodology does not explicitly incorporate a cost per ton factor. However, implicit in this methodology, based on the U.S. Geological Survey's estimates of rock salt production in 2000 of 45,600,000 metric tons valued at $1,000,000,000, would be a cost per metric ton of $21.93 (equivalent to $19.89 per short ton), which is actually slightly less than the commenter's estimated price of $20 to $25 per ton. Thus, we have no information about how the commenter came up with a price of $50–$70 per ton of salt purportedly used in our analysis. *As demonstrated above we implicitly used a cost per metric ton of $21.93.*

Several commenters stated that our compliance cost estimates in the ''31-Mine Study'' were unrealistically low because we didn't recommend major ventilation upgrades for any of the mines in the study. Other comments relating to the ''31-Mine Study'' were that the mines included in the study were not representative of the industry as a whole, that we voided 25% of the samples collected, that we eliminated four mines from the study, and that we significantly underestimated compliance costs for the Stillwater Mine near Nye, MT, which was one of the mines included in the study. In responding to the question of major ventilation upgrades, we noted in the preamble to the 2005 final rule (70 FR 32921) that we did not specify any major ventilation upgrades in the 31-Mine Study because, based on the study methodology, the analysis did not indicate the need for major ventilation upgrades in order to attain compliance with either the interim or final DPM limits at any of the 31 mines. We further went on to explain that the purpose of specifying controls for each mine in this study was simply to demonstrate that feasible controls capable of attaining compliance existed, and to provide a framework for costing such controls on a mine-by-mine basis. We explicitly stated in the final report that the DPM controls specified for a particular mine did not necessarily represent the only feasible control strategy, or the optimal control strategy for that mine.

Since the completion of the 31-Mine Study, we have observed that mine operators in the stone industry, for example, have chosen to attain compliance without utilizing DPFs. These operators instead have opted to upgrade ventilation (usually by adding or re-positioning booster fans and installing or repairing ventilation control structures such as air curtains and brattices); install low-emission engines; utilize equipment that is supplied by the original equipment manufacturer (OEM) with cabs with filtered breathing air; initiate a variety of work practices that contribute to reducing personal exposures to DPM; and in a few cases, use alternative diesel fuels such as bio-diesel fuel blends and diesel/water emulsions.

Regarding the question of the 31 mines being unrepresentative of the industry as a whole, we note that the mines were selected jointly by us and the DPM litigants, and all parties collaborated in the study design. Although an attempt was made to include a variety of commodities in the study, the selected mines were not ever intended by us or the collaborators to be a statistically representative sample of the industry.

In a related comment, an industry organization asserted that our subsequent ''baseline'' sampling was ''similarly non-representative.'' The sampling to which this commenter refers was conducted by us in 2002 and 2003 in accordance with a provision of the second partial settlement agreement. As described in the preamble to the 2005 final rule (70 FR 32873–32874),

> Under the second partial DPM settlement agreement, MSHA agreed to provide compliance assistance to the M/NM underground mining industry for a one-year period from July 20, 2002 through July 19, 2003. As part of its compliance assistance activities, MSHA agreed to conduct baseline sampling of miners' personal exposures at every underground mine covered by the 2001 final rule. Our baseline sampling began in October 2002 and continued through October 2003. During this period a total of 1,194 valid baseline samples were collected. A total of 183 underground M/NM mines are represented by this analysis * * * MSHA [included] 320 additional valid samples [in the analysis of baseline sample data] because MSHA decided to continue to conduct baseline sampling after July 19, 2003 in response to mine operators' concerns.

We are unclear as to why the commenter would characterize the baseline sampling as ''non-representative,'' as it included all underground M/NM mines that were in operation during this period of over one year.

Regarding voided samples, of the 464 samples obtained at the 31 mines, 106 were voided. A key consideration in the sampling conducted at the 31 mines was to insure, to the extent possible, that samples were not contaminated by non-diesel sources of airborne carbon. Testing had verified that the submicron sampler would remove mineral dust contamination (limestone, graphite, etc.), but tobacco smoke, drill oil mist, and possibly vapors from ANFO loading could contaminate a sample filter with non-diesel organic carbon. Thus, in accordance with the study protocol that had been jointly developed and approved by both us and the litigants, any sample that was known to have been, or could potentially have been contaminated with such an interferant was voided. Of the 106 voided samples, 61 were voided due to interferences. There were also some samples that were voided for other reasons, such as laboratory error (2 samples), sample pump failure (22 samples), or incomplete sample or sampling the wrong location (21 samples). Including any of these 106 voided samples in the data analysis would have cast doubt on the validity of the study.

In response to the comment that four mines were eliminated from the study, of the 31 mines selected to participate; only one was eliminated. This mine was not eliminated per se. DPM samples were obtained at this mine; however, none of these samples were included in the data analysis because they all had to be voided due to interferences.

The underestimation of compliance costs for the Stillwater Mine in the 31-Mine Study was also discussed in the preamble to the 2005 final rule (70 FR 32924). We acknowledged that the DPM compliance costs for this mine would probably be significantly higher than we reported in this study because, as we explained previously, our analysts, at the time the 31-Mine Study was conducted, had been supplied with inaccurate information regarding this mine's diesel equipment inventory. Based on updated equipment inventory data, we subsequently revised our analysis and corresponding cost estimates. The revised annual estimated compliance cost for the Stillwater Mine of $935,000 was reported in the preamble to the 2005 final rule (70 FR 32943). Although, this amount is considerably higher than the estimate from the 31-Mine Study, it is significantly less than the estimated compliance cost for a precious metals mine of this size as detailed in our REA for the 2001 final rule.

Several commenters repeated their concerns expressed in previous public comments that the 2001 final rule and subsequent economic feasibility assessment for the 31-Mine Study relied on quantitative analyses supported by a ''flawed'' computer simulation program. They believe that the Regulatory Economic Analyses for all of our DPM rulemakings, from the original 2001 final rule to and including the current rulemaking, are invalid because they incorporate analytical results obtained from this program.

As discussed in the section on technological feasibility, the computer program in question, referred to as the DPM Estimator, is a Microsoft® Excel spreadsheet program that calculates the reduction in DPM concentration that can be obtained within an area of a mine by implementing individual, or combinations of engineering controls. The two specific ''flaws'' identified by the commenters are, ''assumptions of the availability of filters that would fit the entire fleet of equipment in use, and assumptions of perfect ventilation conditions throughout the industry.'' We have responded previously to both of these comments, as well as to other criticisms of the Estimator. We have shown that suitable DPM filters were, and continue to be, available to mine operators that are capable of attaining the final DPM limits within the timeframes established in the final rule, and that the Estimator does appropriately account for complex ventilation effects. Our responses to the previous criticisms on the Estimator and to the comments on the Estimator submitted to this rulemaking are detailed in the technological feasibility section of this preamble.

A number of comments related either directly or indirectly to activities at the Stillwater Mine near Nye, MT. The Stillwater mine is a large multilevel platinum mine that operates 24/7 with a workforce of over 900 miners. The Stillwater Mining Company currently utilizes 288 pieces of diesel equipment in its underground mine. The company has been installing EPA Tier 1 and Tier 2 engines since 2001, and at present, approximately 16% of its engines are Tier 1, and 52% are Tier 2. One Tier 3 engine is in operation, and three additional Tier 3 engines were expected in late January 2006. The company has also upgraded its diesel engine maintenance program. Cabs have been installed on a few pieces of equipment which are operated in areas of the mine where the size of the mine openings provides sufficient clearance for a cab. The company has experimented with a variety of DPM filter systems, including platinum washcoated passively regenerating filters, active on-board filters, active off-board filters, a fuel burner type active regenerating system, and disposable filter element systems. The company has also evaluated a diesel-water emulsion fuel and various biodiesel blends, and the company has made significant improvements to the mine's ventilation system in recent years.

Most of the comments relating to this mine, submitted both by the mine operator and various other mining companies and organizations, suggest that the failure to attain full and consistent compliance with the interim DPM limit at this mine, despite vigorous and sustained efforts by the company, are evidence that neither the interim DPM limit nor the final DPM limit are technologically feasible. They also point out that the funds expended by the company thus far in its effort to attain compliance have been excessive, and that this experience therefore demonstrates the economic infeasibility of the rule as well.

We have found through our Technical Support assistance and enforcement experience that this mine operator, in time, could achieve more consistent compliance with the DPM interim limit and attain the final DPM limits if they would install effective engineering and administrative controls. Although this mine operator has experimented with a number of DPM control technologies, some of these trials were of quite limited scope and duration. Several were conducted as a part of collaborative studies with the NIOSH Pittsburgh Research Laboratory under the auspices of the NIOSH M/NM Diesel Partnership. While it is true that this mine operator has evaluated numerous DPM control technologies, only a few have been the subject of sustained and intensive applications engineering efforts that we believe are required to resolve the associated site-specific and application-specific implementation challenges. To mention a few examples, this operator is not currently utilizing fuel burner DPFs, biodiesel, or water-emulsion fuels. Their use of high temperature disposable diesel particulate filters (HTDPFs) has been hampered by the use of HTDPFs on equipment having very high DPM emission engines, which causes the filters to load up quickly and create possible fire hazards. This operator has not utilized heat exchangers in conjunction with HTDPFs, which would enable their use on a much broader range of equipment. They have expended far greater effort to optimize passive DPF applications compared with active DPF applications, even though they indicate that the vast majority of their equipment is not suitable for application of passive DPFs. Through an extensive MSHA Technical Support study of their ventilation system, we had observed numerous problems with auxiliary ventilation systems in stopes. MSHA is continuing to work with Stillwater to resolve these compliance issues.

Regarding the question of economic feasibility, although the mine operator has incurred substantial costs, as mentioned earlier we do not believe that these costs would be excessive for a mine of this type and size based on expected compliance costs detailed in the Regulatory Economic Analysis (REA) for the 2001 final rule. In the preamble to the 2005 final rule (70 FR 32934–32936), compliance costs for this mine were analyzed in detail. This analysis indicated that when this operator's actual expenditures were annualized at a 7% annualization rate, the operator's yearly compliance costs for the interim limit were less than expected based on the estimates contained in the REA for the 2001 final rule for a precious metals mine of this size.

Two compliance cost issues at this mine were discussed in detail in the preamble to the 2005 final rule: the cost of implementing an active DPF program, and the cost of a major ventilation system upgrade. In that preamble, we presented several options for deploying active diesel particulate filters at this mine. These options were developed in response to a comment from this mine operator submitted to the 2003 NPRM that the cost of implementing an active DPF program for this mine would exceed $100 million over ten years. Our deployment options were functionally equivalent, and the estimated costs were less than $400,000 per year. In the preamble to the 2005 final rule (70 FR 32935–32936), we said,

MSHA does not believe the particular plan developed by Stillwater is the optimal means of utilizing active DPM filters at this mine. Various alternative approaches for utilizing active filters exist which would be far less costly.

Since excavating regeneration stations accounted for over 96% of the total cost of implementing Stillwater's active filter plan, alternatives that do not include such excavation costs would have a significant cost advantage over Stillwater's plan. It is somewhat curious that Stillwater developed its active DPF plan on the basis of this particular on-board active regeneration system, despite the extraordinarily high cost of excavating the regeneration stations, and Stillwater's prior experience with premature failure of the on-board heating elements built into the filters.

A lower cost alternative to Stillwater's approach utilizes an on-board fuel burner system to regenerate filters. The ArvinMeritor® system was used at this mine in 2004 with excellent results. It actively regenerated the filter media during normal equipment operations, regardless of equipment duty cycle, with no elevated levels of potentially harmful NO_2, and without having to travel to a regeneration station to regenerate its filter.

Another less costly alternative would be to utilize off-board regeneration instead of on-board regeneration. In off-board regeneration, a dirty filter is removed and replaced with a clean filter at the beginning of each shift. During shift change, the dirty filters are then transported by the equipment operator or a designated filter attendant to a central regeneration station or stations.

Such stations could be a fraction of the size of the regeneration stations envisioned in Stillwater's plan, because they would only need to accommodate the filters, not the host vehicles. Since the host vehicles would not need to travel to the regeneration stations, the travel distance from normal work areas to the regeneration stations would be less important, greatly lessening the need for frequent construction of new regeneration stations as the workings advance. It is very likely that such stations could be co-located in existing underground shops, unused muck bays, unused parking areas, or other similar areas.

Off-board regeneration might not be practical on larger machines due to the size of the filters. For larger machines that are not suitable for passive regenerating filters, the fuel burner approach might be preferable. But many of the machines targeted for active filtration are quite small, having 40 to 80 horsepower engines. Active filters for these engines are correspondingly small, and could be easily and quickly removed and replaced using quick-disconnect fittings. Another lower cost option would be to utilize disposable high-temperature synthetic fabric filters, especially on smaller, light duty equipment such as pickups, boss buggies, and skid steers. Depending on equipment utilization, such filters might only need to be replaced once or twice per week.

In its comments on our 2005 NPRM, the mine operator states that equipment identified for use with active regeneration systems has been limited to equipment that is parked on the surface at the end of the shift. This would allow the DPF to be removed and placed in a regeneration station. Unfortunately, not all equipment can be brought to the surface for regeneration due to logistical issues, according to this mine operator. The commenter, however, provided no rationale explaining why active regeneration should be limited only to equipment that is brought to the surface at the end of the shift, as active regeneration can easily be accomplished underground. Furthermore, later in the same section, the commenter acknowledges that underground regeneration is possible. The commenter states that for units that must be regenerated underground, additional excavations to house the regeneration equipment and to provide parking during regeneration would be required. These additional excavations are neither practical nor economically feasible, according to this commenter.

These comments neither acknowledge nor refute the recommended options we provided in the 2005 final rule preamble and as summarized above.

In another part of their comments to this rule, the mine operator discusses their experiences with disposable filter element type diesel particulate filters, and indicates that the costs of utilizing this system are excessive because the useful life of the filter is so short. The example provided by the mine operator was a particular model Toyota truck. The commenter operates many such Toyota trucks, which can be configured for a variety of service and support applications. According to the mine operator's analysis, the annual cost of maintaining a disposable element filter system on this type of vehicle is $40,000, which this mine operator characterized as ''cost prohibitive.'' In response, we note that the Toyota truck used in this example is equipped with a model 1HZ engine, which has very high diesel particulate emissions between 0.8 and 0.9 g/bhp–hr. Table 6 in this mine operator's comments indicated that the DPM emissions for this engine were 0.22 g/bhp–hr. At 0.8 g/hp–hr, the 128 hp engine on the subject vehicle would generate 102 g/hr of DPM. A 10 inch diameter, 26 inch long filter with a capacity for capturing and storing 8 g of DPM per inch of filter length could thus store 208 g of DPM. Even with two such filters installed on the subject vehicle, the filters would become fully loaded after only $(208 \times 2)/102 = 4.08$ hours, or about 4 hours and 5 minutes. The mine operator's reports of filters that, ''burnt out,'' may be caused by continued operation of the subject vehicle after the filter has been fully loaded.

The problem with this application is the engine, not the filter system. If this engine were replaced with a modern low emission engine, filter loading would occur at a fraction of the rate experienced with the current high emission engine. The cost of the engine would be partially offset through lower fuel consumption, and the cost of maintaining the disposable filter system would drop by 70% to 90% because the truck could be operated for many more hours before the filter would become fully loaded and need replacement. By optimizing the total system, including the engine and the filter, associated costs could be significantly reduced.

Regarding the major ventilation upgrade, in its comments on the 2003 NPRM, Stillwater provided information and costs relating to a major $9,000,000 ventilation upgrade they stated was a DPM-related compliance expense. In the preamble to the 2005 final rule (70 FR 32934–32935), we disputed this claim. We determined that the expense was only partially DPM-related and that this operator was also able to obtain a significant electrical power cost savings as a result of more efficient deployment of booster fans. Over 60% of the overall $9,000,000 project cost, when annualized, was offset by this electrical power cost savings. In its comments on the current rulemaking, additional general information on the mine's ventilation system is provided, as are plans for future upgrades, but our analysis was not refuted. Another commenter observed that our analysis of the $9,000,000 ventilation upgrade was, ''suspect,'' but provided no factual information to corroborate their position.

Two commenters noted that our 2001 estimate of the cost of compliance for the industry as a whole of $25.1 million per year was too low. One commenter, a mining industry organization, provided no rationale or explanation to support this comment. The other commenter, a stone mining operator, presented estimated compliance costs for this mine and extrapolated these costs to the rest of the industry. This operator stated that it cannot accept our projections that this final rule will not have an annual effect of $100 million or more on the economy. A figure of $100 million divided by 200 M/NM mines would result in $500,000 per mine. This commenter believes that its cost estimates for new or newer equipment in its small mine show capital contribution of over three times our figure.

This mine operator then listed the following estimated equipment costs:

• Drill	$350,000
• Powder truck	$50,000
• Scaler	$350,000
• Loader	$250,000
• Truck 1	$225,000
• Truck 2	$225,000
• Truck 3	$225,000
• Total	$1,675,000

Upon examination, we have determined that this commenter's analysis does not account for several important factors. First, replacement of equipment that is near the end of its useful life and would have been replaced in the near future anyway would not be considered a DPM-related compliance cost, or at most, only partially DPM-related. It is extremely improbable that an entire inventory of underground equipment would need to be replaced all at once purely for DPM compliance. The oldest equipment in a mine's inventory, which would normally be the worst polluters, would be the first that would need to be replaced in the course of the normal equipment turnover process. The cost of replacing such worn out equipment would not be considered DPM compliance-related, because it would have occurred anyway, with or without a DPM rule. The newest equipment, typically mid to late-1990's model year or newer, would most likely not need to be replaced right away, as this equipment would have EPA Tier 1 or Tier 2 engines, and as a consequence, would be low, or at worst moderate polluters. Thus, new equipment purchased strictly for DPM compliance, if any, would typically be limited to only a portion of a mine's overall equipment inventory.

Second, it is very unlikely that the wholesale replacement of equipment is the most cost effective DPM control strategy for this, or any mine. For example, rather than replacing all equipment, an operator could replace just one or two pieces of equipment (if any equipment at all needed to be replaced), utilize diesel particulate filters, upgrade ventilation, switch to a high biodiesel content fuel blend, implement various administrative controls, or use some combination of these strategies. Indeed, this same commenter earlier in their comments stated that buying new equipment is costly. There may be less expensive alternatives to improve DPM levels, such as ventilation or alternative fuels.

This commenter indicates that they, ''have not tried diesel particulate filters due to cost and negative performance history reported by producers and manufacturers.'' However, as discussed extensively in the previous section of this preamble and throughout the rulemaking record, diesel particulate filters are a technologically and economically feasible DPM control once mine operators work through their implementation issues. The commenter indicated that they are considering the use of a B99 biodiesel fuel blend. As noted elsewhere in this preamble, use of high biodiesel fuel blends has been quite successful at other M/NM mines in significantly reducing DPM exposures.

By overlooking lower cost DPM control alternatives, this mine operator's assertion of economic infeasibility of the final limit of 160_{TC} μg/m³, even in 2011, is questionable. A fundamental concept upon which the Regulatory Economic Analysis (REA) for the 2001 final rule was based is that mine operators will choose the lowest cost method of attaining compliance with the applicable DPM limits. If a mine operator chooses other than the lowest cost method for compliance, any resulting determination of economic feasibility would be seriously flawed. We acknowledge that the process of attempting to install various alternative control technologies may be imprecise at best, and that testing multiple designs can be inherently cost-inefficient because some designs will inevitably be found to be unsuitable for a particular purpose. However, we continue to emphasize that mine operators can obtain compliance assistance from our District Managers, or utilize our DPM Single Source Page and access the internet-hosted DPF Selection Guide to help streamline this process. Economic feasibility is based on the assumption that optimal, lowest-cost controls are implemented to attain compliance taking into account recognized implementation difficulties. In the cost estimates for this final rule, we have included cost related to operator evaluation of different technologies in an effort to determine the most effective method for compliance.

Third, the equipment listed by the commenter would be expected to have a long useful life, possibly up to 20 years. Thus, the total first year acquisition cost of this equipment is an incorrect representation of the corresponding yearly cost to the operator. Even in the unlikely event that a mine operator would need to purchase all new major underground equipment in a single year, we would first need to determine that these controls are economically feasible for the operator. Moreover, when the $1,675,000 cost of this equipment is amortized over a 10-year period (to account for depreciation) at a 7% discount rate, the annualized cost to the operator is $238,482. This annualized cost is 48% of the commenter's threshold of $500,000 per year that, according to the commenter's calculations, would be required, on average, to generate industry-wide annual compliance costs greater than $100,000,000.

A mining industry organization stated that even though the Mine Act is a ''technology forcing'' statute, the projections that we made in this rule ''go far beyond this into the realm of pure theory.'' They go on to state that, Underground stone mines cannot make purchasing decisions based on hypotheses as to what technologies may be available during the coming decade when there is scant evidence to support MSHA's assertions.

We disagree with the commenter's position regarding our conclusions on economic feasibility. As we discussed extensively in this preamble, technologically and economically feasible DPM controls are available, however, mine operators will need to resolve these implementation issues to meet the final limit of 160_{TC} μg/m³. In the 2005 NPRM, we stated that mine operators may need more time to comply with the final rule due to implementation issues, including cost implications. We nonetheless believe that in time, most of these implementation issues can be overcome, especially by May 2008. The five principal engineering controls discussed throughout this preamble—DPFs, equipment for ventilation upgrades, environmental cabs, alternative fuels, and low emission engines—are all commercially available off-the-shelf from many suppliers. The final rule, however, provides mine operators with additional time to work through their individual implementation issues. These individual issues, when viewed as a whole, result in our need to phase-in the 160_{TC} μg/m³ final limit.

Several mine operators and an industry organization commented on the costs associated with DPFs. Comments included:

Average operating life of the Englehard DPF utilized at Stillwater is 3000–4000 hours at a cost ranging from $7,000–$8,500 per unit. [Note: This mine operator reported the average unit cost of 103 passive systems installed since 2004 plus those planned for installation in 2006 is $7,170.]

For equipment not compatible with passive regeneration systems, active regeneration systems have been researched and tested at Stillwater. The cost for these systems have ranged from $4,000–$8,000 per unit. [Note: This mine operator reported the average total acquisition, installation, and maintenance cost for 10 active off-board filter systems and 4 regeneration stations sufficient for filtering the DPM emissions from 5 vehicles was $95,000, resulting in a per vehicle cost of $19,000.]

The passive regeneration filter systems we have purchased range from $6,600 to $8,700 each. These filters also have backpressure monitors costing roughly $700 each. Installation on equipment usually will cost about $1,000.

Costs for our passive regeneration filters systems will be borne over the filter life, which in our experience has ranged between 2,500 and 9,000 hours with most falling around 6,000 hours.

The last quote we received for an on-board active regeneration filter was $28,000, excluding the regeneration station which would cost an additional $8,600 and a backpressure monitor estimated at $1,100, for a total cost of $37,700 excluding freight and installation.

What many NSSGA members are experiencing is that they do not have any way of establishing the true costs of diesel particulate filters because, setting aside the direct costs and questionable results related to filter usage, the filters affect equipment in ways that are adverse but cannot be readily quantified.

We agree that the cost for passive regeneration diesel particulate filters for typical production equipment (loaders or trucks with 300 hp to 500 hp engines) would range from about $7,000 to about $8,500. A number of industry commenters agree that passive regenerating filter systems are feasible for equipment that operates at a sufficiently demanding duty cycle. Typical comments were:

Practical experiences with equipment that have the capability to operate with passive regeneration systems indicate this type of control can reduce DPM exhaust emissions.

At the present time, however, we are increasingly confident that passive regeneration filter technology can be effective in the mine's larger horsepower production units.

Turquoise Ridge believes that properly sized and fitted filters can reduce DPM emissions, and the Turquoise Ridge Mine is now at the sustained level of production to begin testing.

Both DPM filter vendors and mine operators are now gaining experience in the application of DPM filters underground. Some progress is being made. For example, the application of passive regeneration filter technology is becoming effective on larger horsepower production units. However, NMA agrees with MSHA's observation in the preamble of the NPR that '[r]elying on [filters] to be installed on older, higher DPM emitting engines may also introduce additional implementation issues since [filter] manufacturers normally do not recommend adding [filters] to older engines.' Furthermore, the application of DPM filters to equipment with medium- to low-duty cycle engines remains problematic.

Industry objections to active filter systems center on operational aspects that result in higher overall costs for applying this type of control. These systems are very efficient in capturing and retaining DPM, and the hardware costs of such systems, though higher than a comparable passive system, are not excessive for many mine operators.

An example of active off-board regeneration DPF system costs was provided by the commenter who indicated that ten filter systems and four off-board regeneration stations cost $95,000. This cost included acquisition, installation, and maintenance, and was sufficient for filtering the DPM emissions from five utility and support type vehicles. Assuming the filters would last two years and the regeneration stations would last five years, the per vehicle yearly cost, when annualized at a discount rate of 7% would be $8,963. The cost of an active on-board regeneration DPF system was quoted by another commenter at $28,000 plus an additional $1,100 for a backpressure monitor and $8,600 for the regeneration station, for a total of $37,700. The per vehicle yearly cost for this system, when annualized at a discount rate of 7% would be $18,192. We believe the difference in costs between these systems relates more to the engine horsepower they are intended to filter rather than the type of regeneration employed. The unit cost for this second active DPF system is about the same as we estimated in the 31-Mine Study for a similar system. For that study, we estimated an active system for a 400 hp to 500 hp engine would cost $18,000 and the associated regeneration station would cost another $20,000 for a total of $38,000.

Rather than the cost of the systems themselves, operators' comments primarily addressed the associated implementation issues, such as the required frequency of regeneration, travel time to a regeneration station, providing locations for regeneration stations, equipping regeneration stations with the necessary facilities and utilities, equipment downtime while regenerating, etc. and the perceived increased labor and infrastructure costs associated with applying active filter technology. These concerns have limited more widespread utilization of active systems. Comments concerning these logistical issues included:

Active filters require that equipment be idled for a considerable period of time either with on-board regeneration, or with an off board filter change-out system * * * In addition, active systems require considerable space * * * The record to date has identified other feasibility problems with DPFs that include physical size of filter systems, the short life span of filter elements, the required downtime for regeneration of active regeneration systems, the need for regeneration stations with electric power and compressed air supply near producing zones for active regeneration systems * * *

Practical experience with active regeneration systems has not indicated these control options are economically feasible for the Stillwater diesel fleet * * * Initial operating time before the unit is required to be removed and placed on a regeneration station is, at best, 10–15 hours. However, experience has shown this time can be as little as 4 hours before off-board regeneration is required. Due to the low utilization of the active DPF before the system needed to have active regeneration, two active DPFs were purchased to ensure the equipment would be operational for the next shift. This option has proven to be cost prohibitive; it is unrealistic to logistically store spare active DPFs and regeneration stations for even the small fraction of equipment that has the capability to operate with active DPFs * * * For units that must be regenerated underground, additional excavations to house the regeneration equipment and to provide parking during regeneration would be required. These additional excavations are neither practical nor economically feasible. Additionally, moving equipment to the regeneration stations is time consuming, unproductive, and cost prohibitive.

One active regenerative DPF system, specifically DCL Mine-X Black Out Soot filter, was tested on a Tamrock 1400, 8 yard^3 scoop over an 8 month period. Because of filter limitations, the scoop was only operational for 7 to 8 hours per shift before the backpressure increases caused the need for filter regeneration. This rendered the equipment unusable for the remainder of our normal 11 hour production shift. The active regeneration system was determined to be impractical because it was not effective for an entire shift and could not be regenerated between shifts (regeneration typically took between 2 and 5 hours).

The feasibility of equipping medium-to low-duty cycle engines with passive and active regeneration DPF filter systems continue to be evaluated by Greens Creek Mine personnel. However, the need for fixed locations for installation of equipment used for active filter regeneration poses serious logistical problems due to the spread out nature of the mine's layout.

Other mine operators have not even attempted to utilize diesel particulate filter systems because of perceived logistical problems and associated costs. Typical comments from these operators who have had no first hand experience with diesel particulate filters included:

* * * the current methods to achieve compliance are not economically feasible or present other hazards to employees, specifically some of the filtration technology that we've investigated. I would state that we have not tried those technologies as of yet. As I said, the current filtering technology is a capital cost and a long-term operating cost that's difficult to absorb in the operations.

