within the five years allotted due to technological constraints. The final rule establishes the information that must be contained in the application for an extension, the procedure to follow to make application, and the conditions that must be observed during the special extension period. Subsection (c) of the final rule refers to this extension as ''special'' because the final rule provides all mines in this sector with an extension of time (five years) to meet the final concentration limit. The final rule is the same as the proposed rule in this regard.

Subsection (d) provides that under certain conditions, a miner engaged in inspection, repair or maintenance activities in certain areas of a mine may work in concentrations of dpm in excess of the applicable concentration limit. Among the conditions that must be met in order for such work to be permitted is the use of proper personal protective equipment. This exception was not included in the proposed rule.

Subsection (e) provides that apart from the extraordinary circumstances where the use of such controls may be authorized under subsections (c) and (d), an operator must not utilize personal protective equipment to comply with either the interim or final concentration limit. The wording in the final rule clarifies the intent of the proposed rule, and accommodates new subsection (d).

Subsection (f) provides that an operator must not utilize administrative controls to comply with either the interim or final concentration limit. The proposed rule included the same requirement, but in the final rule this has been separated into a separate paragraph.

General Comments. Some commenters questioned MSHA's rationale for establishing concentration limits at this time. They pointed out that a large scale study by NIOSH of the health risks of dpm exposure is still on-going. Accordingly, they accused MSHA of acting prematurely, and urged delaying implementation of any limits until the health risks of dpm exposure are fully quantified. MSHA was also challenged to justify the specific numerical values chosen for the limits; several commenters suggested that these limits are based on unsubstantiated and unquantified health risks, and that therefore, the levels chosen cannot be justified. But another commenter suggested that the health risks are sufficiently documented to justify even lower limits than were contained in the proposed rule. This commenter suggested 100 µg and 50 µg for the interim and final limits, respectively. As these comments involve questions about the risk to underground metal and nonmetal miners, they are addressed in Part III of this preamble.

Some commenters also objected to the proposed concentration limits because they argued that MSHA lacked evidence that the limits were technologically feasible and economically feasible, and some objected to the use of unvalidated simulations to demonstrate the feasibility of compliance. An alternative to concentration limits was proposed wherein mine operators would ''Examine and adopt technically and economically feasible methods of preventing potentially hazardous or irritating exposure to diesel exhaust.'' But another commenter argued that the metal and nonmetal industry could feasibly meet even lower concentration limits than those proposed. And another suggested that a concentration limit alone will not adequately protect miner health because, given the freedom to choose control options, mine operators may elect to boost ventilation rather than cut emissions. As these comments concern feasibility, they are generally discussed in part V of this preamble.

A number of commenters argued that MSHA should allow operators considerable additional flexibility dealing with dpm. Some felt operators should be left complete flexibility on controls, and that a concentration limit at all was inappropriate. Others argued that the range of operator choice of controls should include personal protective equipment as well as administrative controls. These comments are discussed below in connection with this section (§ 57.5060).

Still other commenters argued that concentration limits should not be proposed, or should be much higher, because they argue MSHA lacks a method to measure dpm concentrations in underground metal and nonmetal mines that provides the accuracy, consistency, and reliability that are needed for compliance determinations. These comments are discussed in this part in connection with § 57.5061.

Another commenter expressed concern about the interplay between this rule and those already in effect for diesel gases. This commenter expressed concern that, in addition to complying with the interim and final dpm concentration limits, mine operators would be required to comply with a concentration limit that considers the additive effect of diesel particulate matter and the principal gaseous emissions from a diesel engine (carbon monoxide, carbon dioxide, nitric oxide, and nitrogen dioxide).

MSHA's risk assessment in part III does not specifically evaluate the possible additive effects of diesel particulate matter and diesel gases. Accordingly, the agency does not at this time have a basis upon which to enforce either the interim or final dpm concentration limit in combination with any other substance or substances, including diesel exhaust gases. MSHA will, of course, continue to enforce the limits applicable to diesel gases, but this enforcement will be separate from the enforcement of the dpm concentration limits under the final dpm rule. The Agency understands that Canada does consider the additive effect of diesel exhaust gases and particulate, and will notify the mining community if it decides to look into this matter further based upon additional information.

Finally, the Agency notes it received only two comments on a related matter on which it specifically sought comment—whether to establish an ''Action Level'' for dpm (63FR 58119). An ''Action Level'' is a defined contaminant level (usually one-half of the compliance limit) which, if exceeded, triggers actions that must be taken to effectuate control of the contaminant. In the preamble to the proposed rule, MSHA noted it had considered the possibility of establishing an Action Level because the dpm concentration at which exposure does not result in adverse health effects is not known at this time. If an Action Level were in place and compliance sampling results exceeded this level, certain remedial steps, or ''best practices,'' would have to be initiated by management to reduce exposures, such as limits on fuel type, idling, and engine maintenance—whatever steps MSHA determined would be feasible at the Action Level for this sector as a whole. One comment that addressed this approach recommended against establishing an Action Level because the commenter was of the view that no limits at all could be justified at this time based on available health risk data. The other commenter suggested that an Action Level should be adopted in lieu of a rule incorporating a concentration limit requiring mandatory compliance.

After further consideration, MSHA determined it does not have enough information to proceed with an Action Level at this time, although it notes that the concept of an Action Level is well recognized in occupational health protection and included in many other standards. Furthermore, MSHA determined that these ''best practices'' are technologically and economically feasible for all mines, so there is no reason to withhold their

implementation until an Action Level is reached. The rationale for requiring these ''best practices'' is discussed in more detail later in this section under ''Meeting the concentration limit: operator choice of controls.''

Concentration limit expressed as an ''average eight-hour equivalent full shift airborne concentration.'' MSHA recognizes that work shifts longer than eight hours are common in the underground metal and nonmetal mining industry. It is for this reason that MSHA expressed its concentration limit as an ''average eight-hour equivalent full shift airborne concentration.'' Health-related standards for airborne contaminants are typically established on the basis of an eight-hour work shift. Standard industrial hygiene practice, and MSHA's past practice for metal and nonmetal health sampling, involve adjusting the actual measured concentration of an airborne contaminant to an eight-hour equivalent concentration when work shifts are longer than eight hours. This adjusts an exposure occurring over an extended workshift (*e.g.,* 10 or 12 hours) to enable a valid comparison to an established exposure limit that is based on an 8-hr workshift.

The mathematical formula for making this adjustment is thoroughly described in the MSHA Metal and Nonmetal Health Inspection Procedures Handbook. This formula is as follows:

$$\frac{\text{Contaminant mass}}{(\text{sampling pump flow rate}) \times (480 \text{ minutes}) \times (0.001 \text{ m}^3/\text{l})}$$

When the sampling pump flow rate is expressed in units of liters per minute, the formula results in a contaminant concentration expressed in units of mg or µg per cubic meter. The factor of 480 minutes is used regardless of actual shift duration so as to adjust the actual concentration to an eight-hour equivalent concentration that can be appropriately compared to a standard limit.

MSHA specifically asked for comment on whether a more explicit definition is required in this regard (63 FR 58183). The agency did not receive any such suggestions. However, it is apparent that the term may be confusing to some. For example, one commenter observed that ''miners working overtime hours would be exposed to more dpm than miners on a normal eight-hour shift,'' and that a formula to determine eight-hour equivalency should be included. Another commenter expressed concern that the final rule would place a restriction on the number of hours or overtime hours miners could work.

MSHA disagrees with these interpretations of the rule. The only impact of the rule relative to work hours is the aforementioned determination of ''average eight-hour equivalent full shift airborne concentration'' for dpm-exposed miners whose work shifts exceed eight hours. Although the Agency has no suggestions for a more clear formulation, it will endeavor to clarify this matter further for operators in its compliance guide.

Dpm concentration limits expressed in terms of total carbon. The purpose of the interim and final concentration limits is to limit the amount of diesel particulate matter; but the limit is being expressed in terms of a restriction on the amount of total carbon. The reason for this involves the measurement method that MSHA intends to utilize to determine the concentration of dpm. As discussed in connection with § 57.5061(a), the final rule specifies that MSHA will use a sampling and analytical method developed by NIOSH (NIOSH Method 5040) to measure dpm concentrations for compliance purposes. Using NIOSH's analytical method, the amount of total carbon (TC) contained in a dpm sample from any underground metal and nonmetal mine can be determined; the method does not directly yield the amount of dpm in a particular sample. However, as explained in detail in Part II of this preamble, TC represents approximately 80–85 percent of the total mass of dpm emitted in the exhaust of a diesel engine. The remaining 15–20 percent consists of sulfates and the various elements bound up with the organic carbon to form the adsorbed hydrocarbons. Using the lower boundary of this range, limiting the concentration of total carbon to 400 micrograms per cubic meter (400_{TC} µg/m^3) effectively limits the concentration of whole diesel particulate to about 500_{DPM} µg/m^3. Similarly, limiting the concentration of total carbon to 160_{TC} µg/m^3 effectively limits the concentration of whole diesel particulate to about 200_{DPM} µg/m^3. Expressing the concentration limit in terms of total carbon enables miners, mine operators and inspectors to directly compare a measurement result with the applicable limit.

Where the concentration limit applies. The concentration limits—both interim and final—would apply *only* in areas where miners normally work or travel. The purpose of this restriction is to ensure that mine operators do not have to monitor and control dpm concentrations in areas where miners do not normally work or travel—*e.g.,* abandoned areas of a mine where, for example, the roof may not be monitored for safety or ventilation may not be provided. At the same time, it should be noted that the interim and final concentration limits apply in any and all areas of a mine where miners *normally* work or travel—not just where miners might be present at any particular time.

MSHA generally intends for inspectors to determine which portions of a given mine are subject to the concentration limit based on whether normal work or travel activities routinely do, or could occur there, whether areas are designated as ''abandoned'' on mine maps, whether areas are made ''off limits'' through the use of signs or barricades, etc.

MSHA has, however, in the final rule (§ 57.5060(d)), explicitly authorized the Secretary, upon making certain findings and ensuring that certain protections are in place for miners, to allow miners engaged in certain inspection, maintenance or repair activities to work in areas of a mine which are considered areas in which miners normally work or travel but that exceed the concentration limits. These situations are discussed immediately below.

Exception: Specific mining activities which may be conducted in areas which exceed the concentration limit. Although feasible engineering and work practice controls were found to exist for most underground metal and nonmetal mining situations, MSHA did determine that certain maintenance and repair activities might have to be performed in areas where feasible engineering and work practice controls may not be capable of maintaining the dpm concentration at or below the applicable concentration limit. Therefore, in the final rule, § 57.5060(d) under certain conditions permits miners to work in areas where the concentration limit is exceeded, and only when specified precautions have been implemented to protect affected miners. As explained in

detail below, principal among these precautions is the use by all affected miners, of proper personal protective equipment (*i.e.*, respiratory protection devices) within the context of a comprehensive respiratory protection program.

More specifically, § 57.5060(d)(1) permits, with the pre-approval of the Secretary, employees engaged in inspection, maintenance, or repair activities to work in concentrations of dpm exceeding the applicable limit if they are protected by appropriate respiratory protective equipment. This provision applies only to miners performing the identified activities, and only when certain mandatory protections are implemented. If respiratory protective equipment is used, the final rule requires implementation of a respiratory protection program consistent with the minimum requirements established in § 56/57.5005 (a) and (b), which address such factors as selection, maintenance, training, fitting, supervision, and cleaning. These requirements include by reference, the elements of a minimally acceptable respiratory protection program as delineated in the American National Standard on ''Practices For Respiratory Protection'' (ANSI Z88.2–1969).

The rule specifies that areas for which a request to allow employees to work in areas that exceed the concentration limit are limited to—areas where miners work or travel infrequently or for brief periods of time for equipment or mine inspection; areas where miners otherwise work exclusively inside of enclosed and environmentally controlled cabs, booths and similar structures with filtered breathing air; and in shafts, inclines, slopes, adits, tunnels and similar workings that are designated as return or exhaust air courses and that are also used for access into, or egress from an underground mine.

The standard applies in areas of the mine where miners ''normally'' work or travel. Normally does not equate to frequency, but rather to the nature of the area. Areas where miners work or travel infrequently are treated by the rule no differently than areas where miners work or travel frequently. For example, if a remote pump is checked on a weekly basis, the area in which that pump is located would be considered an area where miners normally work or travel, even though the area is visited infrequently.

Approval to allow miners to work in areas that exceed the concentration limit would be contingent on the Secretary determining that engineering controls are not feasible, and that adequate safeguards would be employed by the mine operator to prevent hazardous exposure to dpm. The final rule requires mine operators to submit a plan to the Secretary to justify the infeasibility of engineering controls, and to explain the circumstances of the job, the location where work will be performed, resulting dpm exposures, and controls to be used, including, but not necessarily limited to personal protective equipment.

In order for MSHA to determine the reasonableness of a mine operator's request for approval under 5060(d), certain details regarding the work need to be provided. These include the types of inspection, maintenance or repair activities planned, the locations of such activities, the dpm concentrations at these locations, the reasons why engineering controls would not be feasible, the anticipated frequency of these activities, the anticipated number of miners involved, and the safeguards the mine operator will employ to minimize dpm exposures. These factors will tend to change over time as the mine develops, as new equipment or procedures are introduced, as ventilation system parameters change, etc. MSHA believes that an annual updating of these factors is necessary to insure that approval is granted only where justified by the actual circumstances.

In essence, this exemption allows the use of personal protective equipment as a substitute for engineering controls under a limited number of circumstances. Many commenters suggested MSHA permit the use of PPE much more broadly in lieu of engineering controls; MSHA's review and reaction to these comments is discussed below.

One commenter, a mine operator, agreed with MSHA's approach that stresses engineering controls first and foremost. The commenter stated that, ''engineering controls, as close to the source of the diesel emission as possible, must be the first line of DPM exposure control.'' The commenter further suggested that, ''The proposed rule should allow personal protective equipment to be used as a last resort. The proposed rule should require written documentation explaining how the mine determined the appropriate exposure controls. This written documentation should clearly explain why engineering controls, commonly used in industry to control diesel emissions, are not technically or economically feasible.''

Although MSHA has embraced the commenter's basic idea of requiring written documentation when personal protective equipment is proposed as an alternative to engineering controls, the final rule includes other necessary safeguards to insure that this option is used only when absolutely necessary and that appropriate steps are taken to insure that respirator wearers are adequately protected. The final rule requires such plans to identify, at a minimum, the types of anticipated inspection, maintenance, and repair activities that must be performed for which there are no feasible engineering controls sufficient to comply with the concentration limit, the locations where such activities could take place, the concentration of dpm in these locations, the reasons why engineering controls are not feasible, the anticipated frequency of such activities, the anticipated duration of such activities, the anticipated number of miners involved in such activities, and the safeguards that will be employed to limit miner exposure to dpm, including, but not limited to the use of respiratory protective equipment.

The final rule requires mine operators to utilize all feasible engineering and work practice controls, however, the exception under subsection (d) permits such controls to be supplemented with respirator use in certain limited situations where reliance solely on feasible engineering and work practice controls would be inadequate to control exposures below the applicable concentration limit. The proposal's prohibition on administrative controls under any and all circumstances is retained in the final rule in subsection (e).

Examples of situations where MSHA believes engineering controls might not be feasible include cleaning up a roof fall in an exhaust air course, replacing a conveyor belt idler in a conveyor tunnel that is carrying exhaust air, or shaft inspection in an exhaust air shaft. The provisions of subsection (d) are not intended to suggest that MSHA believes these and similar activities should automatically be considered exempt from the requirement to utilize engineering and work practice controls to comply with the concentration limit. Rather, MSHA recognizes that under certain site specific circumstances, feasible engineering and work practice controls alone may not be capable of achieving compliance with the concentration limit. Therefore, MSHA agrees that respirator use should be permitted if the applications are sufficiently justified and approved in advance.

MSHA does not intend that plans submitted for advance approval need to identify specifically and individually

every activity for which advance approval is sought. The intent is that plans must identify, in a generic sense, the types of activities and related circumstances as can reasonably be anticipated, sufficient to enable the Secretary to determine whether advance approval is warranted.

Meeting the concentration limit: operator choice of engineering controls. 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.

MSHA intends for engineering controls to refer to controls that remove the dpm hazard by applying such methods as substitution, isolation, enclosure, and ventilation. MSHA intends for work practice controls to refer to specified changes in the way work tasks are performed that reduce or eliminate a hazard, such as traffic controls (speed limits, one-way travel, etc.), prohibiting unnecessary engine idling, or designating areas that are off-limits for diesel equipment operations. As discussed below, the final rule does not permit utilization of administrative controls as a means of complying with the dpm concentration limit. In the context of this rule, MSHA intends for administrative controls to refer to controls that limit a miner's exposure to dpm by distributing the exposure among other miners through various work scheduling and worker rotation practices.

Some commenters asserted that implementation of certain dpm control measures may create other, unrelated health or safety problems. One example given concerned the complications and safety trade-offs of increasing ventilation to control dpm concentrations. The increased ventilation would tend to dry out roadways, causing increased problems with respirable silica bearing dust exposure. This problem, would, in turn, require application of greater amounts of water on the roadways for dust control, which, in turn, would create traction problems for vehicles. Increased ventilation might also accelerate the drying out of certain roof strata, creating roof control problems. Another commenter worried that enclosed cabs can reduce an equipment operator's field-of-view, and dirt or glare on windows can obscure visibility, possibly creating safety problems.

MSHA acknowledges that dpm control measures need to be selected and implemented carefully, both to insure they achieve the desired effect on dpm concentrations, and to minimize or avoid undesirable effects on other aspects of the mine's health and safety environment. In most cases, implementation of a given control will not have any undesirable effects. In other isolated cases, the undesirable effects of a given control can most likely be negated through additional work practice controls or other measures. For example, the increased application of water on roadways to reduce dust control problems caused by higher ventilation rates may require that equipment be operated at slower speeds. Roof control problems resulting from the accelerated drying out of strata may require a reassessment of the mine's roof control plan, such as its roof bolting practices. Vehicle operator field-of-view and visibility problems could be addressed by instituting new traffic controls, requiring slower speeds, and use of window washers. For these reasons, MSHA does not wish to explicitly deny operators a particular type of engineering control because in some circumstances an adjustment to customary mining practices may have to be made.

Because information on available controls has been described in other parts of this preamble (part II and part V), further discussion is not provided here. Mine operators are also directed to the MSHA ''estimator'' model to help them determine which control or combination of controls would be best able to produce the reduction in dpm concentrations necessary to comply with the appropriate concentration limit. The ''estimator'' mathematically calculates the effect of any combination of engineering and ventilation controls on existing dpm concentrations in a given production area of a mine. This model is in the form of a spreadsheet template permitting instant display of outcomes as inputs are altered. The model and some examples illustrating its potential utility are described in Part V of this preamble.

Several commenters expressed disappointment that the proposal did not embrace what they sometimes referred to as ''MSHA's toolbox approach.'' In some cases, this appears to mean the commenters want operators to have the flexibility to use personal protective equipment and administrative controls, as well as engineering and work practice controls, to meet the required concentration limits. In other cases, however, it appears the commenters meant that MSHA should allow them the discretion not only to choose the controls they wish, but to choose whether or not to use controls at all. In other words, to these commenters, the ''toolbox approach'' means voluntary implementation of controls without enforcement of a concentration limit.

By way of background, in 1997, MSHA published a pocket-sized handbook called, ''Practical Ways to Reduce Exposure to Diesel Exhaust in Mining—-A Toolbox.'' This handbook describes and discusses a variety of emission control equipment, methods, and strategies, both in terms of laboratory emissions testing and in-mine experience. The rationale for a ''toolbox approach'' to controlling diesel emissions is explained in the handbook. ''A toolbox offers a choice of tools, each with a specific purpose. One tool after another may be used to find a solution to a problem, or several tools may be tried at the same time.* * * Reducing exposure to diesel emissions lends itself to a toolbox approach because no single method or approach to reducing exposure may be suitable for every situation.'' Since its publication, this handbook, which is referred to simply as the ''MSHA toolbox'' or ''toolbox'' has become quite well known and is widely used in the mining industry.

Commenters who urged MSHA to adopt a ''toolbox approach'' in its rulemaking praised the approach taken in MSHA's publication, and indicated that they had successfully implemented some of the control strategies discussed. They urged MSHA to maintain this flexibility. One commenter suggested that, ''The toolbox is just simply best practices, if you would. If we're doing this, this, and this, then we're doing all we can without enforcement.* * * That's what a toolbox is. A toolbox is not an enforcement tool.''

The MSHA Toolbox was issued before this rulemaking, in which, after considering all the evidence, MSHA has concluded that miners are at significant risk of material impairment at the concentration levels still found in underground metal and nonmetal mines. When MSHA makes such a finding, it is required to act to protect miners to the extent feasible. MSHA has concluded that requiring operators to comply with a concentration limit using engineering controls is necessary to protect miners and feasible for the mining industry as a whole, while still

providing underground metal and nonmetal mine operators with maximum flexibility to address this problem. Thus, MSHA believes the final rule does incorporate the ''toolbox approach'' by allowing mine operators to choose, from among numerous alternatives, the mix of control measures most suitable for the site specific conditions at a given mine—provided that the controls bring exposures down to the required limit.

MSHA has determined that certain types of controls discussed in the toolbox—PPE and administrative controls—are not considered acceptable ways to meet a concentration limit. PPE does not reduce the concentrations of a contaminant in the environment, though such equipment does offer limited protection to miners who must work in areas where the applicable concentration limit cannot be achieved using feasible engineering or work practice controls. The rule permits PPE to be used to protect miners in those limited situations where it permits work to take place despite dpm concentrations in excess of the concentration limit (special extension of time to meet final concentration limit under paragraph (c), discussed below, and special permission to perform inspection, maintenance and repair activities in areas that exceed the concentration limit under paragraph (d), discussed above.) Administrative controls (*e.g.,* limiting the hours worked by a particular miner in a high concentration area) simply spread risk among miners. The reasons for MSHA's position in this regard are discussed in detail below.