We've talked about what filters mean and what filters do and how they work and what they are. We've closely watched how that technology has moved forward. As of this point, even the employees don't see a benefit in doing that. Mainly because the maintenance that they're going to be required to do to change filters, to move filters around, is going to cause them to pull out the ladder and climb the ladder and work around the hot exhaust and move the heavy thing back down, you know, the ladder, put it where it needs to go. And they're exposed physically to something—these guys are smart. They understand these are real physical hazards I'm exposed to try and get filters on and off.

We have not gone to diesel particulate filters. In our hierarchy of controls, quite honestly diesel particulate filters would be our last choice. First of all, just from a practical perspective, there is still issues with the types of filters you might use and if you are making the engines—if the engines are inefficient to start with and you have to use a—you want to use a diesel particulate filter as the correction method, it could very well be that because of the inefficiency of the engine, it makes the filters a lot more difficult to deal with. Because they're going to clog up, they're going to create problems for you and it's just going to increase the difficulties of implementing a program. So we looked at diesel particulate filters as the last resort. It certainly may be one that we want to take, but it's not one that we would choose to go at early * * * One of the things also about diesel particulate filters and off board regeneration is you're talking about increasing the labor cost.

There's no way around it. It's going to take more people.

We believe that active regenerating filter technology is available to enable compliance with the final limit. However, these commenters have highlighted some of the implementation issues we believe will be encountered by a great many mine operators that may need to utilize this technology to attain compliance with the final rule. The additional time required to resolve these issues is provided by the two-year phase in of the final limits incorporated in this final rule.

We continue to advise that the ''toolbox approach'' be used for compliance with this rule, and that DPM controls be carefully selected on the basis of attaining compliance at the lowest cost. However, where circumstances indicate that active regenerating DPM filtration would be the optimum control method, we believe that the application of such a system would be economically feasible over time. We do intend to continue to assess feasibility of effective controls on a case-by-case basis.

We do not dispute that implementing an active regenerating filter program at an underground mine will create logistical and implementation challenges, and that mine operators will need to incur costs to solve these problems. As mines begin to solve these implementation issues, however, most should be able to reduce miners' exposure to DPM in the process. We acknowledge that a certain amount of trial and error experimentation may be unavoidable before an optimum selection is made. However, we do not believe this evaluation and selection process is economically infeasible for mine operators to successfully complete over time.

We believe that the applications engineering process followed by mine operators for overcoming implementation issues with passive DPF systems establishes a realistic model for overcoming implementation issues with active DPF systems. The early attempts at applying passive DPF systems in M/NM mines were inefficient and costly. Applications and duty cycles were not fully characterized, inappropriate filters were selected, installation methods were crude, and system maintenance requirements were not well understood, leading to short filter life and a variety of related problems. The final rule's phased-in final DPM limits provide the additional time required by the industry to successfully address these issues. With respect to the above specific comments, while it is true that active filter regeneration can require several hours, the associated piece of diesel equipment need not be idled for that entire period. As one mine operator indicated, two filter elements can be acquired for each piece of diesel equipment so that one element can be in use while the other element is being regenerated. Using quick disconnect couplings in the equipment's exhaust system, swapping out the active DPF elements could be accomplished quickly with very little physical effort. Equipment downtime in the context of this active filter regeneration scenario would be measured in minutes rather than hours.

Nonetheless, the subject mine operator declared this strategy to be ''cost prohibitive,'' due to the need to purchase two filters for each piece of equipment and the required space to store the extra filter elements. We disagree with this conclusion. First, the annualized yearly cost of providing two filters for each piece of equipment is not significantly greater than the annualized yearly cost of providing a single filter for each piece of equipment because each filter, being used only on every other shift, will last twice as long as it would have if it were used on every shift. Second, there would be no need for storing extra filters since filters would simply be swapped back and forth between the regeneration station and the piece of diesel equipment.

We agree that there will be costs associated with providing facilities and utilities such as electrical power and compressed air for the regeneration stations. However, we believe these costs will be small or negligible in the context of implementing such a system, or at worst, should not be economically infeasible. As noted above, we believe an optimally deployed active regeneration system would utilize existing locations with utilities already in place as regeneration stations, thereby simplifying implementation and minimizing associated costs. Although several commenters have identified this requirement as a compliance cost, the actual magnitude of these costs has not been presented.

The size of active DPF filter elements has been discussed previously. Typically, active systems would be applied to smaller support and utility equipment that does not operate at a severe enough duty cycle to permit passive regeneration. Smaller equipment requires smaller DPF filter elements that can be handled without specialized materials handling equipment or lifting aids. Unlike passive systems that usually have to be installed as close as possible to the engine manifold so that the exhaust is hot when it reaches the filter, there is greater flexibility in installing active DPF systems on a piece of equipment, usually enabling convenient access for swapping out filters. In rare cases where filter elements may be too large to be conveniently handled by the equipment operator, accommodation could be made, such as providing lifting aids at the regeneration station or the exhaust could be divided into dual separately filtered branches with a smaller filter on each branch. Implementing either of these options by May 2008 would incur some cost, but not so great as to approach economically infeasible.

In instances where filters load up with soot and require regeneration before the end of a shift, a possible solution is to utilize a larger filter that has more soot storage capacity. The mine operator that was able to run an actively filtered loader for only 7 to 8 hours of an 11 hour shift could utilize a 40% larger filter to extend the loader's operating time to the full shift duration of 11 hours. Adding more filter capacity could also be accomplished by dividing the exhaust into dual separately filtered branches, as was done at the mine referenced above that used a dual element disposable filter system on its Toyota support and utility vehicles.

Another option for extending the operating time of an active filter is to replace the diesel engine with one that produces less DPM. For example, replacing a 100 horsepower Tier 1 compliant engine with the equivalent Tier 2 engine would reduce DPM emissions by over 60%. While a given active filter on a Tier 1 engine may require regeneration before the end of the shift, the same filter on a Tier 2 engine might operate for the entire shift or longer. A similar situation exists at the Stillwater Mine in Nye, MT with respect to the disposable filter element systems on their Toyota trucks. As discussed earlier in this section, a possible solution to the problem of these filters loading up to quickly is to replace the engines with a model that produces significantly lower DPM emissions. Again, there are some costs associated with these approaches, but we do not believe they would reach the level of economic infeasibility.

Regarding the feasibility of providing space for regeneration stations and parking areas, we refer to our analysis of the active regeneration system proposed by the Stillwater Mining Company and discussed in the preamble to the 2005 final rule (70 FR 32934–32936). The rationale supporting our suggested alternative active regeneration system for this mine remains our current position, and given the extra time afforded by the phased-in final limit included in the final rule, we believe a similar optimization process can be used at other mines to solve a number of implementation challenges.

We do not dispute that mine operators have had less success with active regenerating filter systems compared to passive systems. As noted above, we believe this result is largely due to greater experimentation, trial and error, and applications engineering by mine operators on passive systems. During the remaining period before enforcement of the final limit of 160_{TC} $\mu g/m^3$ begins, mine operators will have sufficient time to meet these challenges and successfully apply active regeneration systems.

Several commenters have said that they favor passive regeneration over active regeneration. For example, one mine operator said, ''Research and testing of DPF regenerations systems has concluded that passive regeneration systems are preferred over active regenerations systems.'' As a result, most mine operators who have evaluated DPFs have concentrated their efforts on passive systems. We realize, however, that mine operators who have successfully implemented passive regeneration filter systems have had to work long and hard to overcome difficult implementation issues. One mine operator commented, ''The process of achieving filter reliability has been arduous * * *'' The product of these sustained efforts has been longer filter life, acceptance and support by operating and maintenance personnel, and the streamlined integration of passive filters into these mines' overall operating procedures, all of which we believe could contribute to controlling costs.

We are confident that such efforts, applied to active systems, can achieve similar results. These systems are widely used in other industries, and they have been used successfully on a limited basis in M/NM mining. Their successful use on a more widespread basis in the mining industry is possible, but not without time and similar dedicated efforts by mine operators to solve the mine-specific and application-specific logistical and implementation issues discussed above. This point was emphasized by NIOSH in its opinion submitted on June 25, 2003 and repeated in its comments on the current rule that:

> With regard to the availability of filters and the interim standard, the experience to date has shown that while diesel particulate filter (DPF) systems for retrofitting most existing diesel-powered equipment in underground metal and nonmetal mines are commercially available, the successful application of these systems is predicated on solving technical and operational issues associated with the circumstances unique to each mine. Operators will need to make informed decisions regarding filter selection, retrofitting, engine and equipment deployment, operation, and maintenance, and specifically work through issues such as in-use efficiencies, secondary emissions, engine backpressure, DPF regeneration, DPF reliability and durability.

When these implementation issues are resolved, we believe an inevitable consequence will be significantly reduced costs due to decreased waste, fewer damaged or failed filters, increased efficiency and effectiveness of filter system installations, operations, and maintenance, acceptance by miners, minimal adverse effects on equipment operations, and smoother integration of filter regeneration into the mining process.

Two commenters provided information on the costs of utilizing low DPM emission engines. One mine operator said, ''Since 2001, Stillwater has performed a proactive engine campaign to replace the higher DPM emitting engines with the newer EPA Tier I and Tier II rated engines.'' This commenter also provided a table of the costs incurred in 2004 and 2005 for engine replacements and upgrades showing that 48 new engines were installed at a total cost of $576,000 (average cost of $12,000 each) and 98 engine upgrades (electronic engine governors) were completed at a total cost of $198,000 (average cost of $2,020 each). Several other commenters indicated they had replaced engines or had purchased new equipment with low DPM emission engines, but the only other commenter to provide cost data on engines said they had completed eight ''engine repowers'' at a total cost of $120,000, for an average cost of $15,000.

As we have suggested throughout the DPM rulemakings, utilization of low DPM-emitting engines is an excellent way of reducing DPM concentrations underground. Depending on the specific emissions from the original and replacement engines, DPM reductions of up to 90% or more are possible. However, we acknowledge that replacing engines can be costly, especially when the replacement engine requires significant adaptations to the host vehicle to accommodate physical size constraints, new plumbing and wiring harnesses, etc. Comments on the 1998 Preliminary Regulatory Economic Analysis (PREA) suggested such ''non-like-for-like'' retrofits could cost up to $60,000. Although costs may reach $60,000 in certain extreme or worst case situations, we believe in reality, that the costs quoted above of $12,000 to $15,000 are more typical. When amortized over the 10 year life of an engine, the annualized yearly cost of a $15,000 engine at a discount rate of 7% is $2,136.

We also received comments to the 1998 PREA indicating that mining equipment at underground M/NM mines can have a useful life of up to 20 years. However, engines typically last only half that long or less, meaning that engine replacement is a routine procedure that is necessary to maintain mine production levels. We do not view replacing a worn out or blown engine with a new low DPM engine as a DPM related compliance cost. It is not clear from the commenters' data whether the subject engines were replaced due to the normal engine turnover process or whether serviceable engines were replaced solely for DPM compliance purposes.

We also note that the new low DPM emitting engines provide other significant benefits to mine operators. The electronic maintenance diagnostics reduce maintenance-related downtime, and the fuel savings between a non-EPA Tier rated engine and an EPA Tier 2 engine can be 10%–15% or more. For a 400 horsepower engine that normally consumes 8 gallons of fuel per hour (approximately 50% duty cycle), a 10% reduction in fuel consumption over 3,000 annual operating hours results in a 2,400 gallon fuel savings per year. At a diesel fuel cost of $2.00 per gallon, the new $15,000 Tier 2 engine would almost pay for itself in 3 years due to lower fuel consumption. At a diesel fuel cost of $2.30 per gallon, if an old engine was replaced with one that consumed 15% less fuel and was operated for 6,000 hours per year, the payback period for the $15,000 replacement would be less than one year. In fact, the current price of diesel fuel (in May 2006) has risen to approximately $2.90 per gallon.

A mining company that operates two gold mines in Nevada commented that,

> Our estimate of the total cost of measures taken to achieve compliance with the current interim standard [interim DPM limit] is approximately $1.68 million annually ($8.4 million since 2001). Our experience indicates that MSHA's 2001 cost estimates dramatically understated the costs of compliance.

This commenter then itemized the compliance costs incurred at their two mines since 2001 as follows:

• Engine repowers (8 @ $15,000)	$120,000
• Cab installed on KMS 608	$43,000
• Cabs on 2 new loaders @ $43,000 each	$86,000
• Cabs on 3 new loaders @ $48,000 each	$144,000
• 1225 South Meikle Spray Chamber	$139,000
• Rodeo Betze Portal Drift	$1,200,000
• Rodeo Betze Port Drift Vent Intake	$1,300,000
• Increase size of auxiliary fans	$750,000
• Higher power cost, $560,000/yr × 3 yrs	$1,680,000
• Total costs since 2001	$5,462,000

The sum of the items listed by the commenter, $5,462,000, is about 65% of the $8.4 million amount the commenter claims was spent to attain DPM compliance. Without a thorough study of these elements, and based on the limited information provided by this mine operator in their comments, we are not able to verify that all of these costs are DPM-related. For example, we determined at another precious metals mine that claimed DPM-related ventilation upgrades were actually justified on the basis of other needs, such as planned production increases and the desire to improve overall ventilation system efficiency. Of the approximately $5.46 million in claimed DPM compliance costs itemized above, over $5.07 million, or 93% are ventilation related. Likewise, installing cabs on mobile equipment or acquiring new equipment with OEM cabs can also solve dust and noise overexposure problems and improve operator comfort.

However, even if all the listed costs were entirely justified solely on the basis of complying with the DPM rule, when the individual cost elements are amortized at a discount rate of 7% over their expected life, annualized yearly costs to the operator are about $980,000. The estimated yearly compliance cost for a medium sized gold mine was determined in the Regulatory Economic Analysis (REA) for the 2001 final rule to be $171,778 (not adjusted for inflation) based on an inventory size of 24 pieces of diesel equipment. In their comments, this mine operator indicated they are currently operating 154 pieces of diesel equipment for mining and support activities. In 2002, this operator reported 236 pieces of diesel equipment in its diesel equipment inventory. Using the lower number and applying a ratio multiplier of 6.4 (154/24) to the $171,778 compliance cost estimate from the 2001 REA results in an estimated compliance cost for the commenter's two mines of $1,099,379. Thus, this commenter's actual annualized compliance cost of $980,000 is about 89% of the expected annualized compliance cost for gold mines of this size, as estimated for the 2001 final rule. Under the new final rule, the mine operator's compliance costs would be expected to decrease due to the phase-in of the final DPM limits.

This same mine operator urged us to update our compliance cost estimates based on the current price of diesel fuel. They indicated that,

> In 2001, when the proposed limit was adopted, diesel costs were approximately $1.40 per gallon. Currently, diesel prices are in the range of $2.39 per gallon, an increase of over 70%. Available control technologies, particularly filters, reduce horsepower and increase fuel consumption and costs to accomplish the same work. The agency's cost estimates should acknowledge current diesel fuel prices.

Since 2001, a major component of DPM compliance strategies that are being widely adopted throughout the industry, including by this operator, is the use of modern low emission engines, which in addition to significantly lowering DPM emissions, also reduces fuel consumption by 10% to 15% compared to older, high DPM emission engines. We also note that the fuel penalty of using a properly sized diesel particulate filter is very small. Even the fuel burner system, which combusts diesel fuel in the exhaust to raise the exhaust gas temperature sufficient for filter regeneration, only increases fuel consumption by about 1%.

We received comments on the costs of environmental cabs from gold mines in Nevada. One company indicated they had retrofitted five fully enclosed cabs onto haulage trucks and loaders, and that as a result, the operators of this equipment were in compliance with the final limit. These cabs were installed during major re-builds on the subject equipment at a cost of $30,000 to $50,000 each. Another operator indicated they had installed environmental cabs on six loaders at a cost of $43,000 to $48,000 each. These unit costs are higher than we originally estimated for environmental cabs in the REA for the 2001 final rule. However, our original cost estimate applied to the industry in general and to all equipment. We expected the cost of retrofitting cabs onto purpose-built underground mining equipment to be substantially higher than the cost of cabs installed at the factory on construction-type equipment by the OEM. The costs quoted by the commenters reflect this expected difference. It is also important to note that the costs of these retrofitted cabs are only a small part of overall compliance costs for these mines, and their overall compliance costs are less than expected based on the REA for the 2001 final rule.

We received several comments on the cost of biodiesel fuel. These comments generally fell into three categories: the cost of the fuel itself, the biodiesel tax credit, and the cost of infrastructure for fuel storage and handling. Regarding the cost of the fuel itself, typical comments were:

Fuel prices will have a substantial impact as Bio-Fuel cost is over $1.00 per gallon higher than diesel.

[Biodiesel] * * * is not widely distributed or accessible at a reasonable cost to many mining operations.

Our current diesel fuel supplier has indicated that the cost for bio-diesel fuel * * * would be priced at a premium of 20 to 25 cents per gallon for a B20 blend.

Regarding the tax credit, typical comments included:

We are now considering a B99, with the hope that the current $1.00 per gallon tax credit remains to help control costs.

The economic feasibility of alternative fuels depends upon uncertain government price supports that are due to expire in the near future.

Regarding the cost of infrastructure upgrades, typical comments included:

Cost analysis concerning on-site storage was conducted with a regional supplier and proved cost prohibitive. The cost of the infrastructure to support biodiesel at the mine would include a 10,000 gallon tank for diesel, 15,000 gallon tank for biodiesel, and a 10,000 gallon tank for the blended product. The cost for this system would be in excess of $250,000.

[The higher cost per gallon for biodiesel] does not include costs for specialized transport during the winter season to keep the biodiesel fuel from gelling. Further, we would have to install separate fuel tankage to segregate biodiesel fuels from other fuels * * *

We agree with the commenters who indicated that the cost of biodiesel is typically about $1.00 per gallon more than standard diesel fuel, though this has not always been the case. Prices for standard diesel and biodiesel are determined by the market, and when the price of standard diesel fuel spiked in the late summer and fall of 2005, the price difference between standard diesel and biodiesel was considerably less than $1.00 per gallon. But the $1.00 per gallon price difference quoted by the commenters is more typical. However, the net cost of biodiesel to mine operators is significantly affected by the federal excise tax credit for biodiesel fuels, which applies to fuel blenders (typically the fuel distributor), and is valued at $0.01 per gallon per percentage of biodiesel in a fuel blend for biodiesel made from agricultural feedstock (such as soy biodiesel). Because the cost of biodiesel is typically approximately $1.00 per gallon more than standard diesel, the credit of $0.01 per gallon per percent biodiesel has nominally eliminated the cost difference between standard diesel and biodiesel. For example, if standard diesel is $2.00 per gallon, and the cost of biodiesel before the excise tax credit is applied is $3.00 per gallon, a 98% biodiesel fuel blend (98% biodiesel mixed with 2% standard diesel) with the tax credit applied would cost:

[$2.00/gal × 2%] + [$3.00/gal × 98%] − [98% × $0.01] = $2.00/gal. Thus, a gallon of the 98% blend of biodiesel, after the tax credit is applied, would cost the same as a gallon of standard diesel.

This tax credit, which has been in effect since 2004, was scheduled to expire in 2006, but has been extended through 2008. It is impossible to predict whether the credit will be extended beyond 2008, as its further extension is subject to Congressional action. It is also impossible to predict the future price difference between standard diesel and biodiesel, as the prices of both commodities are determined by market forces. The only factor affecting the price of either fuel that can be predicted with any degree of certainty is the supply of biodiesel. Biodiesel production in the United States has grown from 0.5 million gallons in 1999 to an estimated 75 million gallons in 2005. Production growth between 2004 and 2005 alone was 300%, from 25 million gallons to 75 million gallons. Annual production capacity that is currently under construction is 329 million gallons. Biodiesel production plants in the pre-construction phase will have an annual capacity of an additional 529 million gallons. To the extent that increased supply tends to attenuate upward pressure on price, the expected effect of this large increase in biodiesel supply would be to moderate price increases, if any, or possibly serve to lower the price. Another indicator of future price trends is the capacity of individual plants. At present, only 13 of 52 plants have an annual capacity of 10 million gallons or more. In contrast, of the plants currently under construction or in the pre-construction phase, 27 have an annual capacity of 10 million gallons or more, including several ranging from 30 million to 80 million gallons of annual capacity. To the extent that larger plants can reduce costs through economies of large scale production, the growth of larger plants will also attenuate upward price pressure. Thus, even without the tax credit, we expect the price difference between standard diesel and biodiesel to shrink over time. Our determination of whether biodiesel fuel is a feasible DPM control at a particular mine, however, does not depend on extension of the federal excise tax incentive.

Regarding the issue of infrastructure upgrades to accommodate biodiesel, we agree that some upgrades may be necessary at some mines. For example, due to the cold weather properties of the fuel, storage tanks at mines that experience sub-freezing temperatures would need to be heated, moved to a heated indoor space, or moved underground. Some mines that are using high biodiesel content fuel blends have, or are planning such changes. There may also be costs incurred by the fuel distributor. Some distributors are already capable of off-loading, handling, and storing biodiesel in cold weather. However, those that do not have this capability would need to acquire the necessary infrastructure upgrades, and the associated costs would reasonably be passed along to their biodiesel customers. However, such costs, whether incurred by the mine operator or the fuel distributor and passed on to the mine operator, would largely be one-time expenses that would be amortized over a period of many years. For example, although we dispute the commenter's assertion that infrastructure upgrades to support biodiesel at their mine would cost $250,000, even this amount, when amortized over 20 years, results in an annualized yearly cost of $23,598. We assume a tank already exists at the mine for standard diesel, so it is not clear why another tank is necessary. We also question why a tank for blended fuel is needed, as greater DPM reductions are obtained when biodiesel content is maximized. While it is true that biodiesel needs to be blended with standard diesel to qualify for the federal excise tax credit, the IRS has determined that a 99.9% blend (nominally 10 gallons of standard diesel mixed with 10,000 gallons of biodiesel) satisfies this requirement. Such a blending process would not require a separate blending tank. Thus, the commenter's $250,000 cost estimate for infrastructure to support biodiesel appears high. However as noted above, even if this cost is supportable, the total cost, when amortized over the life of the asset, results in an annualized yearly cost of $23,598. It is also significant to note that this commenter's fuel consumption is about 80,000 gallons per month. The corresponding costs for infrastructure upgrades at an average or typical mine would be much lower.

Depending on circumstances at a given mine, there may also be a need to provide vehicle fuel tank heaters, fuel line heaters, and fuel filter heaters. These items are commercially available at reasonable costs. For example, the MSRP for an Artic Fox model AF–F–203 14″ to 29″ in-tank fuel warmer is $169.27, the MSRP for an Artic Fox model AF–D3085–2180 24V, 600W, 12 ft heated fuel line is $614.86, and the MSRP for a Diesel Therm fuel filter heater is $180.81.

The operator of two large stone mines commented that there are occupations at their mines such as roof bolters that require personnel to work outside of a cab near the mine roof where DPM concentrations would be expected to be the highest. Due to the high cost of major ventilation upgrades, this commenter asked that consideration be given to allowing such miners to utilize PPE for compliance with the DPM limit. Another stone mine operator made a similar comment, asking:

> Is it economically sensible to expend monies to ensure compliance with the DPM rule for 15 employees exposed to the polluted air when they venture outside of the cab and can use PPE? MSHA also did not allow the most cost-effective method of use of PPE and other administrative controls to reach the final limit.

In responding to these comments, we note first that mine operators have available engineering control options other than cabs and ventilation, and second, that under certain circumstances, PPE is allowed as a means of compliance. Under § 57.5060(d), mine operators have been granted great flexibility in choosing controls to attain compliance, and are not limited to only cabs or ventilation. The operator of the two large stone mines has acknowledged having had success with alternative diesel fuels, and has also acquired new equipment with low emission engines. However, they have not utilized diesel particulate filters on any equipment, and it is not clear whether expanded use of low emission engines or the use of administrative controls might also be possible.

As noted previously in the technological feasibility section, it is a widely accepted principle of industrial hygiene that PPE is inherently inferior compared to engineering and administrative controls for reducing exposures, so the requirement to implement all feasible engineering and administrative controls before PPE could be utilized as a means of compliance was promulgated in the 2005 final rule and is applicable to this final rule. We also note that, in accordance with our DPM sampling procedures, a miner's exposure to DPM is determined through full-shift personal sampling. This sampling procedure integrates or averages a miner's exposure throughout the shift so that an occasional exposure to a high concentration to DPM will not cause the full shift sample to exceed the DPM limit if the majority of the miner's exposure is sufficiently below the limit. Given adherence to this sampling procedure, it is highly unlikely that any of the, ''15 employees exposed to the polluted air when they venture outside of the cab,'' would be overexposed to DPM on a full-shift basis if their excursions outside their cabs were brief, and their cabs were properly maintained and provided with filtered breathing air.

The operator of the two large stone mines included cost estimates for a new ventilation shaft and fan for one of its mines. They indicated the cost of a 16-foot diameter shaft at $1,000 per vertical foot and 800 to 1,200 feet deep would be $800,000 to $1.2 million, and that when fan costs are added, the total cost approaches $1.5 million. We note that the upper end of the range of the commenter's estimated cost for a new shaft and fan of $1,500,000, would not necessarily be considered economically infeasible for a stone mine of this size. The cost of this shaft and fan, when amortized over 20 years at a discount rate of 7%, results in an annualized yearly cost to the operator of $142,000. The estimated total yearly compliance cost for a medium sized stone mine was determined in the Regulatory Economic Analysis (REA) for the 2001 final rule to be $150,738 based on an inventory size of 17 pieces of diesel equipment. In 2002, this mine operator reported a total diesel equipment inventory of 60 pieces of diesel equipment at the subject mine. Applying a ratio multiplier of 3.5 (60/17) to the estimated $150,738 compliance cost from the 2001 REA results in an estimated yearly compliance cost for the mine of $527,583. Thus, if a new ventilation shaft and fan are installed to attain compliance at the subject mine, the annualized yearly cost of $142,000 for this major ventilation upgrade, though significant, is less than 30% of the expected total yearly compliance cost for a stone mine of this size.

Not all commenters disagreed with the economic feasibility of the rule. One commenter said,

> In January 2001, MSHA estimated that compliance with the rule would cost approximately $25.1 million on an annual basis (66 FR 5889). MSHA estimated that 73% of those costs would be expended to comply with the interim level and 27%, or just $6.6 million annually, to comply with the final limit. MSHA found these costs to be economically feasible. They represent less than one percent of industry revenues. Nothing in the record suggests that these compliance costs have increased. If anything, advances in technology and the availability of substitute fuels mean the likely costs of compliance have decreased since the 2001 estimates were completed.

Another commenter said,

> A standard is not infeasible simply because it is financially burdensome, or even because it threatens the survival of some companies within an industry. MSHA estimated that the annual cost of the final rule was $25.1 million or $128,000 annually for an average underground metal and nonmetal mine. (70 FR 53282) The NPRM does not contain any data suggesting that these minimal costs would be significantly greater than originally estimated, let alone that costs would be so high to threaten the economic viability of the industry.

The DPM rulemaking record contains considerable comments supporting the need for more time to effectuate controls that are economically feasible for mine operators. In the cost estimates for this final rule, we have included cost related to operator evaluation of different technologies in an effort to determine the most effective method for compliance.

A number of comments were received on the cost of medical evaluations. Under the final rule, a miner is required to wear respiratory protection if the miner is overexposed to DPM and all feasible engineering and administrative controls are installed. Prior to being fit tested or assigned to a task where respiratory protection is required, the miner must be evaluated by a physician or other licensed healthcare professional to determine whether the miner is medically capable of wearing a respirator in the mine. As shown in Table IX.1 later in this preamble, the estimated yearly cost to the underground M/NM mining industry of this medical evaluation requirement is about $20,000. Comments on medical evaluation included:

• Prior to any miner being placed into a respirator, steps are taken to ensure that the miners are medically fit for wearing a negative pressure respirator. A formal medical evaluation is conducted prior to being fit tested and annually thereafter. To date, approximately 65 miners needed additional evaluation to receive clearance to wear a negative pressure respirator. The average cost for the additional medical evaluation was $250/visit. Estimated annual cost for medical clearance has been $16,000.

• MSHA seeks comments on whether the final rule should include 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. Barrick already complies with this proposed requirement. Each of our employees undergoes a medical evaluation before being fitted with a respirator * * * Based on currently available data, we estimate that the average cost per person for medical evaluations for our Goldstrike operations is $660.

• Greens Creek also conducts its own pulmonary function tests on individuals required to wear respirators under our respiratory protection program. That program includes proper fit testing. We have on-site technicians who are certified to conduct these tests, however, the analysis of the pulmonary function tests is provided by a licensed healthcare provider. The tests cost roughly $17.00 per individual.

• At our mines, we provide a medical exam and certification of the ability to wear a respirator upon hire * * * If the miner's health conditions change preventing the safe use of a respirator, then additional tests can be provided including spirometry and if indicated, a medical examination. We have not had a case where a miner's health changed preventing the wearing of a respirator, that the miner was not aware of the health condition. We do not object to annual spirometry testing following guidelines developed and supervised by a medical doctor or other medical professional. We do object to the added expense of requiring a medical exam every year if there are no indicators of a medical necessity, either by the miner's own request or the conditions mentioned.

Mine operators that provided comments on the cost of medical evaluations for respirator users already routinely conduct such evaluations. Based on the significant disparity in quoted costs from $17 to $660 per miner, it appears that some operators' evaluations are quite basic, consisting of a simple pulmonary function test and possibly the completion of an employee questionnaire, whereas other operators are apparently conducting actual medical examinations. No commenters provided information suggesting that the requirement for medical evaluations would be economically infeasible. Although we require a medical evaluation to determine a miner's ability to wear a respirator before using a respirator, we only require a re-evaluation when the mine operator has reason to believe that conditions have changed which could adversely affect the miner's ability to wear a respirator. We also will accept prior medical evaluations to the extent the mine operator has a written record and there have not been any changes that will adversely affect the miner's ability to wear a respirator. We believe that this approach will minimize the economic burden on the mine operator in conducting medical evaluations while still protecting the miner.

VI. Summary of Benefits

In Chapter III of the Regulatory Economic Analysis in support of the 2001 final rule (2001 REA), we demonstrated that the DPM final rule for M/NM mines will reduce a significant health risk to underground miners. This risk included the potential for illnesses and premature death, as well as the attendant costs to the miners' families, the mine operators and society at large.

We have incorporated into this rulemaking record the previous DPM rulemaking records, including the risk assessment to the 2001 final rule. Benefits of the 2001 final rule include continued reductions in lung cancers. In the long run, as the mining population turns over, we estimated that a minimum of 8.5 lung cancer deaths will be avoided per year. We noted that this estimate was a lower bound figure that could significantly underestimate the magnitude of the health benefits. For example, the mean value of all eight quantitative estimates examined in the 2001 final rule was 49 lung cancer deaths avoided per year.

Other benefits noted in the 2001 REA were reductions in the risk of premature death from cardiovascular, cardiopulmonary, or respiratory causes and reductions in the risk of sensory irritation and respiratory symptoms. However, we did not include these health benefits in our estimates because we could not make reliable or precise quantitative estimates of them. Nevertheless, we noted that the expected reductions in the risk of death from cardiovascular, cardiopulmonary, or respiratory causes and the expected reductions in the risk of sensory irritation and respiratory symptoms are likely to be substantial.

The 2001 risk assessment used the best available data on DPM exposures at underground M/NM mines to quantify excess lung cancer risk. ''Excess risk'' refers to the lifetime probability of dying from lung cancer during or after a 45-year occupational DPM exposure. This probability is expressed as the expected excess number of lung cancer deaths per thousand miners occupationally exposed to DPM at a specified mean DPM concentration. The excess is calculated relative to baseline, age-specific lung cancer mortality rates taken from standard mortality tables. In order to properly estimate this excess, it is necessary to calculate, at each year of life after occupational exposure begins, the expected number of persons surviving to that age with and without DPM exposure at the specified level. At each age, standard actuarial adjustments must be made in the number of survivors to account for the risk of dying from causes other than lung cancer. Occupational exposure is assumed to begin at age 20 and to continue, for surviving miners, until retirement at age 65. The accumulation of lifetime excess risk continues after retirement through the age of 85 years.

Table IV–9 in Section IV of this Preamble, taken from the 2001 risk assessment, shows a range of excess lung cancer estimates at mean exposures equal to the final DPM limit. The eight exposure-response models employed were based on studies by Säverin *et al.* (1999), Johnston *et al.* (1997), and Steenland *et al.* (1998). All of the exposure-response models shown are monotonic (i.e., increased exposure yields increased excess risk, though not proportionately so). Thus, despite evidence from recent sampling of substantial improvements attained since the 1989–1999 sampling period addressed by the 2001 risk assessment, underground M/NM miners are still faced with an unacceptable risk of lung cancer due to their occupational DPM exposures.

Another principal conclusion of the 2001 risk assessment was:

> By reducing DPM concentrations in underground mines, the rule will substantially reduce the risks of material impairment faced by underground miners exposed to DPM at current levels.

DPM levels have declined since MSHA's first sampling period (from 1989 to 1999). MSHA expects that further improvements will continue to significantly reduce the health risks identified for miners. There is clear evidence of DPM's adverse health effects, not only at pre-2001 levels but also at the generally lower levels currently observed at many underground mines. These effects are material health impairments as specified under section 101(a)(6)(A) of the Mine Act. During the time period from November 1, 2003 to January 31, 2006, 1798 valid personal compliance samples from all mines covered by the

2001 rule were collected. From these samples collected, 18% (324) of samples exceeded 308_{EC} µg/m³, 22% (396) exceeded 350_{TC} µg/m³, and 64% (1151) exceeded 160_{TC} µg/m³. Because the exposure-response relationships shown are monotonic, MSHA expects that industry-wide implementation of the final limit of 160_{TC} µg/m³ will significantly reduce the risk of lung cancer and other adverse health effects among miners.

This final rule would amend the 2001 final DPM rule by phasing in the final limit over a two-year period to address feasibility constraints that have arisen. By phasing in the final limit to address the feasibility issues, this final rule would contribute to the realization of the benefits mentioned above. In addition, the medical evaluation and transfer provisions of this final rule would provide further benefits by ensuring that miners who are required to wear a respirator are able to do so safely, thereby obtaining the full health protection available from that equipment.

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

Section 101(a)(9) of the Mine Act provides that: ''No mandatory health or safety standard promulgated under this title shall reduce the protection afforded miners by an existing mandatory health or safety standard.'' We interpret this provision of the Mine Act to require that all of the health or safety benefits resulting from a new standard be at least equivalent to all of the health or safety benefits resulting from the existing standard when the two sets of benefits are evaluated as a whole. The U.S. Court of Appeals for the D.C. Circuit approved such a ''net effects'' application of Section 101(a)(9). *Int'l Union, UMWA* v. *Federal Mine Safety and Health Admin.*, 407 F. 3d 1250, 1256–57 (D.C. Cir. 2005).

We conclude that this final rule will not reduce protection afforded miners under the 2001 final rule. The phase-in period of the 2001 final limit of 160_{TC} µg/m³ is not feasible for the mining industry as a whole in May 2006, but we could not justify a greater reduction in the final limit than 350_{TC} µg/m³ before May 2008. Feasibility issues with respect to operator compliance are discussed above. Moreover, we intend to convert the final limits of 350_{TC} µg/m³ and 160_{TC} µg/m³ in a separate rulemaking by January 2007. As we said in the 2005 NPRM, if we do not complete this rulemaking by that time, we will use the EC equivalent as a check to validate that an overexposure to the 350_{TC} µg/m³ final limit is not the result of interferences. This enforcement policy, which is based on the Second Partial Settlement Agreement and data in the rulemaking record, would be the same that we used to implement the 400_{TC} µg/m³ interim limit before we converted it to 308_{EC} µg/m³ in the June 2005 final rule. Whereas we have evidence that we can obtain an accurate sample analysis of the final limit of 350_{TC} µg/m³, there is no evidence in the rulemaking record suggesting that the 1.3 conversion factor is appropriate for substantially lower limits, such as the final limit of 160_{TC} µg/m³. In the 2005 NPRM, we stated that we have an additional concern with whether an effective sampling strategy exists to enforce the final limit of 160_{TC} µg/m³ with TC as the surrogate. Evidence after January 2001 suggests that without an appropriate conversion factor, which we do not have presently, there is no practical sampling strategy that would adequately remove organic carbon interferences that occur when TC is used as the surrogate without the ability to confirm the sample results with an EC analysis. Thus, we acknowledge that it is questionable whether the final limit with a TC surrogate of 160_{TC} µg/m³ would provide more protection for miners than the final limits of 350_{TC} µg/m³ when we use the 1.3 conversion factor to confirm an overexposure. We have the burden of proof in court to demonstrate that an overexposure to DPM actually occurred and the sample result is not due to interferences. If we were to enforce the final DPM limit of 160_{TC} µg/m³, we would need to validate a TC sample result, which cannot be done without an appropriate conversion factor for EC at that level. Discussion of the complexity of developing an appropriate conversion factor for the final limit is discussed in *Variability of the Relationship Between EC and TC.*

We requested comments in the 2005 NPRM on whether a five-year phase-in period for lowering the final limit to 160_{TC} µg/m³ complies with Section 101(a)(9) of the Mine Act. A number of commenters objected to our 2005 NPRM that would have delayed implementation of the final limit of 160_{TC} µg/m³ until 2011. They stated that the 2005 NPRM would weaken protection provided by the 2001 final rule, a consequence that Section 101(a)(9) prohibits, since the lower level can be met in some jobs in underground metal and nonmetal mines, if not in all jobs. They believe that the 2005 NPRM violates the law since we would be raising the final limit above 160_{TC} µg/m³ and extending the timeframe for its applicability. In response, we emphasize that we determined that it is presently infeasible for the mining industry to comply with 160_{TC} µg/m³, and we have no data to confirm in court that a 160 TC sample is not the result of interferences.

Regarding feasibility, we chose May 2008 for the effective date of the final limit to correspond with when we believe mine operators, especially small mine operators, will be able to find effective approaches to utilizing available DPM control technology so that they will be capable of meeting the standard. Over the five years since the 2001 final rule was promulgated, both MSHA and the mining industry have gained considerable experience with the implementation, use, and cost of DPM control technology. We have reviewed this experience, and our own enforcement data, and conclude in the final rule that effective DPM controls will be feasible and commercially available to mine operators by 2008.

Other commenters stated that the proposed five year phase-in period, a longer phase-in period, or a decision to adopt the current interim limit of 308_{EC} µg/m³ as a final standard would all comply with Section 101(a)(9) of the Mine Act, and that we should take no action to require reductions below the current interim standard. These commenters also noted that our inability to enforce a final limit of 160_{TC} µg/m³ is critical because Section 101(a)(9) is predicated on the assumption that the existing standards are enforceable, and therefore, ensure the health of miners. They do not believe that the final limit of 160_{TC} µg/m³ would provide any more protection than the 308_{EC} µg/m³, and that many mines will not be able to comply with the 160_{TC} µg/m³ due to economic and technological feasibility issues. These commenters further stated that most miners at these sites will be required to wear respirators for extended periods of time.

We disagree with these commenters. As discussed above under Section V.A. Technological Feasibility, and Section V.B., Economic Feasibility, we are confident that feasible technology exists to reduce miners' exposures to DPM to the final limit by May 2008. Although most mines can feasibly comply with the existing DPM final limit of 308_{EC} µg/m³ we expect that some miners will continue to have to wear respiratory protection under the final limit of 160_{TC} µg/m³. By phasing in the 160_{TC} µg/m³ final limit over two years, we believe that many existing compliance difficulties can be successfully resolved as mine operators are able to access alternative fuels and become more adept and familiar with DPFs.

Similarly, some commenters stated that the proposed standard is based on the wrong exposure matrix, is infeasible, and should be withdrawn. They believe that implementation of the 160_{TC} µg/m^3 final limit would result in widespread experimentation with unproven and untested control technology that presents new and potentially significant risks to miners. In these commenters' views, such a result would violate the Mine Act and should not be permitted.

We responded to these control technology issues in our feasibility discussion of this preamble at Section V. It is important to note, nevertheless, that we stated in the 2005 NPRM that implementation issues may adversely affect the feasibility of using DPFs to reduce exposures despite the results reported in NIOSH's Phase I Isozone Study. Under the prescribed timeframes of the final rule, mine operators should be able to resolve their unique implementation issues with DPFs. Moreover, proper selection of available filters will resolve the problem with risks to miners from increased levels of nitrogen dioxide. As we stated previously, we are confident that the current rulemaking record includes sufficient scientific data to retain the final limit of 160_{TC} µg/m^3.

More importantly, we have no evidence to substantiate deleting the final limit, especially when miners' exposures are expected to further decline over time, based on our enforcement sampling results. The 2001 risk assessment and its updates confirm the serious health risks to miners from exposure to DPM, and we intend for the mining industry to continue to reduce miners' exposures to the final limit of 160_{TC} µg/m^3 by May 2008. Additionally, although some mines may experience implementation difficulties in meeting the DPM limits, the final rule allows for instances where mine operators may request special extensions of time in which to comply with the final limits in situations where controls may be technologically or economically infeasible. Finally, our longstanding enforcement policy considers an individual mine operator's ability to feasibly comply with the applicable limit. If we determine that the mine operator has installed all feasible controls and has placed affected miners in an appropriate respiratory protection program, we will not issue a citation for an overexposure.

Another commenter stated that due to the scientific uncertainty that DPM poses, we should wait for the outcome of the NIOSH/NCI study to help identify the appropriate exposure limit. The commenter also stated that we are violating the requirements of Section 101(a)(6)(A) by proceeding with the rulemaking. We disagree. We have discussed our data to support our position to proceed with requiring the mining industry to continue to take the initiative to further reduce miners' exposures to DPM. Throughout this rulemaking, we expressed our intent to phase in the final limit of 160_{TC} µg/m^3 over time rather than in 2006. With regard to the collaborative study between NIOSH/NCI, if the study becomes available, we will assess it to determine if it provides additional information about the relationship between DPM exposure levels and disease outcomes. NIOSH, in its recent comments to our 2005 final rule, stated that, ''In summary, new peer-reviewed publications addressing the health effects of exposure to diesel exhaust continue to support MSHA's 2001 risk analysis and its 2005 updated information on health effects.'' Considering the foregoing, we do not believe that it is in the best interest of miners' health to delay beyond the implementation dates of the final rule.

A number of other commenters believe that the five year phase-in period would have complied with 101(a)(9) of the Mine Act unless this rulemaking is not completed before May 20, 2006, the existing effective date of the 160_{TC} µg/m^3 final limit. They stated that the Mine Act provision applies only upon the effective date of a requirement rather than the promulgation date of the standard. Consequently, they advise that if the Secretary were to allow the 160_{TC} µg/m^3 final limit to take effect on May 20, 2006 then the Mine Act would prohibit any subsequent reduction or phase-in period. We do not agree with these commenters' interpretation of the Mine Act. We refer the commenters to our explanation in this section as to why we must phase in the final limit of 160_{TC} µg/m^3, and why we do not believe that we have violated our mandate under Section 101(a)(9) not to reduce protection afforded by an existing standard.

VIII. Section-by-Section Analysis

A. PEL § 57.5060(b)

Section 57.5060(b) in the 2001 final rule established a final concentration limit of 160_{TC} µg/m^3 which was scheduled to become effective on January 20, 2006. The final limit restricts total carbon (TC) concentrations in underground mines in areas where miners normally work or travel. Total carbon is the sum of elemental and organic carbon. In the 2001 final rule, we chose TC as the surrogate for measuring DPM concentrations. In our 2005 final rule, we changed the surrogate for the interim concentration limit measured by TC to a comparable permissible exposure limit (PEL) measured by elemental carbon (EC), which renders a more accurate DPM exposure measurement. We also committed to revising the 2001 final concentration limit of 160_{TC} µg/m^3 in future rulemaking. Currently, the 160_{TC} µg/m^3 final limit is to become applicable on May 20, 2006.

In our 2005 NPRM, we recommended staggering the effective dates for implementing the final limit, to be phased-in over a five-year period, and decreased approximately 50 micrograms each year until the final limit of 160_{TC} µg/m^3 would be reached in January 2011. This proposal was based on our position that the industry was encountering economic and technological implementation issues that could affect feasibility, while seeking to further reduce miners' exposures (70 FR 53283). These implementation issues surfaced following promulgation of the 2001 final rule. We stated in the 2005 NPRM that the mining industry, as a whole, may need additional time to address these implementation issues and find effective solutions for implementing additional DPM controls (70 FR 53284).

We also proposed changing the final concentration limit to final permissible exposure limits (PELs), and we noted that special extensions of time in which to comply with the final PELs under existing § 57.5060(c) would apply to each of the phased-in final limits, including the initial final limit of 308_{EC} µg/m^3. We explained that mine operators could apply to the District Manager if they were seeking additional time to come into compliance with each of the final limits, due to technological or economic constraints. We requested comments on the impact of granting extensions for compliance with exposure limits that are greater than the 160_{TC} µg/m^3 final limit.

In the 2005 NPRM, we also asked the mining community to provide us their views on whether five years is the correct timeframe for reducing miners' exposures to 160_{TC} µg/m^3. Additionally, we requested 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. We asked whether our reduction scheme for the final limit of 50 micrograms of TC each succeeding year, from 400_{TC} µg/m^3 (converted to a comparable limit of 308_{EC} µg/m^3) is feasible, and whether it will provide additional time for the implementation of controls, development of distribution centers for alternative fuels, and consideration of the economic impact of the proposed phased-in approach (70 FR 53288). Finally, we emphasized our need for information and views on the mining industry's current experiences with feasibility of compliance with a lower limit than the interim PEL of 308_{EC} µg/m^3. In addition to our requests for comments, we notified the mining community that we were committed to initiating a separate rulemaking to determine the correct TC to EC conversion factor for the phased-in final limits. As discussed later in the subsection ''*Variability of the Relationship Between EC and TC*'', we will address those comments in our future rulemaking. We further stated in the 2005 NPRM that in the event that we did not complete this subsequent rulemaking to establish a conversion factor before January 20, 2007, the date of the first proposed reduction of the final limit, we were considering using the current 1.3 conversion factor that we use to establish the interim DPM PEL of 308_{EC} µg/m^3 to convert the phased-in final DPM TC limits to EC equivalents. As we did with the interim TC limit pursuant to the Second Partial Settlement Agreement, we would use the EC equivalents as a check to validate that an overexposure is not the result of interferences until this issue is addressed in future rulemaking.

In development of this final rule, we also considered public comments related to the final limit which we received in response to the 2002 ANPRM to revise the DPM limits. Some commenters to the ANPRM recommended that we propose separate rulemakings for revising the interim and final DPM limits to give us an opportunity to gather further information to establish a final DPM limit. In the 2003 NPRM, we agreed with these commenters and solicited other information from the mining community that would lead to an appropriate final DPM standard. Moreover, we announced our intention to publish a separate rulemaking to amend the existing final concentration limit in § 57.5060(b).

To assist us in achieving this objective, we requested comments on an appropriate final limit to replace the 160_{TC} µg/m^3 concentration limit, and asked for information on an appropriate surrogate for measuring miners' DPM exposures. We concluded our request for information by clarifying that revisions to the final DPM concentration limit would be included in a separate rulemaking. The public comments in response to our requests are reflected below in this section.

Based on feasibility with respect to compliance and an effective strategy for implementing the final limits, we believe the mining industry as a whole can reduce DPM levels to the 2001 final limit of 160_{TC} µg/m^3 by May 20, 2008. We have determined that M/NM underground mines using diesel powered equipment are capable of reducing miners' exposures to 160_{TC} µg/m^3 by May 20, 2008, rather than on January 20, 2011. As proposed, the initial final limit will be the same as the current interim limit of 308_{EC} µg/m^3 and will remain in effect through January 19, 2007. On January 20, 2007, the final limit will be reduced, as we proposed, to 350_{TC} µg/m^3, which represents a 50 microgram reduction. This limit, and the 160_{TC} µg/m^3 final limit, will be TC limits rather than EC limits, since we do not have current data establishing a conversion factor from TC to EC. We discuss the complexity of developing a conversion factor later in this section under ''*Variability of the Relationship Between EC and TC*.''

As we did with the 400_{TC} µg/m^3 interim limit pursuant to the Second Partial Settlement Agreement, we will use the EC equivalent as a check to validate that an overexposure to the 350 TC limit is not the result of interferences (67 FR 47296, 47298). We will implement an enforcement policy for the 350_{TC} µg/m^3 final limit that will use EC as an analyte to ensure that a citation based on the 350_{TC} µg/m^3 limit is valid and not the result of interferences. Under our policy, we will first develop an appropriate error factor to account for variability in sampling and analysis from such things as pump flow rate, filters, and the NIOSH Analytical Method 5040. If the TC measurement is below 350_{TC} µg/m^3 plus the error factor, we will not issue a citation for an overexposure. If the TC measurement is above 350_{TC} µg/m^3 times the error factor, we would look at the EC measurement from the sample obtained through the NIOSH Analytical Method 5040, and multiply EC by a factor of 1.3 to produce a statistical valid estimate of what the TC result is without interferences. If the TC measurement is above this estimate, we would not issue a citation when the EC measurement times the multiplier is below the TC analysis.

The 1.3 multiplier that we will use to estimate TC (*i.e.*, EC × 1.3 = estimated TC) is derived from NIOSH's determination that TC is 60–80% EC. We will announce our enforcement policy in our updated DPM Compliance Guide.

As we stated in the 2005 proposed rule, we will continue to cite a violation of the DPM limit only when we have solid evidence that a violation actually occurred. Accordingly, we will apply the existing error factor to the first phased-in final limit of 308_{EC} µg/m^3 to determine that an overexposure to the final limit has occurred. The error factors for the first step-down limit of 350_{TC} µg/m^3 and second step-down limit of 160_{TC} µg/m^3 will be slightly different.

We will continue to base our compliance determinations on a single, personal sample, taken over the miner's full shift as specified in existing § 57.5061, Compliance determinations. Also, under existing § 57.5060(d), we will continue to require mine operators to install all feasible engineering and administrative controls to reduce miners' exposures to DPM. When such controls do not reduce a miner's exposure to the DPM limit, controls are infeasible, or controls do not produce significant reductions (as defined in the 2005 rule (70 FR 32868, 32916) in DPM exposures, operators must continue to use all feasible engineering and administrative controls and supplement them with respiratory protection. When respiratory protection is required under the final standard, mine operators must establish a respiratory protection program that meets the specified requirements. See the discussion of respirator use in Section VIII.C. Medical Evaluation and Transfer.

We have determined that these new final limits are both technologically and economically feasible for the M/NM mining industry to achieve as scheduled. Feasibility data, however, do not support delaying the applicability of the 160_{TC} µg/m^3 final limit until 2011, nor do they support application of the 160_{TC} µg/m^3 final limit as early as May 2006. Regarding feasibility, we chose May 2008 for the effective date of the final limit to correspond with when we believe mine operators, especially small mine operators, will be able to find effective approaches to utilizing available DPM control technology so that they will be capable of meeting the standard. Over the five years since the 2001 final rule was promulgated, both MSHA and the mining industry have gained considerable experience with the implementation, use, and cost of DPM control technology. We have reviewed this experience, and our own enforcement data, and conclude in the final rule that effective DPM controls will be feasible and commercially available to mine operators by 2008. We continue to acknowledge that our 2001 feasibility projections for the ability of the M/NM mining industry to comply with the final limit of 160_{TC} µg/m^3 by January 2006 were incorrect.

In the 2005 proposed rule, we continued to project that many mine operators would have to use DPFs to reduce DPM levels to the final concentration limit. We believe that DPFs can be a very effective engineering control throughout the mining industry for reducing miners' exposures to DPM, provided mine operators address their implementation issues. These implementation issues include such decisions as DPF media selection, sizing, regeneration scheme, and installation.

The rulemaking record includes updated data and promising information from the Biodiesel industry on the progress of increasing mine operators' access to this fuel. Accessing biodiesel fuels has been a feasibility issue for M/NM mine operators primarily due to the lack of sufficient distribution centers. The growing trend on demand and supply of alternative fuels; availability of special extensions; enforcement of our hierarchy of controls strategy; additional time for the mining industry to continue to resolve their existing maintenance and other implementation issues with control technology; ventilation upgrades; continued introduction of cleaner engines; and current enforcement data support both the economic and technological feasibility of the final limits as prescribed in this final rule. Although the risk assessment indicates that a lower DPM limit, lower than 160_{TC} µg/m^3, would enhance miner protection, it is infeasible for the underground M/NM mining industry to reach a lower final limit.

We acknowledge in the Technological Feasibility discussion in Section V of this preamble that our projections for availability of alternative fuels were underestimated in the 2005 proposal. We also considered our updated enforcement data from November 2003 to January 2006 which show that 82% of the 1,798 samples we collected were below the initial final limit of 308_{EC} µg/m^3, 78% were below the January 2007 final limit of 350_{TC} µg/m^3, and 46% were below the May 2008 final limit of 160_{TC} µg/m^3. We remain committed to assuring that mine operators continue the significant progress they have already demonstrated in reducing miners' exposures to DPM.

We received a number of comments from the mining community on our proposed revisions to the final limits. Establishing a standard that focuses control efforts on diminishing the DPM level in air breathed by a miner is supported by some commenters in labor. These commenters stated, "We agree that personal sampling gives a better representation of real exposure, and we support the change in the final rule." A number of industry commenters stated that we should rescind the 160_{TC} µg/m^3 final limit, since they believe that it is unjustifiable and infeasible, and urged us to adopt as the final limit the current interim exposure limit of 308_{EC} µg/m^3 currently in place. We disagree, primarily because the 2001 risk assessment concludes that exposure to DPM could result in a material impairment of miners' health and functional capacity, including lung cancer, and that our analysis has concluded that controls significantly reducing DPM exposure are both technologically and economically feasible. Moreover, in the 2005 NPRM, when we decided that we should consider phasing in the final limit of 160_{TC} µg/m^3, we acknowledged complications with feasibility and stated the following:

> We believe that wider use of alternative fuels and filter technology can make the 160_{TC} µg/m^3 final limit feasible if a staggered phase-in approach is adopted. By lowering the exposure limit in intervals over five years beginning in January 2007, market forces should have sufficient time and incentive to adjust to the new standard. Specifically, a reliable alternative fuel distribution system should induce mine operators to adopt this relatively low-cost method to achieve compliance. The development and distribution of alternative fuels is also encouraged by existing tax credits. We believe that regional distribution networks are beginning to emerge. We seek data on alternative fuel distribution systems (70 FR 53283–84).

We received comments on the availability of distribution systems and other means of DPM exposure controls and have discussed them in detail in Section V of this preamble. Our sampling data, compliance experience, and comments in the rulemaking record lead us to conclude that reductions below the 308_{EC} µg/m^3 limit are achievable by the phase-in dates specified.

Another industry commenter suggested that the proposed five-year phase-in of the final limit would drive technology development but would not allow sufficient time for further research and development, and in-field testing. This commenter did state, however, that a two-phase approach would allow mine operators to implement changes in mining techniques and strategies and would provide for continued protection of miners. Some other commenters state that if we pursue our proposed course, or worse, allow the 160_{TC} µg/m^3 limit to take effect immediately, it would result in an infeasible rule with which the underground M/NM mining industry could not comply. They believe that this could potentially subject mines to closure orders, and require miners to wear respirators to protect against what many regard as undemonstrated adverse health effects. These commenters also urge that we retain the interim limit of 308_{EC} µg/m^3, limit pending results of NIOSH/NCI study.

Another mine operator noted that the proposed phase-in of the final limit is an improvement, but agreed with some other commenters that we need to stay the interim and final limits and wait for completion of the NIOSH/NCI Study. We have sufficient evidence in the DPM rulemaking record which supports the need for us to lower miners' current exposures to DPM beginning in January 2007. We will, however, continue to closely monitor the progress of the NIOSH/NCI joint study, and when the results of this study become available, we will carefully consider them.

As discussed at length in Section V. addressing feasibility of the final rule, we now have more definitive information on availability of alternative fuels and the implementation issues that mine operators face to warrant the time frames under this final rule. We, therefore, cannot justify further delays of implementing the applicability of the 160_{TC} µg/m^3 beyond May 2008.