MSHA has also determined that certain other types of dpm control measures discussed in the toolbox must be implemented at all underground metal and nonmetal mines that use diesel equipment, regardless of the dpm concentration level, to minimize miner risks. These ''best practices'' include such requirements as low sulfur content diesel fuel, limits on unnecessary idling of diesel engines, maintenance standards, and a requirement for newly introduced engines to be MSHA approved or meet certain EPA standards. MSHA's rationale for why it is mandating such ''best practices'' is summarized below. Further detail is provided in the preamble to the proposal (63FR 58119), and in the sections of this Part which discuss the individual practices themselves (diesel fuel (§ 57.5065(a)), maintenance (§ 57.5066), and engines that are MSHA approved or meet EPA standards (§ 57.5067).

In the proposal, MSHA explained that it had considered implementing an ''Action Level'' for dpm, possibly at a level one-half of the final concentration limit, or 80_{TC} $\mu g/m^3$ because the dpm concentration at which exposure does not result in adverse health effects is not known at this time. Under this approach, when dpm levels exceeded the Action Level, implementation of certain ''best practice'' controls, such as limits on fuel types, idling, and engine maintenance would have been required. However, this approach was not incorporated into the proposal, nor has it been incorporated into the final rule. MSHA determined it does not have enough information to proceed with an Action Level at this time, although it notes that the concept of an Action Level is well recognized in occupational health protection and included in many other standards. Instead, MSHA determined that these ''best practices'' would be required for all mines at all times.

MSHA followed this course for several reasons, including: (1) Sampling by both mine operators and MSHA would have been much more frequent under an approach incorporating an Action Level; (2) tracking equipment maintenance requirements would have been much more complicated, as diesel equipment could move from an area of the mine where the dpm concentration was less that the Action Level, to another area where the Action Level had been exceeded; (3) these ''best practices'' are already in place, and have proven to be workable and practical in coal mines; (4) given the history of lung problems associated with the mining industry, and considering that these practices were determined to be economically and technologically feasible for the industry as a whole, a more protective course seemed prudent; and (5) a number of the work practices appear to have significant benefits, such as improving the efficiency of maintenance operations.

One commenter suggested that other ''best practices'' related to mine ventilation should be mandated in the final rule. This commenter recommended requiring mine operators to provide details on the design and operating parameters of auxiliary ventilation systems, that they be required to utilize an appropriate air measurement and recording program, and that they properly attend to uncontrolled recirculations and leakages. MSHA believes that existing ventilation regulations adequately address these concerns, and that mine operators, in utilizing a ''toolbox approach'' to implement dpm control measures, have the option of incorporating ventilation system improvements if they are judged to be feasible, practical, desirable, and appropriate to the site specific conditions at a given mine. Thus, MSHA did not include a mandate to use such ventilation ''best practices'' in the final rule.

Concentration limit: time to meet. As noted, the dpm limitation requires metal and nonmetal mines to reduce total carbon concentrations in areas where miners normally work or travel to 160 micrograms per cubic meter of air (equating to about 200 micrograms of dpm per cubic meter of air.) § 57.5060 provides for an extension of time for underground metal and nonmetal mines to meet the concentration limit. Mines do not have to meet any limit for the first 18 months after the final rule is promulgated. Instead, this period will be used to provide compliance assistance to the metal and nonmetal mining community to ensure it understands how to measure and control diesel particulate matter concentrations in individual operations. Moreover, the rule provides all mines in this sector an extension of three and a half additional years to meet the final concentration limit established by § 57.5060(b). During this extension, however, all mines will have to bring total carbon concentrations down to 400 micrograms per cubic meter, equating to a limit of 500 micrograms per cubic meter in dpm.

Comments on the implementation schedule for the concentration limits focused on the technological and economic feasibility of complying within the time frames established. Commenters expressed the view that the rule is technology forcing, and that the mining sector of the economy is too small to justify the expense by manufacturers (mining equipment, diesel engines, aftertreatment devices, etc.) to develop the necessary products to enable mine operators to fully comply by the deadlines contained in the final rule.

MSHA provided these phase-in times for meeting the interim and final concentration limits after carefully reviewing comments on the economic and technological feasibility of requiring all mines in this sector to meet the applicable limits using available controls. This review is presented in Part V of this preamble. MSHA has studied a number of metal and nonmetal mines in which it believed dpm might be particularly difficult to control. The Agency has concluded that in combination with the ''best practices'' required under other provisions of the

final rule (§§ 57.5065, 57.5066 and 57.5067), engineering and work practice controls are available that can bring dpm concentrations in all underground metal and nonmetal mines down to or below 400_{TC} μg/m³ within 18 months. Moreover, the Agency has concluded that controls are available to bring dpm concentrations in all underground metal and nonmetal mines down to or below 160_{TC} μg/m³ within 5 years. The Agency has concluded that it is not feasible to require this sector, as a whole, to lower dpm concentrations further, or to implement the required controls more swiftly.

Despite its conclusions on the feasibility of these timeframes for the underground metal and nonmetal industry as a whole, MSHA has included a provision in the final rule to allow an additional two years for mines experiencing difficulty in complying due to technological problems. A discussion of this special extension follows.

Special extension. Pursuant to § 5060(c), an operator may request more than five years to comply with the final concentration limit only in the case of technological problems. In light of the risks to miners posed by dpm, however, the Agency has concluded that the economic constraints of a particular operator are not an adequate basis for a further extension of time for that operator, and the final rule does not provide for any extension grounded in economic concerns. Moreover, if it is technologically feasible for an operator to reduce dpm concentrations to the final limit within the established five year compliance period, no extension would be permitted even if a more cost effective solution might be available in the future for that operator.

However, the Agency has determined that if an operator can actually demonstrate that there is no technological solution that could reduce the concentration of dpm to 160_{TC} μg/m³ within five years, a special extension would be warranted.

Extension application. § 57.5060(c)(1) provides that if an operator of an underground metal or nonmetal mine can demonstrate that there is no combination of controls that can, due to technological constraints, be implemented within five years to reduce the concentration of dpm to the limit, MSHA may approve an application for an extension of time to comply.

Such a special extension is available only once, and is limited to 2 years. In this regard, MSHA does not anticipate that an extension will automatically last 2 years, and the agency will closely scrutinize applications to determine how much time is really required to implement a technological solution. To obtain a special extension, an operator must show that diesel powered equipment was used in the mine prior to publication of the rule, demonstrate that there is no off-the-shelf technology available to reduce dpm to the limit specified in § 57.5060, and establish the lowest concentration of dpm attainable. In this regard, the Agency reiterates that cost is not a consideration; thus, simply because a more cost-effective solution will become available in the future is not an acceptable reason for an extension.

One commenter questioned whether it is reasonable to limit mine operators to one special extension when the necessary technology to comply with the concentration limits does not exist today. This commenter suggests a five to ten year compliance schedule is more realistic to allow time to develop the technology and to phase in the replacement of equipment. MSHA believes that very few, if any, underground metal and nonmetal mining operations should need a special extension, based on the feasibility information discussed in part V of this preamble. Despite this information, the final rule makes specific provision for a special extension for the very few mines that might experience technical problems that cannot be foreseen at this time. In the unlikely event any mines experience such technical problems, MSHA believes that a two year extension, in addition to the five years granted in the final rule for all mines, will be sufficient for them to achieve compliance.

The final rule further requires that to establish the lowest achievable concentration, the operator must provide sampling data obtained using NIOSH Method 5040 (the method MSHA will use when determining concentrations for compliance purposes; this sampling method is further discussed in connection with § 57.5061(a)).

The application would also require the mine operator to specify the actions that are to be taken to ''maintain the lowest concentration of diesel particulate achievable'' (such as ensuring strict adherence to an established control plan) and to minimize miner exposure to dpm (*e.g.,* such as providing and requiring the use of suitable respirators at mines or areas of mines under extension). MSHA's intent is to ensure that personal protective equipment is permitted only as a last and temporary resort to bridge the gap between what can be accomplished with engineering and work practice controls and the concentration limit. It is not the Agency's intent that personal protective equipment be permitted during the extension period as a substitute for engineering and work practice controls that can be implemented immediately.

Filing, posting and approval of extension application. The final rule requires that an application for an extension be filed no later than 6 months (180 days) in advance of the date of the final concentration limit (160_{TC} μg/m³), and a copy of the extension be posted at the mine site for the duration of the extension period. In addition, a copy of the application would also have to be provided to the designated representative of the miners.

The application must be approved by MSHA before it becomes effective. While pre-approval of plans is not the norm in this sector, an exception to the final concentration limit cannot be provided without careful scrutiny. Moreover in some cases, the examination of the application may enable MSHA to point out to the operator the availability of solutions not considered to date. MSHA notes that it received no comments on this requirement for pre-approval.

While the final rule is not explicit on the point, it is MSHA's intent (as set forth in the preamble to the proposed rule, 63 FR 58184) that primary responsibility for processing of the operator's application for an extension will rest with MSHA's District Managers. This ensures familiarity with the mine conditions, and provides an opportunity to consult with miners as well. At the same time, MSHA recognizes that District Managers may not have the expertise required to keep fully abreast of the latest technologies and of solutions being used in similar mines elsewhere in the country. Accordingly, and again consistent with the preamble to the proposed rule, the Agency intends to establish, within its Technical Support Directorate a special panel to consult on these issues and to provide assistance and guidance to its District Managers. In the preamble to the proposed rule (63 FR 58184) the Agency requested comment on whether further specifics regarding this approach to approving applications for special extensions should be incorporated into the final rule, however, no such comments were received.

The rule specifies that a mine operator shall comply with the terms of any approved application for a special extension, and provides that a copy of the approved application be posted at the mine site for the duration of the application.

Personal protective equipment and administrative controls. In the proposal, mine operators were expressly forbidden to use personal protective equipment (*e.g.,* respirators) or administrative controls (*e.g.,* job rotation) to comply with either the interim or final dpm concentration limit. MSHA's rationale for these provisions was that limiting individual miner exposure through the use of respirators or job rotation would not reduce the airborne concentrations of dpm in the mine. Rather, in the proposal, MSHA chose to incorporate the widely accepted industrial hygiene concept of ''hierarchy of controls'' which places the highest priority on eliminating or minimizing hazards at the source through implementation of engineering and work practice controls.

The ''hierarchy of controls'' paradigm regards administrative controls and the use of personal protective equipment to be inherently inferior methods of controlling contaminant exposures in the workplace. Support for this position is virtually universal in the field of industrial hygiene. *Patty's Industrial Hygiene and Toxicology* (Vol I, General Principles) states, ''Evidence of the importance of engineering control of the work environment among the various alternative solutions to industrial hygiene problems is found in every current industrial hygiene text: all list the possible solutions in priority fashion as engineering controls, administrative controls, and as a last resort, use of personal protective equipment.'' The National Safety Council's *Fundamentals of Industrial Hygiene* states, ''Engineering controls should be used as the first line of defense against workplace hazards whenever feasible. Such built-in protection, inherent in the design of a process, is preferable to a method that depends on continual human implementation or intervention.''

This text goes on to describe administrative controls as, ''not as satisfactory as engineering controls,'' and notes that such controls ''have been criticized by some as a means of spreading exposures instead of reducing or eliminating the exposure.'' This latter statement is particularly relevant to dpm, and to carcinogens in general, because administrative controls, such as job rotation, result in placing more workers at risk. Among the reasons *Patty's Industrial Hygiene and Toxicology* recommends that a given chemical should not be controlled by administrative reduction of exposure time is that it may be a carcinogen.

In the proposed rule, MSHA prohibited administrative controls as an acceptable dpm control method because they fail to eliminate the exposure hazard and result in placing more miners at risk. Since MSHA determined that compliance with the interim and final dpm concentration limits was feasible for the underground metal and nonmetal mining industry as a whole using exclusively engineering and work practice controls, the Agency logically chose to prohibit personal protective equipment as a compliance option as well.

In the Preamble to the proposed rule, MSHA stated that it intended that the normal meaning be given to the terms personal protective equipment and administrative controls, and asked for comment as to whether more specificity would be useful. MSHA noted that it assumed the mining community understands, for example, that an environmentally controlled cab for a piece of equipment is an engineering control and not a piece of personal protective equipment.

Numerous commenters took issue with the proposal's prohibition on administrative controls and personal protective equipment as compliance options. They noted that both administrative controls and personal protective equipment are accepted industrial hygiene exposure control methods that should be permitted under the rule. Most commenters agreed that engineering controls would be the preferred option for reducing an occupational health exposure, but that engineering controls sufficient to reduce dpm concentrations below the applicable concentration limit might not be the most cost-effective approach, and more importantly, that engineering controls may not be feasible in all situations. They argued that prohibiting administrative controls and personal protective equipment would, as a result, place mine operators in an impossible compliance dilemma.

It is significant to note that the commenters did not disagree with MSHA's fundamental reasoning for using the ''hierarchy of controls'' concept as the basis for prohibiting administrative controls and personal protective equipment. Likewise, there was no direct disagreement with MSHA's endorsement of the widely accepted industrial hygiene principle that administrative controls are inappropriate in the case of exposure to carcinogens because job rotation will expose more miners to the hazard.

Rather, commenters argued that administrative controls and personal protective equipment should be permitted simply to give mine operators greater flexibility in dealing cost effectively with a workplace contaminant, and because certain situations exist where no feasible engineering control would be available to enable compliance with the concentration limit.

Regarding the question of affording greater operator flexibility, a typical commenter observed that, ''If MSHA's goal is protection of miners, in the context of a viable and profitable industry, it should encourage flexible control approaches to the control of dpm exposure, and not penalize operators for using all effective means available—including administrative controls and PPE.'' Another commenter asked MSHA to, ''reconsider the use of personal protective equipment as a cost effective solution when appropriate.'' MSHA responds to these comments by noting that it did incorporate compliance flexibility into the requirements for this rule. As noted earlier under the discussion on ''Meeting the concentration limit: operator choice of engineering controls,'' mine operators do have considerable freedom to choose the control, or combination of controls necessary to achieve and maintain compliance with the applicable concentration limit in their mines. However, this freedom is not total, particularly with respect to administrative controls and personal protective equipment. Operator flexibility, convenience, or cost effectiveness are not acceptable bases for permitting dpm control methods that are widely acknowledged to be inherently inferior to engineering and work practice controls.

Regarding the question of the feasibility of controls, several commenters argued that there are situations where engineering controls are either economically infeasible, technologically infeasible, or both. Some typical examples of these comments include a mining company that objected to, ''the Agency's continued downgrading of administrative controls and the use of personal protective equipment in favor of considerably more expensive, presently infeasible, engineering controls.'' Another commenter complained that, ''the standard must be attained with engineering controls alone,'' and that, ''personal protective equipment and other means cannot be used even where compliance with engineering controls is not feasible.'' Still another commenter observed that, ''The proposal is not [economically or technologically] feasible for metal mines * * * which are designed specifically for use of diesel equipment. In these

mining scenarios, use of electric equipment is not cost-effective, and elimination of diesel equipment would eliminate the process for which the mines were designed.''

The question of economic feasibility will be discussed separately from the question of technological feasibility. MSHA acknowledges that administrative controls or the use of personal protective equipment may be less costly than engineering or work practice controls in certain situations. However, a difference in cost between two approaches is simply that—a difference in cost. MSHA does not regard a cost difference per se as prima facia proof that an approach is economically infeasible simply because a less expensive alternative exists.

Commenters also questioned MSHA's compliance cost estimates, asserting that compliance costs will actually be much higher. MSHA's compliance cost estimates are discussed in the REA. However, in answer to this comment, MSHA determined that exclusive reliance on engineering and work practice controls are economically feasible for the underground metal and nonmetal mining industry as a whole (with the exception of the situations addressed in § 57.5050(d)). Thus, MSHA rejects the argument that administrative controls and the use of personal protective equipment should be permitted based on consideration for economic feasibility.

Regarding the question of the technological feasibility of engineering and work practice controls, the high number of comments addressing this issue suggested that the underground metal and nonmetal mining industry considered it to be of vital importance. Despite their number, however, none of these comments identified specific equipment or mining situations where exclusive reliance on engineering or work practice controls to achieve and maintain compliance with the applicable dpm concentration limit would be impossible due to technological infeasibility.

In the preamble to the proposed rule, MSHA provided extensive information on how mine operators might use a computer program known as the ''Estimator'' to conduct assessments of controls that might be necessary to deal with problems in individual mines, and requested comments based on such specific information. The comments that were received were critical of the ''Estimator'' because it produces an estimate of average dpm concentration in a given area, not the specific concentration that might exist at a specified sampling location; and because its accuracy depends on the quality of the input data, which is suspect due to the perceived inherent inaccuracy of the dpm sampling methods which must be used to obtain the input data.

Regarding the first criticism, MSHA notes that the average dpm concentration in a given area, which is the output obtained from the ''Estimator,'' is a more accurate indicator of the potential dpm hazard than a specific concentration that might exist at a specified sampling location. Since compliance is based on a shift weighted average concentration produced by diesel equipment that is normally in constant motion throughout the shift, the average dpm concentration in a given area is a better predictor of compliance or noncompliance than a determination of specific concentration that might exist at a specified sampling location. It might also be advisable to consider relocating a miner who, by virtue of their specific work location, is thought to be at risk of being exposed to a concentration of dpm that is greater than the average for that area (for example, move the miner from being in the direct line of the exhaust stream). Finally, MSHA notes that the ''Estimator'' is just that, a means of *estimating* dpm concentration. It was never claimed that this model could predict dpm concentrations with pinpoint accuracy. However, in verification testing of the model, MSHA has observed good agreement between predicted and measured dpm concentrations (as discussed in part II, section 3 of this preamble).

Regarding the second criticism, MSHA notes that users have the option of inputting actual dpm data, or estimating such values. If users desire to input in-mine measurements of dpm concentrations, MSHA is confident that dpm sampling and analysis using the NIOSH Method 5040, as described elsewhere in this preamble, will accurately represent actual dpm concentrations.

Nonetheless, MSHA reevaluated the feasibility of engineering and work practice controls as the exclusive means of complying with the applicable dpm concentration limits. This reevaluation identified potential compliance problems related to performing certain inspection, repair, and maintenance work if only engineering and work practice controls were permitted as means of achieving compliance. Therefore, the Agency has adjusted the final rule to allow such work, when sufficiently justified and preapproved by the Secretary, to be performed using personal protective equipment as a supplement to engineering and work practice controls. But apart from these very limited situations, the Agency has concluded that the use of engineering controls to meet the concentration limit is both economically and technologically feasible for the underground mining industry as a whole, and in light of the health risks to miners, and the superiority of engineering controls, the Agency has concluded that they (and not PPE or administrative controls) must be utilized to meet the concentration limit.

57.5061 Compliance Determinations

Summary. This section of the final rule establishes the criteria for determining compliance with the concentration limits. It has three subsections.

Subsection (a) provides for compliance sampling to be performed by MSHA directly, requires that such compliance sampling be done in accordance with the other requirements of this section, and further provides that a single such sample will be adequate to establish a violation. This is consistent with the proposed rule.

Subsection (b) provides that MSHA will collect dpm samples using a respirable dust sampler equipped with a submicrometer impactor, and analyze such samples for the amount of total carbon (TC) using NIOSH Method 5040 (or by using any method of collection and analysis subsequently determined by NIOSH to provide equal or improved accuracy for the measurement of dpm in underground metal and nonmetal mines). This is like the proposed rule except that the final rule explicitly requires a submicrometer impactor to be used in collecting all dpm compliance samples in underground metal and nonmetal mines.

Subsection (c) provides for MSHA inspectors to determine the appropriate sampling strategy for compliance determinations—personal sampling, occupational sampling, or area sampling—based on the circumstances of the particular exposure or exposures to be evaluated. This provision was not explicitly stated in the proposed rule; it was, however, stated in the preamble to the proposed rule as MSHA's intent. The final rule makes explicit MSHA's discretion in this regard.

As discussed in more detail in Part II, section 3, an important factor in the agency's decision as to which sampling practice to utilize in a particular situation, and how the sampling should be conducted (*e.g.,* how far away from a smoker or source of oil mist), is a careful review of other sources of total carbon in the environment to be

sampled which could cast doubt on whether the sample result was based solely on the amount of dpm present. MSHA will provide guidance in this regard to metal and nonmetal inspectors and the mining community—based on the information noted already in Part II, section 3 of this preamble, such new information as may be developed, and continued experience in this regard—so as to avoid wasting the limited resources of the Agency and its counsel, the Mine Safety and Health Review Commission, and the underground metal and nonmetal mining community by taking compliance samples whose validity is questionable.

Numerous comments were received on this section—addressing the validity of single samples for determining compliance with an occupational health standard; the accuracy, precision, appropriateness, and practicality of using the NIOSH Method 5040 for determining dpm concentrations for enforcement purposes; and the legitimacy of using area sampling to determine compliance with a health standard. These comments, and MSHA's response to them, are discussed below.

Single sample compliance determination. Pursuant to § 57.5061(a), a single dpm sample showing that the applicable TC concentration limit has been exceeded on any individual shift will constitute a citable violation. Such a violation will also trigger further action pursuant to § 57.5062, as discussed below in connection with that section.

As is standard practice with other health compliance measurements, MSHA intends to account for normal variability in the sampling and analytical process by allowing a margin of error in the sampling result before issuing a citation. This margin of error will be based on the accuracy of the sampling and analytical method (Method 5040) used to measure the total carbon (TC) concentration in the mine environment, after correcting for potential interferences.

The variability associated with Method 5040, as expressed by the relative standard deviation (RSD), decreases with increased load on the filter. Based on a laboratory experiment, NIOSH has determined that, at a TC concentration as low as 23 $\mu g/m^3$, the variability associated with an 8-hour sample using Method 5040 and a pump flow rate of 2.0 L/min is approximately 8.5 percent. (NIOSH Manual of Analytical Methods, Method 5040, Issue 2, 1998)

MSHA will issue a citation for exceeding the applicable concentration limit only when such a citation can be issued at a confidence level of at least 95 percent. Each measurement made for purposes of compliance determination may be adjusted, if necessary, to compensate for any expected biases due to interferences such as tobacco smoke and oil mist. To account for sampling and analytical variability associated with Method 5040, the adjusted measurement will then be compared to the appropriate level established in § 57.5060 multiplied by an ''error factor.'' The error factor will be calculated so as to achieve the required 95-percent confidence that a violation has actually occurred. Based on the standard normal distribution for measurement errors, this will be 1 + 1.645 times the variability of the sampling and analytical method, as expressed by its RSD.