We also considered that the mining industry has had since January 2001 to work through many of their implementation issues. By now mine operators have implemented more effective controls to meet the interim limit. These controls can be used to assist in reducing miners' exposures even further, ultimately resulting in successful achievement of the final limits. We acknowledge that the mining industry as a whole still needs more time to meet the 160_{TC} µg/m^3 final limit and believe May 2008 will give them an appropriate amount of time for implementing additional controls needed to comply with the final limit.

Most industry commenters, however, emphasized that compliance with the interim limit of 308_{EC} µg/m^3 still poses feasibility issues for the mining industry as a whole. Some other industry commenters added that the proposed reductions are infeasible for 90% of the industry.

We disagree with these commenters. Our data in the 2005 final rule demonstrate that compliance with the interim limit is both technologically and economically feasible (70 FR 32915, 32939). Moreover, our updated compliance sampling results demonstrate that most mines are presently capable of meeting the interim limit of 308_{EC} µg/m^3. Like in the 2005 final rule, compliance with this final rule also relies on our traditional hierarchy of controls enforcement strategy (70 FR 32915–16) discussed above. Thus, this regulatory scheme adequately accomplishes control of exposure under circumstances where an individual mine operator cannot reduce a miner's exposure to the final limit solely by use of engineering and administrative controls, including work practices.

One commenter took the position that we should retain the current interim limit of 308_{EC} µg/m^3 based on EPA's timeframe for industry to develop cleaner burning engines for diesel engines regulated by EPA. The commenter stated that the Tier 4 engines mandated by EPA are to be available in the very near future and are designed to reduce the DPM levels by at least 90%. Tier 4 engines that are greater than 130 hp are to be available in 2011; engines from 56 to 130 hp will be available in 2012; and 19 to 56 hp will be available in 2013. This includes the availability of very low sulfur fuel as well. According to the commenter, this Tier 4 technology deals with the source of DPM exposures; however, they believe that the final DPM limit should not be reduced until these engines are available and tested in the underground mine environment. They also remark that if MSHA believes that the technology will eventually catch up to its DPM final limit, then the phase-in schedule should coincide with the EPA mandated schedule for clean engines. In response, the EPA specifically exempts underground mining diesel powered equipment, as we addressed in the 2001 final rule (Control of Emissions of Air Pollution From Nonroad Diesel Engines, 40 CFR Parts 9, 86, and 89 (1998)). However, § 57.5067, Engines, allows the mine operator to introduce EPA certified diesel engines into mines using either an on-highway vehicle that is a 1994 model year or newer, a Tier 1 nonroad diesel engine, or a Tier 2 nonroad engine dependent on the horsepower. Also in the 2001 final rule, we documented through our risk assessment the need for us to proceed presently to reduce miners' exposures. The final rule requires the mining industry to continue to make progress in further reducing DPM levels in underground M/NM mines.

The EPA standards referred to by the commenter only include newly manufactured diesel engines based on EPA's implementation dates with no requirements on engine retrofits. As discussed in the Technological Feasibility section of this preamble, the EPA's emission regulations will significantly reduce DPM through the use of DPFs installed on newly manufactured engines. We agree that this technology will benefit the mining industry by offering mine operators the opportunity to purchase this technology in the form of new and used machines over time. However, we do not believe that it would be cost effective for the mining industry to purchase all new equipment when the EPA engines become available in order to get the DPM controls that will be mandated by the EPA as suggested by the commenter. We do believe however, that the EPA standards will make it easier for mine operators over time to purchase diesel engines and machines which are equipped with DPFs which should decrease the need to retrofit DPFs. The MSHA DPM final rule provides mine operators with an opportunity to purchase some on-highway vehicles which will include DPFs but will not be available until January 2007. As discussed in Section V of this preamble, this will initially include automotive pickup trucks and other utility trucks.

In addition, EPA is mandating the use of ultra low sulfur diesel fuel, less than 15 ppm, for on-highway vehicles starting in mid 2006. This fuel will not be required by MSHA; however this may be the only economical diesel fuel to purchase over the coming years based on availability. Eventually by 2010, 15 ppm sulfur fuel will be required for all nonroad diesel powered vehicles and due to the EPA requirements, we anticipate that 15 ppm sulfur fuel will be the only available diesel fuel to purchase. Even though 15 ppm sulfur fuel does directly reduce DPM or EC, it will be needed for compatibility with specialized catalyst formulations used by engine manufacturers for DPM and nitrous oxide reductions.

A number of industry commenters noted that experience of both MSHA and the industry under the DPM rules demonstrate an evolving learning process regarding controlling diesel exhaust. It is in this context that these commenters stated that they support the proposed staggered effective date schedule for implementation of the final limit, provided that we address their other concerns related to the final limit. They believe that it would be more appropriate to promulgate a two-step phased-in approach for the final limit ending on January 20, 2011, rather than an annual, 50 microgram reduction of the final limit. These commenters recommended that the first reduced final limit be the EC equivalent of 250_{TC} µg/m^3 on January 20, 2009. The final EC equivalent of 160_{TC} µg/m^3 would become effective on January 20, 2011. They suggest that this schedule would more realistically take into account the purchasing decisions by the mining industry to buy new equipment and engineering controls designed to ultimately achieve compliance with the final limit. In this final rule, we based our timetable on definitive information on availability of alternative fuels and the implementation issues that mine operators face in complying with the final limit of 160_{TC} µg/m^3. We discussed this at length in Section V, Feasibility, of this final rule.

Organized labor commented that exposure to DPM causes cancer, and lawful or not, they believe that delay will cost miners' lives, since they are breathing these fumes at toxic levels. These commenters discussed what they believe to be our protracted rulemakings to revise the 2001 final rule. They also expressed their disagreement with us in changing the applicability of the 2001 final limit of 160_{TC} µg/m^3, and not including medical evaluation and transfer protection for miners. They stated, among other things, that:

> On September 7, 2005, the agency proposed to postpone the final PEL by five more years, reducing it instead by small steps. The agency also suggested there might be difficulties converting the 160 µg/m^3 TC limit to an appropriate EC limit, and proposed to leave that determination to yet another rulemaking. The final standard has now been delayed until May 20, but MSHA clearly intends to delay it far longer,[2] ostensibly on the grounds of feasibility, and based primarily on unsubstantiated claims from the mine operators. These proposed changes would significantly weaken the rule by permitting the continued exposure of miners to levels of DPM the agency has found to be unacceptable * * *
>
> MSHA made a promise to underground M/NM miners in 2001. It told them that help was on the way and that they would someday be protected from choking levels of diesel exhaust. Relief would come slowly, and exposures would be reduced in steps, but by January 2006, a protective standard would be in place. MSHA now proposes to break that promise.
>
> Instead, MSHA should withdraw the proposal to delay the 160 µg/m^3 TC limit, and revise its effective date to no later than July 20, 2006. The USW has no objection to converting the standard to one based on EC at some time in the future, when the data exists to do so. For the time being, TC and EC measurements should be taken

[2] The USW did not object to the 5 month delay; it was necessary to allow the rulemaking process to be as complete as possible. However, we object strenuously to the 5 year delay.

simultaneously, so that MSHA or NIOSH can calculate a proper conversion factor when the time comes. (USW, AB29–COMM–117)

As we stated earlier in this preamble, data continue to support our 2001 risk assessment. That risk assessment establishes a material impairment of health or functional capacity to miners from exposure to DPM. We have incorporated into this rulemaking record the previous DPM rulemaking records, including the 2001 risk assessment. In the 2005 NPRM, we discussed the decline in miners' exposures to DPM from a mean of 808_{DPM} µg/m^3 (646_{TC} µg/m^3 equivalent) prior to the implementation of the 2001 standard, to a mean of 233_{TC} µg/m^3 based on enforcement sampling at that time (70 FR 53283). More recent enforcement data show that miners' exposures to DPM continue to decline. Nevertheless, we continue to believe that mine operators' experiences with control technology confirm that it is infeasible for us to implement the 160_{TC} µg/m^3 final limit earlier than May 2008. We believe that these data dictate the need to afford the mining industry more time to work through their implementation and maintenance issues with DPFs, and to allow sufficient time for construction of more biodiesel fuel distribution centers.

Some industry commenters strongly suggest that feasibility of the final DPM limits must be based on fair and effective implementation of existing § 57.5060(c) regarding special extensions of time in which to comply with the final DPM limit. It is their contention that many mines will be unable to meet the lower DPM limit of 160_{TC} µg/m^3, even if staggered over a five-year period as the agency proposed. Some other mine operators stated that the special extension process ''is not a feasible means of salvaging the infeasible 160_{TC} µg/m^3, or the unworkable and unsupported yearly 'phase-in' proposal.''

Section 57.5060(c) allows mine operators to apply to the MSHA District Manager for additional time to meet the final DPM limits due to economic or technological constraints. Mine operators must demonstrate infeasibility of compliance to the District Manager before they can qualify for a special extension. The feasibility considerations for the District Manager in granting special extensions are very similar to those for determining feasibility under our hierarchy of controls enforcement scheme. Given the progress the mining industry has shown in reducing DPM levels thus far, we do not believe that the industry, as a whole, will be unable to meet the lower DPM limit of 160_{TC} µg/m^3 by May 2008. Initially, we expect to have greater numbers of miners overexposed to the final limit, than with the interim limit. However, we believe that miners in this category will decline over time as mine operators introduce improved engines and continue to resolve their implementation and maintenance problems with DPFs and access problems with biodiesel.

These industry commenters also point out that we should develop, in their views, an accurate, scientifically supportable conversion factor to change the current TC-based final limit of 160_{TC} µg/m^3 to an EC-based limit. We intend to use the best available evidence to develop a proposed rule to appropriately and accurately convert the final DPM limit in the near future.

We received comments from the mining industry on establishing an appropriate surrogate for the DPM final limit. In our 2005 final rule, we changed the surrogate for the interim limit by changing from a concentration limit measured by TC to a comparable PEL measured by EC, which renders a more accurate DPM exposure measurement, and committed to revising the final concentration limit in a future rulemaking. The final rule adopts 308_{EC} µg/m^3 as the initial final limit, but retains TC as the surrogate for the 350_{TC} µg/m^3 and 160_{TC} µg/m^3 final limits. We will initiate a separate rulemaking to determine the correct TC to EC conversion factor for the phased-in final limit of 160_{TC} µg/m^3.

Several commenters to the proposed rule continue to question the applicability of the 2001 risk assessment when using a surrogate measure of elemental carbon to regulate exposures to DPM. These commenters also question the accuracy of the NIOSH Analytical Method 5040 and expressed disapproval for our using EC as a surrogate. In contrast, a number of other commenters objected to MSHA not enforcing a limit of 160_{TC} µg/m^3 immediately. We refer the commenters to the preamble to the 2005 final rule (70 FR 32868) for our position on these issues. Commenters presented some new information, however, in response to the 2005 NPRM.

NIOSH Analytical Method 5040 Validation and Accuracy

The guidelines for development and evaluation of analytical methods are documented in the NIOSH publications NIOSH Manual of Analytical Methods, Chapter E (NIOSH 2nd Supplement Publication No. 98–119) and *Guidelines for Air Sampling and Analytical Method Development and Evaluation* (NIOSH Publication No. 95–117). These documents are guidelines that are used in the process of determining that an analytic method accurately measures what it purports to measure. NIOSH validation criteria state that the NIOSH Analytical Method 5040 provides a result that differs no more than ±25% from the true value 95 times out of 100.

The NIOSH Analytical Method 5040 validation is documented in several publications. These publications include:

(1) Chapter Q of the NIOSH Manual of Analytical Methods (NMAM), DHHS (NIOSH) Publication No. 94–113,

(2) Occupational Monitoring of Particulate Diesel Exhaust by NIOSH Analytical Method 5040, Birch, Applied Occupational and Environmental Hygiene, Vol. 17(6):400–405, 2002,

(3) Diesel Particulate Matter (as Elemental Carbon) 5040, Issue 3: March 15, 2003, NIOSH Manual of Analytical Methods (NMAM), Fourth Edition.

In addition to the above documented validations, there are additional peer-reviewed studies providing evidence that the NIOSH Analytical Method 5040 method is valid. In a study published by Noll, et al., in January 2005 evaluating sampling results of DPM cassettes, the authors report a 95% upper confidence limit Coefficient of Variation (CV) of 7% when analyzing samples for EC and 6% for TC. In this same study, NIOSH reported good agreement and precision between EC for DPM samples using SKC impactor and respirable samples in both laboratory and field studies. The CVs for EC measurements between SKC impactors and respirable samples ranged from 0.2% to 12.3% when taking measurements in an underground mine. The CVs for EC ranged from 3.5% to 5.4% when samples were taken in a laboratory chamber. Two studies published in 2004 (Noll, et al., 2004 and Birch, et al., 2004) reported results from investigating sampling for EC in the presence of coal dust using submicron impactors. The results show good agreement between submicron EC and respirable samplers for collecting DPM samples.

Error Factor

In accordance with generally accepted good industrial hygiene practice and MSHA policy, we develop method-specific error factors to assure that a personal exposure result is more than likely to represent an overexposure. These error factors account for normal and expected variability inherent in any analytic method and sampling protocol and provide a basis for interpretation of sampling results. When we interpret sampling results and make a determination of compliance, we apply the error factor to the result to gage whether the sample indicates a true overexposure. We use the validated NIOSH Analytical Method 5040 for diesel particulate matter to analyze our personal exposure samples collected for compliance determinations.

The NIOSH criteria and guidelines used for method validation do not directly apply to the development of error factors. However, similar statistical procedures to develop analytical methods can also be used to develop error factors. The commenters fail to recognize other differences between validation of methods and development of error factors.

Error factors are developed to compare an infinite number of sampling results to a specific target value of the analyte whereas the method validation protocol specifies a range of 0.1 to 2 times a specific value. Many other differences exist between the two procedures.

We believe the NIOSH Analytical Method 5040 is most appropriate for use in a mining environment because:

(1) The results from the additional method validation efforts by NIOSH using samples collected in mines, as mentioned above, show the method is valid, and

(2) The data we used are generated from miners' samples and analyzed in our laboratory (using multiple analyzers) and other laboratories account for variability in the determination of the error factor.

In response to commenters' concerns that ''MSHA has developed this Error Factor as though the NIOSH Analytical Method 5040 were perfectly accurate for measurements of EC,'' we refer the commenter to item (2) above. We have incorporated inter-laboratory variability and inter-instrument variability into the calculation of the error factor that does, in fact, address accuracy. By incorporating this type of variability we account for some possible biases. It was stated in the 31-Mine study that, based on the available data from all laboratories, the estimated coefficient of variation for analytical TC measurements declines from 12.7% to 8.0% at TC loadings corresponding to 8-hour equivalent concentrations of 160 μg/m³ and 400 μg/m³, respectively. These estimates are approximately 60 percent greater than those based on the MSHA and NIOSH data alone. Intra- and inter-laboratory analytical imprecision appears to be similar to other airborne contaminants' monitoring methods used by us and other regulatory agencies.

Specific Issues Raised by Commenters on Elemental Carbon Variability of the Relationship Between EC and TC

Industry commenters raised the following specific issues regarding the use of EC as a surrogate for DPM exposure. Commenters asserted that the EC content of DPM is neither stable nor predictable and thus the proposed conversion of TC limits to EC limits is not feasible.

We have addressed this issue in the 2005 final rule (70 FR at 32945–32951), and we continue to support using EC as the most suitable surrogate for measuring DPM. Our 2005 final rule (70 FR 32868) establishes the measurement of DPM using EC as a direct measure of total DPM. Using EC as the surrogate permits personal sampling of miners (such as those who smoke, operate jackleg drills, or load ANFO) that would otherwise be difficult or impossible using the OC components in the calculation of TC. Several commenters also noted that the ratio of EC:TC in DPM can vary widely. One commenter pointed out that EC appeared to make up nearly all of the TC at the mine with which he was affiliated. This commenter stated that replacing a 400_{TC} μg/m³ limit with a 308_{EC} μg/m³ limit would impose a much more stringent standard at that mine. Another commenter noted that a 308_{EC} μg/m³ limit would be less protective of miners than the 400_{TC} μg/m³ limit in cases where the ratio of EC comprised less than 78% of the TC. One industry association submitted comments authored by a consultant who emphasized that the highly variable nature of the EC to OC ratio introduces ''large and important uncertainties in the exposure assessments needed to sustain QRA [i.e., quantitative risk assessment].''

We addressed these concerns regarding variability previously in our discussion of the *Relationship Between EC and TC* in our preamble to the 2005 final rule (70 FR 32894–32899). In the 2005 NPRM we solicited comments about converting the final phased-in limits based on TC measurements to corresponding EC limits. In the 2005 NPRM, we also notified the mining community that we would initiate a separate rulemaking to determine what the correct TC to EC conversion factor would be for the phased-in TC final limits below 308_{EC} μg/m³. We requested 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.

Several commenters agreed with our use of the 1.3 conversion factor for the interim limit and the first phased-in final limit of 400_{TC} μg/m³ (308_{EC} μg/m³), but did not believe sampling evidence supported its use at a lower PEL. One commenter recommended we either use the EC number from the lab evaluation, or use a compliance strategy similar to the method used by the Agency in 2004 for the interim limit of 400_{TC} μg/m³.

Several commenters agreed that more work is required to develop an appropriate conversion factor from TC to EC for the final limits. They stated it was reasonable to expect sampling and analysis variability to increase, and accuracy and precision to decrease at lower EC levels. They further stated that MSHA data demonstrate that no accurate conversion factor exists for the highly variable ratio of TC to EC at levels below the interim standard and that this ratio becomes even more unstable once diesel equipment is modified by installation of DPM filtering devices.

Other commenters also believed more research is needed to determine an appropriate conversion factor and noted that recent evidence indicated the EC to TC relationship may change depending on various factors such as fuel type, engine duty cycle, and the control technologies being used.

A number of commenters stated that an accurate, scientifically supportable conversion factor was essential to their acceptance of a staggered effective date schedule. One of them further stipulated the need for peer review of the conversion factor. Other commenters believe that the EC content of DPM is not stable or predictable so the proposed conversion of TC limits to EC limits is not feasible and that the measurement of EC is not accurate.

Organized labor commented that the only proper course of action for MSHA would be to leave the standard at 160 μg/m³ TC until an equally protective standard based on EC can be established. They said that leaving the standard at 308 μg/m³ EC, or going to an EC level not equivalent to 160 μg/m³ TC would violate the ''no-less protection'' restriction under section 101(1)(9) of the Mine Act.

We maintain that the 31-Mine Study data establish that a conversion factor of 1.3 is appropriate for both the initial and final limit of 308_{EC} μg/m³. As we determined in the 2005 final rule, we believe that the limit of 308_{EC} μg/m³ is equally protective of miners' health and equally feasible for the mining industry to meet. Although the EC:TC ratio can exhibit considerable variability in specific cases, we concluded that application of the 1.3 conversion factor, pursuant to the Second Partial Settlement Agreement, achieves the goal of equal protection and feasibility at the 308_{EC} µg/m³ final PEL.

We are considering various alternatives for converting the 350_{TC} µg/m³ and 160_{TC} µg/m³ final limits to comparable EC limits. We will consider all comments in this rulemaking record concerning the relationship between EC, OC and TC in a separate rulemaking to determine the most appropriate conversion of the final TC limits. Presently, we believe that the DPM rulemaking record is inadequate for us to make determinations regarding a more appropriate conversion factor other than 1.3 for the 350_{TC} µg/m³ final PEL. If a rulemaking to establish a conversion factor is not completed before January 20, 2007, we intend to use the 1.3 conversion factor to convert the 350_{TC} µg/m³ final limit to an EC equivalent. We will use the EC equivalents as a check to validate that an overexposure is not the result of interferences as we did with the 400_{TC} µg/m³ interim limit pursuant to the Second Partial Settlement Agreement 67 FR 47296, 47298). We discussed this concept earlier in this section.

Measurement of EC

Some commenters stated that any carcinogenic effect of DPM is due entirely to the organic fraction. We believe this assumption is speculative. This assumption contradicts findings reported by Ichinose *et al.* (1997b) and does not take into account the contribution that inflammation and active oxygen radicals induced by the inorganic carbon core of DPM may have in promoting lung cancers. Indeed, identifying the toxic components of DPM, and particulate matter in general, is an important research focus of a variety of government agencies and scientific organizations (see, for example: Health Effects Institute, 2003; Environmental Protection Agency, 2004b).

In focusing on the carcinogenic agents in OC, the commenters seem to have ignored non-cancer health effects documented in the 2001 risk assessment—e.g., immunological, inflammatory, and allergenic responses in healthy human volunteers exposed to 300_{DPM} µg/m³ (i.e., ≈ 240_{TC} µg/m³) for as little as one hour (66 FR at 5769–70, 5816–17, 5820, 5823, 5837, 5841, 5847). We discussed this also in our 2005 final rule (70 FR 32898,32899).

The implication of non-organic chemicals in a chemical pathway explaining the induction of lung carcinogenesis indicates that organic and inorganic chemical compounds, acting together, contribute to the toxicity of DPM. Identification of a single carcinogenic component of DPM (whether EC, OC, or some combination of chemicals in DPM) is not germane to the issue of whether DPM actually causes adverse health effects as established by the 2001 risk assessment and its updates. This rule reduces the adverse health risks associated with miners' exposure to DPM and not just those associated with the EC or OC fractions of DPM.

The NIOSH Analytical Method 5040 characterizes compounds found in DPM into several classes of substances. These classifications are convenient categories and do not distinguish hazardous compounds from other compounds. As stated by NIOSH (Birch, 1996), ''[M]ethods that speciate EC and OC are considered operational (Cadle and Groblicki, 1980) in the sense that the method itself defines the analyte.''

The possible chemical pathways causing adverse health effects (including lung cancer) include both organic and inorganic chemical elements. Since we believe that both organic and inorganic chemicals contribute to the overall toxicity of DPM our use of EC as a surrogate is intended to control miners' exposure to whole DPM. As NIOSH stated:

> Elemental carbon is the superior measure of exposure to particulate diesel exhaust because elemental carbon constitutes a large portion of the particulate mass, it can be quantified at low levels, and its only significant source in many workplaces is the diesel engine. Selection of an elemental carbon marker also was based on previous work by Fowler (1985), who evaluated various analytes as indices of ''overall diesel exposure.'' (Birch, 1996)

We have not obtained additional information, either provided in comments or from peer-reviewed literature, to change our position that the EC and OC fractions of DPM contribute to the adverse health effects of miners caused by exposure to DPM found in diesel exhaust and that EC is the superior measure of exposure to DPM.

The 308_{EC} µg/m³ final PEL established by this rule is intended to be commensurate with the interim TC limit of 400 micrograms established under the 2001 rule—i.e., to be equally protective and equally feasible as well as the 308 µg/m³ interim EC PEL established by the 2005 final rule. Although the EC:TC ratio can exhibit considerable variability in specific cases, we concluded that application of the 1.3 conversion factor, as suggested in the Second Partial Settlement Agreement, achieves equal protection and feasibility at the 308_{EC} µg/m³ final PEL.

In the 2005 NPRM we solicited comments about converting the final phased-in limits based on TC measurements to corresponding EC limits. We have discussed the relationship between EC and TC and conclude the relationship of EC:TC is adequate to promulgate a personal exposure limit of 308_{EC} µg/m³ final PEL. However, we are considering various alternatives for converting the 350_{TC} µg/m³ and 160_{TC} µg/m³ final limits to commensurate EC limits. We will consider all comments in this rulemaking record concerning the relationship between EC, OC and TC in a separate rulemaking to determine the most appropriate conversion of the final TC limits. Presently, we believe that the DPM rulemaking record is inadequate for us to make determinations regarding a more appropriate conversion factor other than 1.3 for the 350_{TC} µg/m³ final PEL. If a rulemaking to establish a conversion factor is not completed before January 20, 2007, we intend to use the 1.3 conversion factor to convert the 350_{TC} µg/m³ final limit to an EC equivalent. We will use the EC equivalents as a check to validate that an overexposure is not the result of interferences as we did with the 400_{TC} µg/m³ interim limit pursuant to the Second Partial Settlement Agreement (67 FR 47296, 47298). We discussed this concept earlier in this section.

Other commenters asserted that measurement of EC is not accurate and the inherent inaccuracies are not accounted for by the MSHA ''error factor.'' NIOSH Analytical Method 5040 has been validated. The Error Factor accounts for uncontrollable components of measurement except for the variability inherent in EC:TC ratios. We have shown these ratios vary between mines and within mines. The commenters obtained additional information from us and presented a new analysis addressing the validity of the NIOSH Analytical Method 5040.

Based on this new analysis, they concluded 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.'' We disagree. We have demonstrated the mathematical fallacies of the commenters' position in the 2005 final rule. We show it is plausible to have 32 percent of sampling clusters with the experimental design specified by Cohen, *et al.*, 2002 with an inherent coefficient of variation (CV) of 12% and still be consistent with the NIOSH accuracy criterion. The Monte Carlo analysis we performed shows that the commenters' data are consistent with NIOSH validation criteria even though the commenters' collection procedures and analyses were substandard.

The commenters' experimental design and results as presented to the 2003 NPRM were critiqued in the 2005 final rule. No explanation has been provided by these commenters as to why the submitted data were restricted to 75_{EC} µg/m^3 to 200_{EC} µg/m^3 and whether additional basket data falling outside of this range were collected. The samples were collected without the submicron impactor. The sample results are, therefore, inappropriate to address this rulemaking. The study reference does not indicate the type of filter holder and cyclone attachment configuration or if the mineral-dust-related carbonate that occurs in the organic portion of the analysis was subtracted off the OC determination. When using a filter holder with an internal cyclone connection, the cyclone nozzle acts as an impactor jet and mineral dust is deposited in the center of the filter. This inferior sampling equipment arrangement gives a high level of mineral dust in the center of the filter, and a non-uniform deposit of material on the filter surface. A non-uniform deposit precludes any analysis of duplicate sample punch repeatability.

Additionally, three of the seven mines in the referenced study produced either limestone or trona. Both of these minerals contain carbonates which are evolved in the organic portion of the analysis. The referenced study indicates that up to 15 mg/m^3 of total mineral dust was present at one of the mines. Failure to remove this mineral dust by use of an impactor may affect the ability of the analytical analysis to discern between OC and EC, thus introducing an artificially high variability of results.

No information is provided on sampling times or filter loadings (µg/cm^2), both of which affect expected analytical variability. Commenters provided no information as to whether multiple punches were used to determine EC concentrations similar to what we do in our analyses. Only summary data, consisting of the EC measurement range, mean, standard deviation (SD), and coefficient of variation (CV), were provided for each group of ''four or five'' samples. No confidence intervals or other measures of statistical uncertainty were provided for their summary statistics. The commenters failed to address these issues.

Some commenters presented a new analysis addressing the validity of the NIOSH Analytical Method 5040. The new Monte Carlo simulation study results are not persuasive. The commenters' statement that ''MSHA employed its Monte Carlo simulation to support the conclusion that their sampling and analytical method was adequately precise and therefore feasible'' misrepresents our inferences. We used a Monte Carlo simulation to show that, even with all the uncertainties in the quality of the referenced study and conjectures made by the commenter, it is possible for those results to have been generated by a valid analytical method. We generally agree with the commenters insofar as hypothetically generated data seem to only obscure the discussion of real-world data that document analytical precision.

Industry commenters believed that our analysis of more than 600 EC samples (punch-repunch) show that the results are neither precise nor reproducible. This issue was addressed in the preamble to the 2005 final rule. We continue to rely on our previous analysis of the commenters' statement. The commenters' analysis of the punch-repunch data used in the calculation of the error factors for the PELs is incorrect. We summarize our critique of the commenters' analysis here in response to their new analyses of their updated data set.

1. The commenter's analysis of the punch-repunch data is now closer to the mathematical definition of a Coefficient of Variation (CV). Their calculation of a ''difference between punches, to the average of the two punch results'' presents artificially larger variations in the analytic method compared with those with properly calculated CVs. We point out that the commenters did not follow the guidelines specified in NIOSH validation guidelines. The calculation used by the commenters to show large variability is misleading and inconsistent with their own criticisms, and overstates the variation of the NIOSH Analytical Method 5040 instrumentation.