For example, assuming the 8.5-percent limit on the RSD established by NIOSH under laboratory conditions, the error factor would be $1 + 1.645 \times .085 = 1.14$. Suppose MSHA takes a sample during the interim period when the limit is 400_{TC} $\mu g/m^3$. Then, if expected interferences are negligible, MSHA would cite noncompliance only if the TC measurement exceeded $1.14 \times 400 = 456$ $\mu g/m^3$.

MSHA recognizes that measurement uncertainty may be higher for samples collected under mining conditions than under laboratory conditions. Therefore, MSHA intends to base the margin of error required to achieve a 95-percent confidence level for all noncompliance determinations on samples collected under field conditions. The Agency anticipates that the sampling and analytical error factor will be somewhere between 1.1 and 1.2. The Agency will, however, be governed by the actual data obtained to establish an appropriate margin of error.

Several comments were received regarding the value of the error factor for dpm sampling using NIOSH Method 5040. One commenter asserted that it will be impossible to establish a meaningful error factor, stating, ''* * * there is insufficient information available to quantify the margin of error with any level of certainty.'' Another commenter expressed confusion with respect to the various ways in which measurement uncertainty was quantified in the proposal. This commenter argued as follows:

> MSHA states on page 58116 that the 5040 Method meets NIOSH's accuracy criteria that measurements come within 25% of the concentration at least 95% of the time. This standard is for a known particle size distribution in a laboratory setting, not a mine environment. Then on page 58184 states that, ''the variability associated with the Method 5040 to be approximately 6% (one relative standard deviation)''! These do not compare! Then it states MSHA will issue a citation if the measured value was 10% over the established level! There is a contradiction somewhere in the MSHA proposal—how can MSHA take 25% NIOSH laboratory criteria and shrink it to 6% in a mining environment?

This commenter has apparently misunderstood the NIOSH Accuracy Criterion. Any unbiased method for which the RSD is known to be less than 12.75 percent meets the criterion, because any RSD less than 12.75 percent implies (assuming no measurement bias) that measurements will come within 25 percent of the true value at least 95 percent of the time. An RSD of 6 percent meets the NIOSH accuracy criterion, simply because 6 percent is less than 12.75 percent. In order to achieve 95-percent confidence that a specific measurement demonstrates noncompliance, a 6-percent RSD would, nevertheless, have to be multiplied by a 1-tailed 95-percent confidence coefficient of 1.645, yielding the 10-percent adjustment to which the commenter was referring. Therefore, these quantities are internally consistent. As stated earlier, however, MSHA intends to base its estimate of the RSD on data appropriate for field conditions in underground mining environments.

Another commenter suggested that the NIOSH Method 5040 is prone to excessive errors because it is ''complex and requires highly skilled technicians.'' The inherent capacity of the method to produce accurate results was criticized by one commenter who stated, ''* * * it is not possible to evaluate the accuracy of the method. In fact, the method has been shown to produce massive errors when side-by-side samples and control filters are analyzed. Even blank filters produce high and widely-varying readings for TC.''

Based on MSHA's extensive experience using NIOSH Method 5040 and related sampling practices, the Agency is confident that such sampling and analysis will meet or exceed MSHA's accuracy criteria. This is discussed in detail in Part II, section 3, and later in this section under ''Using NIOSH Method 5040 for compliance determinations.''

Regarding the issue of uncertainty in the sampling and analytical process for field measurements, MSHA has not yet completed its determination of an appropriate error factor for this method. As noted above, MSHA will determine an appropriate factor and apply it when enforcing the applicable compliance

limit. As a matter of general practice, however, the Agency does not include error factors in occupational health rules, since the accuracy of measurement methods may change over time. When this determination is made, the error factor, along with its derivation, will be promptly communicated to the underground metal and nonmetal mining industry through the appropriate channels.

MSHA recognizes that in recent years courts have closely scrutinized Agency actions to ensure they are consistent with the requirements of the Administrative Procedures Act and, in MSHA's case, with the requirements of the Mine Safety and Health Act as well. Courts have held that certain actions, traditionally regarded as enforcement policies issued at an agency's discretion, require notice and comment and even the development of feasibility analyses. MSHA has carefully considered its obligations in light of these precedents and has concluded that the determination of a margin of error to be allowed before issuing a citation remains among the type of actions left to Agency discretion. To require the Agency to go through rulemaking each time such an error factor is established or updated based upon improved sampling or analytical methods would not serve the best interests of the mining community. Therefore, MSHA wishes to emphasize that the Agency does not regard the determination of an appropriate margin of error as a necessary part of this rulemaking, but rather as strictly a matter of enforcement policy. As noted explicitly in the rule, the Agency is retaining discretion to switch to better techniques should NIOSH certify that they provide ''equal or improved accuracy for the measurement of diesel particulate matter in'' underground metal and nonmetal mines. (§ 57.5061(b))

Notwithstanding its decision not to be explicit in this standard about the error factor to be used, MSHA recognizes the strong interest the underground metal and nonmetal mining community has in this issue and will ensure the matter is fully discussed with that community before the concentration limits are scheduled to go into effect. In working with this community on diesel particulate matter controls (see the history of this rulemaking in Part II of this preamble), the Agency has repeatedly demonstrated its commitment to good communications in this regard—*e.g.,* the workshops, the advance and final circulation of the diesel toolbox, the use of the Agency's web site and direct notification in appropriate cases.

As explained elsewhere in this preamble, MSHA has determined that it is feasible for underground M/NM mines to maintain dpm concentrations at or below the limits specified in § 57.5060 on each and every shift, everywhere that miners normally work or travel, with the exception of the circumstances defined in § 57.5060(d). Therefore, MSHA will protect miners' health to the maximum extent feasible by citing a violation whenever a single sample demonstrates that the limit has been exceeded on a full shift at any appropriate sampling location. This single-sample enforcement strategy is consistent with all other occupational health enforcement practices in the metal and nonmetal sector. As per long-standing policy in this sector, single out-of-compliance samples for dust (*e.g.,* silica-bearing respirable dust, total nuisance particulate, etc.), gas (*e.g.,* CO, NO_2, solvent vapors, etc.), mist (*e.g.,* cutting oil mist, spray paint, etc.), fume (*e.g.,* welding fumes, fumes from melting furnaces, etc.), and noise are all considered citable violations of the respective standards. Nevertheless, the Agency decided it would be best, in this rulemaking, to avoid any possible ambiguity in this regard by explicitly stating in the rule itself that a single sample by the Agency would provide the basis for a citation. MSHA highlighted this matter in the preamble of its proposed rule (63 FR 58117, part of Question and Answer 12).

Some commenters suggested that MSHA should collect numerous samples and base noncompliance determinations on the average value of all samples collected. These commenters argued that a single sample is not a statistically valid representation of the subject's ''typical'' or ''normal'' exposure to the contaminant. The commenters noted that a single sample, if taken on a randomly selected work day, could result in an unusually high measurement (unusual with respect to a ''typical'' or ''normal'' day). Therefore, a single sample could give rise to a noncompliance determination, even if the environment being sampled is in compliance on most shifts. These commenters contended that such a sample was ''unrepresentative'' of typical exposure concentrations and should not, therefore, be used as a basis for a noncompliance determination.

MSHA recognizes that the day-to-day exposure of a miner will not be constant and that on some days the sample collected over a single shift may be lower than the miner's long term average and on other days higher. However, MSHA has several compelling reasons for considering noncompliance on any individual shift to be a citable violation of the dpm concentration limit.

First, MSHA has identified significant risks associated with short-term dpm exposures (i.e., exposures over a 24-hour period). As documented in Part III of this preamble, adverse health effects associated with short-term exposures include (1) acute sensory irritations and respiratory symptoms (including allergenic responses) and (2) premature death from cardiovascular, cardiopulmonary, or respiratory causes. These risks alone would fully justify enforcing the concentration limits established in § 57.5060 on each and every shift.

Second, the concentration limits that MSHA has established are not expected to fully protect miners from these risks or from the excess risk of lung cancer associated with chronic dpm exposure. Instead, they are based on what can be feasibly achieved at this time to control dpm. By requiring compliance with the concentration limit on each shift measurement, it is MSHA's intent to protect miners to the maximum extent feasible.

Third, it is not MSHA's objective, when sampling for compliance determination purposes, to estimate average dpm concentrations for any period greater than the shift sampled or for any mine location other than the location sampled. Some commenters confused the objective of estimating cumulative exposures for purposes of risk assessment with the objective of limiting cumulative exposures for purposes of risk management. MSHA's objective is to limit exposures to protect miners against both short- and long-term effects. It is not practical for MSHA to track miners' cumulative exposures over an occupational lifetime. Therefore, as a practical matter of enforcement policy, MSHA can best protect miners from both the health risks associated with acute exposures and from the excess lung cancer risk due to chronic dpm exposure by limiting exposure on each shift wherever miners normally work or travel.

In addition, MSHA wants to emphasize that compliance limits in the metal and nonmetal sector, whether personal exposure limits or concentration limits, apply to every individual work shift. Every full-shift exposure, not just the typical, or ''average'' exposure, must be in compliance with the limit. Basing compliance on the typical, or ''average'' shift would permit frequent or sustained exposures to the contaminant at concentrations significantly higher than the compliance limit.

Although MSHA's dpm compliance limit was not derived from any corresponding ACGIH TLV©, the explanation of the proper interpretation and application of TLV©'s provided in the 1999 TLV©'s and BEI©'s booklet (American Conference of Governmental Industrial Hygienists, 1999), is relevant to this discussion. Compliance limits are specifically intended to be applied over a conventional eight-hour work day and forty-hour workweek, and not to the average exposure received during a series of consecutive work shifts or workweek. Although an allowance is made in some instances for calculating exposures on the basis of a workweek average concentration, MSHA believes such an exception should not apply to dpm because of (1) the seriousness of associated health risks (such as lung cancer and premature death from cardiovascular, cardiopulmonary, or respiratory causes) and (2) the significant risk of adverse health effects associated with short-term exposures).

The only circumstance in which a single, out-of-compliance sample would not be used as the basis for a non-compliance determination is if the sample itself were considered invalid; for example, an inspector following an improper sampling procedure. MSHA is of course concerned primarily with the health and safety of miners so the magnitude of any citation for a single out-of compliance sample will take into account the actual risk posed to miners.

MSHA's policy on health inspections requires inspectors to rigorously follow established sampling procedures to ensure the validity of samples collected. As a practical matter, MSHA will not sample for diesel particulate at the tailpipe of any diesel powered equipment in metal and nonmetal underground mines. As discussed below, MSHA's sampling strategy for determining operator compliance is established in paragraph (c) of Section 57.5062. That section specifically states that MSHA will conduct personal sampling, occupational sampling, and/or area sampling, depending upon the circumstances of the particular exposure. Because MSHA has an environmental exposure limit, MSHA is interested in obtaining the level of diesel particulate in the environment where miners normally work or travel. In the alternative, MSHA may conduct personal sampling where circumstances necessitate it. For example, if a mine operator has a miner working inside a cab and there are no other workers in that area working outside the cab, MSHA will conduct personal sampling of the cab operator and not conduct environmental sampling outside the cab in the same area of the mine. Moreover, MSHA's sampling would be conducted inside the cab rather than outside the cab. On the other hand, if there are miners working outside the enclosed cab, MSHA will sample the environment to determine the level of exposure to dpm for these miners. Also, if an operator has a miner who is operating a shuttle car, and that miner is replaced by another miner during that shift, MSHA intends to place the sampler on the shuttle car in the vicinity of the miner and not at the tailpipe. However, in no case will area sampling be performed closer than five feet to a piece of operating diesel equipment, and no tailpipe sampling will be performed to determine compliance with any concentration limit.

Among other precautions, sampling equipment is maintained and operated in strict accordance with manufacturer recommendations, and pumps are calibrated before and after samples are collected. Sampling media are blank-corrected, and all laboratory handling and analytic procedures are in accordance with AIHA laboratory certification. Sample integrity is ensured through chain-of-custody seals. If any breach in procedure occurs, all affected samples are invalidated.

In order to assure compliance with the limit, mine operators need to implement controls sufficient to ensure that the entire range of concentration values is always safely below the compliance limit. The purpose of both MSHA sampling and mine operator monitoring is to verify, on an on-going basis, that this limit is always met on every shift.

When mine operators implement effective engineering controls, the range of the concentration values becomes narrower so that once control of dpm is demonstrated, it is unlikely that the concentration limit will be exceeded.

MSHA believes the same justification for determining noncompliance based on a single sample applies to dpm as to other contaminants and noise. Therefore, MSHA has retained the provision permitting a noncompliance determination to be based on a single sample.

Using NIOSH Method 5040 for compliance determinations. Pursuant to paragraph (b) of section 5061 of the final rule, MSHA will collect dpm samples for compliance using a respirable dust sampler equipped with a submicrometer impactor, and analyze such samples for the amount of total carbon using NIOSH Method 5040 (or by using any method of collection and analysis subsequently determined by NIOSH to provide equal or improved accuracy) for the measurement of dpm in underground metal and nonmetal mines. As noted above, this is like the proposed rule except that the final rule explicitly requires that a submicrometer impactor be used in collecting all dpm compliance samples in underground metal and nonmetal mines.

Section 3 of part II of this preamble discusses alternative methods for measuring dpm concentrations, and reviews the many comments MSHA received on this topic. As noted in that discussion, methods other than NIOSH Method 5040 do not at this time provide the accuracy required to support compliance determinations at the concentration levels required to be achieved under this rule. Moreover, after a careful review of the comments and hearing record, the available technical information submitted in response to MSHA's proposed rule, and the results of studies performed by agency experts to ascertain the veracity of those comments and submissions, MSHA has determined that NIOSH method 5040 provides an accurate method of determining the total carbon content of a sample collected in any underground metal or nonmetal mine when a submicron impactor is used with the otherwise prescribed sampling procedure, and when sampling strategies avoid sampling under circumstances that could compromise the integrity of the analytical process. Accordingly, MSHA will use this method for determining TC concentrations for compliance purposes, and the rule has been specifically amended to require that such samples be taken with a submicron impactor.

As indicated in the discussion of the proposed rule (p. 58129), utilizing the submicron impactor—a device that limits particles entering the sampler to those less than 0.9 micron in size when operated at a flow rate of 1.7 LPM—does cause a reduction in the amount of dpm that can enter the sampler, since some dpm is larger than 0.9 microns. Thus, in making this amendment, MSHA recognizes that underground metal and nonmetal miners will be exposed to more dpm than will be ascertained by these compliance measurements. However, for the reasons noted in section 3 of Part II, MSHA has determined that requiring use of the impactor is the only way to ensure that certain potential interferences (sources of total carbon other than dpm) are avoided at this time. Thus, to ensure the integrity of the sampling method, the agency has determined that it must use such an impactor.

One commenter suggested that, in addition to basing concentration limit compliance determinations on samples collected pursuant to § 57.5061, samples collected and analyzed in accordance with § 7.89 should also be used as a basis for compliance determinations. Section 57.5061 is the compliance determination for the ambient concentrations in the mine. Based on the ventilation being supplied, the number of engines being used, the condition of the engines, the duty cycle of the machines, the sample will show if the mine is in compliance with the dpm standard. Section 7.89 is the laboratory test for the diesel in engine in the lab to measure the raw dpm from the engine. The § 7.89 test data is used to calculate the particulate index for a single engine. Section 7.89 data can give the mine operator an idea of the dpm being emitted from the single engine and can use this data in the ''Estimator'' to calculate an estimated dpm ambient concentration. However, as explained elsewhere in the preamble, this is an estimate to set up proper ventilation when adding other pieces of equipment or deciding on which engine to buy. The section 7.89 dpm concentration does not take into account the duty cycle of the engine. Section 7.89 tests all engines on a specific test cycle. Section 7.89 test data can only be used to estimate dpm, cannot be used to know exactly what the concentration is in a mine at any given time. The test in 57.5061 is used for that determination. MSHA believes this procedure is inappropriate for determining compliance with the concentration limits and provision for doing so has not been included in the final rule.

Sampling strategy—personal, occupational, and area sampling. Subsection (c) of section 5061 provides for MSHA inspectors to determine the appropriate sampling strategy for compliance determinations: personal sampling (attaching a sampler to an individual miner within the miner's breathing zone), area sampling (sampling at a fixed location where miners normally work or travel), or occupational sampling (locating the sampler on a piece of equipment where a miner may work).

Personal sampling is well understood in the metal and nonmetal sector because it is commonly used by MSHA to determine compliance with TLV©'s for silica-bearing respirable dust, welding fumes, and other airborne contaminants. Area sampling is less well known in this sector, but it is used by MSHA for compliance determinations in some situations, such as where miners are exposed to a contaminant having a ceiling limit. Occupational sampling is not well known in the metal and nonmetal sector because it is not currently used by MSHA for compliance determinations in this sector. However, MSHA does employ occupational sampling in the coal sector for compliance determinations.

Occupational sampling is a method which measures the exposure of an occupation to a given contaminant, as opposed to personal sampling, which measures the exposure of an individual, or area sampling, which measures the contaminant concentration at a fixed location throughout the working shift. All three methods determine contaminant concentration on a shift weighted average basis (see previous discussion of ''Concentration limit expressed as an average eight hour equivalent full shift airborne concentration'' under § 57.5060). In occupational sampling, a full-shift sample is collected from the working environment of the occupation. The sampling apparatus (sample pump, size selection devices, sample filter, etc.) remains in the environment of the work position being sampled rather than with the individual miner, even when miners change positions or alternate duties during the shift.

A very common example of where occupational sampling would be the appropriate sampling method is where the sampling objective is to determine the full shift exposure of the operator of a particular piece of equipment, but where two or more individuals alternate operating the equipment. Personal sampling would capture both the exposure received while the equipment is being operated, as well as the exposure received while performing other duties. Area sampling would be limited to measuring the contaminant concentration in the general area where the equipment is operated, but would not capture the operator's exposure. In this example, occupational sampling, with the sample apparatus remaining in the cab or operator's compartment of the equipment throughout the shift, would be the only sampling method that could satisfy the sampling objective.

As noted above, the provision for utilizing either personal sampling, area sampling, or occupational sampling was not explicitly stated in the proposed rule. It was, however, clearly stated in the preamble to the proposed rule as MSHA's intent; indeed, a specific Question and Answer was devoted to the topic. (63 FR 58117, Question and Answer 14; the topic is further explored at 63 FR 58185). Moreover, in explaining its adoption of a ''concentration limit'', MSHA noted that its intention was to emulate the approach taken with coal mine dust, where inspectors have similar discretion (63 FR 58184) in the preamble to the proposal). Accordingly, the mining community was fully informed in this regard. The topic was the subject of considerable discussion at the hearings and received considerable comment.

After evaluating the comments, and reviewing the verification data on possible interferences discussed in Part II of this preamble, MSHA determined that its proposed position in this regard should be explicitly incorporated into the final rule. At the same time, as a result of the comments, the Agency has refined its thinking as to when various types of sampling would be appropriate. The Agency will provide further information in this regard in its compliance guide, but is using this opportunity to inform the underground metal and nonmetal mining community of its current views on how it will initially approach this matter.

Numerous commenters expressed concern about the proposed rule's provision for using either personal sampling or area sampling for determining compliance with the concentration limit for dpm. They pointed out that area sampling was a departure from previous enforcement practice in metal and nonmetal mines. They also questioned whether it was appropriate to use area sampling to determine compliance when there may be no one exposed (or very limited miner exposure) to dpm at the time and in the location where the area sample is taken, as well as in situations where miners work in enclosed cabs with filtered breathing air, and in other areas where engineering controls are not feasible. One commenter also argued that sampling at a fixed location (area sampling) and then equating the results with a personal exposure was invalid.

Commenters also asserted that the superiority of personal sampling for quantifying worker exposures is a commonly accepted industrial hygiene principle. Some commenters noted that in underground mines which use mobile diesel equipment, the positions of diesel-powered vehicles with respect to intake and return air streams vary from hour to hour. Therefore, they asserted, it is virtually impossible to obtain meaningful information from stationary instruments. One commenter stated that area sampling was appropriate as a screening tool to determine whether personal sampling would be warranted, or to evaluate the effectiveness of controls, but that it

should not be used to determine compliance with a mandatory limit.

In responding to these comments, MSHA would like to emphasize to the metal and nonmetal mining community, as it did in the preamble to the proposed rule, that while the concept of a concentration limit is new for this sector, it is a well established concept in the mining industry, and has been implemented for many years with respect to coal dust. Questions about whether a particular sampling method are appropriate in a given situation have been raised and resolved many times.

Moreover, the courts have upheld MSHA's use of area sampling for enforcing compliance. In a 1982 decision (*American Mining Congress* v. *Secretary of Labor,* Nos. 80–1581 and 80–2166), the U.S. Court of Appeals, Tenth Circuit ruled that the decision to employ area sampling for respirable dust compliance determinations was a reasonable exercise of MSHA's discretion and authority. The court stated:

''Nothing in the record supports the conclusion that either type of sampling provides a perfect measure of exposure to respirable dust. Since there is no perfect sampling method, the Secretary has discretion to adopt any sampling method that approximates exposure with reasonable accuracy. The Secretary is not required to impose an arguably superior sampling method as long as the one he imposes is reasonably calculated to prevent excessive exposure to respirable dust. On this record, the difference between area and personal sampling is not shown to be so great as to make Secretary's choice of an area sampling program irrational. Keeping in mind that our task is not to determine which method is better, we hold that the Secretary's choice of area sampling over personal sampling is not legally arbitrary and capricious.''

''We are not unmindful that area sampling may effectively require lower dust levels than might be required under a personal sampling program.''

''The fact that in theory the regulation may require operators to maintain a dust level below [the limit] in its person-by-person impact does not render the regulation arbitrary and capricious. We repeat that all proposed sampling methods are less than perfect and are designed to provide only estimates of actual exposure. Since measurement error is inherent in all sampling, the very fact that Congress authorized a sampling program indicates that it intended some error to be tolerated in enforcement of the dust standard. The method selected by the Secretary, while perhaps more burdensome in its impact on mine operators than other methods, is not beyond the scope of his discretion.''