2. Although the commenters adjust their calculation of the difference between punches by the mean of the punches, they fail to make meaningful statistical inferences of the results. They simply tabulate instances in which the ''% Difference'' exceeds a specified CV. The CV values used for their demonstration thresholds do not represent an upper bound on individual deviations or differences. Approximately one-third of individual errors (without regard to direction) would normally be expected to exceed the corresponding CV.

This is why we multiply the appropriate CVs used in calculating the error factor (EF) by a ''Confidence Coefficient'' when establishing a 1-tailed confidence error factor for noncompliance determinations along with other sources of uncontrollable variability of the measurement system.

Industry commenters also contended that there is no NIST ''standard'' for defining EC for analysis and measurement, thus accurate measurement is not feasible. The National Institute of Standards and Technology (NIST) provides two Standard Reference Materials that define not only EC but also TC. These reference materials are well characterized to help determine the operating characteristics of NIOSH Analytic Method 5040 and others. NIST Standard Reference Material 1649a (Urban Dust) provides a Certified Concentration Value for TC. NIST provides an Information Concentration Value for the fraction of EC (EC/TC) contained in this standard material. Although components of the material assigned Information Concentration Values are not as well characterized as those with certified Concentration Values, they are valuable sources of information used by laboratories to validate and assure proper operation of analytic methods.

NIST Standard Reference Material 8785 (Air Particulate Matter on Filter Media) has been available since July 8, 2005 and provides the means to compare methods and laboratories for the measurement of EC. This reference material has value-assignments for TC, EC, and OC measured according to two thermal-optical methods: the NIOSH and IMPROVE (Interagency Monitoring of Protected Visual Environments) protocols. Our laboratory utilizes these NIST Standard Reference Materials as part of a comprehensive quality assurance program.

Health Implications of Using EC

Commenters also asserted that 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. The particulate component of combustion products produced by a diesel engine is characterized by the analytic method as primarily either EC or OC. The analytic decomposition of DPM defines which components are characterized as EC or OC without specifically determining the exact chemical, physical, or carcinogenic chemicals found in DPM (NIOSH Analytical Method 5040, March 15, 2003). Diesel particulate matter is firmly characterized as a hazardous substance and we do not further characterize DPM into hazardous components and non-hazardous components. The final rule intends to limit exposures to total DPM rather than any single constituent of DPM. The NIOSH Analytical Method 5040 characterizes compounds found in DPM into two classes of substances. These classifications are convenient categories and do not distinguish hazardous compounds from other compounds. As stated by NIOSH (Birch, 1996), ''[M]ethods that speciate EC and OC are considered operational (Cadle and Groblicki, 1980) in the sense that the method itself defines the analyte.''

The assumption that any carcinogenic effect of DPM is due entirely to the organic fraction is speculative. This assumption contradicts findings reported by Ichinose *et al.* (1997b) and does not take into account the contribution that inflammation and active oxygen radicals induced by the inorganic carbon core of DPM may have in promoting lung cancers. Indeed, identifying the toxic components of DPM, and particulate matter in general, is an important research focus of a variety of government agencies and scientific organizations (*see,* for example: Health Effects Institute, 2003; Environmental Protection Agency, 2004b). The 2001 risk assessment discusses possible mechanisms of carcinogenesis for which both EC and OC would be relevant factors (66 FR at 5811–5822). Multiple routes of carcinogenesis may operate in human lungs—some requiring only the various organic mutagens in DPM and others involving induction of free radicals by the EC core, either alone or in combination with the organics (70 FR 32898).

The implication of non-organic chemicals in a chemical pathway explaining the induction of lung carcinogenesis indicates that organic and inorganic chemical compounds, acting together, contribute to the toxicity of DPM. Identification of a single carcinogenic component of DPM (whether EC, OC, or some combination of chemicals in DPM) is not germane to the issue of whether DPM actually causes adverse health effects as established by the 2001 risk assessment and its updates. This rule reduces the adverse health risks associated with miners' exposure to DPM and not just those associated with the EC or OC fractions of DPM.

We have not obtained additional information, either provided in comments or from peer-reviewed literature, to change our position that the EC and OC fractions of DPM contribute to the adverse health effects of miners caused by exposure to DPM found in diesel exhaust and that EC is the superior measure of exposure to DPM.

B. Special Extensions § 57.5060(c)(3)(i)

In our 2005 final rule addressing the interim limit, we revised the requirements at § 57.5060(c) regarding special extensions of time in which to meet the final DPM limit. We retained the requirement in § 57.5060(c)(3)(i), however, that the mine operator must specify in the application whether diesel-powered equipment was used in the mine prior to October 29, 1998. The purpose of the 2001 restriction was to limit special extensions to underground mines that operated diesel-powered equipment prior to October 29, 1998. We chose this date because we released the NPRM to our 2001 final rule on that date. We reasoned that some mines in operation prior to that date could experience compliance difficulties relating to such factors as the basic mine design, use of older equipment with high DPM emissions, etc., and that as a result, some of these mines may require additional time to attain compliance with the 2001 final concentration limit. Also, we envisioned that mines opened after that date would be using cleaner engines to help them comply with the final limit. Furthermore, we stated in the 2005 proposal that we had reason to believe that our 2001 assumptions were incorrect, and that it was unnecessary to limit extensions to mines operating diesel equipment prior to October 29, 1998.

We believe the consequence of such a conclusion does not compromise the level of health protection afforded under the existing prohibition. This is because it is optional as to whether a mine operator applies for a special extension under current § 57.5060(c). Special extensions involve considerable paperwork for mine operators, but they result in a document that a mine operator can rely on for a period of one year (renewable) to demonstrate to our inspectors that we have determined that it is infeasible for that particular mine operator to achieve compliance with the final limit using engineering and administrative controls. If affected miners are included in a respiratory protection program which meets the requirements of § 57.5060(d), the mine operator is in compliance and no citation will be issued. To qualify for a special extension, a mine operator must demonstrate infeasibility, which is the same test which we use for enforcement of § 57.5060(d) at mines that don't have a special extension. Current § 57.5060(d) requires mine operators to install, use, and maintain all feasible engineering and administrative controls to achieve compliance. If we determine that reaching the final limit is infeasible for technological or economic reasons, and over-exposed miners are in an appropriate respiratory protection program, the operator is deemed to be in compliance and we will not issue a citation. We will periodically check to determine current DPM exposures and the ability of the mine operator to implement new control technology.

We received no comments objecting to deleting § 57.5060(c)(3)(i). Commenters supporting the deletion stated that they saw no reason to limit special extensions to those mine operators who were operating diesel equipment prior to the arbitrary date of October 29, 1998. They also stated that there would be no reduction in the level of health protection from a standard that was not feasible, nor with which health risks were never associated. Another commenter stated that if this restriction is left in the DPM standard, mines that are just starting will not be allowed to file for a special extension. They claimed that in their case, if they were to develop a new mine, they would have essentially the same constraints as far as mine opening dimensions, maximum air volumes, and equipment as their existing mines have. Consequently, they would not necessarily have lower DPM levels in a new mine. For this reason, they believe that it is critical that we allow new mines the same opportunity to qualify for special extensions after taking all reasonable steps to reduce DPM emissions.

Other commenters agreed that we should delete § 57.5060(c)(3)(i) from the existing DPM standard, but provided no information as to whether elimination of this requirement would result in a reduction in the current level of health protection afforded to miners.

We also received numerous comments recommending that we make other changes to the special extension provisions. These commenters suggested that the final rule include: Comprehensive criteria for granting a special extension; specific language to expand the application of an extension to the entire mine or to portion(s) of a mine; additional procedures for the District Manager to consider in making a determination of whether to grant a special extension; requirements that the District Manager include reasons for any denial of a special extension; and, procedures allowing appeal of the District Manager's determination to the Administrator, and ultimately, to the independent Federal Mine Safety and Health Review Commission.

In the 2005 proposed rule, we informed the public that the scope of revision to § 57.5060(c) was limited to the removal of paragraph (c)(3)(i). Accordingly, such changes would be beyond the scope of this rulemaking. Consequently, the final rule does not reflect consideration of the above stated issues. We note that we made comprehensive revisions to § 57.5060(c) in the 2005 final rule.

Some other commenters discussed how the special extension procedures enhance feasibility and that the courts have recognized that such procedures can resolve individual problems with feasibility. The commenter refers us to the *United Steelworkers of America* v. *Marshall,* 647 F. 2d 1189, 1266 (1980). We address this comment under our discussions on feasibility.

Based on the comments received supporting the deletion of § 57.5060(c)(3)(i), and our discussions above, we have deleted this provision from the DPM standard. For the forgoing reasons, we do not believe that deletion of this provision reduces miners' current level of health protection, and there were no comments submitted to the contrary.

C. Medical Evaluation and Transfer § 57.5060(d)

In the preamble to the 2005 NPRM, we requested comments from the mining community on whether we should include in the final rule 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. In addition, we asked for 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 as a result of the medical evaluation that the miner is unable to wear a respirator for medical reasons.

Further, we asked whether we should amend the existing respiratory protection requirement at § 57.5060(d) by adding new paragraphs (d)(3) and (d)(4) to address medical evaluation and transfer rights for miners. We particularly wanted 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.

We also requested comments in the preamble to the proposed rule on whether a transfer provision in the final rule should include issues of notification to the District Manager of the health professional's evaluation and the fact that a miner will be transferred; the appropriate time frame 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. Our current DPM requirements for respiratory protection at § 57.5060(d) do not include requirements for medical evaluation of miners before they are required to work in an area where respiratory protection must be worn, or transfer of miners who are medically unable to wear respirators.

Section 101(a)(7) of the Mine Act authorizes medical evaluation and transfer protection for miners, and states, in pertinent part:

Where appropriate, such mandatory standard shall also prescribe suitable protective equipment and control or technological procedures to be used in connection with such hazards and shall provide for monitoring or measuring miner exposure at such locations and intervals, and in such manner so as to assure the maximum protection of miners. In addition, where appropriate, any such mandatory standard shall prescribe the type and frequency of medical examinations or other tests which shall be made available, by the operator at his cost, to miners exposed to such hazards in order to most effectively determine whether the health of such miners is adversely affected by such exposure. Where appropriate, the mandatory standard shall provide that where a determination is made that a miner may suffer material impairment of health or functional capacity by reason of exposure to the hazard covered by such mandatory standard, that miner shall be removed from such exposure and reassigned. Any miner transferred as a result of such exposure shall continue to receive compensation for such work at no less than the regular rate of pay for miners in the classification such miner held immediately prior to his transfer. In the event of the transfer of a miner pursuant to the preceding sentence, increases in wages of the transferred miner shall be based upon the new work classification.

Existing § 57.5060(d) requires that mine operators comply with the respiratory protection requirements under § 57.5005(a) and (b) (control of exposure to airborne contaminants) of our air quality standards for M/NM underground mines. Sections 57.5060(d)(1) and (d)(2) designate acceptable respirator filters under the standard. Section 57.5005(a) requires that respirators be furnished and miners use the protective equipment in accordance with training and instruction. Currently, we do not require mine operators to provide miners with medical evaluation before they wear a respirator and transfer protection in the event that they cannot wear one.

Existing § 57.5005(b) for control of miners' exposures to airborne contaminants requires that mine operators establish a respiratory protection program consistent with the (ANSI Z88.2–1969) ''American National Standard for Respiratory Protection —''ANSI Z88.2–1969, ''American National Standards Practices for Respiratory Protection.'' The final rule, however, adopts our approach taken in the proposed preamble recommendations along with additional requirements which we deem necessary to protect miners. These additional requirements address issues related to medical confidentiality, evaluation of a miner's ability to wear a PAPR, reevaluation of miners, and recordkeeping requirements, along with other revisions to clarify our intent under the standard.

We believe that there is adequate evidence in the rulemaking record establishing the need for medical evaluation of miners. We incorporated into the DPM rulemaking record the Occupational Safety and Health Administration's (OSHA) data from its rulemaking record supporting its generic respiratory protection standard at 29 CFR 1910.134 related to the health risk to persons from using respirators with certain medical conditions. Based on their data, OSHA concluded, and MSHA agrees, that use of a respirator may place a physiological burden on a worker while wearing such a device. Depending on the medical condition of the person, this burden could result in illness, injury, and in some instances, even death. OSHA also concludes that common health problems can cause difficulty in breathing while a person is wearing a respirator. Most healthy persons, however, will not have physiological problems wearing properly chosen and fitted respirators.

The final rule amends the existing DPM respiratory protection standard at § 57.5060(d) by adding requirements for mine operators to provide, at no cost to the miner, a confidential medical evaluation by a physician or other licensed health care professional (PLHCP) to determine the 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. When these conditions occur the miner must be reevaluated to determine the miner's ability to use the respirator.

Also included in the final rule is the right of miners to discuss their medical evaluations with the PLHCP before the PLHCP submits to the mine operator a copy of the PLHCP's medical determination. The mine operator must have a written record of the most recent medical evaluation to confirm that the miner was evaluated. We believe that the final rule includes a practical approach for requiring medical evaluations that lessens the compliance burden on mine operators without compromising miners' health.

In addition, the final rule includes requirements for transferring a miner to an existing job in an area of the mine where respiratory protection is not required if a PLHCP has determined that the miner's medical condition precludes the miner from safely wearing any required respirator, including a powered air-purifying respirator (PAPR). The details of this requirement are discussed below in this preamble. We believe that compliance with the final rule will enhance miner protection.

Section 57.5060(d)(3) of the final rule requires that the mine operator provide a confidential medical evaluation by a PLHCP to determine the miner's ability to use a respirator before the miner is required to be fit tested or to use a respirator at the mine. The mine operator must provide the medical evaluation to the miner and pay the cost of each of the miner's medical evaluations. Mine operators must make certain that the PLHCP administers the testing in a manner that protects the confidentiality of the miner being evaluated.

If the PLHCP determines that the miner is able to wear a negative-pressure respirator, the mine operator must provide it and require the miner to wear it under our existing respiratory protection requirements. On the other hand, if the PLHCP concludes that the miner is unable to wear a negative-pressure respirator, the mine operator must make certain that the PLHCP also determines the miner's ability to wear a PAPR. If the PLHCP finds that the miner can wear a PAPR, the mine operator must provide the PAPR and require the miner to wear it.

The miner must be evaluated by a PLHCP prior to the miner wearing the respirator for any duration or frequency of respirator use, including prior to fit testing of the respirator. This is because we intend that a miner not be assigned to tasks in the mine that require use of a respirator unless a PLHCP makes a written determination that the miner is physically able to perform the work to which the miner is assigned while using the respirator. For enforcement purposes, we will use the results of the most recent written determination of the PLHCP to assess compliance with this provision. Whereas we have chosen not to include a specific protocol for how evaluations must be conducted, we expect the PLHCP to conduct an evaluation based on the individual miner's medical information.

As part of the PLHCP's determination, § 57.5060(d)(4) requires that the mine operator provide the miner with an opportunity to discuss their evaluation results with the PLHCP before the PLHCP submits the written determination to the mine operator. If the miner disagrees with the determination of the PLHCP, the miner has up to 30 days to submit to the PLHCP additional evidence of their medical condition. Depending upon the miner's medical history, it may be critical for the miner to discuss any discrepancies or errors in a PLHCP's determination. The miner, however, may at any time provide additional medical information to the mine operator if the miner believes that it may impact the miner's ability to wear a respirator.

Section 57.5060(d)(5) requires the mine operator to obtain a written determination from the PLHCP regarding the miner's ability to wear a respirator. The mine operator must make certain that the PLHCP provides a copy of the determination to the miner. Though the rule does not specify a timeframe in which the mine operator must have the PLHCP provide a copy to the miner of his or her medical determination, we intend for the mine operator to exercise diligence in getting this important information to the miner.

Section 57.5060(d)(6) requires the mine operator to reevaluate the miner when the operator has reason to believe that conditions have changed such as when the miner is assigned to a new task requiring a significantly greater degree of physical exertion, or the miner is assigned to work at a lower level of a deep mine that is hotter and imposes greater physiological stress. We expect the mine operator to exercise sound judgment when deciding whether the miner must be reevaluated by a PLHCP.

Section 57.5060(d)(7) requires that upon written notification that the PLHCP has determined that the miner is unable to wear a respirator (including a PAPR), the miner must be transferred within 30 days of the PLHCP's determination to work in an existing position in an area of the same mine where respiratory protection is not required. Congress specifically included in Section 101(a)(7) of the Mine Act that when transfer of a miner is required under this section that their compensation must be as we specifically stated in this final rule. As a result, 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. However, wage increases of the transferred miner must be based on the new work classification.

Under § 57.5060(d)(8) of the final rule, the mine operator must maintain a record of the identity of the PLHCP and the most recent written determination of each miner's ability to wear a respirator for the duration of the miner's employment plus six months thereafter.

In response to our 2005 NPRM, we received numerous comments on issues related to medical evaluation of respirator wearers and transfer of miners medically unable to wear respirators. We requested comments in the 2005 NPRM regarding whether we should amend existing § 57.5060(d) addressing respiratory protection requirements by adding regulatory language to provide miners medical evaluations and transfer rights pursuant to Section 101(a)(7) of the Mine Act. One mine operator commented that they still face significant challenges to compliance with the interim limit. They currently require miners to wear respirators when performing certain tasks that have been a significant source of DPM exposure. Based on their own samples, they believe that the use of respiratory protection would increase under the final limit and be required of all miners through the entire shift. They also stated their concern for the burden this would place on affected miners and noted that mandatory respirator usage for the entire shift would compromise miners' acceptance of the rule and their ability to safely remain productive. Further, they believe that most companies that have a formal respiratory protection program are currently conducting medical evaluation in the program, and consequently, should not have to perform medical evaluation ''solely to comply with the rule.'' Some other mine operators commented that they perform medical evaluations of a miner's ability to wear a respirator during pre-employment examination, and annually thereafter for workers who must wear respirators, but did not believe it was necessary to require medical evaluations through regulation.

Although some mine operators are already conducting medical evaluations before fit testing and requiring miners to wear respirators, not all underground M/NM mine operators using diesel powered equipment are conducting voluntary medical evaluations. We believe that the data establishing the need for the evaluations support a uniform approach for requiring reevaluations.

We agree with the commenters who acknowledged that existing voluntary medical evaluations currently provided by some mine operators do not establish uniform protection for all miners covered under the DPM standard. These commenters also stated that simply because some mine operators have provided miners this protection does not justify why others should continue to be denied them. These commenters support the need for including medical evaluation in the final rule and stated that voluntary medical evaluation programs in the industry show that mine operators, acting in good faith, can easily implement a respirator program, including transfer rights, without practical or financial difficulty.

One commenter recommended that we defer requiring medical evaluation and transfer until we are able to establish an accurate database on the number of miners projected to be affected. Our 2005 NPRM preliminary estimates of the number of miners that may be affected resulted from the available data in the rulemaking record at the time of the proposal. We have since received comments from several mine operators who included their current costs for medical evaluations and the number of miners affected. We used this information in assessing our cost analysis for the Regulatory Economic Analysis (REA) supporting this final rule.

Several other commenters voiced concern over worker acceptance of respirators in general, but believed that medical evaluations were a good idea. Organized labor stated that there is substantial evidence in the record of the relevant OSHA hearings to support medical evaluations, and requested that we incorporate that evidence into this record as well. We have incorporated these data into the DPM rulemaking record. As stated earlier, OSHA acknowledges within its current standards addressing respiratory protection at 29 CFR 1910.134(e) that use of a respirator may place a physiological burden on workers while using them. At a minimum, OSHA requires employers to provide medical evaluations before an employee is fit tested or required to use respiratory protection. Employers are required to have a physician or other licensed health care professional have the worker complete a questionnaire, or in the alternative, conduct an initial medical examination in order to make the determination. If the worker has a positive response to certain specified questions, the employer must provide a follow-up medical examination. The questionnaire is contained in the body of the OSHA rule. The preamble to the OSHA final rule states:

> Specific medical conditions can compromise an employee's ability to tolerate the physiological burdens imposed by respirator use, thereby placing the employee at increased risk of illness, injury, and even death (Exs. 64–363, 64–427). These medical conditions include cardiovascular and respiratory diseases (*e.g.*, a history of high blood pressure, angina, heart attack, cardiac arrhythmias, stroke, asthma, chronic bronchitis, emphysema), reduced pulmonary function caused by other factors (*e.g.*, smoking or prior exposure to respiratory hazards), neurological or musculoskeletal disorders (*e.g.*, ringing in the ears, epilepsy, lower back pain), and impaired sensory function (*e.g.*, a perforated ear drum, reduced olfactory function). Psychological conditions, such as claustrophobia, can also impair the effective use of respirators by employees and may also cause independent of physiological burdens, significant elevations in heart rate, blood pressure, and respiratory rate that can jeopardize the health of employees who are at high risk for cardiopulmonary disease (Ex. 22–14). One commenter (Ex. 54–429) emphasized the importance of evaluating claustrophobia and severe anxiety, noting that these conditions are often detected during respirator training. [See 63 FR 1152, 01/08/1998]

Organized labor also stated:

> * * * In all of our certification programs we have included blood pressure and spirometry measurements. In respirator certification for a group of electrical workers, we identified 7.5% who had abnormal spirometry and were not given a respiratory certificate until they had received further medical evaluation and a repeat of the spirometry.
>
> This observation was [sic] supported in a study of nurses working in a hospital close to the World Trade Center at the time of the disaster. Although exhibiting no respiratory symptoms on their questionnaires, 10 of 110 nurses had abnormal spirograms and were referred to a Pulmonologist for further evaluation.
>
> In our evaluation of World Trade Center Rescue workers, we have found similar discrepancies between the questionnaire and spirometry.
>
> A report by S. Levine *et al.* (MMWR Sept. 10, 2004) notes that 33% [sic] had abnormal spirometry but wheeze was [sic] only reported in 0.9%. (David Parkinson, MD, United Steelworkers Consultant, Occupational Physician)

The final rule does not include a protocol to guide the PLHCP on how to conduct medical evaluations as the OSHA standard does, but places the responsibility on the mine operator to provide an appropriate medical evaluation by a PLHCP to determine the miner's ability to use a respirator before the miner is required to be fit tested or to use a respirator at the mine.

We intend that a ''physician or other licensed health care professional (PLHCP)'' be a physician, physician's assistant, nurse, emergency medical technician or other person qualified to provide medical or occupational health services, as we have defined a ''health professional'' under our Hazard Communication standards at 30 CFR 47.11. We will accept the license as proof of qualification to perform the medical evaluation. We specified that the health care worker be licensed to ensure an acceptable level of competency, but have not specified which states' licensing to accept. As we said in our preamble to the final rule (64 FR 49578) on Health Standards for Occupational Noise Exposure at 30 CFR Part 62, ''* * * although some state licensing requirements are more stringent than others, even the least rigorous of the state requirements will provide an acceptable level of competence * * * [for audiologists].''

NIOSH commented that in other industries where respirators were used, they supported the requirements specified in the OSHA Respiratory Protection Standard (29 CFR 1910.134), with the exception of:

> (a) The use of irritant smoke for qualitative respirator fit testing, and (b) unsupervised medical evaluations conducted by health care professionals who are not licensed for independent practice to perform or supervise medical evaluations.

We also received comments from mine operators who stated that they already conduct medical evaluations, or at the very least, pulmonary function tests, during pre-employment examinations. From the mine operators who commented on their frequency of these examinations, several commenters stated that they test annually, another tests every three years, while another performs them bi-annually. Others noted that the tests were initially performed during pre-employment examinations, and thereafter, were conducted whenever a miner was about to be required to wear a respirator. One commenter that provides a medical exam upon employment and annually thereafter stated:

If the miners health conditions change preventing the safe use of a respirator, then additional tests can be provided including spirometry and if indicated, a medical examination. We have not had a case where a miner's health changed preventing the wearing of a respirator, that the miner was not aware of the health condition. We do not object to annual spirometry testing following guidelines developed and supervised by a medical doctor or other medical professional. We do object to the added expense of requiring a medical exam every year if there are no indicators of a medical necessity, either by the miners own request or the conditions mentioned.

The final rule requires that miners be reevaluated when the mine operator has reason to believe that conditions have changed which could adversely affect the miner's ability to wear the respirator. We believe that the final rule provision is more appropriate and cost effective than a restrictive schedule of frequency of reevaluation to detect or confirm the miner's ability to safely wear respiratory protection. We do not envision, in most instances, that miners will be in a respiratory protection program for an extended length of time. We recognize, however, that more miners may have to wear respirators when the PEL is reduced to 160_{TC} μg/m^3. We received no comments in support of establishing the need for a specific frequency, but we did receive several comments opposing them. Also, a miner should alert the mine operator whenever the miner experiences changes in his or her health that could impact his or her ability to safely wear a respirator. Mine operators have the responsibility for conducting a reevaluation where a change in workplace conditions may result in a substantial increase in the physiological burden that respirator use places on the miner. For example, a change in the miner's work task may require greater physical exertion or a change in the work environment could increase the stress on the miner.

A mine operator stated that the use of PAPRs was not practical in most mining applications. They believe that the need for battery charging stations for the PAPRs, storage facilities and maintenance would significantly increase the cost of a respiratory protection program. NIOSH commented that PAPRs have some of the same limitations as negative-pressure respirators in that both impede communication, hearing, vision, and require periodic replacement of the purifying elements, as well as other disadvantages. NIOSH further stated:

* * * In addition, the battery must be recharged on a daily basis so that the blower will deliver enough respirable air to the respiratory inlet covering. Batteries have a limited useful life and cannot be recharged indefinitely. The blower's high speed motor can wear out and require replacement; if the blower fails in a loose-fitting PAPR, the wearer will be without respiratory protection. Other disadvantages include the weight and bulk of the PAPR with its blower and battery, which can hinder movement; complex design; and the need for a higher level of maintenance than a negative pressure respirator.

NIOSH also commented, however, that under normal use, PAPRs do not impose the resistance to breathing that is associated with negative-pressure respirators and that for a miner who has a medical condition placing the miner at risk from using a negative-pressure respirator, use of a PAPR is a potential alternative to transfer of duties.

Another commenter stated that anybody who is working underground at their operations is provided a pulmonary function check to make sure that they are capable of wearing a respirator. That commenter was not aware of anyone being found unable to do so. Several industry commenters stated that they performed medical evaluations for testing the ability of miners to wear a negative-pressure respirator during pre-employment and annually thereafter. One commenter noted that although they had found a few miners who were unable to wear negative-pressure respirators initially, each of them responded to medical treatment and subsequently was found medically able to wear a negative-pressure respirator.

Another commenter specified that they have pulmonary function tests performed on anyone entering a respiratory protection program (about 10 miners), and had no one who was determined to be unable to wear a negative-pressure respirator. While a commenter, on behalf of organized labor, stated that only a few miners would be unable to wear a negative-pressure respirator, most of these miners would be able to wear a PAPR. A medical testing company that provides pulmonary function and respiratory fits, primarily for compliance with OSHA regulations testified that, in their experience, ''with maybe a hundred workers, anywhere from three to five [workers] could not go to work because of their lung problems over the years.'' They also stated that they had not found any workers unable to wear an air-supplying respirator or powered air-purifying respirator, as long as they were clean-shaven. We agree with these commenters that few miners will be unable to wear a PAPR while performing their tasks in a mine.

In the event that a miner is medically unable to wear a negative-pressure respirator, § 57.5060(d)(3) requires the mine operator to make certain that a PLHCP evaluates the miner's ability to use a PAPR, such as those that are integrated into a hard hat. Although a determination needs to be made that the miner is medically able to wear a PAPR, it is likely that most miners could wear a PAPR. We believe that such respirators are an effective option for persons who cannot wear a negative-pressure respirator and, in most instances, will negate the need to transfer the miner.

One commenter suggested that mine operators be required to provide PAPRs to miners who are medically unable to wear a negative-pressure respirator, and not be required to transfer the miner to another position at equal pay unless the miner was unable to wear either a negative-or positive-pressure respirator. Most commenters favored leaving the choice to the mine operator. NIOSH suggested transfer be reserved for those who could not use either a negative-pressure respirator or a PAPR. Final § 57.5060(d)(7) requires transfer of miners when the PLHCP determines that the miner cannot wear a respirator, including a PAPR. If the PLHCP finds that the miner cannot wear a negative-pressure respirator, the mine operator must make certain that the PLHCP tests the miner's ability to wear a PAPR. Pursuant to existing § 57.5060(d), if the mine operator can wear a PAPR, the mine operator has an obligation to provide it and require the miner to wear it.

One commenter stated that as the DPM standard becomes more stringent and respirator usage increases, the medical evaluation would need to be adapted to evaluate the miner's ability to wear the respirator for the full shift during high workload duties. The commenter believes this would increase the number of miners that are unable to successfully pass the medical evaluation, increasing the need for transfer or termination. Although we agree that the number of miners required to use respirators would increase as the DPM final limit is lowered, we do not believe that it would result in any significant increase in the number of transfers, because most miners could wear a PAPR if they cannot wear a negative pressure respirator.

Most commenters stated that in the event that we require medical transfer of a miner, they opposed creating a job for the transferred miner. They strongly believe that transfer rights should be limited to those circumstances where a position is available where respiratory protection is not required, and the miner is qualified for that position. Several of these commenters stated that not giving consideration to miners' skills or qualifications could result in a miner being transferred into a position where they are unqualified to perform the work. As a result, this could create a threat to the safety of the transferred miner as well as to other miners.

We concluded in final § 57.5060(d)(7) that the miner must be transferred to an existing job in an area of the same mine where respiratory protection is not required. We believe that the rulemaking record is insufficient to establish justification for requiring mine operators to create jobs for transferred miners. The mine operator is in the best position to determine if a miner is qualified to perform the job to which the miner is transferred based upon the tasks involved. We would, however, expect the mine operator to provide necessary task training under our existing standards at 30 CFR part 48.

Several small mine operators were particularly concerned with the difficulty of moving people to different positions within their small workforce. One operator said they often do cross-training, but that their labor market was limited and it was becoming more difficult to find people willing to work underground. Our primary objective under this standard is to prevent miners from being required to use a respirator before the miner is determined to be medically able to wear the respirator. Section 101(a)(7) of the Mine Act, and the data confirming the potential health consequences of using a respirator with certain illnesses and other medical conditions, lead us to disagree with these commenters.

Several mine operators commented that available positions were limited for transferred miners due to terms of labor contracts. One mine operator with several properties said it might be difficult to find an available job at their mine having about 25 employees, but that they would consider offering a position at one of their other properties if a position was available there. Another mine operator said that they might not be able to find a job underground, but that one on the surface might be available. The final standard does not prohibit mine operators from transferring a miner to an existing job on the surface of the same mine. Mine operators, however, must make certain that they comply with the compensation requirements in § 57.5060(d)(7)(i) and (ii). Moreover, they must make certain that the new miner is not overexposed to DPM on the new job and is not required to use respiratory protection, until such time that a subsequent medical evaluation by a PLHCP determines that the miner is able to use the respirator.

One mine operator stated that most of their underground miners would be required to wear respirators, and as a consequence, the availability of alternative positions would be extremely limited. The commenter stated that the rate of pay should not be tied to the position held by the worker prior to the transfer but should be based on the new position because wage scales for underground workers are typically higher than for comparable above ground positions. Several other commenters also wanted the wage rate for a transferred miner to be based on the new position. Again, we emphasize that the final rule adopts our statutory mandate articulated in the Mine Act regarding compensation of transferred miners. Under § 57.5060(d)(7)(i), transferred miners are to receive ''no less'' than the regular rate of pay that they received in the job classification that they were in immediately before the transfer. Under § 57.5060(d)(7)(ii), mine operators must base increases in wages of transferred miners on the new work classification.

We received several comments regarding an appropriate regulatory response to when a miner cannot meet the requirements of wearing a respirator while performing their duties, and there is no available work that the restricted miner is qualified to perform. Some commenters suggested that the miner should be considered medically unfit for duty and terminated subject to their company policies, collective bargaining agreements, and State or Federal laws. One commenter stated that they did not have transfer rights in their contracts, but had been assured that if the circumstance arose, their human resources department would see whether the miner could be moved to an available job. In response, the final rule does not require mine operators to create a job for miners who need to be transferred.

Organized labor stated its strong support for medical evaluation and transfer. They believe that since a mine operator who assigns a miner to work in a respirator without a medical evaluation puts that worker's life at risk, we have an obligation to protect miners from such harm. We agree that medical evaluation and transfer requirements are a necessary component to the existing DPM respiratory protection program, and we have included this protection in the final rule for improving miners' health.

In our preamble to the 2005 final rule, we stated our belief that a requirement for medical evaluation of respirator wearers and transfer of miners unable to wear respirators was inappropriate for that rulemaking (70 FR 32957). At that time, we believed that these requirements would have minimal application, particularly considering the extent to which mine operators were voluntarily implementing such provisions and the limited long term use of respirators envisioned under the interim rule. We are now persuaded that under the final limit, this is no longer the case.

Notwithstanding the continuation of some voluntary use of these programs in the mining industry, we are concerned that more miners may be required to wear respirators for longer periods of time as the final limit is lowered, and therefore, medical evaluation and transfer should not remain an elective. If, however, we fail to include transfer rights for miners unable to wear respiratory protection, the effect may be worse than not requiring a medical evaluation at all. The mine operator, acting on false information given by the miner to protect his or her job, is then in the position of assigning a respirator to a miner who cannot safely wear it. The best course of action for miner's health is to remove the fear of reprisals to the degree necessary to allow the miner to truthfully and fully participate in a medical evaluation.

We realize that particularly at a small mine, an alternative position may not exist. Under this circumstance, we believe that the mine operator is best suited to determine how to accommodate that miner based on existing employment rights pursuant to collective bargaining agreements, and state and federal laws, etc. The final rule, however, prohibits a mine operator from allowing a miner to voluntarily work in an area where respiratory protection is required without a respirator and when the miner is medically unable to wear a respirator.

We received one comment objecting to notification to the District Manager of the health professional's evaluation and the fact that a miner will be transferred. We have not included notification requirements in the final rule due to our objective to limit the paperwork burden on mine operators, and due to the fact that our inspectors have access to mine operators' records and can determine that miners have been transferred.

NIOSH recommended that mine operators be required to maintain records of miners' medical evaluations, respirator use, and transfers required under this rule and that the records be kept confidential and in a secure location. The final rule requires mine operators to keep a record of the identity of the PLHCP and the most recent written determination of each miner's ability to wear a respirator for the duration of the miner's employment plus six months. It is important that we note that our compliance specialists have access to these records pursuant to Section 103(h) of the Mine Act, and operators must make these records available to the authorized representatives of the Secretary of Labor.

NIOSH recommended that the timeframe for transfer be as rapid as possible if a miner is experiencing acute health effects from exposure. The final rule requires the mine operator to transfer the affected miner within 30 days of the final determination by the PLHCP that the miner is unable to wear a respirator. We anticipate most overexposures to be chronic rather than acute, and therefore, have given greater latitude in the time for compliance.

A number of commenters stated that where miners' exposures cannot be reduced below the applicable final limit, the standard should provide that the mine operator may assign other miners who must wear respiratory protection to work in the affected area to reduce the amount of time that any given miner must wear respiratory protection. We do not agree. Allowing this practice fails to eliminate the hazard of DPM exposure and results in placing more miners at risk. We do believe that a two-year phase-in approach of the final limit of 160_{TC} µg/m^3 will resolve many of the existing feasibility issues as discussed in the feasibility section of this preamble. Although the number of miners required to wear respirators is likely to increase initially under the 160_{TC} µg/m^3 final limit, with the use of biodiesel and other available DPM controls, we project that the number of miners in respiratory protection should decrease over time.

In the 2005 NPRM, we estimated that medical evaluation and transfer requirements would affect about 50 miners annually for evaluation, about 3 miners annually for transfer, and cost about $40,000 annually. We asked for comments on costs to mine operators for implementing a rule requiring medical evaluations and transfer of miners.

One mine commented that they have a formal medical evaluation conducted prior to being fit tested and annually thereafter. Their average cost for an evaluation to be able to wear a negative-pressure respirator was $250 per miner. They also estimated that the cost for them to provide a PAPR for miners unable to wear a negative-pressure respirator would be approximately $700. One large gold mine commented that they believed approximately 70% (480) of their 686 underground personnel would require respiratory protection in meeting the final 160 TC limit.

Another commenter said they have onsite technicians who are certified to conduct these tests (medical evaluation), however, the analysis of the pulmonary function tests is provided by a licensed healthcare provider. Their cost for the pulmonary function tests is roughly $17.00 per individual. Another company estimated that the average cost per person for medical evaluations is $660. The range for costs varied widely depending on the types of tests performed and whether the cost of the respirator itself was included. We have considered these new data in our REA in support of the final rule and have revised our costs estimates.

As explained in section IX.A. of this preamble, a total of 680 miners will require a medical evaluation in the first year after the rule takes effect to meet the 350_{TC} µg/m^3 limit. An additional 244 miners will require a medical evaluation when the 160_{TC} µg/m^3 takes effect. The estimated yearly medical evaluation and transfer costs to mine operators to meet the requirements of the final rule are $69,170.

D. Diesel Particulate Records § 57.5075(a)

The recordkeeping requirements of the DPM standards contained in §§ 57.5060 through 57.5071 are listed in a table entitled ''Table 57.5075(a)—Diesel Particulate Matter Recordkeeping Requirements.'' The table lists the records the operator must maintain pursuant to §§ 57.5060 through 57.5071, and the retention period for these records.

The final rule also makes a confirming change to the Table in § 57.5075(a) which includes a record of the identity of the physician or other licensed health care professional (PLHCP) and the most recent written determination of each miner's ability to wear a respirator for the duration of the miner's employment plus six months.

As discussed in detail under section VIII.C. Medical Evaluation and Transfer, we have determined that medical evaluation and transfer requirements are a necessary component to the existing DPM respiratory protection program, and have included this requirement for improving miners' health in the final rule. Thus, we are amending the existing DPM respiratory protection standard at § 57.5060(d) by adding 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.

The final rule also includes requirements for transferring a miner to an existing job in an area of the mine where respiratory protection is not required if a PLHCP has determined that the miner's medical condition precludes the miner from safely wearing any type of respirator, including a PAPR.

Under paragraph (d)(8) the mine operator must maintain a record of the identity of the PLHCP and the most recent written determination of each miner's ability to wear a respirator for the duration of the miner's employment plus six months. We consider this document to be a medical record and our retention requirements are consistent with other medical records that we require mine operators to maintain, such as those specified in our existing Hearing Conservation Program requirements in 30 CFR 62.171. By requiring the operator to retain a copy of these documents, it will help protect miner's health and assist with compliance with § 57.5060(d). This new recordkeeping requirement will be incorporated into existing Table 57.5075(a)—Diesel Particulate Recordkeeping Requirements.

IX. Regulatory Costs

Section IX.A discusses the costs attributable to this final rule. These costs arise from new provisions for medical evaluation and transfer. Section IX.B discusses the costs of implementing the 160_{TC} µg/m^3 final limit, given that the existing 308_{EC} µg/m^3 interim limit is in effect. The move from the existing higher limit to the lower final limit results from a series of final rules, including both this final rule and two prior rules. Other than the costs for medical evaluation and transfer (estimated in Section IX.A and reported in Section IX.B), the costs presented in Section IX.B are not attributable to this final rule. All costs are reported in 2004 dollars.

A. Costs of Medical Evaluation and Transfer

The medical evaluation and transfer provisions would require the mine operator to provide a medical evaluation by a physician or other licensed health care professional (PLHCP) to each miner required to wear a respirator. MSHA will accept a prior medical evaluation to the extent the mine operator has a written record and there have not been any changes that will adversely affect the miner's ability to wear a respirator. For those miners who do not have an existing medical evaluation, we expect that the mine operator would need to provide the PLHCP with information, including the types and weights of the respirator that the miner will use, the duration and frequency of respirator use, the expected physical work effort, additional protective clothing and equipment worn, and temperature and humidity extremes that may be encountered. The mine operator would also need to provide additional medical evaluations if: the miner's supervisor notifies the PLHCP of medical signs or symptoms related to the miner's ability to use a respirator; the PLHCP informs the mine operator that the miner needs to be reevaluated; information from the respiratory protection program indicates a need for miner reevaluation; or a change in workplace conditions occurs.

If a respirator is needed, the mine operator would have to provide a negative-pressure respirator. However, if the PLHCP determines that the miner cannot wear a negative-pressure respirator but can wear a positive-pressure respirator, then the mine operator would be required to provide a powered air-purifying respirator (PAPR) to the miner.

The mine operator would have to transfer the miner to an existing position in the same mine where respiratory protection is not required if the PLHCP determined that the miner was unable to wear either a negative-pressure respirator or a PAPR. The mine operator would be required to compensate the miner at no less than the regular rate of pay received by the miner immediately before the transfer.

To estimate the cost of these medical evaluation and transfer provisions, for the 308_{EC} μg/m^3, 350_{TC} μg/m^3, and 160_{TC} μg/m^3 limits, MSHA made the following assumptions:

In each year that medical evaluations are required for a mine, it would take a mine health and safety specialist, earning $52.31 per hour, 1 hour to prepare information for the PLHCP.[3]

The cost of a medical evaluation is $50. This medical evaluation consists of a medical questionnaire or interview with the PLHCP and a simple pulmonary function test.

Four miners per mine in mines with fewer than 20 employees will need to use respirators and therefore require a medical evaluation in the first year that respirators are required for mines that need them.[4] Twelve miners per mine in mines with 20–500 employees will need to use respirators and therefore require a medical evaluation in the first year that respirators are required for mines that need them.[5] Thirty miners per mine in mines with over 500 employees will need to use respirators and therefore require a medical evaluation in the first year that respirators are required for mines that need them.[6]

Based on these assumptions a total of 680 miners will require a medical evaluation in the first year after the rule takes effect to meet the 308_{EC} and 350_{TC} μg/m^3 limits. An additional 244 miners will require a medical evaluation at the beginning of the third year when the 160_{TC} μg/m^3 limit takes effect.

Because of turnover, new miners will require medical evaluations in years subsequent to the first year in which respirators are first used. In each year after the first year, approximately 0.28 additional miners per mine will require a medical evaluation in mines with fewer than 20 employees. In each year after the first year, approximately 0.84 additional miners per mine will require a medical evaluation in mines with 20–500 employees. In each year after the first year, approximately 2.1 additional miners per mine will require a medical evaluation in mines with 20–500 employees.[7]

In ten percent of the cases, the PLHCP will determine that additional tests are needed for the miner's medical evaluation. These additional tests may include X-rays and cardio-pulmonary tests. The cost of the additional tests is $250.

Five percent of the miners required to wear a respirator will need a PAPR. A PAPR costs approximately $1,000 and has a useful life of about 5 years.

At any point in time, approximately ½% of the number of miners using respirators will need to be transferred. The total is expected to be fewer than five transferred employees at any one time for the entire mining industry. The normal hourly wage rate in an existing position where respiratory protection is not required averages 20% less than the miner's hourly wage rate in the position where respiratory protection is required, taking into account the rare cases where there is no position in the mine to which the miner can be transferred. A miner works 2,000 hours per year on average. The average remaining work life of a miner is 20 years.

Based on the preceding assumptions, Table IX–1 summarizes the costs of medical evaluation and transfer by mine size for 308_{EC} μg/m^3, 350_{TC} μg/m^3, and 160_{TC} μg/m^3 limits. The estimated yearly medical evaluation and transfer costs to mine operators to meet the requirements of the final rule are $69,170 in 2004 dollars.[8] The costs shown in Table IX–1 are the only costs attributable to this final rule.

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[3] MSHA assumes that the wage of a health and safety specialist is the same as the wage of a mine supervisor. The wage is reported in 2004 dollars.

[4] This estimate is based on the assumption of two two-person crews for one shift in mines with fewer than 20 employees.

[5] This estimate is based on the assumption of three two-person crews for each of two shifts at mines with 20–500 employees.

[6] This estimate is based on the assumption of five two-person crews for each of three shifts at mines with over 500 employees.

[7] These numbers are based on a turnover rate of 7% for the four miners per mine in mines with fewer than 20 employees, the 12 miners per mine in mines with 20–500 employees , and the 30 miners per mine in mines with over 500: $4 \times 0.07 = 0.28$; $12 \times 0.07 = 0.84$; $30 \times 0.07 = 2.10$.

[8] The spreadsheets underlying the development to the cost estimates presented in this section, as well as in Sections V, X, and XI of this preamble, are posted on MSHA's Web page.

Table IX-1. Itemized Summary of the Estimated Yearly Costs of the Medical Evaluation and Miner Transfer Provisions of the Final Rule

Yearly Costs to Meet the 308_{EC} and 350_{TC} µg/m^3 Limits						
Mine Size by Number of Employees	Providing Information to the PLHCP	Medical Evaluations	PAPRs	Transfers Of Miners Who Cannot Wear Respirators	Total Yearly Costs	Yearly Cost Per Mine
1-19	$445	$1,847	$1,185	$4,115	$7,591	$131
20-500	$2,113	$10,126	$6,497	$22,559	$41,295	$390
Over 500	$94	$955	$613	$2,128	$3,790	$948
All Mines	$2,652	$12,928	$8,294	$28,802	$52,676	$314
Additional Yearly Costs to Meet the 160_{TC} µg/m^3 Limit[1]						
Mine Size by Number of Employees	Providing Information to the PLHCP	Medical Evaluations	PAPRs	Transfers Of Miners Who Cannot Wear Respirators	Total Yearly Costs	Yearly Cost Per Mine
1-19	$139	$578	$371	$1,288	$2,377	$41
20-500	$662	$3,171	$2,034	$7,064	$12,930	$122
Over 500	$29	$299	$192	$666	$1,187	$297
All Mines	$830	$4,048	$2,597	$9,018	$16,494	$98
Yearly Costs to Meet the 308_{EC}, 350_{TC}, and 160_{TC} µg/m^3 Limits						
Mine Size by Number of Employees	Providing Information to the PLHCP	Medical Evaluations	PAPRs	Transfers Of Miners Who Cannot Wear Respirators	Total Yearly Costs	Yearly Cost Per Mine
1-19	$584	$2,425	$1,556	$5,403	$9,968	$172
20-500	$2,775	$13,297	$8,531	$29,623	$54,225	$512
Over 500	$123	$1,254	$805	$2,795	$4,977	$1,244
All Mines	$3,482	$16,976	$10,891	$37,820	$69,170	$412

[1]The additional costs to meet the 160_{TC} µg/m^3 limit are discounted for two years at the 7% discount rate (divided by $(1.07)^2$), since the 160_{TC} µg/m^3 limit takes effect after two years.

B. Costs of Implementing the 160_{TC} µg/m^3 Limit

This subsection discusses all the costs of reducing the existing 308_{EC} µg/m^3 interim limit to the 160_{TC} µg/m^3 final limit. These costs arise from both this final rule and the existing 2001 and 2005 final DPM rules for metal/nonmetal mines. Most of the costs estimated in this subsection are not attributable to this final rule. The costs described and explained in this subsection are presented for purposes of completeness and clarity and to support the Agency's finding of feasibility for the final limit, as shown in Section V.

In Chapter IV of the Regulatory Economic Analysis in support of the January 19, 2001 final rule (2001 REA), we estimated that underground M/NM mine operators would incur yearly costs to comply with the DPM final rule of $25,149,179 (p. 106). Of this amount, $6,612,464 was the discounted (from 2006 to 2001) yearly cost of compliance with the final limit. The yearly cost for compliance with the final limit beginning in 2006 was estimated as $9,274,325 (p. 58). If we adjust for the change in the number of mines and also adjust for inflation (from 1998 dollars, in which the costs of the 2001 rule were reported, to 2004 dollars), this yearly cost becomes $9,259,519. These calculations are shown in Table IX–2.

Table IX-2. Estimate From 2001 REA, Adjusted for Inflation and Number of Mines, of the Yearly Cost of Implementing the 160_{TC} μg/m^3 Final Limit Given 400_{TC} (308_{EC}) μg/m^3 Interim Limit in Effect

Mine Size	Yearly Cost Estimate from 2001 REA[1]	1998 Number of Diesel Mines[2]	2004 Number of Diesel Mines[3]	Yearly Cost Adjusted for Number of Mines[4]	Yearly Cost Adjusted for Inflation[5]	Yearly Cost Per Mine[6]
1-19 Employees	$2,413,542	77	58	$1,817,993	$2,106,864	$36,325
20-500 Employees	$6,004,029	112	106	$5,682,385	$6,585,291	$62,125
Over 500 Employees	$856,753	7	4	$489,573	$567,364	$141,841
All Mines	$9,274,325	196	168	$7,989,950	$9,259,519	$55,116

[1]2001 REA, Table IV-10, page 58, with cost figure for over 500 employees corrected based on error discovered in Table IV-7, page 54.

[2]2001 REA, Table II-4, page 14.

[3]Number of mines based on data from MSHA's Directorate of Program Evaluation and Information Resources, 2004 calendar year data, for mines with employment. Diesel mines are identified based on DPM sampling data.

[4](Yearly Cost Adjusted for Number of Mines) = (Yearly Cost Estimate from 2001 REA) x (2004 Number of Diesel Mines) / (1998 Number of Diesel Mines).

[5](Yearly Cost Adjusted for Inflation) = (Yearly Cost Adjusted for Number of Mines) x (Price Index), where (Price Index) = (2004 Annual CPI) / (1998 Annual CPI) = (188.9) / (163.0) = 1.159.

[6](Yearly Cost Per Mine) = (Yearly Cost Adjusted for Inflation) / (2004 Number of Diesel Mines).

This final rule would amend the January 19, 2001 final DPM rule by phasing in the 160_{TC} μg/m^3 final limit over an additional two-year period, from May 20, 2006 to May 20, 2008, to address feasibility issues that have surfaced since the 2001 final rule. The discounted present value of the reduction in the cost estimate for this two-year phase-in period is $15,467,387. The annualized value of this reduced cost estimate, using an annualization rate of 7%, is $1,082,717 in 2004 dollars. Table IX–3 shows these calculations, as well as the breakdown by mine size of this reduced cost estimate. Because of feasibility issues associated with currently meeting the 160_{TC} μg/m^3 limit, this reduction in cost estimate is not properly attributable as a cost saving due to this final rule.

Table IX-3. Reduced Cost Estimate from Two-Year Phase-In of 160_{TC} µg/m^3 Final Limit

Year[1]	Yearly Cost of Immediate Phase-In[2]	TC Limit (µg/m^3)	Percent of Phase-In[3]	Yearly Cost of Delayed Phase-In[4]	Reduction in Yearly Cost Estimate[5]	Discount Factor[6]	Discounted Reduction in Yearly Cost Estimate[7]
1	$9,259,519	400 & 350	7%	$643,022	$8,616,497	1.0000	$8,616,497
2	$9,259,519	350	21%	$1,929,067	$7,330,453	0.9346	$6,850,890
3	$9,259,519	160	100%	$9,259,519	$0	0.8734	$0
4	$9,259,519	160	100%	$9,259,519	$0	0.8163	$0
Sum of Discounted Reduction in Yearly Cost Estimate							$15,467,387
Annualized Value of Reduced Cost Estimate (All Underground M/NM Mines)[8]							$1,082,717
Annualized Value of Reduced Cost Estimate (Mines with under 20 Employees)[9]							$246,356
Annualized Value of Reduced Cost Estimate (Mines with 20 to 500 Employees)[9]							$770,019
Annualized Value of Reduced Cost Estimate (Mines with over 500 employees)[9]							$66,342

[1]Years are measured from May 20 of one calendar year to May 19 of the next calendar year. The first year begins May 20, 2006.

[2](Yearly Cost of Immediate Phase-In) is obtained from Table IX-2, Yearly Cost Adjusted for Inflation.

[3](Percent of Phase-In) = {(400 - (TC Limit)) / (400 - 160)} x (100%), where the (TC Limit) = 383.333 in the first year, because it is a weighted average of 400_{TC} µg/m^3 for 8 months (May 20 to January 19) and 350_{TC} µg/m^3 for 4 months (January 20 to May 19).

[4](Yearly Cost of Delayed Phase-In) = (Yearly Cost of Immediate Phase-In) x (Percent of Phase-In).

[5](Reduction in Yearly Cost Estimate) = (Yearly Cost of Immediate Phase-In) - (Yearly Cost of Delayed Phase-In).

[6](Discount Factor) = $1 / (1.07)^{(Year - 1)}$.

[7](Discounted Reduction in Yearly Cost Estimate) = (Reduction in Yearly Cost Estimate) x (Discount Factor).

[8](Annualized Value of Reduced Cost Estimate, All Underground M/NM Mines) = (Sum of Discounted Reduction in Yearly Cost Estimate) x (0.07), where 0.07 is the annualization factor.

[9](Annualized Value of Reduced Cost Estimate, employment size subset) = (Annualized Value of Reduced Cost Estimate, All Underground M/NM Mines) x (Table IX-2, Yearly Cost Adjusted for Inflation, employment size subset) / (Table IX-2, Yearly Cost Adjusted for Inflation, All Mines).

The process of evaluating and implementing DPM control technologies has been more difficult, time consuming, and costly for some mine operators than we had initially anticipated in the 2001 final rule. For example, some mine operators that initially installed a passive regeneration system on a machine learned through trial and error that the machine did not have a consistent duty cycle that would support passive regeneration, so they had to alter their regeneration strategy to incorporate an active regeneration system. Another mine operator, who initially tried a high-temperature disposable particulate filter (HTDPF) without exhaust gas cooling prior to the filter media, needed to add a heat exchanger prior to the filter media to meet the manufacturer's exhaust gas temperature specifications. Yet another mine operator, who used biodiesel fuel during the summer months, needed to make changes to the fuel delivery system during the winter months in order to deal with the lower ambient temperatures.

These evaluation and implementation costs, it should be noted, do not involve testing the workability of the known methods for reducing DPM emissions. Rather, the evaluation is for determining the suitability of the various existing DPM-control technologies for mine-specific applications and integrating such technology into the mining and maintenance process. While the industry has provided examples of its experience with implementation difficulties, they provided limited information as to the magnitude of these particular costs. Accordingly, the costs associated with evaluating various methods to achieve compliance are difficult to quantify.

Evaluation costs typically will not involve all diesel equipment. For example, we would expect a mine operator to evaluate filters on one or a few pieces of diesel equipment, probably during maintenance shifts. We therefore expect that costs of evaluation will be only a fraction of MSHA's estimated costs of achieving the final limit. Accordingly, based on its technical expertise and experience with DPM controls, MSHA estimates that, for the average mine that has evaluation costs, annual costs of evaluating alternative methods of compliance are 25% of the previously estimated compliance costs for mines to reduce the 308_{EC} µg/m^3 limit to the 160_{TC} µg/m^3 limit.

Not all the diesel mines will incur evaluation costs, beyond the costs previously estimated, to comply with the rule. Many mines are already in compliance or can achieve compliance using technologies already proven to work in these mines. MSHA estimates that during the first two years of the rule, 50% of mines will experience evaluation costs. Further, MSHA estimates that during the third and fourth years of the rule, 10% of mines will continue to experience evaluation costs. These evaluation costs are being recognized in this final rule, as needed to achieve the final limit. However, these costs were not caused by, or attributable to, this final rule. These costs would exist even in the absence of this final rule. These cost estimates are shown in Table IX–4.

Table IX-4. Increased Cost Estimate for Mines to Evaluate Technologies Needed to Meet 350_{TC} and 160_{TC} µg/m^3 Final Limits

Year[1]	Evaluation Costs Per Mine[2]	Percent of Mines with Evaluation Costs[3]	Number of Mines with Evaluation Costs[4]	Yearly Cost of Evaluating Controls[5]	Discount Factor[6]	Discounted Yearly Cost of Evaluating Controls[7]
1	$13,779	50%	84.0	$1,157,440	1.0000	$1,157,440
2	$13,779	50%	84.0	$1,157,440	0.9346	$1,081,720
3	$13,779	10%	16.8	$231,488	0.8734	$202,191
4	$13,779	10%	16.8	$231,488	0.8163	$188,963
Sum of Discounted Yearly Cost of Evaluating Controls						$2,630,313
Annualized Value of Evaluation Cost (All Underground M/NM Mines)[8]						$184,122
Annualized Value of Evaluation Cost (Mines with under 20 Employees)[9]						$41,894
Annualized Value of Evaluation Cost (Mines with 20 to 500 Employees)[9]						$130,946
Annualized Value of Evaluation Cost (Mines with over 500 employees)[9]						$11,282

[1]Years are measured from May 20 of one calendar year to May 19 of the next calendar year. The first year begins May 20, 2006.