In addition to affirming MSHA's discretion to employ area sampling on the basis that it can be ''reasonably calculated to prevent excessive exposure,'' the court also observed that area sampling can be considered superior to personal sampling for enforcement purposes:

''The area sampling program has several advantages over a personal sampling program. The most important advantage is that area sampling not only measures the concentration of respirable dust, it allows identification and thus control of dust generation sources. Control of dust at the source will obviously contribute to reducing the level of personal exposure. By contrast, the results of personal samples do not allow identification of dust sources due to the movement of miners through various areas of the mine during the course of a working shift. Thus, while a personal sampling system makes possible the identification of discrete individuals who have been overexposed, it does nothing to ensure reduction of dust generation because the source of the dust cannot be determined. Therefore, it clearly appears that area sampling can rationally be found to be superior to personal sampling as a means of enforcing (as opposed to merely measuring) compliance with [the standard].''

Although this decision relates specifically to respirable dust, it is clear that the Court of Appeals did not find that area sampling is inherently unreliable. Moreover, the logic expressed by the Court in describing the application of area sampling to respirable coal mine dust applies equally to dpm. Both are solid particulates that are produced from discrete sources during mining and are transported via the mine's ventilation system and inhaled by miners.

Accordingly, the fact that some in the metal and nonmetal sector, or some not engaged in mining at all, may not be familiar with this approach does not make it invalid or inappropriate.

Implementation by MSHA of its discretion. For the reasons noted above, MSHA has determined that personal sampling, occupational sampling, and area sampling are all viable sampling methods, and that inspectors should have the discretion to utilize whichever sampling strategy is appropriate in a given situation to determine compliance with the concentration limit for dpm. Accordingly, all three approaches are permitted in the final rule.

The Agency will provide further information about how these approaches should be used for dpm sampling in its compliance guide; however, it is using this opportunity to inform the underground metal and nonmetal mining community of its current views on some common situations.

For example, one commenter noted that an area sample could be taken adjacent to where a piece of diesel equipment was accelerating at low RPM, which is the time that an engine is working at its lowest efficiency. This commenter expressed concern that such a sample could indicate that the applicable dpm concentration was exceeded, even though the duty cycle as a whole for that equipment might be in compliance. MSHA believes this situation shouldn't result in a violation, because such an area sample would be taken for an entire shift, not just for the short time period when the piece of diesel equipment passes by the sampler.

Moreover, MSHA recognizes that it would not provide an accurate measure of the concentration of dpm to place a sampler in the area immediately around a machine's tailpipe when no workers would be in that location for any great length of time. An area sample would not be taken in that manner. But if a worker were assigned to work in a location on or immediately adjacent to diesel equipment, a personal or occupational sample might well be appropriate to determine if the limit is being exceeded for that worker or for such occupation.

Similarly, the agency would not consider it appropriate to conduct area sampling for compliance determinations in areas where dpm exposures, if any, would be infrequent and brief; in areas where miners work exclusively inside enclosed cabs; and in shafts, inclines, slopes, adits, tunnels and similar workings that are designated as return or exhaust air courses and that are also used for access into, or egress from an underground mine.

Examples of the first situation would be work areas that are visited infrequently and briefly, such as a remote pump that needs to be checked weekly, or a remote area where roof conditions need to be inspected at periodic intervals. These areas would clearly be subject to the concentration limit because miners ''normally work or travel'' there. Area sampling in such areas would be inconsistent with the regulation's intent to, '' * * * limit the concentration of [dpm] to which miners are exposed * * *,'' because exposure would occur for only a few minutes per week, or possibly less.

Examples of the second situation would be production areas or haulageways where the only miners present work inside of enclosed and isolated cabs with appropriate filtration of breathing air, and underground crushing stations where crusher operator booths or similar fixed structures are provided with appropriately filtered breathing air. Area sampling outside such cabs or structures, which would have been permitted under the proposed rule,

would be inconsistent with the regulation's intent to, '' * * *limit the concentration of [dpm] to which miners are exposed * * *,'' because miners in these areas are not exposed; they are already protected by an accepted engineering control. This approach is consistent with MSHA's intent as stated in the preamble to the proposed rule (63 FR 58184). It also reflects MSHA's awareness that enclosed cabs may provide many other important health and safety benefits, such as reducing noise exposure and reducing exposure to silica bearing respirable dust.

However, as a result of the comments concerning whether NIOSH method 5040 can effectively be used to determine compliance when miners are smoking, the agency recognizes that it faces a particular difficulty in sampling miners when they smoke inside an enclosed cab or booth, whether such sampling is area, occupational, or personal. As noted in Part II, section 3, MSHA has verified that sampling using NIOSH method 5040 immediately adjacent to smokers can undermine the validity of the sample result—since some of the total carbon detected may be from the smoke). While MSHA can generally avoid this problem by not sampling immediately near smokers, as discussed in that section of this preamble, it does face a problem when the area to be sampled is an enclosed cab or booth: it can neither sample inside nor outside an enclosed cab or booth if the subject miner smokes. The Agency intends to address this problem by obtaining the concurrence of the miner not to smoke while sampling the environment of the cab.

MSHA is troubled that, under certain circumstances, it will need to rely on miners voluntarily refraining from smoking in order to perform compliance sampling for dpm. Since miners are usually free to choose to smoke if they wish, this need to rely on the voluntarily cooperation of miners could seriously limit the agency's ability to sample when and where it desires. Though MSHA has determined that sampling of nonsmokers would usually be unaffected by the presence of smokers elsewhere in the mine, there will be situations where sampling of a specifically targeted area, occupation, or person would be prevented due to the presence of a smoker at that immediate location. Therefore, MSHA intends to continue to search for a means to reliably measure dpm concentrations despite the presence of cigarette, cigar, and pipe smoke in close proximity to the sampling equipment.

As noted in Part II, section 3, MSHA has determined that samples analyzed only for elemental carbon are unaffected by the presence of cigarette smoke. At this time, however, MSHA cannot limit its analysis to elemental carbon, because no consistent quantitative relationship has been established between elemental carbon concentration and the concentration of whole dpm.

MSHA intends to implement any newly developed sampling procedure and/or analytical method that is capable of directly or indirectly measuring the concentration of whole dpm in the presence of cigarette, cigar, and pipe smoke, provided such procedure and/or method is determined by NIOSH to provide equal or improved accuracy compared to the NIOSH Method 5040. If MSHA decides that such a change in sampling procedure and/or analytic method should be adopted, the agency will utilize standard communication channels to provide specific notification of its intention in this regard to the underground metal and nonmetal mining industry. However, MSHA wishes to be clear that, in accordance with § 57.5061(b), implementing such a change does not require new rulemaking.

Examples of the third situation include return or exhaust air courses that are shafts, inclines, slopes, adits, tunnels, etc. which terminate on the surface, but which are also used for mine access or egress by mine personnel.

Since the purpose of a return or exhaust air course is to collect and remove contaminated air from the mine, one would expect such an air course could contain high dpm levels. However, being a major travelway, one would naturally consider them to be areas ''where miners normally work or travel.'' As miners travel into the mine at the beginning of the shift and out of the mine at the end of the shift through these mine openings, relatively brief exposures to potentially high dpm levels could be expected. Full shift area sampling in such a location would likely indicate dpm levels in excess of the concentration limit. Should area sampling in such an air course result in a determination of noncompliance (which would be highly likely), the mine operator would be required to implement a change of some kind to bring the area into compliance, such as requiring that miners use a different access to the mine that is an intake or neutral air course, or that the ventilation system would need to be changed so that the access in question is no longer a return or exhaust air course. Since neither of these options may be feasible, the operator would be placed in an impossible compliance situation.

In such situations, MSHA believes that it would not be appropriate to use area sampling; rather, personal sampling would be more appropriate. Personal sampling would capture the exposure as miners travel into the mine at the beginning of the shift and depart at the end of the shift. Since the exposure time is brief, overexposure on a full-shift basis would be unlikely (assuming dpm levels in the working places are in compliance). Also, since exposure time is brief, the health risk associated with the exposure would be minimal.

It should be noted, however, that miners whose jobs require them to spend significant periods of time in these areas would continue to be at risk of overexposure if the dpm levels are high. For example, a haulage truck driver that spends much of the shift driving in and out of the mine through exhaust air hauling material to a surface dump point or crusher may need to be protected with an enclosed cab that is provided with filtered breathing air. Personal sampling on miners who engage in such activities would reveal the problem.

Another situation requiring clarification as to MSHA's intended compliance sampling procedures concerns miners who perform multiple work tasks during a shift. If a miner's work on a given shift includes a task or tasks for which the sampling procedures would not provide an accurate measurement of the dpm, MSHA would not use that measurement for the basis of a compliance determination. An example would be a miner who begins the shift operating a diesel-powered loader, and who finishes the shift operating a jack leg drill equipped with an in-line oil bowl. While operating the loader, MSHA would consider a personal or occupational sampling procedure to be acceptable for obtaining an accurate measurement for compliance purposes. However, as noted in Section II, MSHA would not consider personal or occupational sampling to be acceptable for sampling a miner who is operating a jack leg drill equipped with an in-line oil bowl, because there is the potential that oil mist emitted from the drill may be collected on the sample filter causing an inaccurate measurement of dpm to be made.

In this case, full shift area sampling would be performed at a location where the oil mist would not interfere with the measurement of dpm. If the drilling operation takes place in a different location from the loading operation (a different stope, for example), MSHA would consider full shift area sampling in both locations, if appropriate.

However, if no source of dpm is present at the drilling location, the inspector would probably choose to sample only the location where the loader is operating.

The agency considered whether it would be appropriate to deal with these situations through an amendment of the rule, and decided this would not be appropriate. The specific facts in a specific situation should determine the appropriateness of the sampling approach; trying to lock down this situation or that in the rule would prove very complex and restrict the flexibility to react to developments in the industry. The rule reserves to MSHA the flexibility to adjust the use of sampling approaches for any situation where use of one or another method might not be appropriate.

At the same time, the Agency wishes to make it clear that in putting explicitly into the rule that the Agency can use any of the three methods specified, it intends by that action to ensure that any policy that would broadly restrict the use of one or another of these methods would have to be the subject of new rulemaking. Thus, for example, any policy to significantly restrict the use of area sampling to enforce compliance with this rule would have to be the subject of new rulemaking action, as the availability of that method was a key consideration in MSHA's decision that it could implement a concentration limit.

Section 57.5062 Diesel Particulate Matter Control Plan

Under the final rule, a determination of noncompliance with either the interim or final concentration limit prescribed by § 57.5060 would trigger two requirements: first, the operator must establish a diesel particulate matter control plan (dpm control plan) meeting certain basic requirements—or modify the plan if one is already in effect; and second, the operator must demonstrate that the new or modified plan will be effective in controlling the concentration of dpm to the applicable concentration limit. The final rule also sets forth a number of other specific details about such plans, and states that failure of an operator to comply with the provisions of a plan or to conduct required verification sampling will be a violation of Part 57 without regard for the concentration of dpm that may be present. In all respects, this section of the final rule is essentially the same as in the proposed rule.

Only a few comments were directed specifically at § 57.5062. Some of those were supportive of the concept, such as the remark by one mine operator that, ''Generally, the Diesel Particulate Matter Control Plan (DPMCP) contained in § 57.5062 is well conceived.'' One commenter noted that once a plan is in place, failure to abide by its provisions is a citable violation, even if dpm levels are below the applicable concentration limit. Another commenter recommended that rather than a single out-of-compliance sample triggering the requirement to implement a plan, the provisions of § 57.5062 should not be triggered unless there is a significant history of non-compliance with the limit. Another commenter questioned why a determination of non-compliance requires MSHA to obtain only one non-compliant sample, whereas proof of operator compliance (both with respect to § 57.5062 and § 57.5071) requires multiple operator samples. A commenter also observed that a single sample is not ''statistically significant or representative and cannot determine if the mine is out of compliance.'' The same commenter argued that the requirements for documenting dpm control plan effectiveness were unnecessary, burdensome, and duplicated other MSHA requirements.

Triggering plan. Under the final rule, a single out-of-compliance dpm sample constitutes a citable violation of the applicable concentration limit and triggers the requirement to implement a diesel particulate matter control plan. As noted above, one commenter recommended that a diesel particulate matter control plan should not be required unless a mine has a significant history of non-compliance with the applicable dpm concentration limit. MSHA disagrees with the commenter's position because MSHA does consider a single sample to be a valid means of determining compliance (see discussion under § 57.5060 on single sample), and because a ''significant history of non-compliance'' at a given mine, would almost certainly be accompanied by significant, prolonged, and repeated exposure of miners to dpm levels in excess of the applicable concentration limit. Such exposures cannot be tolerated. When sampling indicates non-compliance, remedial action consisting of the implementation of a dpm control plan, or modification of an existing plan, must be initiated without delay. This will insure a timely reduction in dpm levels, and will help prevent dpm levels from rising above the applicable concentration limit in the future.

No advance approval of plans required. § 57.5062 will maintain the Agency's metal and nonmetal mine plan tradition by not invoking a formal plan approval process. That is, the plan would not require advance approval of the MSHA District Manager. As noted in the discussion of § 57.5060(c) and (d), MSHA is requiring advance approval for an operator to obtain a special extension of up to 2 years to meet the final concentration limit, and/or to allow miners performing inspection, maintenance or repair work to conduct such activities in areas that exceed the concentration limit. But a plan required because the limit has been exceeded need not obtain such advance approval.

In the preamble to the proposal for this Part, MSHA requested comment from the mining industry as to whether dpm control plans should require pre-approval by the Agency (p. 58119). The only comment received was in support of the Agency's proposal that such plans not require pre-approval.

A dpm control plan would, however, have to meet certain requirements set forth in the final rule, and as noted in the preamble to the proposed rule, it would be a violation of § 57.5062 if MSHA determines that the operator has failed to adequately address each of the plan's required elements.

Moreover, as discussed subsequently in connection with paragraph (f) of this section, once in place, a dpm control plan becomes law for that mine, and an operator must comply with it.

Elements of plan. Under § 57.5062(b), a dpm control plan must describe the controls the operator will utilize to maintain the concentration of diesel particulate matter to the applicable limit specified by § 57.5060. The plan must also include a list of diesel-powered units maintained by the mine operator, together with information about any unit's emission control device and the parameters of any other methods used to control the concentration of diesel particulate matter.

Relationship to ventilation plan. At the discretion of the operator, the dpm control plan may be consolidated with the ventilation plan required by § 57.8520.

Demonstration of plan effectiveness. The final rule would require monitoring to verify that the dpm control plans are actually effective in reducing dpm concentrations in the mine to the applicable concentration limit. Because the dpm control plan was initiated as a result of a compliance action, the final rule would require the use of the same measurement method used by MSHA in compliance determinations—total carbon using NIOSH method 5040—to conduct verification sampling. As a result, mine operators who are required to establish a dpm control plan would need to acquire the necessary sampling equipment to conduct the verification sampling, or arrange for such sampling

to be conducted for them. As noted in Part II, the necessary sampling equipment is commercially available.

MSHA recognizes concerns about the commercial availability of the sampling equipment for NIOSH Method 5040. It is important that operators know whether they are in compliance with the standard. MSHA understands that the equipment will be available before this standard is in effect. MSHA will not use any equipment for sampling for compliance with this standard that is not commercially available. If the equipment is not commercially available by the effective date of the standard it is MSHA's intention not to enforce the dpm levels in the standard until the sampling equipment is available.

Effectiveness must be demonstrated by ''sufficient'' monitoring to confirm that the plan or amended plan will control the concentration of diesel particulate to the applicable limit under conditions that can be ''reasonably anticipated'' in the mine.

The final rule, like the proposed rule, does not specify that any defined number of samples must be taken—the intent is that the sampling provide a fair picture of whether the plan or amended plan is working. Instead, as indicated in the preamble to the proposed rule, MSHA will determine compliance with this obligation based on a review of the situation involved. While an MSHA compliance sample may be an indicator that the operator has not fulfilled the obligation under this section to undertake monitoring ''sufficient'' to verify plan effectiveness, it would not be conclusive on that point.

One commenter questioned the fairness of holding operators responsible for verifying plan effectiveness, the need for documentation to verify that plans will control dpm to the applicable limit, and for the requirement that such documentation must be provided upon request by MSHA. This commenter suggested that mine operators are already required to show compliance with air quality standards under § 57.5002, and that further documentation relating to the diesel particulate matter control plan therefore duplicates existing requirements.

While it is true that § 57.5002 requires mine operators to conduct ''dust, gas, mist, and fume surveys'' as frequently as necessary to determine the adequacy of control measures, this regulation does not specifically address diesel particulate matter, nor does it specify that dpm concentrations must be determined using the NIOSH Method 5040 (as is required in § 57.5062(c)). Thus, compliance with § 57.5002 will not insure compliance with the intent of § 57.5062. Section 57.5062(c) also requires that mine operators demonstrate that dpm concentrations will be controlled to applicable limits, not only under current conditions (*i.e.*, that a compliant sample be obtained), but also under reasonably anticipated conditions in the future.

MSHA disagrees with the commenter's suggestion that ''rigorous enforcement of existing TLV©'s and air quality rules, and * * * utilization of recommendations in the 'Diesel Toolbox''' will result in ''adequate safety levels.'' The 1973 Threshold Limit Values© or TLV©'s (the TLV©'s incorporated by reference in § 57.5001, and therefore currently enforceable in underground metal and nonmetal mines) do not include a limit of any kind for dpm. It is interesting to note that, as indicated in Table II–2 of Part II, section 5, the TLV©'s enforced by MSHA are derived from recommendations of the American Conference of Governmental Industrial Hygienists (ACGIH). That organization has recently proposed a limit for dpm (ACGIH Notice of Intended Changes for 1999) of $50_{DPM}\mu g/m^3$, well below what is being established by this rule. As noted in Part V of this preamble, MSHA has concluded that $50_{DPM}\mu g/m^3$ is an unreasonably low limit for dpm concentration in underground metal and nonmetal mines because MSHA's technological and economic feasibility assessment indicate that this level cannot be achieved using feasible control measures.

If a diesel particulate matter control plan is in effect, the final rule specifies that monitoring must be ''sufficient to verify that the plan will control the concentration of diesel particulate matter to the applicable limit under conditions that can be reasonably anticipated in the mine.'' Again, as conditions and circumstances in the mine change, the mine operator must demonstrate, on a continuing basis, through sampling results using NIOSH Method 5040, that compliance with the applicable concentration limit is consistently achieved.

MSHA believes that dpm control requires a holistic approach. A piecemeal solution to a dpm problem may result in shifting an overexposure from one area to another, but not eliminating the problem entirely. If an overexposure in one part of the mine is addressed by re-routing more ventilation air to that area, it means another part of the mine will have to give up some air, possibly causing an overexposure there. If an overexposure in one part of the mine is addressed by exchanging a dirty machine for a clean machine, it means the dirty machine is still polluting somewhere else. In these examples, the actions taken may simply move an overexposure to a different location, or they may result in overall compliance. The only way of knowing for sure whether the problem has actually been solved, is to consider the effects of a given action on the mine as a whole. That is what the regulation requires. MSHA does expect operators will focus their control plans on the areas of the mine in which dpm presents a hazard to miners.

The reason that MSHA can determine non-compliance based on a single sample whereas mine operators need multiple samples to demonstrate compliance is due to the fundamental difference between proving non-compliance versus proving compliance. For example, proving that at least one non-compliance condition exists somewhere in a mine requires only one non-compliant sample result. Proving conditions are fully compliant everywhere in a mine all the time requires more than one compliant sample result. The actual number of compliant samples necessary to prove that every location in the mine is fully compliant all the time would have to be determined, but it would rarely, if ever, be only one.

The differences between determining non-compliance versus determining compliance are incorporated into standard industrial hygiene practice. For example, regarding the evaluation of the exposure of a worker over a single day by means of a full-period measurement (which is MSHA's compliance sampling approach), *Patty's Industrial Hygiene and Toxicology* (3rd Edition, 1994) states, ''In that case, the error variance is determined by only the sampling and analytical error, and confidence limits tend to be quite narrow.'' By appropriately accounting for sampling and analytic errors, MSHA will assure, at the 95% confidence level, that an out-of-compliance sample accurately reflects an out-of-compliance condition in the mine.

This contrasts with the mine operator's need to verify compliance. *Patty's* states, ''Usually, however, our concern is with the totality of a workers exposure, and we wish to use the data collected to make inferences about other times not sampled. There is little choice; unless the universe of all exposure occasions is measured, we must ''sample,'' that is, make statements about, the whole based on measurement of some parts.''

''The American Industrial Hygiene Association has addressed the issue of

appropriate sample size (Hawkins et al., 1991) and recommends in the range of 6–10 random samples per homogeneous exposure group. Fewer than 6 leaves a lot of uncertainty and more than 10 results in only marginal improvement in accuracy. Also, it is usually possible to make a reasonable approximation of the exposure distribution with 10 samples although a rigorous goodness-of-fit test often requires 30 or more.'' Although a single sample is not adequate to demonstrate compliance, MSHA does not specify in the final rule, a minimum number of samples that will constitute adequate verification of compliance in all cases. It is the mine operator's responsibility to determine the appropriate level of sampling effort and explain the rationale in the diesel particulate matter control plan.

Like the final rule, the proposed rule provided that verification sampling would be conducted under conditions that can be ''reasonably anticipated'' in the mine. The Agency very specifically solicited comment on ''whether, and how, it should define the term 'reasonably anticipated.' '' (63 FR 58185) The agency noted that with respect to coal dust, the Dust Advisory Committee recommended that ''MSHA should define the range of production values which must be maintained during sampling to verify the plan. This value should be sufficiently close to maximum anticipated production.'' (MSHA, 1996) For dpm, the Agency suggested, the equivalent approach might be based on worst-case operating conditions of the diesel equipment—*e.g.,* all equipment is being operated simultaneously with the least ventilation. No comments were received on this point.

Recordkeeping retention and access. Pursuant to section 5062(b), a copy of the current dpm control plan is to be maintained at the mine site during the duration of the plan and for one year thereafter. Section 5062(c) requires that verification sample results be retained for 5 years. And, section 5062(d) provides that both the control plan and sampling records verifying effectiveness be made available for review, upon request, by the authorized representative of the Secretary, the Secretary of Health and Human Services, and/or the authorized representative of miners. Upon request of the District Manager or the authorized representative of miners, a copy of these records is to be provided by the operator.

Duration. The final rule requires the dpm control plan to remain in effect for three years from the date of the violation resulting in the establishment/modification of the plan. Section 57.5062(e)(1) and (e)(2). MSHA has concluded that operators have sufficient time under the final rule to come into compliance with the concentration limits; if a problem exists, maintaining a plan in effect long enough to ensure that daily mine practices really change is an important safeguard. MSHA noted its view in this regard in the preamble to the proposed rule; no comments were received on this point.

Modification during plan lifetime. If a diesel particulate matter control plan is already in effect at a mine, section 57.5062(a) requires the mine operator to modify the current plan upon a subsequent violation of section 57.5060, and to demonstrate the effectiveness of the modified plan.

Section 57.5062(e)(3) would require the mine operator to independently initiate the modification of an existing dpm control plan to reflect changes in mining equipment and/or the mine environment, and requires the operator to demonstrate the effectiveness of the modified plan.

It should also be noted that a mine operator, based on dpm sampling data or other information or analysis, may at any time, modify the provisions of a dpm control plan to make it less restrictive, provided sufficient sampling data confirm the plan's continuing effectiveness in controlling dpm to compliant levels. A modification made in this manner does not affect the 3-year duration of the plan (end date unaffected). These plans made by the operator do not require advance approval by MSHA.

Compliance with plan requirements. Section 57.5062(f) states that failure by a mine operator to comply with the provisions of a diesel particulate matter control plan is a violation of the rule, regardless of the concentration of dpm that may be present at any time. Once an underground metal or nonmetal mine operator adopts a dpm control plan, it is considered law for the mine. Section 57.5062(f) specifically provides that MSHA would not need to establish (by sampling) that an operator is currently in violation of the applicable concentration limit under § 57.5060 in order to determine (by observation) that an operator has failed to comply with any requirement of the mine's dpm control plan.

One commenter observed that, ''It does seem odd * * * that § 57.5062(f) contemplates that the mere failure to adhere to the [dpm control plan] itself is deemed a violation of the regulation—irrespective of the fact that the exposure to dpm may indeed be less than the [concentration limit].''

MSHA's rationale for making a mine's dpm control plan law for that mine derives from the rule's approach to setting control requirements. MSHA recognizes that every mine faces a unique set of conditions and circumstances relating to equipment, engines, emission controls, ventilation, etc. that would make uniform dpm control requirements across the entire underground metal and nonmetal mining industry unworkable, impractical, and ineffective. Hence, the final rule, with just a few exceptions, permits mine operators considerable freedom to select the mix of dpm control options they believe are necessary to comply with the applicable concentration limit. An operator can filter the emissions from diesel-powered equipment, install cleaner-burning engines, increase ventilation, improve fleet management, or use a variety of other readily available controls, all without consulting with, or seeking approval from MSHA.

However, if MSHA sampling indicates non-compliance with the applicable concentration limit, the rule requires the operator reduce to writing his or her specific plans for controlling dpm to the concentration limit and to adhere to that plan. MSHA considers miner exposure to dpm, a probable carcinogen, as a very serious matter, and has not established that exposures, even at the concentration limit, are safe. That is why a single non-compliant sample triggers the requirement for a compliance plan. The plan lays out the minimum steps the operator has determined must be followed in that mine to insure compliance. Failure to adhere to the requirements of the operator-developed plan must thus be viewed as a failure to take actions that are necessary for compliance with the concentration limit.

Because of the importance of adhering strictly to an effective dpm control plan, a means of enforcing such adherence is necessary. The plan is made law for that mine so that its provisions can be enforced by MSHA. The plan need not be approved by the MSHA District Manager, but it is, nonetheless, law for that mine, and any violation of the plan is therefore a violation of the regulation. As discussed above, an operator is free to modify a dpm control plan to make it less restrictive at any time during its life, and as often as desired, as long as sufficient sampling data confirm the plan's continuing effectiveness in controlling dpm to compliant levels. MSHA is of course concerned primarily with the health and safety of miners so the magnitude of any citation for a

violation of the plan will take into account the actual risk posed to miners.

With respect to the required diesel particulate matter control plan, the mine operator is essentially telling MSHA what steps are necessary for that mine to comply with the applicable concentration limit. If MSHA observes a violation of the plan, it is only reasonable and proper for MSHA to conclude that full compliance is therefore not possible. If enforcement of the provisions of the dpm control plan depended upon obtaining an out-of-compliance dpm sample, plan enforcement would be greatly diminished, both in terms of timeliness and effectiveness. If such a sample were taken, and found to be out of compliance, implementation of needed corrective measures would be delayed because MSHA could not require the mine operator to take remedial actions until the sample results were obtained from the analytic laboratory, which could involve several weeks of time. If such a sample were taken, and found to be in compliance, that fact would not constitute conclusive evidence that the plan as a whole was fully effective (see earlier discussion on the need for multiple samples to establish continuing compliance). Thus, while providing inconclusive information at best, such a sampling outcome would prevent MSHA from enforcing a provision of the plan. Regardless of sampling outcome, it is important to remember that a violation of the plan means the mine operator did not adhere to the very requirements that were represented to MSHA by the operator as being necessary for compliance.

It should also be noted that MSHA already has similar enforcement authority relative to various other plans that are required in the underground metal and nonmetal sector. Mine operators are required to prepare plans for such purposes as escape and evacuation, rock bursts, ventilation, and training. MSHA has the authority to enforce the provisions of these plans without first verifying that the observed violation has caused an immediate outcome which itself, is prohibited by regulation. There is also ample precedent for citing health-related violations without sampling, such as § 58.620 on drill dust control, and § 57.5005 on respiratory protection.

The mine operator is required to modify dpm control plans to reflect changes in mining equipment or circumstances. The mine operator is also required to modify dpm control plans if the plan proves to be inadequate, as evidenced by a subsequent non-compliance determination during the three year period that the plan is in effect. In either case, the modifications to the original plan become law for that mine, and violations are subject to enforcement action by MSHA regardless of dpm concentration.

It is also important to remember that dpm levels are determined by the complex interaction of numerous factors, such as equipment type, engine size, type, and horsepower, duty cycles, engine maintenance, equipment operator training and work practices, fuel and fuel additives, the characteristics and performance of exhaust filtering systems, mine ventilation flows, and many others. Effectively controlling dpm levels throughout a mine requires a systematic approach that acknowledges the interrelationships and interactions between these factors to produce the desired end result, which is compliance with the applicable concentration limit. A determination of non-compliance indicates that the system of controls has failed. Thus, an effective permanent solution requires a comprehensive approach which not only corrects the immediate cause of the non-compliance (an out-of-tune engine, for example), but also addresses the underlying system failure (deficient maintenance management, inadequate dpm monitoring, ineffective equipment operator training, failure to tag equipment believed to require maintenance, etc.).

The implementation of a dpm control plan avoids piecemeal solutions that result in a repetitive pattern of mines being in and out of compliance without ever coming to grips with underlying problems. The required elements of a dpm control plan force a comprehensive approach, and facilitate effective, permanent solutions to systemic failures. The three year duration of such plans insures that the necessary system changes become institutionalized and integrated into daily mine practices. This, in turn, will increase the chances that mines will be in compliance with the applicable concentration limit on a continuous, on-going basis.

MSHA recognizes that some operators may want to supplement the compliance plans required by the regulation with additional internal instructions that provide supplementary protection—i.e., to achieve concentration levels below those required. MSHA does not want to discourage such supplemental plans; indeed, it would like to encourage them. Accordingly, MSHA will, upon request, work closely with mine operators to help avoid confusion by mine and Agency personnel between required compliance plans that contain the minimum elements considered essential to achieve compliance (and whose provisions are therefore enforceable by MSHA) and non-required supplemental plans that contain elements the mine operator wishes to implement as a matter of company policy (but whose provisions are not enforceable by MSHA).

Section 57.5065 Fueling Practices

Summary. This section of the final rule establishes the requirements for fueling practices in underground metal and nonmetal mines. Unlike the proposed rule, the final rule has two subsections.

Subsection (a) limits the amount of sulfur that may be contained in diesel fuel used to power equipment in underground areas, and requires mine operators to maintain purchase records that verify the sulfur content of the fuel they use.

Subsection (b) requires that fuel additives used in underground diesel-powered equipment be restricted to those registered by the U.S. Environmental Protection Agency.

These subsections of the final rule have not been changed from the proposed rule.

The practices being required by these two subsections are accepted industry practices to reduce dpm emissions. They are among the methods for reducing dpm explicitly included in MSHA's toolbox publication, and were made requirements for underground coal mines as part of MSHA's diesel equipment rulemaking. They are among the ''best practices'' for reducing dpm emissions that MSHA has determined are technologically and economically feasible for all underground metal and nonmetal mines. Part II of this preamble contains some background information on these practices together with information about the rules currently applicable in underground coal mines.

Low-sulfur fuel. In the final rule, § 57.5065(a) would require underground metal and nonmetal mine operators to use only low-sulfur fuel having a sulfur content of no greater than 0.05 percent. This requirement is identical to that currently required for diesel equipment used in underground coal mines [30 CFR 75.1901(a)]. Both number 1 and number 2 diesel fuel meeting the sulfur content requirement of this rule are commercially available.

Sulfur content can have a significant effect on diesel emissions. Use of low-sulfur diesel fuel reduces the sulfate fraction of dpm matter emissions, and

reduces objectionable odors associated with diesel exhaust.

Another major benefit of using low-sulfur fuel is that the reduction of sulfur allows oxidation catalysts to perform properly. Some diesel emission aftertreatment devices, such as catalytic converters and catalyzed particulate traps, are ''poisoned'' with fuels having high-sulfur content (greater than 0.05 percent sulfur). MSHA believes the use of these aftertreatment devices is important to the mining industry because they will be necessary for many mines to meet the specified concentration limits. The requirement to use low-sulfur fuel will allow these devices to be used without additional adverse effects caused by the high-sulfur fuel.

Several commenters questioned why low-sulfur fuel was mandated, even for operators who could meet the applicable concentration limit using other means. MSHA responds by noting that the use of low-sulfur fuel is one of the ''best practices'' that MSHA requires all mines to follow, regardless of current dpm levels. Further elaboration on the rationale for mandating these ''best practices'' was included in the preamble to the proposed rule (63 FR 58119), and a summary was provided in this Part under the portion of § 57.5060 that discussed ''Meeting the concentration limit, operator choice of engineering controls.'' As noted in those discussions, MSHA is required by statute to reduce a significant risk to the extent feasible; the use of low-sulfur fuel is feasible, has not created any problems in the underground coal sector where it is required as a result of the diesel equipment rule, and its use will reduce dpm emissions from underground engines.

In the preamble to the proposal (63 FR 58186), MSHA indicated it did not believe a requirement mandating the use of low-sulfur fuel will add additional compliance costs. Several commenters contradicted this conclusion, arguing that the provision requiring low-sulfur fuel would have an adverse cost impact. One commenter supplied actual cost figures that showed their fuel costs increased over $18,000 per year after they switched to low-sulfur fuel. However, it is significant to note that this increase is quite small on both a cost per gallon of fuel basis (less than $0.03 per gallon), and a cost per ton basis (about $0.008 per ton), and that this mine had already made the switch to low-sulfur fuel, apparently because they perceived that the benefits justified the small additional expense.

As discussed in the Section IV of the PRIA, MSHA determined that the cost difference between high-sulfur and low-sulfur diesel fuel was less than $0.02 per gallon in many parts of the country, and in some areas, there was no difference at all, or a slight cost advantage to using low-sulfur fuel. Fuel used in over-the-road diesel engines is currently required by EPA regulations to meet the same 0.05% sulfur content limit that is being implemented for underground metal and nonmetal mines. Because over-the-road diesel engines represent the bulk of the diesel fuel market, such low-sulfur fuel is already readily available throughout the country. EPA has proposed regulations that would further reduce allowable fuel sulfur content to 0.0015% for over-the-road diesel engines. Current MSHA regulations limit the sulfur content of diesel fuel used in underground coal mines to 0.05%, and the availability of this fuel in remote coal mining areas has not been a problem for coal mine operators. As discussed above, MSHA has determined, based on extensive study of the metal and nonmetal mining industry, that compliance with the rule is economically feasible for the industry as a whole. Thus, although the provision requiring use of only low-sulfur fuel may, in some instances, result in a small cost increase for some operators, MSHA estimates that on average, the overall measurable impact is negligible. When they are measurable, it is because the mine is located in an area where heating fuel has relatively large market share compared to diesel fuel used for vehicles. This circumstance is unrelated to mine size. Most mines are not located in these regions and there is no evidence that small mines are disproportionately concentrated in these regions.

Fuel additives. Paragraph (b) of this section requires mine operators to use only diesel fuel additives that have been registered by the Environmental Protection Agency (40 CFR Part 79). Again, this rule is consistent with current requirements for diesel equipment used in underground coal mines [30 CFR 75.1901(c)], and is another of the ''best practices'' that MSHA considers to be feasible for all underground metal and nonmetal mines. The restricted use of additives would ensure that diesel particulate concentrations would not be inadvertently increased, while also protecting miners against the emission of other toxic contaminants. MSHA has published Program Information Bulletin No. P97–10, issued on May 5, 1997, that discusses the fuel additives list. The requirements of this paragraph do not place an undue burden on mine operators because operators need only verify with their fuel suppliers or distributors that the additive purchased is included on the EPA registration list. To assist mine operators in this regard, EPA's Internet site contains a current listing of additives registered with EPA. This site can be accessed at the following address: http://www.epa.gov/oms/regs/fuels/additive/web-dies.txt. No commenters objected to this requirement.

Idling practices. Proposed paragraph (c) of § 57.5021 would have prohibited idling of mobile diesel-powered equipment, except as required for normal mining operations. After further consideration of all comments received during the comment period, as well as testimony presented at the public hearings, MSHA has decided to delete this requirement from the final rule. Therefore, the final rule does not contain a restriction for operators on idling diesel-powered equipment. MSHA does, however, recommend as a best practice that mine operators do not allow miners to idle diesel-powered equipment unnecessarily.

Although commenters generally agreed with MSHA's statement in the proposal that this requirement would aid in the reduction of dpm concentrations at the mine, they pointed out that the total amount of diesel particulate matter emitted from this single source might have little effect on the levels of dpm in the overall mining environment. Also, several commenters questioned the need for an idling restriction in light of the proposed concentration limits established in the regulation. Additionally, another commenter indicated that the provision was not necessary because mine operators, in an effort to comply with the applicable concentration limits, would be forced to institute work rules to this effect anyway. Moreover, as pointed out by commenters, nothing in the regulatory language prohibits operators from voluntarily restricting idling at the mine, eliminating the need to include this provision. Accordingly, we have deleted proposed paragraph (c) from the final rule.

Section 57.5066 Maintenance standards.

Summary. This section of the final rule establishes maintenance standards for diesel-powered equipment operated in underground areas of metal and nonmetal mines. It has three subsections.

Subsection (a) addresses maintenance of diesel engines, emission related components, and emission or particulate control devices.

Subsection (b) institutes a mandatory procedure by which diesel equipment operators must be authorized and required to tag equipment they believe requires maintenance in order to comply with subsection (a) above, for mine operators to insure that equipment so tagged is promptly examined, and for mine operators to retain a log of tagged equipment and the corresponding equipment examinations.

Subsection (c) requires that persons maintaining diesel equipment in underground metal and nonmetal mines be appropriately qualified by virtue of training or experience, and that mine operators must retain evidence of the competence of such persons.

The provisions of this section in the final rule are unchanged from the proposal.

Maintain Approved engines in approved condition. § 57.5066(a)(1) requires that mine operators maintain any approved diesel engine in ''approved'' condition. Under MSHA's approval requirements, engine approval is tied to the use of certain parts and engine specifications. When these parts or specifications are changed (i.e., an incorrect part is used, or the engine timing is incorrectly set), the engine is no longer considered by MSHA to be in approved condition.

Often, engine exhaust emissions will deteriorate when this occurs. Maintaining approved engines in their approved condition will ensure near-original performance of an engine, and maximize vehicle productivity and engine life, while keeping exhaust emissions at approved levels. The maintenance requirements for approved engines in this rule are already applicable to underground coal mines. 30 CFR 75.1914.

Thus in practice, with respect to approved engines, mine maintenance personnel will have to maintain the following engine systems in near original condition: air intake, cooling, lubrication, fuel injection and exhaust. These systems shall be maintained on a regularly scheduled basis to keep the system in its ''approved'' condition and thus operating at its expected efficiency.

One of the best ways to ensure these standards are observed is to implement a proper maintenance program in the mine—but the final rule would not require operators to do this. A good program should include compliance with manufacturers' recommended maintenance schedules, maintenance of accurate records and the use of proper maintenance procedures. MSHA's diesel toolbox provides more information about the practices that should be followed in maintaining diesel engines in mines.

Maintain emissions related components of non-approved engines to manufacturer specifications. For any non-approved diesel engine, paragraph (a)(2) requires mine operators to maintain the emissions related components to manufacturer specifications.

The term ''emission related components,'' refers to the parts of the engine that directly affect the emission characteristics of the raw exhaust. These are basically the same components which MSHA examines for ''approved'' engines. They are the piston, intake and exhaust valves, cylinder head, injector, fuel injection pump, governor, turbo charger, after cooler, injection timing and fuel pump calibration.

Engine manufacturers are required to build engines in a manner that ensures continued compliance with EPA emissions levels and to establish specifications for adjusting and maintaining these engines to the engine manufacturer's specifications to ensure that the engines continue to perform properly and emit acceptable levels of emissions.

As it indicated in the preamble to the proposed rule, the Agency does not intend that this requirement could be misconstrued as establishing the basis for ''picky'' citations. It is not MSHA's intent that engines be torn down and the engine components be compared against the specifications in manufacturer maintenance manuals (63 FR 58187). Primarily, the Agency is interested in ensuring that engines are maintained in accordance with the schedule recommended by the manufacturer. However, if it becomes evident that the engines are not being maintained to the correct specifications or are being rebuilt in a configuration not in line with manufacturers' specifications or approval requirements, an inspector may ask to see the manuals to confirm that the right manuals are being used, or call in MSHA experts to examine an engine to confirm whether basic specifications are being properly observed.

This explanation of MSHA's intent relative to its enforcement of this provision was included in the Preamble to the proposed rule, accompanied by an invitation for comment from the mining industry to suggest alternative ways to rephrase this requirement so the Agency has a basis for ensuring compliance while minimizing the opportunity for overprescriptiveness (63 FR 58187). However, no such suggestions were received.

Maintain emission or Particulate Control Devices in effective operating condition. Paragraph (a)(3) requires that any emission or particulate control device installed on diesel-powered equipment be maintained in effective operating condition. Depending on the type of devices installed on an engine, this would involve having trained personnel perform such basic tasks as regularly cleaning aftertreatment filters, using methods recommended by the manufacturer for that purpose, or inserting appropriate replacement filters when required, checking for and repairing any exhaust system leaks, and other appropriate actions. This explanation of MSHA's intent relative to subsection (a)(3) was contained in the preamble to the proposed rule (63 FR 58187). One comment was received on this subsection from a commenter who submitted a complete regulatory alternative to MSHA's proposed dpm rule. The section of this regulatory alternative that corresponds to subsection (a)(3) of both the proposed and final rules reads as follows: ''Emission related components of diesel powered equipment shall be maintained in effective operating condition.'' This alternative language is functionally identical to both the proposed and final rules. It incorporates the phrase ''Emission related components of diesel powered equipment * * *,'' whereas the rules incorporate the phrase, ''Any emission or particulate control device installed on the equipment * * *,'' however, the requirement that such equipment, ''shall be maintained in effective operating condition,'' is identical. Therefore, MSHA concluded that no change from the proposal was necessary.

Ensuring equipment that may be out of compliance with maintenance standards is attended to—Tagging. Section 57.5066(b)(1) of the final rule requires underground metal and nonmetal mine operators to authorize and require miners operating diesel powered equipment to affix a visible and dated tag to the equipment at any time the equipment operator ''notes any evidence that the equipment may require maintenance in order to comply with the maintenance standards of paragraph (a) of this section.'' Moreover, § 57.5066 (b)(2) requires that the equipment be ''promptly'' examined by a person authorized by the mine operator to maintain diesel equipment, and prohibits removal of the tag until such examination has been completed. Section 57.5066 (b)(3) requires a log to be retained of all equipment tagged.

In proposing this approach, MSHA noted its view that tagging would

provide an effective and efficient method of alerting all mine personnel that a piece of equipment needs to be checked by qualified service personnel for possible emission problems, and that such a check is performed in a timely way (63 FR 58187).

The agency noted that the presence of a tag serves as a caution sign to miners working on or near the equipment, as well as a reminder to mine management, as the equipment moves from task to task throughout the mine. While the equipment is not barred from service, operators would be expected to use common sense and not use it in locations in which diesel particulate concentrations are known to be high.

The agency noted it was not requiring that equipment tagged for potential emission problems be automatically taken out of service. The rule is not, therefore, directly comparable to a ''tag-out'' requirement such as OSHA's requirement for automatic powered machinery, nor is it as stringent as MSHA's requirement to remove from service certain equipment ''when defects make continued operation hazardous to persons'' (see 30 CFR 57.14100). In the Preamble to the proposed rule, MSHA indicated that it did not think there was a need for something as stringent as these requirements because, although exposure to dpm emissions does pose a serious health hazard for miners, the existence or scope of an equipment problem cannot be determined until the equipment is examined or tested by a person competent to assess the situation. Moreover, the danger is not as immediate as, for example, an explosive hazard.

In the preamble to the proposed rule, MSHA also provided additional insights into how this approach would be implemented. It noted, for example, that the tag may be affixed because the equipment operator detects a problem through a visual exam conducted before the equipment is started, or because of a problem that comes to the attention of the equipment operator during mining operations, (i.e., black smoke while the equipment is under normal load, rough idling, unusual noises, backfiring, etc.) MSHA also noted it had not defined the term ''promptly'' with respect to how quickly tagged equipment must be examined by a qualified person, and sought comment on whether it should define this term—for example, by limiting the number of shifts it could operate before the required examination is performed (63 FR 58187).