[2](Evaluation Costs Per Mine) = (Table IX-2, Yearly Cost Per Mine) / 4.

[3](Percent of Mines with Evaluation Costs) is 50% for the first two years and 10% for the third and fourth years.

[4](Number of Mines with Evaluation Costs) = (Table IX-2, 2004 Number of Diesel Mines) x (Percent of Mines with Evaluation Costs).

[5](Yearly Cost of Evaluating Controls) = (Evaluation Costs Per Mine) x (Number of Mines with Evaluation Costs).

[6](Discount Factor) = $1 / (1.07)^{(\text{Year - 1})}$.

[7](Discounted Yearly Cost of Evaluating Controls) = (Yearly Cost of Evaluating Controls) x (Discount Factor).

[8](Annualized Value of Evaluation Cost, All Underground M/NM Mines) = (Sum of Discounted Yearly Cost of Evaluating Controls) x (0.07), where 0.07 is the annualization factor.

[9](Annualized Value of Evaluation Cost, employment size subset) = (Annualized Value of Evaluation Cost, All Underground M/NM Mines) x (Table IX-2, Yearly Cost Adjusted for Inflation, employment size subset) / (Table IX-2, Yearly Cost Adjusted for Inflation, All Mines).

Table IX–5 integrates all the cost estimates and cost adjustments discussed in this subsection to provide an updated estimate of the cost for the industry to comply with the 160_{TC} µg/m^3 final limit, given that the existing 308_{EC} µg/m^3 interim limit is already in effect. Table IX–5 also includes the costs of the medical evaluation and transfer provisions discussed in Section IX.A of this preamble and the costs of the special extensions for the final limit provided for in the 2005 DPM final rule.[9] The yearly cost of implementing the 160_{TC} µg/m^3 final limit is $8,454,853. The economic feasibility of the 160_{TC} µg/m^3 final limit, as reflected in these revised cost estimates, is discussed in Section V.B.

Table IX-5. Updated Estimate, Adjusted for Several Factors, of the Yearly Cost of Implementing the 160_{TC} µg/m^3 Final Limit Given 400_{TC} (308_{EC}) µg/m^3 Interim Limit in Effect

Mine Size by Number of Employees	Adjusted Estimate from 2001 REA[1]	Medical Evaluation and Miner Transfer Provisions[2]	Reduced Cost Estimate from Two-Year Phase-In[3]	Increased Cost Estimate for Mines to Evaluate Controls[4]	Revised Costs of Special Extension for Final Limit[5]	Yearly Cost Adjusted for Several Factors[6]	Yearly Cost Per Mine[7]
1-19	$2,106,864	$9,968	($246,356)	$41,894	$5,234	$1,917,604	$33,062
20-500	$6,585,291	$54,225	($770,019)	$130,946	$18,815	$6,019,259	$56,785
Over 500	$567,364	$4,977	($66,342)	$11,282	$710	$517,991	$129,498
All Mines	$9,259,519	$69,170	($1,082,717)	$184,122	$24,759	$8,454,853	$50,327

[1]From Table IX-2, Yearly Cost Adjusted for Inflation.

[2]From Table IX-1, Total Yearly Costs to Meet the 308_{EC}, 350_{TC}, and 160_{TC} µg/m^3 Limits.

[3]From Table IX-3, Annualized Value of Reduced Cost Estimate, for each employment size category.

[4]From Table IX-4, Annualized Value of Evaluation Cost, for each employment size category.

[5]From Regulatory Economic Analysis for Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners, May 2005 (2005 REA), page 15, Table IV-3, "Adjusted Total Annual Cost". Figures are adjusted for change in number of underground M/NM diesel mines and for inflation between 2002 and 2004.

[6](Yearly Cost Adjusted for Several Factors) = (Adjusted Estimate from 2001 REA) + (Medical Evaluation and Miner Transfer Provisions) + (Reduced Cost Estimate from Two-Year Phase-In) + (Increased Cost Estimate for Mines to Evaluate Controls) + (Revised Costs of Special Extension for Final Limit).

[7](Yearly Cost Per Mine) = (Yearly Cost Adjusted for Several Factors) / (Table IX-2, 2004 Number of Diesel Mines).

X. Regulatory Flexibility Act Certification and Small Business Regulatory Enforcement Fairness Act (SBREFA)

Pursuant to the Regulatory Flexibility Act (RFA) of 1980 as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA), we have analyzed the impact of the final rule on small businesses. Further, we have made a determination with respect to whether or not we can certify that the final rule would not have a significant economic impact on a substantial number of small entities that are covered by the final rule. Under the SBREFA amendments to the RFA, we must include in the rule a factual basis for this certification. If a rule would have a significant economic impact on a substantial number of small entities, we must develop a regulatory flexibility analysis.

A. Definition of a Small Mine

Under the RFA, in analyzing the impact of a rule on small entities, we must use the Small Business Administration (SBA) definition for a small entity or, after consultation with the SBA Office of Advocacy, establish an alternative definition for the mining industry by publishing that definition in the **Federal Register** for notice and comment. We have not taken such an

[9] The cost savings due to other provisions of the 2005 DPM final rule are not included in the estimates here because they have already accrued to mine operators in achieving the interim limit.

action and hence are required to use the SBA definition. The SBA defines a small entity in the mining industry as an establishment with 500 or fewer employees.

We have also looked at the impacts of our rules on a subset of mines with 500 or fewer employees—those with fewer than 20 employees, which we and the mining community have traditionally referred to as ''small mines.'' These small mines differ from larger mines not only in the number of employees, but also in economies of scale in material produced, in the type and amount of production equipment, and in supply inventory. Therefore, their costs of complying with our rules and the impact of our rules on them will also tend to be different. It is for this reason that ''small mines,'' as traditionally defined by us as those employing fewer than 20 workers, are of special concern to us.

This analysis complies with the legal requirements of the RFA for an analysis of the impacts on ''small entities'' while continuing our traditional definition of ''small mines.'' We conclude that we can certify that the final rule would not have a significant economic impact on a substantial number of small entities that are covered by this rulemaking. We have determined that this is the case both for mines affected by this rulemaking with fewer than 20 employees and for mines affected by this rulemaking with 500 or fewer employees.

B. Factual Basis for Certification

MSHA's analysis of impacts on ''small entities'' begins with a ''screening'' analysis. The screening compares the estimated compliance costs of a rule for small entities in the sector affected by the rule to the estimated revenues for the affected sector. When estimated compliance costs are less than one percent of the estimated revenues, the Agency believes it is generally appropriate to conclude that there is no significant economic impact on a substantial number of small entities. When estimated compliance costs exceed one percent of revenues, it tends to indicate that further analysis may be warranted.

As shown in Table X–1, using either MSHA's traditional definition of a small mine (those having fewer than 20 employees) or SBA's definition of a small mine (those having 500 or fewer employees), the estimated yearly costs of this final rule for small underground M/NM mines that use diesel-powered equipment is less than 0.01 percent of their estimated yearly revenues, well below the level suggesting that this rule might have a significant economic impact on a substantial number of small entities. Accordingly, we have certified that this final rule will not have a significant economic impact on a substantial number of small entities covered by the final rule.

Table X-1. Estimated Yearly Costs of Final Rule Relative to Yearly Revenues For Selected Small Underground M/NM Mines That Use Diesel-Powered Equipment

Mine Size	Yearly Costs of Final Rule[1]	Yearly Revenues[2]	Costs as Percentage of Revenues[3]
Fewer than 20 Employees	$9,968	$222,357,776	0.004%
500 or Fewer Employees	$64,193	$3,875,386,233	0.002%

[1]Table IX-1, Total Yearly Costs of the final rule for given small entities.

[2]Yearly revenues for underground metal/nonmetal mines were obtained by multiplying price and production figures from Mining & Quarrying Trends, 2004 (Tables 1 and 3). These revenues were then prorated by hours of employment to obtain an estimate of revenues only for mines that use diesel equipment. Data for mine hours and employment are from MSHA's Directorate of Program Evaluation and Information Resources, 2004 calendar year data. Diesel mines are identified based on DPM sampling data.

[3](Costs as Percentage of Revenues) = (Yearly Costs of Final Rule) / (Yearly Revenues).

XI. Paperwork Reduction Act

This final rule addresses information collection requirements under OMB Control Number 1219–0135 that have been submitted to the Office of Management and Budget (OMB) for review under 44 U.S.C. 3504(h) of the Paperwork Reduction Act of 1995, as amended.

The paperwork costs presented in this section are a subset of the total costs presented in Table IX–1 and reflect only those costs which relate to burden hours that are a result of the final rule. Both paperwork burden hours and costs were derived from the spreadsheets (posted on our Web page) used to estimate the costs in Table IX–1.

MSHA estimates that the final rule would create 3,687 burden hours for the first year, 299 burden hours for the second year, 1,120 burden hours for the third year, and 371 burden hours each year after the third year. This is equivalent to an annualized value of 1,261 burden hours per year and related annualized burden costs of $28,905 per year. On a per-mine basis, the annualized paperwork burden is 7.5 hours and $172 per year.

The paperwork burden to the mine operator is attributable primarily to § 57.5060(d)(3), to prepare and provide information to the PLHCP and to send the miner to the PLHCP for a medical evaluation to determine the miner's ability to use a respirator. The annualized paperwork and cost burden to the mining industry for this provision is 1,140 hours and $26,330 per year. The remaining paperwork burden is attributable to § 57.5060(d)(4), which allows miners to submit additional evidence of their medical condition to the PLHCP, and to § 57.5060(d)(8), which requires mine operators to maintain a record of the identity and written determination of the PLHCP. The annualized paperwork and cost burden to the mining industry for these two provisions is 103 and 17 hours per year, and $2,190 and $385 per year, respectively.

The total paperwork hour and cost burden is summarized in Table XI–1 by first year, second year, third year, and each year after the third year.

Table XI-1. Total Paperwork Burden Hours and Costs by Year

Mine Size	Burden Hours	Burden Cost
First Year Burden Hours and Costs		
< 20	541.0	$12,219
20-500	2,877.2	$62,348
> 500	268.9	$5,750
Total	3,687.0	$80,318
Second Year Burden Hours and Costs		
< 20	43.0	$1,122
20-500	235.6	$6,153
> 500	20.4	$484
Total	298.9	$7,759
Third Year Burden Hours and Costs		
< 20	165.4	$3,989
20-500	875.1	$20,205
> 500	79.8	$1,763
Total	1,120.3	$25,957
Annual Burden Hours and Costs After Third Year		
< 20	53.4	$1,419
20-500	292.6	$7,777
> 500	25.1	$603
Total	371.1	$9,799

XII. Other Regulatory Considerations

A. The Unfunded Mandates Reform Act of 1995

This final rule does not include any Federal mandate that may result in increased expenditures by State, local, or tribal governments; nor does it increase private sector expenditures by more than $100 million annually; nor does it significantly or uniquely affect small governments. Accordingly, the Unfunded Mandates Reform Act of 1995 (2 U.S.C. 1501 *et seq.*) requires no further agency action or analysis.

B. National Environmental Policy Act

We have reviewed this final rule in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 *et seq.*), the regulations of the Council on Environmental Quality (40 U.S.C. 1500), and the Department of Labor's NEPA procedures (29 CFR part 11). This final rule has no significant impact on air, water, or soil quality; plant or animal life; the use of land; or other aspects on the human environment. We solicited public comment concerning the accuracy and completeness of this environmental assessment when this rule was first proposed, and received no comments relevant to this environmental assessment. We find, therefore, that the final rule has no significant impact on the human environment. Accordingly, we have not provided an environmental impact statement.

C. The Treasury and General Government Appropriations Act of 1999: Assessment of Federal Regulations and Policies on Families

This final rule has no affect on family well-being or stability, marital commitment, parental rights or authority, or income or poverty of families and children. Accordingly, Section 654 of the Treasury and General Government Appropriations Act of 1999 (5 U.S.C. 601 note) requires no further agency action, analysis, or assessment.

D. Executive Order 12630: Government Actions and Interference With Constitutionally Protected Property Rights

This final rule does not implement a policy with takings implications. Accordingly, Executive Order 12630, Governmental Actions and Interference with Constitutionally Protected Property Rights, requires no further agency action or analysis.

E. Executive Order 12988: Civil Justice Reform

This final rule was written to provide a clear legal standard for affected conduct, and was carefully reviewed to eliminate drafting errors and ambiguities, so as to minimize litigation and undue burden on the Federal court system. Accordingly, this final rule meets the applicable standards provided in Section 3 of Executive Order 12988, Civil Justice Reform.

F. Executive Order 13045: Protection of Children From Environmental Health Risks and Safety Risks

This final rule has no adverse impact on children. Accordingly, Executive

Order 13045, Protection of Children from Environmental Health Risks and Safety Risks, as amended by Executive Orders 13229 and 13296, requires no further agency action or analysis.

G. Executive Order 13132: Federalism

This final rule does not have ''federalism implications,'' because it does not ''have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.'' Accordingly, Executive Order 13132, Federalism, requires no further agency action or analysis.

H. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

This final rule does not have ''tribal implications,'' because it does not ''have substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes.'' Accordingly, Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, requires no further agency action or analysis.

I. Executive Order 13211: Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use

Regulation of the M/NM sector of the mining industry has no significant impact on the supply, distribution, or use of energy. This final rule is not a ''significant energy action,'' because it is not ''likely to have a significant adverse effect on the supply, distribution or use of energy * * * (including a shortfall in supply, price increases, and increased use of foreign supplies).'' Accordingly, Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use, requires no further agency action or analysis.

J. Executive Order 13272: Proper Consideration of Small Entities in Agency Rulemaking

We have thoroughly reviewed this final rule to assess and take appropriate account of its potential impact on small businesses, small governmental jurisdictions, and small organizations. As discussed in Chapter V of the REA, we have determined and certified that this final rule will not have a significant economic impact on a substantial number of small entities. We solicited public comment concerning the accuracy and completeness of this potential impact when the rule was first proposed. We took appropriate account of comments received relevant to the rule's potential impact on small entities. Accordingly, Executive Order 13272, Proper Consideration of Small Entities in Agency Rulemaking, requires no further agency action or analysis.

XIII. Information Quality

In accordance with the Information Quality Act and the Department of Labor Information Quality Guidelines, we are responding to the substantive information quality request of the Methane Awareness Resource Group (MARG) as part of other information/data related comments received in the record to this rulemaking. Some of the commenters' issues are limitations of models, such as the 31-Mine Study and the Estimator model. No better data were offered by commenters and we find that that information remains the best available. We also conclude that some of the corrections requested were policy solutions rather than information corrections, thus they will not be addressed in our response.

We received a number of comments from the mining industry suggesting that our risk assessment does not comply with the present requirements under the data quality guidelines to use the best available, peer reviewed science. In addition, industry commenters stated that the DPM rule does not comply with the congressional, Office of Management and Budget (OMB) and the Department of Labor (DOL) information quality guidelines because the DPM rule is not supported by an adequate scientific basis, and it fails to meet the reproducibility standard required for disseminating influential information. Moreover, these commenters stated that OMB requires agencies in their own data quality guidelines to submit for public comment data on which we rely or disseminate. The guidelines also establish administrative mechanisms that allow affected persons to seek or obtain correction of disseminated information if they believe such information does not comply with either the OMB or MSHA guidelines.

Throughout the DPM rulemakings, we have given serious consideration to the issues raised by commenters. As a result, we have made some adjustments to our data and provided comprehensive responses in this preamble. For example, we conducted the 31-Mine Study, which resulted from a joint protocol of government, the mining industry and organized labor, to address and correct, where necessary, the following issues with regard to our 2001 data:

—The validity, precision and feasibility of the sampling and analysis method specified by the diesel standard (NIOSH Method 5040);
—The magnitude of interferences that occur when conducting enforcement sampling for total carbon as a surrogate for diesel particulate matter (DPM) in mining environments; and,
—The technological and economic feasibility of the underground metal and nonmetal (MNM) mine operators to achieve compliance with the interim and final DPM concentration limits.
—The parties developed a joint MSHA/Industry study protocol to guide sampling and analysis of DPM levels in 31 mines. The parties also developed four subprotocols to guide investigations of the known or suspected interferences, which included mineral dust, drill oil mist, oil mist generated during ammonium nitrate/fuel oil (ANFO) loading operations, and environmental tobacco smoke (ETS). The parties also agreed to study other potential sampling problems, including any manufacturing defects of the DPM sampling cassette (70 FR 32871). (Executive Summary, Report on the 31-Mine Study)

MSHA requested that NIOSH peer review the draft Report on the 31-Mine Study, and NIOSH's conclusions were placed in the rulemaking record and published in the 2005 final rule (70 FR 32871).

We are confident that we have set forth the evidence and rationale behind our decisions to establish a rule amending the existing DPM standard that meets the statutory requirements for promulgating this health standard as required under the Federal Mine Safety and Health Act of 1977 (Mine Act) in Section 101(a)(6)(A). We have presented and discussed with commenters in **Federal Register** notices, in preambles and at public hearings, the evidence supporting our decision to revise the existing rule restricting miner exposure to DPM.

With regard to the 2001 DPM risk assessment, we relied on peer-reviewed scientific studies. Of particular note, is that the two quantitative meta-analyses of lung cancer studies supporting our risk assessment were peer reviewed and published in scientific journals. (Bhatia, Rajiv, *et al.*, ''Diesel Exhaust Exposure and Lung Cancer,'' *Journal of Epidemiology,* 9:84–91, January 1998, and Lipsett M., and Campleman, Susan, ''Occupational Exposure to Diesel Exhaust and Lung Cancer: A Meta-Analysis,'' *American Journal of Public Health,* (89) 1009–1017, July 1999). We informed the public as early as September 25, 2002, in the 2002 ANPRM for the 2005 final rule at M/NM mines, in the 2003 NPRM, in the 2005 final rule and again in the 2005 proposed rule that we would incorporate the existing rulemaking record into the record of this rulemaking, including the 2001 risk assessment. In that risk assessment, we carefully laid out the evidence available to us, including shortcomings inherent in that evidence. Although not required by law to do so, we had the 2001 risk assessment independently peer-reviewed, published the evidence and tentative conclusions for public comment, and incorporated the reviewers' recommendations. We were open to considering any new scientific data relating to the risk assessment. Commenters were encouraged in the instant rulemaking to submit new scientific data related to the health risk from exposure to DPM. Some commenters did submit new evidence and we have included those documents in the record for consideration.

Other commenters stated that we need to stay the interim and final limits and wait for completion of the NIOSH/NCI Study. They believe that any regulatory effort before the completion of the study is not in compliance with the DOL Guidelines that define influential information: ''In rulemaking, influential information is scientific, financial, or statistical information that the agency believes will have a clear and substantial impact on the resolution of one or more key issues in an economically significant rulemaking, as that term is defined in section 3(f)(1) of Executive Order 12866 (DOL Guidelines, p. 6).''

We have a statutory obligation to consider in a rulemaking the best available evidence. (Section 101(a)(6)(A)). Though the NIOSH/NCI Study is ongoing, at this time, we are confident that the current rulemaking record includes credible scientific data to establish occupational exposure limits for DPM. The scientific basis for the health risk of exposure to DPM is supported by the rulemaking record in both the 2001 and 2005 rules. We will continue to closely monitor the progress of the NIOSH/NCI joint study, and when the results of this study become available, we will carefully consider them.

Commenters stated that our statement that TC cannot be measured accurately and our change to a new surrogate, EC, undermines our 2001 justifications for our diesel rules, including the exposure limits. They reasoned that we regulated TC, and that we based our 2001 determinations of risk, benefits, impacts and feasibility on TC as a surrogate for DPM. In response, our rules limit miners' exposures to DPM, not to TC. TC was chosen as the surrogate for measuring that exposure in the 2001 final rule. In concert with the Second Partial Settlement Agreement, we proposed in 2003 to ''[r]evise the existing diesel particulate matter (DPM) interim concentration limit measured by total carbon (TC) to a comparable permissible exposure limit (PEL) measured by elemental carbon (EC) which renders a more accurate DPM exposure measurement.'' (68 FR 48668). As proposed, our 2005 final rule (70 FR 32868) establishes the measurement of DPM using EC as a direct measure of total DPM. The 2001 risk assessment establishes a material impairment of health or functional capacity to miners from exposure to DPM and does not distinguish between adverse health effects specific to either the EC or OC fractions of DPM. The measurement of that exposure, whether using TC, EC or OC as a surrogate, is not related to the material impairment of health endpoints identified in the 2001 risk assessment and in subsequent literature updates. Our discussion in Section VIII.A. of this preamble of the variability of the EC:TC ratio addresses total adverse health risks of DPM. The analysis of the EC:TC ratio is presented in that section, and in the preamble to our 2005 final rule (70 FR 32894–32899). The 2001 risk assessment discusses possible mechanisms of carcinogenesis for which both EC and OC would be relevant factors (66 FR at 5811–5822). Multiple routes of carcinogenesis may operate in human lungs, some requiring only the various organic mutagens in DPM and others involving induction of free radicals regardless of whether the source is the EC fraction, OC fraction, some other unidentified component, or a combination of components. We recognize that identifying the toxic components of DPM, and particulate matter in general, is an important research focus of a variety of government agencies and scientific organizations (see, for example: Health Effects Institute, 2003; Environmental Protection Agency, 2004b).

We are still considering various alternatives for converting the 350_{TC} μg/m³ and 160_{TC} μg/m³ final limits to commensurate EC limits. We will consider all comments in this rulemaking record concerning the relationship between EC, OC and TC in a separate rulemaking to determine the most appropriate conversion of the final TC limits. Presently, we believe that the DPM rulemaking record is inadequate for us to make determinations regarding a more appropriate conversion factor other than 1.3 for the 350_{TC} μg/m³ final PEL.

Some commenters suggested that the data used in the 31-Mine Study and the analytical method used (NIOSH Method 5040) should be subjected to peer review. However, MSHA, organized labor, and the mining industry, through the negotiations process, jointly developed the protocol for conducting the 31-Mine Study. All of the parties agreed on the protocol following numerous discussions among industry, labor, and government experts, and had an opportunity to comment and make changes to the document. Thereafter, we conducted the study, following the agreed upon protocol, and published its results. Industry was given an opportunity to publish their separate results simultaneously with the government. During this rulemaking, industry submitted to us through the notice and comment process their conclusions on the 31-Mine Study in a report titled, ''Technical and Economic Feasibility of DPM Regulations.'' The industry report is contained in the rulemaking record, and we considered it in reaching determinations for the 2005 final rule. We have been transparent about the design of the study and methods of analysis.

Commenters also stated that we disseminated information that relies on non-representative sampling and is therefore in violation of the Information Quality Guidelines. The information they refer to was obtained in the previously discussed 31-Mine Study and also during our baseline sampling. Under the Second Partial DPM Settlement Agreement, we agreed to provide compliance assistance to the M/NM underground mining industry for a one-year period from July 20, 2002 through July 19, 2003. As part of our compliance assistance activities, we agreed to conduct baseline sampling of miners' personal exposures at every underground mine covered by the 2001 final rule.

A total of 1,194 valid baseline samples were collected. A total of 183 underground M/NM mines are represented by this analysis. We used the results of this sampling in our preamble to the 2005 final rule to estimate current DPM exposure levels in underground M/NM mines using diesel equipment (70 FR 32873–32883) and in the risk assessment for this final rule. The sampling results also assist mine operators in developing compliance strategies based on actual exposure levels. Most commodities were well represented in this analysis with the average number of valid samples per mine ranging from 6.0 to 8.2 (average across all mines is 6.5 samples per mine).

MSHA compliance specialists collected baseline samples in the same manner they have been instructed to use for collecting samples for enforcement purposes. It is expected that personal exposure to DPM will fluctuate due to variations in day to day operations in a mine. Reported levels of DPM are representative of the exposures of miners identified as having the highest risks of overexposures to DPM during our compliance assistance work. In an ideal situation, and with unlimited resources, every potentially exposed miner would be individually sampled. It is not necessary or practical, however, to sample all miners on a mine property in order to evaluate personal exposures. Suspected and potential health hazards may be reasonably and adequately evaluated by sampling the maximum risk miner in a work area. Compliance specialists strive to characterize the higher exposure levels during typical work shifts. The baseline samples are representative of the conditions experienced on work shifts during the defined compliance assistance period. MSHA has obtained the best available information for characterizing recent activities at the relevant M/NM mines.

Commenters questioned the accuracy and validity of the NIOSH Analytical Method 5040. NIOSH validation criteria state that the NIOSH Analytical Method 5040 provides a result that differs no more than ±25% from the true value 95 times out of 100. The NIOSH Analytical Method 5040 validation is documented in several publications. See our discussion of this in Section VIII.A. of this preamble for additional peer-reviewed studies providing evidence that the NIOSH Analytical Method 5040 method is valid. In a study published by Noll, et al., in January 2005 evaluating sampling results of DPM cassettes, the authors report a 95% upper confidence limit Coefficient of Variation (CV) of 7% when analyzing samples for EC and 6% for TC. In this same study, NIOSH reported good agreement and precision between EC for DPM samples using SKC impactor and respirable samples in both laboratory and field studies. Two studies published in 2004 (Noll, et al., 2004 and Birch, et al., 2004) reported results from investigating sampling for EC in the presence of coal dust using submicron impactors. The results show good agreement between submicron EC and respirable samplers for collecting DPM samples.

Commenters also stated that we calculated the error factors for our analytical method assuming no related methodological inaccuracies. We develop method-specific error factors to assure that a personal exposure result is more than likely to represent an overexposure. These error factors account for normal and expected variability inherent in any analytic method and sampling protocol and provide a basis for interpretation of sampling results. When we interpret sampling results and make a determination of compliance, we apply the error factor to the result to gauge whether the sample indicates a true overexposure. We use the validated NIOSH Analytical Method 5040 for diesel particulate matter to analyze our personal exposure samples collected for compliance determinations.

The NIOSH criteria and guidelines used for method validation do not directly apply to the development of error factors. However, similar statistical procedures to develop analytical methods can also be used to develop error factors. The commenters fail to recognize other differences between validation of methods and development of error factors. We discuss our error factor in detail in Section VIII.A. of this preamble.

Commenters further questioned whether the NIOSH Method 5040 has been commercially tested. As in the preamble to the 2003 NPRM, we discussed in detail our findings regarding the NIOSH Method 5040 in the 31-Mine Study discussion in the preamble to the 2005 final rule (70 FR 32870–32871) and in Section VIII of this preamble. NIOSH's peer review of the 31-Mine Study also concludes that the analytical method specified by the diesel standard gives an accurate measure of the TC content of a filter sample and that the analytical method is appropriate for making compliance determinations of DPM exposures of underground M/NM miners. NIOSH confirmed this position by letter of February 8, 2002, in which NIOSH stated that,

> MSHA is following the procedures of NIOSH Method 5040, based on our review of MSHA P13 (MSHA's protocol for sample analysis by NIOSH Method 5040) and a visit to the MSHA laboratory.