The equipment tagging requirement was the subject of numerous comments. Most commenters were concerned that equipment operators would be authorized and required to make judgements about equipment function (and malfunction) for which they are unqualified, namely, to tag equipment they believe requires maintenance due to a problem related to dpm emissions. The commenters argued that, although equipment operators may be highly skilled in operating equipment, they are not necessarily qualified to make judgements concerning equipment maintenance requirements. Even though the regulation would not require tagged equipment to be removed from service, the commenters were concerned that such tags would cause unnecessary ''scurrying about of mechanics'' whose time could be more productively spent performing actual needed maintenance, rather than reacting to tags affixed for reasons that might be dubious, at best.

Commenters noted that, in addition to unnecessary maintenance inspections and the possibility of unnecessarily removing equipment from service, this requirement could result in a safety hazard if a tag affixed under § 57.14100(c) is mistaken for a tag affixed under § 57.5066(b)(1). The former addresses safety defects that ''make continued operation hazardous to persons,'' and it requires the equipment to be immediately removed from service. The latter relates to dpm emissions, and does not require the piece of equipment to be removed from service. If a tag under § 57.14100(c) is mistaken for a tag under § 57.5066(b)(1), the affected equipment would be allowed to remain in service, exposing the operator, and possibly others, to potentially dangerous conditions.

Some commenters suggested that the tagging requirement in the final rule was completely unnecessary because its intent is already satisfied by existing § 57.14100, and that for the sake of simplicity, § 57.5066(b)(1) should be eliminated. Another commenter noted that § 57.5066(b)(1) was unnecessary because mine operators already have effective mechanisms in place to identify and correct maintenance problems on diesel equipment, including emissions-related problems. Another commenter worried that a citation could be issued if an inspector believes an operator failed to tag a piece of diesel equipment with a ''smoky'' exhaust, even if the operator believes the exhaust is within the normal range. Several commenters speculated that disgruntled employees would deliberately shut down equipment by tagging it for an emissions check.

Several commenters suggested alternative requirements, including incorporating emissions checks into the pre-shift equipment inspection required under § 57.14100(a), requiring equipment operators to either inform their supervisors of any suspected emissions-related problems or note any suspected emissions-related problems in a log book provided in every piece of equipment for that purpose, and requiring the mine operator to insure that a qualified person examines any piece of equipment for which an emissions-related problem has been identified.

MSHA has considered these comments, and determined that the requirements contained in the proposal are both necessary, and more protective than the alternatives suggested by the commenters. For these reasons, the requirements contained in the proposal have been retained without change in the final rule.

MSHA believes that, since equipment operators spend more time running the equipment than other employees (such as mechanics), and are present when the equipment functions under the widest range of operating conditions, they are often better able to detect emissions-related problems than are mechanics. For this reason, the final rule requires that equipment operators be authorized and required to affix a visible and dated tag if they note any evidence that the equipment may need maintenance in order to comply with the rule's maintenance requirements. Even though equipment operators may not be trained or qualified as diesel mechanics, they often know the difference between normal and abnormal equipment performance, especially as it relates to diesel particulate matter generation, which is often plainly visible or apparent (i.e., black smoke while the equipment is under normal load, rough idling, unusual noises, backfiring, etc.).

MSHA acknowledges that an equipment operator's judgement should not necessarily be relied upon to remove a piece of diesel equipment from service, precisely because equipment operators are not specifically trained or qualified to make such a judgement. Accordingly, the final rule does not require equipment operators to be granted this authority; only that they be granted authority to visibly identify a potential problem machine by affixing a tag. It is then the responsibility of the mine operator to appropriately respond to the presence of a tag. Note that the response by the mine operator need not be immediate, nor does it necessarily require the affected equipment to be removed from service, as some commenters feared. Mine operators have the authority to establish work rules and procedures to prevent equipment from

being removed from service unnecessarily. Equipment operators and mechanics simply need to be trained as to their respective authority and responsibility under this section; namely, that equipment operators need to tag equipment suspected of requiring maintenance attention, and that qualified mechanics need to follow up to determine if a problem actually exists, and if so, what corrective maintenance work is needed.

It is highly unlikely that a tag intended to indicate a suspected emissions-related problems, if properly designed, would be confused with a tag intended to indicate a safety problem as per § 57.14100(c). Such tags could be differentiated by size, color, or other obvious visual characteristics so that mistaking one for the other would be virtually impossible. As noted below, the final rule allows mine operators the freedom to develop a design that suits their circumstances. In contrast, a design mandated by MSHA might be too similar to a given mine's existing § 57.14100(c) safety tag.

MSHA believes that the equipment tagging requirements of § 57.14100(c) and § 57.5066(b)(1) are inherently and significantly different, to the extent that the § 57.14100(c) requirement, even if modified to include health hazards, could not achieve the desired effect of § 57.5066(b)(1). The purpose of § 57.14100(c) is to immediately remove equipment from service if it poses a safety hazard, whereas the purpose of § 57.5066(b)(1) is to identify a potential emissions-related problem that might require maintenance, but does not justify immediate removal from service. Another important difference is that examinations under § 57.14100(c) occur before a piece of equipment is placed in operation on that shift, whereas § 57.5066(b)(1) applies throughout a work shift. These fundamental differences would make any attempt to combine the rules overly complicated, which would defeat the commenter's purpose of simplifying the rule.

As discussed above, MSHA believes that equipment operators should be authorized and required to note emissions-related deficiencies at all times during a work shift, and not be limited to making such observations during a pre-shift equipment inspection or before the equipment is placed into operation. Some emissions-related problems may not become apparent until after the equipment has been fully engaged for some time in heavy duty cycle activities. If the only time emissions-related deficiencies could be identified is before the equipment is placed into operation, the mine operator might never learn about such problems, or the corresponding notification might be unnecessarily delayed.

MSHA acknowledges that many underground metal and nonmetal mine operators utilize effective maintenance programs to identify and correct emissions-related problems in a timely manner. However, MSHA believes that §§ 57.5066(b)(1) and (2) are ''best practices'' that should be implemented at all mines. At mines that already have an effective program, this provision would serve as a complementary element. At mines that have no effective program, this provision would create an important safeguard. Further elaboration on the rationale for mandating these ''best practices'' was included in the preamble to the proposal (p. 58119), and a summary was provided in this Part under the portion of § 57.5060 that discussed ''Meeting the concentration limit, operator choice of engineering controls.''

The tagging provision of § 57.5066(b) requires judgement on the parts of both the equipment operator and the MSHA inspector. There is no absolute standard which precisely defines the physical proof that constitutes, ''evidence that the equipment may require maintenance in order to comply with the maintenance standards of paragraph (a) of this section.'' Thus, MSHA inspectors will be guided by a standard of reasonableness, based on an equipment operator's ability to differentiate normal emissions from grossly abnormal emissions. MSHA does not expect operators to tag equipment whenever there is a minor aberration or excursion from an optimum or perfect emissions condition, or that an inspector should make a fine distinction between emissions that are ''slightly too smoky'' versus ''barely acceptable.'' However, MSHA inspectors will not ignore an operator's failure to tag a piece of equipment suffering from a serious emissions-related problem that is so obvious as to suggest the mine operator is indifferent to, or even discourages such tagging.

MSHA believes that disgruntled employees' attempts to shut down equipment by affixing tags indicating possible emissions-related problems can be effectively controlled and prevented by mine operators through work rules and procedures, and employee discipline policies. Mine operators should treat the inappropriate exercise of this provision by a disgruntled employee no differently than any other disruptive or malicious behavior. In addition to being preventable, MSHA believes the inappropriate tagging of equipment would have minimal impact on mining operations because tagged equipment need not be immediately removed from service. The maintenance examination that is triggered by a tag might not take place until the next shift or the shift after, and if there is truly nothing wrong with the equipment, it would be obvious to the mechanic performing the examination, and would therefore only require a few minutes of a mechanic's time.

MSHA considers the provision for tagging equipment to be preferable to a system which permits equipment operators to simply notify their supervisor of a suspected emissions-related problem, because the presence of a tag serves as a caution sign to other miners working on or near the equipment, as well as a reminder to mine management that this piece of equipment needs to be examined. Simply informing the supervisor does not provide this ongoing visual indicator or reminder, and as miners and equipment are reassigned to different jobs in different parts of a mine, information that is communicated verbally can be easily forgotten. A major advantage of tagging is that the tag goes with the equipment throughout the mine, alerting all who come in contact with it of the potential dpm emissions problem. In this sense, tagging requirements are particularly valuable for mobile equipment that travels from place to place throughout the shift, and may have multiple operators over the course of several shifts.

Design of the tag. MSHA proposed that the design of the tag be left to the discretion of the mine operator, with the exception that the tag must be able to be marked with a date. MSHA sought comment on ''whether some or all elements of the tag should be standardized to ensure its purpose is met''.

Several commenters suggested that MSHA should design the tag to be used for indicating equipment suspected of needing emissions-related maintenance.

As noted above, the final rule leaves this decision to the discretion of the mine operator. Since the design of tags required under § 57.14100(c) is left to the discretion of the operator, it would be impossible for MSHA to insure that any mandated design for a tag under § 57.5066(b)(1) would be easily distinguishable from an existing § 57.14100(c) tag. However, MSHA strongly urges mine operators to adopt a design for their § 57.5066(b)(1) tags that is easily distinguishable from the design of their § 57.14100(c) tags, using, for example, different sizes, colors, or other obvious visual characteristics.

Time to inspect equipment. As noted above, MSHA sought specific comment on whether to define the term ''promptly.'' One commenter referred to ''promptly examined'' as, ''whatever that is,'' indicating they believed the term ''promptly examined'' is too vague. Another commenter suggested that a definite time period for examining equipment should be specified; namely, ''by the end of the next shift.'' However, another commenter agreed with MSHA that equipment tagged by an operator should be, ''promptly examined'' by an authorized diesel maintenance person. Another commenter proposed that, ''the required examination be conducted during normally scheduled maintenance cycles.''

The final rule, like the proposal, does not define the term ''promptly''. Operating and maintenance practices vary from mine to mine to such an extent that a proscriptive requirement mandating a specific time period within which an examination must be completed may be infeasibly short for some operators and unnecessarily long for other operators. However, MSHA's intent is that mine operators will insure such examinations are performed without undue delay. If a tag is affixed during a given shift, it would not be unreasonable to complete that shift before the maintenance examination. If no qualified mechanic is scheduled to work on the following shift, the equipment could be operated during that shift as well. However, if a qualified mechanic was scheduled to work on the next shift, the examination would be required before the equipment was used.

Tagged Equipment Log. Section 57.5066(b)(3) requires a log to be retained of all equipment tagged. Moreover, the log must include the date the equipment is tagged, the date the tagged equipment is examined, the name of the person making the examination, and the action taken as a result of the examination. Records in the log about a particular incident must be retained for at least one year after the equipment is tagged.

MSHA does not expect the log to be burdensome to the mine operator or mechanic examining or testing the engine. Based on MSHA's experience, it is common practice to maintain a log when equipment is serviced or repaired, consistent with any good maintenance program. The records of the tagging and servicing, although basic, provide mine operators, miners and MSHA with a history that will help in determining whether a maintenance program is being effectively implemented, and whether emissions-related components on the equipment are being maintained in a proper and timely fashion.

Several comments addressing the equipment log were received. Proposed revisions generally retained the requirement for an equipment log, but varied as to who would maintain the log (equipment operators, mechanics or supervisors), and how long they should be kept (one year versus until the condition is examined and remedied). It was also suggested that all record keeping could be accomplished under ''existing mobile equipment examination standards and maintenance work order systems,'' and that additional standards were therefore not needed.

MSHA has concluded that the requirements in the proposal relative to tagged equipment logs are essential to effectively controlling dpm, and have therefore been retained in the final rule without change. They enable both the mine operator and MSHA to track emissions-related problems on equipment, and the actions taken by the mine operator to resolve the problems that occur. The logs are also important because they provide a written record documenting when equipment was tagged, and how the mine operator responded.

The log creates an accountability chain that clearly indicates the date the equipment was tagged, the date the tagged equipment was examined, the name of the person making the examination, and the action taken as a result of the examination. Without the written record, MSHA would be unable to ascertain the extent to which mine operators respond in a timely and appropriate manner to emissions-related problems on diesel equipment. The one-year record retention requirement is necessary so that MSHA can review the emissions-related maintenance history on a given piece of equipment over a meaningful time period. This will enable MSHA to judge the mine operator's on-going commitment to proper and timely maintenance of these components. If the log were kept only until a given maintenance operation was completed, MSHA's opportunity to assess the mine operator's on-going responsiveness to emissions-related problems would be limited to the few chance occasions where a piece of equipment is tagged during an MSHA inspection of the mine.

These requirements are protective to miners because they force mine operators to address dpm emissions problems through a systematic and effective program. The combination of equipment tagging and logging helps insure problems will be identified and resolved quickly. If either or both requirements were eliminated, mine operators would be less likely to receive timely notice of a potential problem, and once notified, would be less motivated to promptly initiate the required examination and corrective measures.

Persons qualified to perform maintenance. Section 57.5066(c) requires that persons who maintain diesel equipment in underground metal and nonmetal mines be ''qualified,'' by virtue of training or experience, to ensure the maintenance standards of § 57.5066(a) are observed. Paragraph (c) also requires that an operator retain appropriate evidence of ''the competence of any person to perform specific maintenance tasks'' in compliance with the requirement's maintenance standards for one year.

The requirements being established in this regard are not as stringent as those in effect for the maintenance of diesel powered equipment in underground coal mines. Operators of underground coal mines where diesel-powered equipment is used are required, as of November 25, 1997, to establish programs to ensure that persons who perform maintenance, tests, examinations and repairs on diesel-powered equipment are qualified (30 CFR 75.1915). The unique conditions in underground coal mines require the use of specialized equipment. Accordingly, the persons who maintain this equipment generally must be appropriately qualified.

If repairs and adjustments to diesel engines used in underground metal and nonmetal mines are to be done properly, personnel performing such tasks must be properly trained. MSHA does not believe, however, that the qualifications required to perform this work in underground metal and nonmetal mines necessarily require the same level of training as is required for similar work in underground coal mines. Under the final rule, the training required would be that which is commensurate with the maintenance task involved. If examining and, if necessary, changing a filter or air cleaner is all that is required, a miner who has been shown how to do these tasks would be qualified by virtue of training or experience to do those tasks. For more detailed work, specialized training or additional experience would be required. Training by a manufacturer's representative, completion of a general diesel engine maintenance course, or practical experience performing such repairs could also serve as evidence of having the qualifications to perform the service.

In practice, the appropriateness of the training or experience of the maintenance personnel will be revealed by the performance of the equipment, both the diesel engine itself and any emission aftertreatment devices. If MSHA finds a situation where maintenance appears to be shoddy, where the log indicates an engine has been in for repair with more frequency than should be required, or where repairs have damaged engine approval status or emission control effectiveness, MSHA would ask the operator to provide evidence that the person(s) who worked on the equipment was properly qualified by virtue of training or experience.

It is MSHA's intent that equipment sent off-site for maintenance and repair is also subject to the requirement that the personnel performing the work be qualified by virtue of training or experience for the task involved. It is not MSHA's intent that a mine operator have to examine the training and experience record of off-site mechanics, but a mine operator will be expected to observe the same kind of caution as one would observe with a personal vehicle—*e.g.,* selecting the proper kind of shop for the nature of the work involved, and considering prior direct experience with the quality of the shop's work.

One commenter objected to the requirement that mine operators must retain evidence of the competence of such workers for one year after any applicable maintenance task is completed. MSHA believes the provision is important because the evidence retained by the mine operator is the only means by which MSHA can judge compliance with the competency requirement.

Another commenter recommended this provision be dropped from the final rule because it is unnecessary. This commenter argued that it is in a mine operator's self interest to employ only qualified diesel mechanics to perform maintenance on equipment that is critical to the productive capacity of the mine. Another commenter stated that the rule is unnecessary because they already keep a file on mechanic training. MSHA believes this provision is important because not all mine operators are as careful in employing only qualified persons to maintain the emissions-related components of their diesel equipment. For mine operators that do, this requirement should not be burdensome. For mine operators that don't, this requirement will prevent unqualified persons from performing improper maintenance procedures on this equipment, thereby preventing this equipment from generating potentially excessive diesel emissions.

Another commenter recommended that the final rule should include minimum qualifications for persons responsible for ventilation at underground metal and nonmetal mines. The recommendation applied to mines employing greater than 20 miners, and suggested that the minimum qualification should be a mining engineering degree from an accredited university having a program that includes training in the theory and practice of underground metal and nonmetal mine ventilation, and that qualified persons should also have some minimum level of operating experience in this field. MSHA believes that its existing ventilation regulations and this final dpm rule are appropriately performance oriented regarding the use of mine ventilation as a dpm control measure. Mine operators who rely on ventilation will be judged by MSHA according to their success in complying with the final concentration limit. Therefore, the final rule has not been changed to require persons who are responsible for ventilation at mines employing more than 20 miners to meet any minimum qualifications.

Section 57.5067 Engines

The final rule requires that, with the exception of diesel engines used in ambulances and fire-fighting equipment, any diesel engines added to the fleet of an underground metal or nonmetal mine in the future have to either be engines approved by MSHA under part 7 or part 36 or engines that meet or exceed the applicable dpm emission requirements of the EPA explicitly incorporated into a table in the rule. This requirement takes effect 60 days after the date this rule is promulgated. Only engines approved by MSHA as permissible can be used in areas of the mine where permissible diesel equipment is required. The composition of the existing fleet in an underground metal and nonmetal mine is not impacted by this part of the final rule. However, after the rule's effective date, any engine introduced into the underground areas of the mine must be either MSHA approved or meet the applicable EPA requirements. The term ''introduced'' is explicitly defined in the final rule to eliminate uncertainty regarding MSHA's intent. Engines that are introduced means engines in newly purchased equipment, engines in used equipment brought into the mine, or replacement engines that have a different serial number than the engine it is replacing. The term introduced does not include engines that were previously part of the mine inventory and rebuilt.

The final rule reflects a change from the proposed rule. The proposed rule would have required that, with the exception of diesel engines used in ambulances and fire-fighting equipment, any diesel engines added to the fleet of an underground metal or nonmetal mine in the future would have to have been approved by MSHA under Part 7 or Part 36. As discussed below, after reviewing the comments on this topic, MSHA concluded that it could accomplish the same goal, while providing operators with considerable extra flexibility, by permitting engines compliant with applicable EPA standards as an alternative to MSHA approved engines.

Table § 57.5067–1 in the final rule lists the applicable EPA dpm standards for diesel engines. The EPA standards represent the dpm emission limits set by EPA for light duty vehicles, light duty trucks, heavy duty highway engines, and nonroad engines. MSHA believes that all engines used in underground M/NM mines would come from these categories. MSHA chose the current on-highway dpm standards that have been in effect since 1994 for any commercially available on-highway vehicle. For nonroad, MSHA mainly used the EPA tier 1 standards that have been in effect starting in 1996 through 2000.

MSHA did notice one gap in the EPA nonroad standards. For engines in the 50 to 175 horsepower range, EPA did not list a dpm standard for tier 1. A tier 2 standard is listed in the final rule table for this reason. Full EPA implementation of the tier 2 standard for this horsepower range will become effective in 2003 for engines from 50–100 horsepower and in 2004 for engines 100 to 175 horsepower. However, MSHA believes that engines in this horsepower range are available now to meet the standard. MSHA has approved many engines under part 7 in this horsepower range that would meet the standard, and engine manufacturers are also producing other engine models in this horsepower range that meet the standard. The dpm requirement is the same for this engine horsepower range as was specified for engines in light duty vehicles in the coal final rule. Therefore, MSHA does not believe that mine operators will have problems introducing engines that meet any of the requirements of this section.

Several commenters questioned the need for engine restrictions at all if the applicable concentration limit could be achieved through other means. The rationale for this requirement is to promote the gradual turnover of the

existing fleet to better, less-polluting engines, thereby reducing dpm concentrations and attendant health risks. Without this requirement, there would be no constraint on the introduction of engines that are inherently higher polluting into underground metal and nonmetal mines. Such engines, regardless of the level of maintenance they receive, produce significantly higher dpm emissions than the low polluting engines mandated in the final rule. MSHA acknowledges that older, high polluting engines will eventually be replaced with low polluting engines through the normal equipment turnover process, because EPA emission requirements (and similar requirements imposed by foreign regulatory bodies) will make high polluting engines increasingly difficult for manufacturers to sell for any application. Even if a mine operator wanted to continue using high polluting engines, such engines will become more and more scarce over time. But in light of the risks of dpm exposure to miners, and the history of the underground mining industry to bring old engines underground and keep them operating for a long period of time, MSHA has concluded that a rule is required to bring about the transition to newer engines more quickly than would otherwise be the case. MSHA considers the gradual introduction of cleaner engines to be one of the ''best practices'' that is feasible for all underground metal and nonmetal mines. Further elaboration on the rationale for mandating these ''best practices'' was included in the preamble to the proposal (63 FR 58119), and a summary was provided in this Part under the portion of § 57.5060 that discussed ''Meeting the concentration limit, operator choice of engineering controls.''

Other commenters recommended that EPA certification be an acceptable alternative to MSHA approval. As noted above, after considering the matter, MSHA agrees that engines certified as meeting applicable EPA standards would provide an acceptable level of protection to miner health comparable to that which can be achieved by requiring MSHA approved engines. (For detailed information about the various ''tiers'' of EPA engine requirements, and the various types of engine categories, please see Part II, section 5). Therefore, under the final rule, engines meeting or exceeding applicable particulate emission requirements of the Environmental Protection Agency (as listed in the table in § 57.5067(b)) are an acceptable alternative to engines approved by MSHA as nonpermissible under subpart E of Part 7 of this title. This change in the final rule will provide mine operators with a wider choice of acceptable engines, and may reduce compliance costs.

MSHA is developing a program that will streamline the procedures by which manufacturers of diesel engines intended for use in outby areas of underground coal mines can gain Agency approval. The program will draw on the EPA approval programs for engines used in off-road applications. MSHA will continue to issue approvals for mining engines, but the application process will be abbreviated. Many of the provisions of part 7 are intended to ensure that engines continue to be manufactured in the same configuration and with the same emissions as the engine tested by MSHA. Procedures within the EPA approval programs reach the same end. Additionally, EPA has the resources and the regulatory authority to conduct an extensive quality assurance program to monitor emissions from production engines. In addition to streamlining the application process, MSHA will establish a program under which the engine emission tests conducted for EPA approval will satisfy the part 7 testing requirements. The test cycles under which emissions are tested for both MSHA and EPA are identical, and the gaseous emission results from the EPA tests can be used to establish the ventilating air quantity that appears on the engine approval plate and is referenced in mine ventilation regulations. MSHA will announce the specifics of the program when it is finalized. A listing of MSHA approved nonpermissible engines has been provided on MSHA's Internet web site. This listing can be accessed at the following address: http://www.msha.gov/S&HINFO/DESLREG/1909a.HTM.