Commenters stated that MSHA's former chairman of the DPM Rulemaking Committee had a conflict of interest as he was also author of the ACGIH diesel TLV. In response, our 2001 final rule includes the basis for our interim limit of 400_{TC} µg/m³ and final limit of 160_{TC} µg/m³, and states the following:

> Because of the lack of a generally accepted dose-response relationship, some commenters questioned the agency's rationale in picking a particular concentration limit: 160_{TC} µg/m³ or around 200_{DPM} µg/m³. Capping DPM concentrations at this level will eliminate the worst mining exposures, and bring miner exposures down to a level commensurate with those reported for other groups of workers who use diesel-powered equipment. The proposed rule would not bring concentrations down as far as the proposed ACGIH TLV^R of 150_{DPM} µg/m³. Nor does MSHA's risk assessment suggest that the proposed rule would completely eliminate the significant risks to miners of DPM exposure.
>
> In setting the concentration limit at this particular value, the Agency is acting in accord with its statutory obligation to attain the highest degree of safety and health protection for miners that is feasible. The Agency's risk assessment supports reduction of DPM to the lowest level possible. But feasibility considerations dictated proposing a concentration limit that does not completely eliminate the significant risks that DPM exposure poses to miners.
>
> The Agency specifically explored the implications of requiring mines in this sector to comply with a lower concentration limit than that being adopted. The results, discussed in Part V of this preamble, indicate that although the matter is not free from question, it still may not be feasible at this time for the underground metal and nonmetal mining industry as a whole to comply with a significantly lower limit than that being adopted. The Agency notes that since this rulemaking was initiated, the efficiency of hot gas filters has improved significantly, the dpm emissions from new engines continue to decline under EPA requirements, and the availability of ultra-low sulfur fuel should make controls even more efficient than at present.
>
> The Agency also explored the idea of bridging the gap between risk and feasibility by establishing an ''action level''. In the case of MSHA's noise rule, for example, MSHA adopted a ''permissible exposure level'' of a time-weighted 8-hour average (TWA_8) of 90 dBA (decibels, A-weighted), and an ''action level'' of half that amount—a TWA_8 of 85 dBA. In that case, MSHA determined that miners are at significant risk of material harm at a TWA_8 of 85 dBA, but technological and feasibility considerations preclude the industry as a whole, at this time, below a TWA_8 of 90 dBA. Accordingly, to limit miner exposure to noise at or above a TWA_8 of 85 dBA, MSHA requires that mine operators must take certain actions that are feasible (*e.g.*, provide hearing protectors).
>
> MSHA considered the establishment of a similar ''action level'' for DPM— probably at half the proposed concentration limit, or 80_{TC} µg/m³. Under such an approach, mine operators whose DPM concentrations are above the ''action level'' would be required to implement a series of ''best practices''—*e.g.*, limits on fuel types, idling, and engine maintenance. Only one commenter supported the creation of an Action Level for DPM. However, this commenter suggested that such an Action Level be adopted in lieu of a rule incorporating a concentration limit requiring mandatory compliance. The

Agency determined it is feasible for the entire underground mining community to implement these best practices to minimize the risks of DPM exposure without the need for a trigger at an Action Level (66 FR 5710).

Consequently, MSHA did not rely on data from ACGIH in establishing its 2001 final rule.

Commenters leveled several other criticisms at the Estimator and the 31-Mine Study which they believe violate Data Quality Act requirements and invalidate our conclusions regarding the feasibility of the 2001 and 2005 final rules. The computer program in question, referred to as the Estimator, is a Microsoft® Excel spreadsheet program that calculates the reduction in DPM concentration that can be obtained within an area of a mine by implementing individual or combinations of engineering controls. This program was the subject of a Preprint published for the 1998 Society of Mining Engineers Annual Meeting (Preprint 98–146, March 1998), and it was fully described in a peer reviewed article in a professional journal (Haney and Saseen, Mining Engineering, April 2000).

Commenters objected to the use of input data for the Estimator which they characterized as ''assumed ventilation air flows that do not reflect reality or actual MSHA measurements,'' and ''assumptions regarding perfect mixing of ventilation air to achieve dilution of exhaust particulate,'' which they further characterized as ''another assumption that does not reflect reality or actual measurements.'' The commenters stated that these failures are violations of the Data Quality Act's reproducibility and transparency requirements, and that MSHA admitted to these failures in the preamble to the 2005 final rule.

Regarding the use of ''assumed ventilation flows that do not reflect reality,'' all data used in Estimator analysis for the 31-Mine Study were obtained by MSHA M/NM industrial hygienists or Health Specialists. The ventilation inputs were either measured or estimated by these MSHA personnel. As stated in the final report of the 31-Mine Study, ''Each mine was evaluated individually, based on the DPM concentration data obtained for that mine through sampling, coupled with the mine-specific equipment, operating practices, and ventilation observed at that mine.''

Of the 31 mines addressed in the study, ventilation changes were specified for only five, and those changes were limited to auxiliary ventilation systems only. This fact is very important because when using the ''Column A'' option of the Estimator, which was the only option used in the 31-Mine study, if ventilation changes are not specified, the prevailing ventilation in a given area of the mine is irrelevant to Estimator analysis. The engineering rationale for this effect was explained thoroughly in the final report for the 31-Mine Study (p. 96):

It is significant to note that when ventilation remains the same before and after DPM controls are specified in the Estimator (*i.e.* the DPM control chosen was *not* a change in ventilation), the actual ventilation value used is irrelevant. This characteristic of the Estimator applies to any mine ventilation scheme, but it is particularly important where ventilation velocity is low, and ventilation flow is difficult to accurately measure. Mine ventilation velocity is very low in large parts of many room and pillar mines with large cross-section mine openings. This situation suggests two possible problems with DPM measurement—difficulty measuring mine airflow rates, and non-homogeneous mixtures of DPM in mine air. DPM concentrations in the ambient air at these mines can be profoundly affected by near-stagnant conditions in some areas, as well as by localized air movement that is independent of the overall mine ventilation flow. Such localized air movement can result from pressure differences created by wind from moving vehicles, natural ventilation, diesel engine cooling fans, heat-induced stratification, etc. In these situations, perfect mixing of mine air with DPM emissions would not be expected, hence, the DPM concentration in ambient mine air could not be reasonably estimated by simply dividing the DPM emission rate by the ventilation flow rate.

In its Column A option, the Estimator does not calculate DPM concentration by dividing the DPM emission rate by the ventilation flow rate. Thus, in MSHA's view, neither the difficulty of measuring airflow nor the imperfect mixing of DPM and mine air is important. The Estimator accounts for complex and imperfect mixing of ventilation air and DPM emissions by assuming that this mixing, in whatever manner it occurs when DPM samples are initially collected, would remain unchanged after DPM controls are implemented. MSHA considers this to be a reasonable assumption unless the DPM control that is specified is itself a major ventilation change. Since ventilation changes were not specified for any of the mines where complex and imperfect mixing was likely to occur, MSHA considers it reasonable to estimate a final DPM concentration at these mines based on applying a proportionality factor to the DPM concentration originally measured. The proportionality factor is simply the ratio of the DPM emission rate after controls are implemented to the DPM emission rate before controls are implemented, and is independent of the actual airflow present at that location. Although the Estimator makes simplifying assumptions, MSHA considers its results reasonably accurate. The Estimator's calculations have been compared to actual in-mine data, and good agreement has been achieved.

The differences between the Estimator's user-selectable ''Column A'' and ''Column B'' options are addressed in Section V.A of this preamble and previously were thoroughly discussed in the preamble to the 2005 final rule (70 FR 32920):

The Estimator actually incorporates two independent means of calculating DPM levels: one based on DPM sampling data for the subject mine, and one based on the absence of such sampling data. Where no sampling data exist, the Estimator calculates DPM levels based on a straightforward mathematical ratio of DPM emitted from the tailpipe (or DPF, in the case of filtered exhaust) per volume of ventilation air flow over that piece of equipment. This is referred to in the Estimator as the ''Column B'' option for calculating DPM concentrations. The commenters' observation that the Estimator fails to account for imperfect mixing between DPM emissions and ventilating air flows is a valid criticism of the ''Column B'' option. For this and other reasons, the Estimator's instructions urge users to utilize the ''Column A'' option whenever sampling data are available.''

In the ''Column A'' option, the Estimator's calculations are ''calibrated'' to actual sampling data. Whatever complex mixing between DPM emissions and ventilating air flows existed when DPM samples were obtained, are assumed to prevail after implementation of a DPM control. This is an entirely reasonable assumption, and in fact, there is no engineering basis to assume otherwise. Indeed, comparisons of ''Column A'' Estimator calculations and actual DPM measurements taken in mines before and after implementation of DPM controls have shown good agreement, indicating that Estimator calculations do adequately incorporate consideration for complex mixing of DPM and air flows when the ''Column A'' option is used. The Estimator was originally developed with both the Column A and Column B options because at the time it was developed (1997), the specialized equipment required for reliable and accurate in-mine DPM sampling, such as the submicron impactor, was not widely available. Consequently, few mine operators were able to obtain the in-mine DPM sample data required for utilizing the Column A option.

The commenter refers to the ''Column A option'' as an alternative use of the Estimator. However, we have always recommended that the Column A option be used if sampling data are available. As noted above in the excerpt from the 31-Mine Study, we explained fully at the time the study was released in January 2003 exactly how the Estimator was used in that study, and we also explained its use in the preamble to the June 2005 final rule. The commenter states that the sample data used in Estimator analysis were ''non-representative of routine mining conditions that can vary greatly at each mine from day to day, and from mine to mine throughout the industry.'' However, we stated in the 31-Mine Study final report that we followed standard MSHA enforcement sampling procedures to obtain the DPM samples at the 31 mines. These procedures are public information, and were well known by the labor and industry representatives that collaborated on the study protocol.

Regarding the question of whether the data obtained in the 31-Mine Study were representative of the industry as a whole, the mines in the study were jointly selected by MSHA, labor, and industry representatives. A reasonable attempt was made to achieve a cross-section of the industry in terms of commodities and mine sizes. The MSHA, labor, and industry personnel who collaborated on the study protocol were all fully aware at that time that the study was never intended to be statistically representative of the industry as a whole, and this fact was explicitly stated in the 31-Mine Study final report.

The commenter suggests that the study is ''suspect'' because 25% of the samples were voided. As was explained in the 31-Mine Study final report, of the 464 samples obtained at the 31 mines, 106 were voided. A key consideration in the sampling conducted at the 31 mines was to ensure, to the extent possible, that samples were not contaminated by non-diesel sources of airborne carbon. Testing had verified that the submicron sampler would remove mineral dust contamination (limestone, graphite, etc.), but tobacco smoke, drill oil mist, and possibly vapors from ANFO loading could contaminate a sample filter with non-diesel organic carbon. Thus, in accordance with the study protocol that had been jointly developed and approved by both us and the litigants, any sample that was known to have been, or could potentially have been contaminated with such an interferent was voided. Of the 106 voided samples, 61 were voided due to interferences. There were also some samples that were voided for other reasons, such as laboratory error (2 samples), sample pump failure (22 samples), or incomplete sample or sampling the wrong location (21 samples). Including any of these 106 voided samples in the data analysis would have cast doubt on the validity of the study. The study methodology that resulted in voiding questionable samples was part of the mutually agreed upon study protocol, the rationale for voiding these samples was well known and supported by all parties, and it was fully explained in the study final report.

For 26 of the 31 mines, ventilation flow rates did not factor into Estimator analysis because, as explained above, they were not relevant to the computations. For the remaining five mines, we continue to believe our estimates of ventilation flow rates were sufficiently accurate for the purposes of the study. Both our methods and data sources were explained thoroughly and we have responded previously on the record to these same criticisms of the Estimator.

Some commenters questioned the quality of reports of MSHA's compliance assistance work at mines covered under the standard, and requested that they be stricken from the rulemaking record because these studies were conducted without an apparent protocol or independent peer review. Also, commenters stated that these studies have not been published nor submitted for publication in any scientific journal. In response, the compliance assistance reports in the DPM rulemaking record are not intended for publication in a scientific journal, but instead, are accounts of our experiences at mines where mine operators requested help from MSHA in reducing DPM exposures. Under the second partial DPM settlement agreement, MSHA agreed to provide compliance assistance at underground mining operations using diesel-powered equipment from July 20, 2002 through July 19, 2003.

The Technological Feasibility section of this preamble, Section V.A, discusses the information and data related to feasible engineering and administrative controls currently available for the mining industry as a whole. Mines have implemented many of these DPM controls to meet the interim DPM limit as shown by our enforcement sampling. As further discussed in that section, we expect the industry as a whole will continue to learn more about the available control technologies and implement these control strategies in order to meet the final limits specified in this final rule. We recognized that implementation issues were making it difficult for some mines to use DPFs and obtain alternative fuels such as biodiesel. The extension of time allowed by this final rule was justified due to the greater availability of biodiesel fuels, the variety of DPF systems available, and the cleaner on-highway diesel engines that are becoming available.

The data presented in the Feasibility sections of this rulemaking support the feasibility of the various DPM control technologies. This data were derived from sources such as NIOSH, MSHA, and the Biodiesel Board. The NIOSH work provided mine operators with data that showed expected DPM reductions in a diesel laboratory, an isolated zone, and in production areas. The expected reductions were presented to assist mine operators with choosing DPM controls for implementation in their mines. We discussed information on DPFs that can achieve EC reductions above 90% and informed mine operators of other products that gave very minimal reductions. This was done to give mine operators the ability to choose a single control or combination of controls that would be technologically and economically feasible and appropriate for their particular situation to implement in order to meet the interim limit and the final limits specified in this final rule.

All of the data collected during the 31-Mine Study and subsequent studies performed by NIOSH were gathered using transparent methods, with protocols agreed upon by industry and union representatives. NIOSH performed extensive isolated zone studies that were developed and performed through the M/NM Diesel Partnership (the Partnership). NIOSH's reports were reviewed by the industry and revised based on comments in the record. Our compliance assistance work discussed previously in this section and the data obtained from those studies were developed with industry assistance.

The commenters state that our feasibility determinations for individual mines and for the industry were based in part on the results of Estimator analysis that calculated compliant DPM concentrations after installation of DPM filters, thus demonstrating that such filters could be used by mine operators to attain compliance with the interim and final DPM limits. The commenters object to the use of the Estimator for this purpose because they believe such filters did not exist. They charge that since appropriate filters did not exist, the methodology for our feasibility determination failed to meet our Data Quality requirements.

We disagree with the commenter's statement that our, ''assumptions [regarding the availability of filters] do not reflect reality.'' We have provided extensive discussion throughout the rulemaking record supporting our position that diesel particulate filters suitable for any size diesel engine were commercially available at the time the 2001 final rule was issued, and that a greater variety of such filters have become commercially available since 2001. The commenter states that we were, ''forced to admit'' in the 2005 final rule that there was ''insufficient evidence of feasibility,'' thus contradicting the Estimator and 31-Mine Study feasibility determinations. The sentence from the preamble to the 2005 final rule quoted by the commenter states, in full, ''MSHA acknowledges that the current rulemaking record lacks sufficient feasibility documentation to justify lowering the DPM limit below 308_{EC} μ/m³, at this time.'' This statement was not meant to imply that either the 2001 or 2005 final rule was infeasible, and it is irrelevant to the final DPM limit. It states that at that time, which was June 2005, we did not believe it was feasible for the industry as a whole to achieve DPM levels lower than the interim DPM limit, 308_{EC} μ/m³, which was the DPM limit in effect at that time.

The commenter stated that our explanation for many filter failures reported by Stillwater and other companies was that the user or the manufacturer was at fault, and that if MSHA had selected the filters, we would have selected or used them differently. We have extensively discussed in our preambles in this rulemaking record that the user of a DPF must evaluate and monitor each application in order to verify that the DPF is working properly at all times. We have continually stated that the majority of the DPF failures that have been reported have been related to DPF regeneration. We believe that better choices in selection and maintenance of DPFs would result in greater successes. However, these regeneration issues are not related to the capability of DPFs to effectively collect DPM. All of the data that we have presented on DPFs show that DPFs effectively collect DPM. Tests that were performed in the mining industry have consistently supported the same conclusions and agree with data given in the literature. Again, the failure of the regeneration scheme is the main cause of a clogged filter. The proper selection of DPFs has been discussed in the literature, and NIOSH's Filter Selection Guide extensively provides the information needed for selection.

The commenter also discusses the NO_2 issues related to DPFs. The data presented from studies show that catalyzed DPFs can increase NO_2. This data have been developed with the Partnership. However, we continue to believe that the NO_2 problems reported have been ventilation issues and not specifically a DPF issue. In fact, as discussed in the Technological Feasibility section, NIOSH stated that NO_2 elevations experienced were a result of poorly or marginally ventilated areas. Our data from the Greens Creek study that were developed and reviewed with industry showed no NO_2 issues on production machines in well ventilated areas.

Commenters raised several Data Quality issues relating to our determinations that the 2001 and 2005 final rules were economically feasible. They include whether the data used to make these determinations were representative of the industry, that industry annual revenue is an inappropriate measure of economic feasibility, that erroneous commodity prices were used in the 31-Mine Study to estimate revenue for at least one of the mines in the study, and that the 31-Mine Study incorrectly assumed that none of the mines in the study required major ventilation upgrades. They believe our economic feasibility conclusions were based on improper sampling, and inaccurate and incomplete data.

Each of these issues is discussed in detail in the Economic Feasibility section of this preamble. The key information from that section that relates to commenters' Data Quality concerns is summarized here. Regarding the first issue, that the subject mines in the 31-Mine study were not representative of the industry, this issue has already been addressed above. MSHA, labor, and industry collaborated on the study design, and all parties were aware at the time that the study mines were not randomly selected. Thus, the study results would reasonably accurately reflect feasibility of the subject mines, but would not be statistically representative of the industry as a whole. The entire process was transparent, reproducible, and based on valid assumptions and sound methods.

Regarding the second issue of whether industry annual revenue is an inappropriate measure of economic feasibility, commenters indicated that this method ignores the fact that international commodity markets determine the viability of mines by setting market prices for their production, and that annual revenues of hundreds of millions, if not billions, of dollars have not prevented the domestic underground M/NM mining industry from shrinking in recent years.

We believe that the method we used to determine economic feasibility is valid. We have customarily used compliance costs of greater than 1% of industry annual revenue as our screening benchmark for determining whether a more detailed economic feasibility analysis is required. The commenter correctly points out that despite hundreds of millions, if not billions, of dollars of industry annual revenue, business failures can and do occur, and over a period of decades, the characteristics of an industry can change markedly. However, by utilizing the 1% of annual revenue screening benchmark, we assure that a complete feasibility analysis will be conducted to determine whether a new MSHA rule could potentially affect the viability of an industry.

While it is true that individual business failures can and do occur, and that over a period of many years, substantial portions of a domestic industry can be adversely affected by, for example, international competition, it is highly improbable that such events would be set into motion by a rule imposing costs equal to or less than 1% of industry annual revenue. Threats to an entire industry's competitive structure and resulting large scale dislocations within an industry sector are typically caused by fundamental changes in technology, permanent downward pressure on demand for a commodity due, for example, to the introduction of a superior substitute material, world-wide or regional business cycles, etc. Our practice of utilizing compliance costs of greater than 1% of industry annual revenue as our screening benchmark for determining whether a more detailed economic feasibility analysis is required is reproducible and transparent, and is based on reasonable assumptions and sound economic principles.

The third issue raised by the commenter relating to economic feasibility was that erroneous commodity prices were used to estimate annual revenue for one of the mines in the 31-Mine Study. The commenter states that our revenue estimates suggest we used a price of $50 to $70 per ton for rock salt for highway de-icing, when a more reasonable estimate would have been $20 to $25 per ton.

The commenter did not explain how they inferred a $50 to $70 per ton price for rock salt from our analysis, so we are unable to respond directly to this comment. However, we did not base our economic feasibility determination for the subject mine on this inflated price for rock salt. For the 31-Mine Study, we did not have access to actual annual revenue data for any of the 31 individual mines in the study, so we indirectly estimated annual revenues using our data on the number of employee work hours in 2000 for each mine, the total number of employee work hours reported to us in 2000 by all mines producing that commodity, and data from the U.S. Geological Survey on the industry-wide value of mineral production by commodity for the year 2000. We estimated annual revenues for a particular mine by determining the industry-wide production value per employee hour for the specific commodity each mine produced, and multiplying that amount by the number of annual employee work hours reported to us for that mine. This methodology assumes that each mine's annual revenues would be roughly proportional to each mine's share of the industry's total employee work hours. Thus, our estimates, while not necessarily exact for each mine, were a reasonable approximation for those mines based on industry averages. Our analytical methods and data sources were fully explained in the final report to the 31-Mine Study. The process was transparent and reproducible, and the method was sound. This methodology does not explicitly incorporate a cost per ton factor. Implicit in this methodology, based on the U.S. Geological Survey's estimates of rock salt production in 2000 of 45,600,000 metric tons valued at $1,000,000,000, would be a cost per metric ton of $21.93 (equivalent to $19.89 per short ton), which is actually slightly less than the commenter's estimated price of $20 to $25 per short ton.

The final issue relating to economic feasibility raised by the commenter also concerns the 31-Mine Study. The commenter suggests that our methodology underestimated compliance costs by failing to recommend major ventilation upgrades for any mine in the study. They point out that a total of only $234,000 was recommended in the study for minor ventilation upgrades, whereas the operator of one of the mines in the study estimated at least $4.4 million in ventilation upgrades would be required at that mine alone to attain compliance.

In response to a similar comment on our 2003 NPRM, we noted in the preamble to the 2005 final rule that we did not specify any major ventilation upgrades in the 31-Mine Study because, based on the study methodology, the analysis did not indicate the need for major ventilation upgrades in order to attain compliance with either the interim or final DPM limits at any of the 31 mines. We went on to explain that the purpose of specifying controls for each mine in this study was simply to demonstrate that feasible controls capable of attaining compliance existed, and to provide a framework for costing such controls on a mine-by-mine basis. We explicitly stated in the 31-Mine study final report that the DPM controls specified for a particular mine did not necessarily represent the only feasible control strategy, or the optimal control strategy for that mine.

The fact that the operator of one of the mines in the study estimated costs of $4.4 million for ventilation upgrades to attain compliance with the rule does not invalidate the methodology we used, or the results we obtained in the 31-Mine study. It is impossible for us to verify whether $4.4 million for ventilation upgrades is a reasonable estimate for the subject mine because we don't know which mine the commenter is referring to, and no additional supporting documentation was provided by the commenter. However, even if this figure is accurate, it would not necessarily invalidate our methodology or results. We have received numerous comments throughout the rulemaking process that ventilation upgrades alone would not be a cost-effective DPM control at many mines. These comments support our position that mine operators need to carefully analyze all DPM control options in order to select the most cost-effective control or combination of controls to implement at a particular mine. Although a $4.4 million ventilation upgrade may be required to attain compliance at the subject mine, if ventilation alone was used to attain compliance, it is more likely that compliance could be achieved at this mine at a lower cost if an optimal combination of controls were implemented, including low DPM-emission engines, environmental cabs with filtered breathing air, DPM filters, alternative fuels such as biodiesel, work practices and administrative controls, as well as ventilation.

With respect to ventilation upgrades for the 31 mines, the study methodology and the sources of all data we used in performing the feasibility analyses were thoroughly explained in the 31-Mine Study final report. The process was transparent and reproducible, and the study protocol was developed jointly by MSHA, labor, and industry representatives.

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XV. Regulatory Text

List of Subjects in 30 CFR Part 57

Diesel particulate matter, Metal and nonmetal, Mine safety and health, Underground miners.

Dated: May 9, 2006.

Robert M. Friend,

Acting Deputy Assistant Secretary of Labor for Mine Safety and Health.

■ For reasons discussed in the preamble, MSHA amends 30 CFR part 57 as follows:

PART 57—SAFETY AND HEALTH STANDARDS—UNDERGROUND METAL AND NONMETAL MINES

■ 1. The authority citation for part 57 continues to read as follows:

Authority: 30 U.S.C. 811 and 813.

■ 2. Section 57.5060 is amended by:
■ A. Revising paragraph (b);
■ B. Removing (c)(3)(i); and
■ C. Redesignating paragraphs (c)(3)(ii), (c)(3)(iii), and (c)(3)(iv) as (c)(3)(i), (c)(3)(ii), and (c)(3)(iii) respectively.

The revision reads as follows:

§ 57.5060 Limit on exposure to diesel particulate matter.

* * * * *

(b)(1) Effective May 20, 2006, a miner's personal exposure to diesel particulate matter (DPM) in an underground mine must not exceed an average eight-hour equivalent full shift airborne concentration of 308 micrograms of elemental carbon per cubic meter of air (308_{EC} μg/m^3).

(2) Effective January 20, 2007, a miner's personal exposure to diesel particulate matter (DPM) in an underground mine must not exceed an average eight-hour equivalent full shift airborne concentration of 350 micrograms of total carbon per cubic meter of air (350_{TC} μg/m^3).

(3) Effective May 20, 2008, a miner's personal exposure to diesel particulate matter (DPM) in an underground mine must not exceed an average eight-hour equivalent full shift airborne concentration of 160 micrograms of total carbon per cubic meter of air (160_{TC} μg/m^3).

* * * * *

■ 3. Effective August 16, 2006, § 57.5060 is amended by revising paragraph (d) introductory text and adding paragraphs (d)(3) through (d)(8).

§ 57.5060 Limit on exposure to diesel particulate matter.

* * * * *

(d) The mine operator must install, use, and maintain feasible engineering and administrative controls to reduce a miner's exposures to or below the applicable DPM PEL established in this section. When controls do not reduce a miner's DPM exposure to the PEL, controls are infeasible, or controls do not produce significant reductions in DPM exposures, controls must be used to reduce the miner's exposure to as low a level as feasible and must be supplemented with respiratory protection in accordance with § 57.5005(a), (b), and paragraphs (d)(1) through (d)(8) of this section.

* * * * *

(3) The mine operator must provide a confidential medical evaluation by a physician or other licensed health care professional (PLHCP), at no cost to the miner, to determine the miner's ability to use a respirator before the miner is required to be fit tested or to use a respirator at the mine. If the PLHCP determines that the miner cannot wear a negative pressure respirator, the mine operator must make certain that the PLHCP evaluates the miner's ability to wear a powered air purifying respirator (PAPR).

(4) The mine operator must provide the miner with an opportunity to discuss their evaluation results with the PLHCP before the PLHCP submits the written determination to the mine operator regarding the miner's ability to wear a respirator. If the miner disagrees with the evaluation results of the PLHCP, the miner may submit within 30 days additional evidence of his or her medical condition to the PLHCP.

(5) The mine operator must obtain a written determination from the PLHCP regarding the miner's ability to wear a respirator, and the mine operator must assure that the PLHCP provides a copy of the determination to the miner.

(6) The miner must be reevaluated when the mine operator has reason to believe that conditions have changed which could adversely affect the miner's ability to wear the respirator.

(7) Upon written notification that the PLHCP has determined that the miner is unable to wear a respirator, including a PAPR, the miner must be transferred to work in an existing position in an area of the same mine where respiratory protection is not required. The miner must be transferred within 30 days of the final determination by the PLHCP.

(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) Increases in wages of the transferred miner must be based upon the new work classification.

(8) The mine operator must maintain a record of the identity of the PLHCP and the most recent written determination of each miner's ability to wear a respirator for the duration of the miner's employment plus six months.

* * * * *

■ 4. Section 57.5075 is amended by revising paragraph (a) and paragraph (b)(3) to read as follows:

§ 57.5075 Diesel particulate records.

(a) The table entitled ''Diesel Particulate Matter Recordkeeping Requirements'' lists the records the operator must maintain pursuant to §§ 57.5060 through 57.5071, and the duration for which particular records need to be retained.

TABLE 57.5075(a).—DIESEL PARTICULATE RECORDKEEPING REQUIREMENTS

Record	Section reference	Retention time
1. Approved application for extension of time to comply with exposure limits.	§ 57.5060(c)	Duration of extension.
2. Identity of PLHCP and most recent written determination of miner's ability to wear a respirator.	§ 57.5060(d)	Duration of miner's employment plus 6 months.
3. Purchase records noting sulfur content of diesel fuel	§ 57.5065(a)	1 year beyond date of purchase.
4. Maintenance log	§ 57.5066(b)	1 year after date any equipment is tagged.
5. Evidence of competence to perform maintenance	§ 57.5066(c)	1 year after date maintenance performed.
6. Annual training provided to potentially exposed miners	§ 57.5070(b)	1 year beyond date training completed.
7. Record of corrective action	§ 57.5071(c)	Until the corrective action is completed.
8. Sampling method used to effectively evaluate a miner's personal exposure, and sample results.	§ 57.5071(d)	5 years from sample date.

(b) * * *

(3) An operator must provide access to a miner, former miner, or, with the miner's or former miner's written consent, a personal representative of a miner, to any record required to be maintained pursuant to § 57.5071 or § 57.5060(d) to the extent the information pertains to the miner or former miner. The operator must provide the first copy of a requested record at no cost, and any additional copies at reasonable cost.

* * * * *

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