Many underground metal and nonmetal mines are accustomed to employing front end loaders, haulage trucks, and other production equipment that is developed for, and primarily marketed to the surface mining and construction industries. Likewise, where conditions permit, underground metal and nonmetal mines often employ support vehicles such as pickup trucks, sport utility vehicles, and other small to medium sized trucks that are developed for, and primarily marketed to the surface over-the-road market. Mine operators employ this equipment because it is significantly less costly than purpose-built underground mining equipment, which has special mine-duty features and is produced in relatively low volume.

The engines in newly manufactured surface off-road equipment and over-the-road vehicles are already required to comply with EPA dpm emission regulations. EPA regulations are fashioned in a Tier structure whereby engines in designated horsepower ranges are required to meet increasingly stringent emissions levels. By changing the final rule as indicated above to accept engines meeting or exceeding applicable particulate emission requirements of the EPA, MSHA is, in essence, allowing mine operators to continue the long-standing and cost-effective practice of employing standard off-road equipment and over-the-road vehicles underground (if they are equipped with engines meeting the appropriate EPA requirements), without requiring potentially costly retrofits of approved engines. This change will enable mine operators and mine workers to gain the added benefits of engines that incorporate the most recent emission reducing technology.

Laboratory testing to certify that an engine meets the applicable EPA particulate matter limit or MSHA approval requirements is not the responsibility of the mine operator. MSHA approved engines carry an approval plate so they are easy to distinguish. Engines produced after the date indicated in the Table incorporated into 5067(b) will meet the EPA requirements for the listed category of engines.

Engines in diesel-powered ambulances and fire-fighting equipment are exempted from these requirements. This exemption is identical with that in the rule for diesel-powered equipment in underground coal mines. The rationale for this exemption is that the usage of these vehicles and equipment is so limited that their contribution to overall dpm levels in a mine is negligible. MSHA wishes to caution mine operators, however, that this exemption is intended to apply only to equipment that is used exclusively as an ambulance or fire fighting equipment. This exemption does not apply to vehicles and equipment that are normally used for other purposes, but serve as an ambulance or fire fighting equipment in the event of an accident or mine emergency.

Section 57.5070 Miner Training

Section 57.5070 requires any miner ''who can reasonably be expected to be exposed to diesel emissions'' be trained annually in: (a) The health risks associated with dpm exposure; (b) the methods used in the mine to control dpm concentrations; (c) identification of the personnel responsible for

maintaining those controls; and (d) actions miners must take to ensure the controls operate as intended. The final rule is the same as that proposed, and is identical to the rule being established for underground coal miners through MSHA's rulemaking limiting dpm concentrations in underground coal mines.

The purpose of these requirements is to promote miner awareness. Exposure to diesel particulate is associated with a number of harmful effects as discussed in Part III of this preamble, and the safe level is unknown. Miners who work in mines where they are exposed to this risk ought to be reminded of the hazard often enough to make them active and committed partners in implementing actions that will reduce that risk.

The training need only be provided to miners who can reasonably be expected to be exposed at the mine. The training is to be provided by operators; hence, it is to be without fee to the miner.

The rule places no constraints on the operator as to how to accomplish this training. MSHA believes that the required training can be provided at minimal cost and minimal disruption. The proposal would not require any special qualifications for instructors, nor would it specify the hours of instruction.

Instruction could take place at safety meetings before the shift begins. Devoting one of those meetings to the topic of dpm would be a very easy way to convey the necessary information. Simply providing miners with a copy of MSHA's ''Toolbox'' and, a copy of the plan, if a control plan is in effect for the mine, and reviewing these documents, can cover several of the training requirements. One-on-one discussions that cover the required topics are another approach that can be used.

Operators could also choose to include a discussion on diesel particulate matter emissions in their Part 48 training, provided the plan is approved by MSHA. There is no existing requirement that Part 48 training include a discussion of the hazards and control of diesel emissions. While mine operators are free to cover additional topics during the Part 48 training sessions, the topics that must be covered during the required time frame may make it impracticable to cover the additional material on dpm. Where adequate time is available at mines using diesel-powered equipment, operators would be free to include the dpm instruction in their Part 48 training plans. Since inclusion of dpm-related training in Part 48 training plans is not explicitly prohibited in the final rule, MSHA does not believe special language is required to permit this practice.

The final rule does not require the mine operator to separately certify the completion of the dpm training, but some evidence that the training took place would have to be produced upon request. A serial log with the employee's signature is an acceptable practice. To assist mine operators with this training requirement, it is MSHA's intent to develop an instructor's guide and corresponding training materials.

A few comments were received on § 57.5070, including the suggestion that such training be included under Part 48, and the opposing view that such training be independent of Part 48. Arguments in favor of including the training under Part 48 focused on the need to simplify the rule by not requiring separate diesel particulate emissions training and training recordkeeping. Arguments opposed focused on the difficulty of including more subject matter into a Part 48 training plan that is already overfilled. It was also noted that Part 48 training requires MSHA-certified instructors. By separating Part 48 training from the training required under § 57.5070, mine operators would have greater flexibility in choosing instructors.

MSHA believes the final rule satisfies both positions because inclusion of the specified diesel particulate emissions training topics under Part 48 training is neither required nor prohibited. Mine operators wishing to incorporate diesel emissions training in their Part 48 training plan are free to do so, whereas those wishing to conduct diesel emissions training separate from Part 48 training are equally free to choose that option. MSHA believes it is significant that none of the commenters discounted the importance of providing dpm-exposed miners with such training; their comments only addressed the mechanics of how such training should be delivered.

In its preamble to the proposed rule, MSHA specifically invited comment as to whether special language should be included in the final rule that would expressly permit required dpm training to be incorporated into Part 48 training. Only one commenter responded, expressing the view that special language was not necessary. Therefore, MSHA did not change this provision in the final rule.

Another commenter suggested that training required under § 57.5070 incorporate mandatory coverage of underground metal and nonmetal mine ventilation, that such training address auxiliary ventilation and the use of elementary ventilation measurement instruments, and that similar training be mandatory for first and second line supervisors.

MSHA agrees that ventilation is an important topic and that ventilation can have a significant effect on dpm concentrations underground. However, MSHA believes it would be inappropriate to specify the content of dpm-related miner training to the level of detail suggested by the commenter. Since MSHA allows mine operators considerable freedom to choose dpm control measures, MSHA expects significant variability from mine to mine in the mix of controls selected. For example, some mines may rely heavily on ventilation to comply with the applicable concentration limit, but other mines may rely more on enclosed cabs or diesel particulate filters. As a result, the most important training subject or subjects at one mine could be quite different at another mine.

By requiring training in the health risks associated with dpm exposure, the methods used in the mine to control dpm concentrations, identification of the personnel responsible for maintaining those controls, and the actions miners must take to ensure the controls operate as intended, MSHA believes it has established performance-based training requirements that are applicable to all mines.

As with the proposed rule, the final rule does not require the mine operator to separately certify the completion of dpm training, but some evidence that the training took place will have to be produced upon MSHA request. In this regard, as noted in the preamble to the proposed rule, a serial log with the employee's signature is an acceptable practice. Nevertheless, some commenters complained that the recordkeeping requirements in the training provisions are burdensome, and don't reduce diesel emissions. MSHA believes that dpm training is an essential element of a comprehensive dpm control program because miners who are fully informed are more apt to become active and committed partners in implementing an effective dpm control strategy. In this way, training can have an indirect, yet substantive and positive influence on reducing dpm exposure. The corresponding recordkeeping requirements are important, because the records are the means by which MSHA can insure that the mine operator is complying with the training requirements.

As noted in the preamble to the proposed rule, to assist mine operators with this training requirement, it is MSHA's intent to develop an instruction outline that mine operators can use as

a guide for training personnel. Instruction materials will be provided with the outline.

Section 57.5071 Environmental Monitoring

The final rule requires mine operators to monitor as often as necessary to effectively evaluate, under conditions that can be reasonably anticipated in the mine—(1) whether the concentration of dpm in an area where miners normally work or travel exceeds the applicable concentration limit; and (2) the average full shift airborne concentration at any position or on any person designated by the Secretary. This section also requires operators to provide affected miners and their representatives with notice and an opportunity to observe monitoring, to initiate corrective action by the next work shift should monitoring reveal a violation and to promptly complete such action, and requires certain posting and recordkeeping. The final rule is the same as the proposed rule.

Operator's Monitoring Responsibility. Section 57.5071(a) requires mine operators to monitor the underground mine environment to insure dpm concentrations are within compliance limits wherever the limits apply. Sampling, which could be area sampling, personal sampling, or occupational sampling, is required as often as necessary to ''effectively determine''—under conditions that can be reasonably anticipated in the mine—(1) whether the dpm concentration in any area of the mine where miners normally work or travel exceeds the applicable limit; and (2) the average full shift airborne concentration at any position or on any person designated by the Secretary.

This requirement is similar to existing § 57.5002 which requires mine operators to conduct dust, gas, mist, and fume surveys as frequently as necessary to determine the adequacy of control measures, and to existing § 62.110(a) and (b) which requires mine operators to measure each miner's noise dose sufficient to determine continuing compliance with the established noise limits. Under § 57.5071(a), mine operators are required to monitor dpm concentrations in much the same way they are already required to monitor dust, gas, mist, fume, and noise.

There are three important aspects of this operator monitoring requirement.

First, the responsibility for dpm monitoring rests with the mine operator, not with MSHA. Mine operators cannot rely on MSHA inspectors to conduct dpm monitoring whenever and wherever necessary to ensure compliance with the applicable dpm concentration limit. The purpose of operator monitoring is to determine continuing compliance, whereas the purpose of MSHA sampling is to identify non-compliance. MSHA sampling is neither intended for, nor capable of determining continued compliance.

Second, the information gathered through operator monitoring is to be used by the operator to determine whether action is necessary to maintain compliance anywhere the applicable concentration limits apply in the mine. Gathering dpm concentration data, though necessary, is not the final goal in itself. The reason for gathering this information is so it can be used by the mine operator to assess the effectiveness of dpm control measures. Sampling results which indicate non-compliance should prompt the mine operator to initiate whatever actions are required (i.e., implementation of appropriate engineering controls and work practices) to achieve compliance wherever the applicable concentration limits apply.

Third, this requirement ensures special attention will be focused on locations or persons known to MSHA to have a significant potential for overexposure to dpm.

The obligation of operators to ''effectively determine'' dpm concentrations in a mine is a separate obligation from that to keep dpm levels below the established limit, and can be the basis of a separate citation from MSHA. The final rule is performance-oriented in that the regularity and methodology used to make this evaluation are not specified. However, MSHA expects mine operators to sample with such frequency that they and the miners working at the mine site are aware of dpm levels in their work environment. In this regard, MSHA's own measurements will assist the Agency in verifying the effectiveness of an operator's monitoring program. If an operator is ''effectively determining'' the concentration of dpm at designated positions, for example, MSHA would not expect to regularly record concentrations above the limit when it samples at that location. If MSHA does find such a problem, it will investigate to determine how frequently an operator is sampling, where the operator is sampling, and what methodology is being used, so as to determine whether the obligation in this section is being fulfilled. (See previous discussion in this Part in the portion of § 57.5062 that addressed ''Demonstration of plan effectiveness'' for further information on the number of samples required to demonstrate continuing compliance.)

Operator Monitoring Methods. The final rule requires that full-shift diesel particulate concentrations be determined during periods of normal production or normal work activity in areas where miners work or travel. The rule does not specify a particular monitoring method or frequency; rather, the rule is performance-oriented. Operators may, at their discretion, conduct their monitoring using the same sampling and analytical method as MSHA, or they may use any other method that enables that mine to ''effectively determine'' the concentrations of dpm.

As required by § 57.5061, MSHA will collect samples using a respirable dust sampler equipped with a submicrometer impactor, and use NIOSH Method 5040, the sampling and analytical method that NIOSH has developed for accurately determining the concentration of total carbon, to determine compliance. Operators who must comply with the terms of a diesel particulate control plan pursuant to § 57.5062 must, as noted in the requirements of that section, use the same sampling and analytical method as MSHA to verify plan effectiveness; monitoring performed for that purpose would probably meet the obligation under § 5071 if it is done with enough sufficiency to meet the obligation under § 57.5062(c). But the method may not be necessary to effectively determine dpm in some mines for purposes of § 57.5071(a). For example, dpm measurements in limestone, potash and salt mines could be determined using the RCD method, since there are no large carbonaceous particles present that would interfere with the analysis. For hydrated minerals such as gypsum and trona, a two-step RCD method would be necessary, wherein the first step would elevate the temperature of the sample sufficient to cause dehydration (105 °C). The sample is then reweighed, and the conventional RCD analysis procedure is followed. Such estimates can be useful in determining the effectiveness of controls and where more refined measurements may be required.

Of course, mine operators using the RCD or size-selective methods to monitor their diesel particulate concentrations would have to convert the results to a TC equivalent to ascertain their compliance status. At the present time, MSHA has no conversion tables for this purpose, however a simple conversion approach would be to adjust the sampling result to the corresponding estimated whole dpm concentration, then multiply that value by 0.8. In most cases, the other methods will provide a good indication of

whether controls are working and whether further action is required.

Part II of this preamble provides information on monitoring methods and their constraints, and on laboratory and sampler availability.

One commenter observed that area sampling outside of an enclosed cab would defeat the purpose of installing the cab, and would diminish the status of such a cab, which is a recognized engineering control, to that of personal protective equipment, which is prohibited under the rule. MSHA agrees that area sampling is inappropriate where miners are protected by enclosed cabs with filtered breathing air and no other miners are required to work in the area outside of the cab. As discussed under section 5061(c)(3), area sampling by MSHA for compliance purposes would not be conducted outside of an enclosed cab unless miners are working in the area outside of such cabs, and MSHA would urge operators to follow the same approach. Also, as noted in discussing that section, personal sampling within cabs operated by smokers should only be conducted if the equipment operator agrees not to smoke during the sampling period.

Observation of Monitoring. Section 103(c) of the Mine Act requires that:

> The Secretary, in cooperation with the Secretary of Health, Education, and Welfare, shall issue regulations requiring operators to maintain accurate records of employee exposures to potentially toxic materials or harmful physical agents which are required to be monitored or measured under any applicable mandatory health or safety standard promulgated under this Act. Such regulations shall provide miners or their representatives with an opportunity to observe such monitoring or measuring, and to have access to the records thereof.

In accordance with this legal requirement, § 57.5071(b) of the final rule requires a mine operator to provide affected miners and their representatives with an opportunity to observe exposure monitoring required by this section. Mine operators must give prior notice of the date and time of intended monitoring so that affected miners and their representatives can exercise their right to observe the monitoring if they so choose.

Comments addressing § 57.5071(b) questioned the meaning of the terms ''miner's representative'' and ''affected miners,'' and objected to paying miners to observe dpm monitoring.

MSHA intends for miner's representative to mean any authorized representative of the miners. A representative of the miners could, but does not necessarily have to be, a representative of a certified union. Limiting representatives of miners to certified unions is a violation of the Mine Act and departs from previous MSHA practice.

MSHA intends for affected miners to mean the miners that are potentially exposed to the diesel particulate matter being monitored. The commenter suggested that this provision ''* * * leaves too much for interpretation. How many employees may observe? For how long?'' Consistent with the Mine Act, MSHA does not intend to limit the number of miners who may observe dpm monitoring, however, such miners need not be paid if, as a result of observing the monitoring, they are not performing their jobs.

Corrective Action if Concentration Is Exceeded. Section 57.5071(c) provides that if any monitoring performed under this section indicates that the applicable dpm concentration limit has been exceeded, an operator shall initiate corrective action by the next work shift, promptly post a notice of the corrective action being taken and promptly complete such corrective action.

The Agency wishes to emphasize that operator monitoring of dpm concentrations would not take the place of MSHA sampling for compliance purposes; rather, this requirement is designed to ensure the operator checks dpm concentrations on a more regular basis than is possible for MSHA to do. Paragraph (c) provides that if sampling results indicate the concentration limit has been exceeded in an area of a mine, an operator would initiate corrective action by the next work shift and promptly complete such action. Paragraph (c) does not require an operator to establish a dpm control plan. The establishment of a dpm control plan is triggered by a non-compliance determination based on sampling conducted by the Secretary.

In certain types of cases (*e.g.,* 30 CFR 75.323), MSHA has required that when monitoring detects a hazardous level of a substance, miners must be immediately withdrawn from an area until abatement action has been completed. Although MSHA did not include such a requirement in the final rule, MSHA in its proposal did solicit comment from the mining industry concerning this practice, especially in light of the evidence presented on the various risks posed by exposure to diesel particulate, including material presented in the preamble to the proposal that acute short-term increases in exposure can pose significant risks to miner health. The comments that were received in response to this solicitation were opposed to a provision requiring immediate withdrawal.

The agency also specifically asked for comments on three other points (63 FR 58189, 58190). First, the agency noted that it welcomed comments as to what guidance to provide with respect to corrective actions required where an operator is not using the total carbon analytical method. Second, the agency noted it welcomed comment as to whether personal notice of corrective action would be more appropriate than posting, given the health risks involved. Third, the agency solicited comment on whether clarification of the proposed requirement was needed in light of the fact that operators using more complex analytical procedures (*e.g.,* the total carbon method) may not receive the results for some time period after the posting has taken place.

No comments addressing these points were received.

Posting of Sample Results. Section 57.5071(d)(1) requires that monitoring results be posted on the mine bulletin board within 15 days of receipt, and remain posted for 30 days. A copy of the results must also be provided to the authorized miners' representative. Posting of the results will ensure that miners are kept aware of the hazard so they can actively participate in efforts to control dpm.

Comments that addressed this paragraph recommended that sampling results should not be given to the representative of the miners because this information is private, and recommended that mine operators should not be cited for posting sampling results that exceed the applicable concentration limit.

MSHA disagrees with the assertion that dpm sampling results are private, and therefore, such results should not be given the representative of the miners. The Mine Act clearly states that miners or their representatives have a legal right to access to exposure monitoring information.

Regarding the question of MSHA issuing a citation based on a mine operator posting sampling results that exceed the applicable concentration limit, it is not MSHA's intent to issue a citation under these circumstances. If such sampling indicates that dpm levels exceed the applicable concentration limit, a citation may be issued if the mine operator fails to initiate corrective action by the next work shift, as required under § 57.5071(c). However, mine operator sampling results that exceed the applicable limit is not, by itself, a violation.

MSHA recognizes that this is an important point, and reiterates that, as indicated in § 57.5061, MSHA itself is to conduct compliance sampling.

Retention of Sample Results. Section 57.5071(d)(2) requires that records of the sampling method and the sample results themselves be retained by mine operators for five years. This is because the results from a monitoring program can provide insight as to the effectiveness of controls over time, and provide a history of occupational exposures at the mine.

In the preamble to the proposed rule, MSHA welcomed comments on the sample retention period appropriate for the risks involved. None were received.

In the preamble to the proposed rule, MSHA also asked for comments regarding the advisability of instituting a system of medical surveillance of miners exposed to dpm to identify miners suffering ill effects of dpm exposure, and the subsequent medical removal of miners who are determined to be suffering such ill effects. The comments received in response to this request suggested that medical surveillance for excessive dpm exposure is not feasible at this time because the appropriate biological tests or markers do not exist. One commenter observed that they were, ''* * * unaware of any recognized or generally accepted examinations or tests for detecting whether miners are suffering from ill effects as a result of diesel particulate or exhaust exposure. This view is supported by EPA's Health Assessment Document for Diesel Emissions which states, 'There is no single medical test to determine if DP exposure has occurred. Many symptoms of episodic DP exposure are similar to symptoms caused by other agents or, in some cases, onset of a common cold. Invasive sampling of particle deposits in the upper respiratory tract or lung could be done, yet such particles may not be readily distinguishable from particulate matter from other sources' [EPA, 1998].'' MSHA agrees with these commenters that appropriate medical testing protocols are not currently available. Therefore, provision for neither medical surveillance nor medical removal protections have been incorporated into the final rule.

Section 57.5075 Diesel Particulate Records

Various recordkeeping requirements are set forth in the provisions of the final rule. For the convenience of the mining community, these requirements are also listed in a table entitled ''Diesel Particulate Recordkeeping Requirements,'' which can be found in § 57.5075(a). Each row involves a record that must be kept. The section requiring the record be kept is noted, along with the retention time.

This approach—having a summary table of recordkeeping requirements included in various sections of the rule—is identical to that taken in the proposed rule. MSHA indicated in the preamble to the proposed rule that it would welcome input from the mining community as to whether it liked this approach or found it duplicative or confusing, however, no comments were received.

Location of Records. Section 57.5075(b)(1) provides that any record which is required to be retained at the mine site may be retained elsewhere if it is immediately accessible from the mine site by electronic transmission. Compliance records need to be accessible to an inspector so they can be viewed during the course of an inspection, as the information in the records may determine how the inspection proceeds. If the mine site has a fax machine or computer terminal, there is no reason why the records cannot be maintained elsewhere. MSHA's approach in this regard is consistent with Office of Management and Budget Circular A–130.

One commenter, though supporting the concept of off-site electronic records storage, questioned MSHA's intent relative to the term ''immediately accessible.'' As noted above, MSHA intends that records maintained off-site be made available to an MSHA inspector so the information can be used to guide inspection decisions. Thus, undue delay in retrieving this information from off site electronic storage would impede an inspection, and would not be permitted. If the records are maintained in hardcopy form at an off-site location, and considering the time required to contact off-site personnel to request the records, for those personnel to locate and remove the records from the files, and to fax the records to the mine site, a delay of one or two hours would not be unreasonable. If records are maintained in an off-site electronic database, it is reasonable to assume they could be electronically transmitted to the mine site even faster; perhaps one hour or less.

These time frames are in contrast to the requirement in MSHA's new noise regulation for noise records to be accessible to the MSHA inspector, but not ''immediately accessible.'' The guideline established in the Preamble to the final noise rule states that records must be provided to the MSHA inspector within one business day or less (p. 49625).

The commenter notes further that, ''Even with Y2K compliant systems, computer and electronic transmission equipment is not 100% reliable, especially in remote mining environments.'' MSHA agrees that an insistence on 100% reliability of computer and electronic transmission equipment is unreasonable. However, MSHA will not accept chronic computer or electronic transmission problems as a justification for the repeated denial of timely access to the required records. If chronic computer or electronic transmission problems make ''immediate'' access to records problematic, such records would have to be kept at the mine site.

Records Access. Section 57.5075(b) also covers records access. Consistent with the statute, upon request from an authorized representative of the Secretary of Labor, the Secretary of Health and Human Services, or from the authorized representative of miners, mine operators are to promptly provide access to any record listed in the table in this section. A miner, former miner, or, with the miner's or former miner's written consent, a personal representative of a miner, is to have access to any exposure record required to be maintained pursuant to § 57.5071 to the extent the information pertains to the miner or former miner. Upon request, the operator must provide the first copy of such record at no cost. Whenever an operator ceases to do business, that operator would be required to transfer all records required to be maintained by this part to any successor operator.

General Effective Date of Part 57. The rule provides that unless otherwise specified, its provisions take effect 60 days after the date of promulgation of the final rule. Thus, for example, the requirements to implement certain work practice controls (*e.g.,* fuel type) go into effect 60 days after the final rule is published.

A number of provisions of the final rule contain separate effective dates that provide more time for technical support. For example, the initial concentration limit for underground metal and nonmetal mines would be delayed for 18 months.

A general outline of effective dates is summarized in Part I of this preamble.

Additionally, the paperwork provisions will not become effective until approved by the Office of Management and Budget.

V. Adequacy of Protection and Feasibility of Final Rule; Alternatives Considered

The Mine Act requires that in promulgating a standard, the Secretary, based on the best available evidence, shall attain the highest degree of health

and safety protection for the miner with feasibility a consideration.

Overview. This part begins with a summary of the pertinent legal requirements, followed by a general profile of the economic health and prospects of the metal and nonmetal mining industry.

The final rule establishes a concentration limit for dpm, supplemented by monitoring and training requirements. An operator in the metal and nonmetal sector would have the flexibility to choose any type or combination of engineering controls to keep dpm levels at or below the concentration limit. This part evaluates the final rule to ascertain if, as required by the statute, it achieves the highest degree of protection for underground metal and nonmetal miners that is feasible, both technologically and economically, for underground metal and nonmetal mine operators to provide.

Several regulatory alternatives to the final rule were also reviewed by MSHA in light of the record. The Agency has concluded that compliance with these alternatives either provide less protection than the feasible approach being adopted, or are not technologically or economically feasible for the underground metal and nonmetal industry as a whole at this time.

Pertinent Legal Requirements. Section 101(a)(6)(A) of the Federal Mine Safety and Health Act of 1977 (Mine Act) states that MSHA's promulgation of health standards must:

> * * * [A]dequately assure, on the basis of the best available evidence, that no miner will suffer material impairment of health or functional capacity even if such miner has regular exposure to the hazards dealt with by such standard for the period of his working life.

The Mine Act also specifies that the Secretary of Labor (Secretary), in promulgating mandatory standards pertaining to toxic materials or harmful physical agents, base such standards upon:

> * * * [R]esearch, demonstrations, experiments, and such other information as may be appropriate. In addition to the attainment of the highest degree of health and safety protection for the miner, other considerations shall be the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws. Whenever practicable, the mandatory health or safety standard promulgated shall be expressed in terms of objective criteria and of the performance desired. [Section 101(a)(6)(A)].

Thus, the Mine Act requires that the Secretary, in promulgating a standard, based on the best available evidence, attain the highest degree of health and safety protection for the miner with feasibility a consideration.

In relation to feasibility, the legislative history of the Mine Act states that:

> * * *Section further provides that ''other considerations'' in the setting of health standards are ''the latest available scientific data in the field, the feasibility of the standards, and experience gained under this and other health and safety laws.'' 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 appeal 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 in today's horizon. *AFL-CIO* v. *Brennan,* 530 F.2d 109 (1975); *Society of the Plastics Industry* v. *OSHA,* 509 F.2d 1301, *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 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. S. Rep. No. 95–181, 95th Cong., 1st Sess. 21 (1977).

Court decisions have clarified the meaning of feasibility. The Supreme Court, in *American Textile Manufacturers' Institute* v. *Donovan* (OSHA Cotton Dust), 452 U.S. 490, 101 S.Ct. 2478 (1981), defined the word ''feasible'' as ''capable of being done, executed, or effected.'' The Court stated that a standard would not be considered economically feasible if an entire industry's competitive structure was threatened. According to the Court, the appropriate inquiry into a standard's economic feasibility is whether the standard is capable of being achieved.

Courts do not expect hard and precise predictions from agencies regarding feasibility. Congress intended for the ''arbitrary and capricious standard'' to be applied in judicial review of MSHA rulemaking (S.Rep. No. 95–181, at 21.) Under this standard, MSHA need only base its predictions on reasonable inferences drawn from the existing facts. MSHA is required to produce reasonable assessment of the likely range of costs that a new standard will have on an industry. The agency must also 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. See, *Citizens to Preserve Overton Park* v. *Volpe*, 401 U.S. 402, 91 S.Ct. 814 (1971); *Baltimore Gas & Electric Co.* v. *NRDC*, 462 U.S. 87 103 S.Ct. 2246, (1983); *Motor Vehicle Manufacturers Assn.* v. *State Farm Mutual Automobile Insurance Co.*, 463 U.S. 29, 103 S.Ct. 2856 (1983); *International Ladies' Garment Workers' Union* v. *Donovan*, 722 F.2d 795, 232 U.S. App. D.C. 309 (1983), *cert. denied*, 469 U.S. 820 (1984); *Bowen* v. *American Hospital Assn.*, 476 U.S. 610, 106 S.Ct. 2101 (1986).

In developing a health standard, MSHA must also 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. *United Steelworkers of America* v. *Marshall*, 647 F.2d 1189, 1272 (1980). If only the most technologically advanced companies in an industry are capable of meeting the standard, then that would be sufficient demonstration of feasibility (this would be true even if only some of the operations met the standard for some of the time). *American Iron and Steel Institute* v. *OSHA*, 577 F.2d 825, (3d Cir. 1978); see also, *Industrial Union Department, AFL-CIO* v. *Hodgson*, 499 F.2d 467 (1974).

Industry Profile. This industry profile provides background information about the structure and economic characteristics of the mining industry. It provides data on the number of mines, their size, the number of employees, and the diesel powered equipment used.

The Structure of the Metal/Nonmetal Mining Industry. MSHA divides the mining industry into two major segments based on commodity: (1) Coal mines and (2) metal and nonmetal (M/NM) mines. These segments are further divided based on type of operation (*e.g.,* underground mines or surface mines). MSHA maintains its own data on mine type, size, and employment, and the Agency also collects data on the number of independent contractors and contractor employees by major industry segment.

MSHA categorizes mines by size based on employment. For the past 20 years, for rulemaking purposes, MSHA has consistently defined a small mine to be one that employs fewer than 20 workers and a large mine to be one that employs 20 or more workers. To comply with the requirements of the Small

Business Regulatory Enforcement Fairness Act (SBREFA) amendments to the Regulatory Flexibility Act (RFA), however, an agency must use the Small Business Administration's (SBA's) criteria for a small entity-¾ for mining, 500 or fewer employees ¾ when determining a rule's economic impact.

Table V–1 presents the total number of small and large mines and the corresponding number of miners, excluding contractors, for the M/NM mining segment. The M/NM mining segment consists of metal mines (copper, iron ore, gold, silver, etc.) and nonmetal mines (stone including granite, limestone, dolomite, sandstone, slate, and marble; sand and gravel; and others such as clays, potash, soda ash, salt, talc, and pyrophyllite.) As Table II–1 indicates, 98 percent of all M/NM mines are surface mines, and these mines employ some 90 percent of all M/NM miners, excluding office workers. Table V–2 presents corresponding data on the number of independent contractors and their employees working in the M/NM mining segment.

TABLE V–1.—DISTRIBUTION OF M/NM MINE OPERATIONS AND EMPLOYMENT (EXCLUDING CONTRACTORS) BY MINE TYPE AND SIZE [a]

Size of M/NM mine [b]	Mine type			
	Underground	Surface	Office workers	Total M/NM
Fewer than 20 employees:				
Mines	134	9,635	.....	9,769
Employees	1,054	54,356	9,160	64,570
20 to 500 employees:				
Mines	124	1,419	.....	1,543
Employees	11,299	79,675	15,040	106,014
Over 500 employees:				
Mines	7	18	.....	25
Employees	4,594	16,836	3,543	24,973
All M/NM mines:				
Mines	265	11,072	.....	11,337
Employees	16,947	150,867	27,743	195,557

[a] Source: U.S. Department of Labor, Mine Safety and Health Administration, Office of Standards, Regulations, and Variances based on 1998 MS data, CM441/CM935LA cycle 1998/198. Data for Total Office workers from Mine Injury and Worktime Quarterly (1997 Closeout Edition) Table 2, p. 6.

[b] Based on MSHA's traditional definition, large mines include all mines with 20 or more employees. Based on SBA's definition, as required by SBREFA, large mines include only mines with over 500 employees.

TABLE V–2.—DISTRIBUTION OF M/NM CONTRACTORS AND CONTRACTOR EMPLOYMENT BY SIZE OF OPERATION [a]

Size of contractors [b]	Contractors			
	Underground	Surface	Office workers	Total
Fewer than 20 employees:				
Mines	399	2,783	.....	3,182
Employees	1,717	14,155	649	16,521
20 to 500 employees:				
Mines	36	349	.....	384
Employees	1,639	17,979	802	20,420
Over 500 employees:				
Mines	.....	3	.....	3
Employees	.....	2,560	105	2,665
Total contractors:				
Mines	434	3,135	.....	3,569
Employees	3,356	34,694	1,556	39,606

[a] Source: U.S. Department of Labor, Mine Safety and Health Administration, Office of Standards, Regulations, and Variances based on 1998 MS data, CT441/CT935LA cycle 1998/198. Data for total office workers from Mine Injury and Worktime Quarterly (1998 Closeout Edition) Table 6, p. 21.

[b] Based on MSHA's traditional definition, large mines include all mines with 20 or more employees. Based on SBA's definition, as required by SBREFA, large mines include only mines with over 500 employees.

The M/NM mining sector consists of about 80 different commodities including industrial minerals. There were 11,337 M/NM mines in the U.S. in 1998, of which 9,769 (86%) were small mines and 1,568 (14%) were large mines, using MSHA's traditional definition of small and large mines. Based on SBA's definition, however, only 25 M/NM mines (0.2%) were large mines.[1]

The data in Table V–1 indicate that employment at M/NM mines in 1998 was 195,557, of which 64,570 workers (33%) were employed by small mines and 130,987 miners (67%) were employed by large mines, using MSHA's definition. Based on SBA's definition, however, 170,584 workers (87%) were employed by small mines and 24,973 workers (13%) were employed by large mines. Using MSHA's definition, the average employment is 7 workers at a small M/NM mine and 84 workers at a

[1] U.S. Department of Labor, MSHA, 1998 Final MIS data CM441 cycle 1998/198.

large M/NM mine.[2] Using SBA's definition, there are an average of 15 workers in each small M/NM mine and 888 workers in each large M/NM mine.

Metal Mining. There are about 24 metal commodities mined in the U.S. Underground metal mines use a few basic mining methods, such as room and pillar and block caving. The larger mines rely more heavily on hydraulic drills and track-mounted haulage, and the smaller underground metal mines rely more heavily on hand-held pneumatic drills

Surface metal mines normally include drilling, blasting, and hauling; such processes are typical in all surface mines, irrespective of commodity types. Surface metal mines in the U.S. rank among some of the largest mines in the world.

Metal mines constitute 3 percent of all M/NM mines and employ 23 percent of all M/NM miners. Under MSHA's traditional definition of a small mine, 45 percent of metal mines are small, and these mines employ 2 percent of all miners working in metal mines. Using SBA's definition, 94 percent of metal mines are small, and they employ 53 percent of all miners working in metal mines.[3]

Stone Mining. In the stone mining subsector, there are eight different stone commodities, of which seven are further classified as either dimension stone or crushed and broken stone. Stone mining in the U.S. is predominantly by quarrying, with only a few slight variations. Crushed stone mines typically drill and blast, while dimension stone mines generally use channel burners, drills, or wire saws. Diesel powered-haulage is used to transfer the broken rock from the quarry to the mill where crushing and sizing are done.

Stone mines constitute 33 percent of all M/NM mines, and they employ 41 percent of all M/NM miners. Using MSHA's definition of a small mine, 71 percent of stone mines are small, and these mines employ 29 percent of all miners working in stone mines. Using SBA's definition, 99.9 percent of stone mines are small, and they employ 99 percent of all miners working in stone mines.[4]

Sand & Gravel Mining. Sand and gravel, for construction, is generally extracted from surface deposits using dredges or draglines. Further preparation involves washing and screening. As in other surface mining operations, sand and gravel uses diesel-driven machines, such as front-end loaders, trucks, and bulldozers, for haulage. The preparation of industrial sand and silica flour involves the use of crushers, ball mills, vibrating screens, and classifiers.

The sand and gravel subsector represents the single largest commodity group in the U.S. mining industry when the number of mining operations is being considered. Sand and gravel mines comprise 57 percent of all M/NM mines, and they employ 22 percent of all M/NM miners. Using MSHA's definition of a small mine, 95 percent of sand and gravel mines are small, and these mines employ 76 percent of all miners working in sand and gravel mines. Using SBA's definition, almost 100 percent of sand and gravel mines are small, and they employ approximately 42,800 miners.[5]

Other Nonmetal Mining. For enforcement and statistical purposes, MSHA separates stone and sand and gravel mining from other nonmetal mining. There are about 35 other nonmetal commodities, not including stone, and sand and gravel. Nonmetal mining uses a wide variety of underground mining methods such as continuous mining (similar to coal mining), in-situ retorting, block caving, and room and pillar. The mining method is dependent on the geologic characteristics of the ore and host rock. Some nonmetal operations use kilns and dryers in ore processing. Ore crushing and milling are processes common to both nonmetal and metal mining.

As with underground mining, there is a wide range of mining methods utilized in extracting minerals by surface mining. In addition to drilling and blasting, other mining methods, such as evaporation and dredging, are also utilized, depending on the ore formation.

''Other'' nonmetal mines comprise 7 percent of all M/NM mines, and they employ 14 percent of all M/NM miners. Using MSHA's definition of a small mine, 66 percent of other nonmetal mines are small, and they employ 12 percent of all miners working in these nonmetal mines. Using SBA's definition, 99 percent of other nonmetal mines are small, and they employ 92 percent of all miners working in these nonmetal mines.[6]

Economic Characteristics of the Metal/nonmetal Mining Industry. The value of all M/NM mining output in 1998 was estimated at $40 billion.[7] Metal mines, which include copper, gold, iron, lead, silver, tin, and zinc mines, contributed $17.8 billion. Nonmetal production was valued at $22.2 billion: $9.0 billion from stone mining, $5.2 billion from sand and gravel, and $8 billion from other nonmetals such as potash, clay, and salt.

The end uses of M/NM mining output are diverse. For example, iron and aluminum are used to produce vehicles and other heavy duty equipment, as well as consumer goods such as household equipment and soft drink cans. Other metals, such as uranium and titanium, have more limited uses. Nonmetals, like cement, are used in construction while salt is used as a food additive and for road deicing in the winter. Soda ash, phosphate rock, and potash also have a wide variety of commercial uses. Stone and sand and gravel are used in numerous industries and extensively in the construction industry.

A detailed economic picture of the M/NM mining industry is difficult to develop because most mines are either privately held corporations or sole proprietorships, or subsidiaries of publicly owned companies. Privately held corporations and sole proprietorships are not required to make their financial data available to the public. Parent companies are not required to separate financial data for subsidiaries in their reports to the Securities and Exchange Commission. As a result, financial data are available for only a few M/NM companies, and these data are not representative of the entire industry.

Adequacy of Miner Protection Provided by the Final Rule in Underground Metal and Nonmetal Mines. In evaluating the rule for this purpose, it should be remembered that MSHA has measured dpm concentrations in this sector as high as $5{,}570_{DPM}$ μg/m³—a mean of 808_{DPM} μg/m³. See Table III–1 and Figure III–2 in part III of the preamble. As discussed in detail in part III of the preamble, these concentrations place underground metal and nonmetal miners at significant risk of material impairment of their health,

[2] U.S. Department of Labor, MSHA, 1998 final MIS data CM441 cycle 1998/198.

[3] U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Policy Evaluation, Mine Employment Size-Average Employment 1998.

[4] U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Policy Evaluation, Mine Employment Size-Average Employment 1998.

[5] U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Policy Evaluation, Mine Employment Size-Average Employment 1998.

[6] U.S. Department of Labor, Mine Safety and Health Administration, Office of Program Policy Evaluation, Mine Employment Size-Average Employment 1998.

[7] U.S. Department of Energy, Energy Information Administration, *Annual Energy Review 1998,* July 1999, pp. 3, 6, 142, 158, and 160.

and it does not appear there is any lower boundary to the risk. Accordingly, in accordance with the statute, the Agency has to set a standard which reduces these concentrations as much as is both technologically and economically feasible for this sector as a whole.

Specifically, the standard establishes a concentration limit on dpm. The concentration limit is the equivalent of about 200_{DPM} μg/m³ (as explained in Part IV, in the rule the concentration limit is expressed in terms of a restriction on the amount of total carbon because of the measurement system which MSHA will utilize for compliance sampling).

Alternatives considered. In order to ensure that the maximum protection that is feasible for the underground mining industry as a whole is being provided, the Agency has considered three alternatives that would provide greater protection: a lower concentration limit, a significantly shorter implementation period, and requiring certain categories of metal and nonmetal equipment to be filtered in addition to observing a concentration limit. In addition, the agency has considered whether the approach it is taking in underground coal mines would be feasible in this sector. Specific alternatives and approaches suggested by industry and labor are discussed in detail in part IV.

(1) *Establish a lower concentration limit for underground metal/nonmetal mines.* Based on the Agency's risk assessment, a lower concentration limit would provide more miner protection. The Agency has concluded, however, that at this time it would not be feasible for the underground metal and nonmetal sector to reach a lower concentration limit. The problem is not technological feasibility, but rather economic feasibility.

Technological feasibility of lower limit. In evaluating whether a lower concentration limit is technologically feasible for this sector, MSHA considered several examples of real-world situations. These examples, and a detailed description of the methodology by which they were developed, were published in the preamble to the proposed rule (65 FR 58198 *et seq.*). The examples were based on data about equipment and ventilation from several actual underground metal and nonmetal mines: a salt mine; an underground limestone mine that operates two completely different shifts, one for production, and one for support; and a multi-level underground gold mine. The data was placed into a computer model to estimate the ambient dpm that would remain in a mine section after the application of a particular combination of control technologies. The details of this computer model, referred to as ''The Estimator'', has subsequently been published in the literature (Haney and Saseen, *Mining Engineering,* April 2000). The results for the salt and limestone mines were written up in detail and placed into MSHA's record, with actual mine identifiers removed; the study of the underground gold mine is based on information supplied by inspectors, and all available data was presented in the preamble to the proposed rule.

MSHA had picked these mines because the Agency originally thought the conditions there were such that these mines would have great difficulty in controlling dpm concentrations. As the results indicated, however, even in these apparently difficult situations the concentration of dpm could be lowered to well below 200_{DPM} μg/m³ with readily available control techniques. Moreover as noted above, MSHA can adopt a rule which is not feasible for every mine; the standard is that the rule be feasible for the industry as a whole.

MSHA did receive comments on the Estimator. However, no specific examples of its application were received nor comments taking issue with the examples discussed above. Specific comments received on the Estimator are addressed in part IV.

Economic feasibility of lower concentration limit. MSHA estimates that it will cost the underground metal and nonmetal industry about $25.1 million a year to comply with a concentration limit of 160_{TC} μg/m³ (200_{DPM} μg/m³). For an average underground metal and nonmetal dieselized mine that uses diesel powered equipment, this amounts to about $128,000 per year.

The assumptions used in preparing the cost estimates for the final review are discussed in detail in the Agency's REA. They are based on a careful review of the evidence on the capabilities of various controls, and a careful review of an economic analysis submitted on behalf of several industry associations. That analysis estimated costs to be three times as high as MSHA's initial estimate. MSHA's analysis and the industry analysis agree on many of their assumptions; however, MSHA believes the industry analysis to be an overestimation primarily because it failed to properly optimize.

In general, MSHA has concluded that:

- The interim standard of 400_{TC} μg/m³ (500_{DPM} μg/m³) will be met primarily through the use of filters, but with cabs and ventilation in certain instances; and
- The final standard of 160_{TC} μg/m³ (200_{DPM} μg/m³) will be met through the use of more filters, ventilation changes, and the turnover in equipment and engines to less polluting models that will have occurred by the time the final standard goes into effect.

Based on its cost estimates, the Agency has concluded that this sector would not find it economically feasible to reduce dpm concentrations to a lower limit at this time. The incremental cost of additional controls would rise sharply if the industry were required to reach a substantially lower concentration level. It would begin to be necessary to retrofit cabs on equipment that was not designed with cabs and/or did not have off-the-shelf parts—at a cost per unit nearly three times as great as the costs for more limited retrofitting of suitably designed equipment. Additional ventilation improvements (*e.g.,* new shafts) could easily run into the millions of dollars—compared with the $300,000 estimate for more limited ''major system improvements'' used in the cost analysis. Additional replacement of engines beyond the natural turnover included in the baseline could run as high as $27,500 for the engine itself, with additional costs possibly as high as $65,000 for equipment modifications and installation.

(2) *Significantly shorten the phase-in time to reach the final concentration limit in underground metal/nonmetal mines.* Under the rule, there is a phase-in period for a dpm concentration limit. Operators have 18 months to reduce dpm concentrations in areas of the mine where miners work or travel to 400_{TC} μg/m³ (500_{DPM} μg/m³), and up to 60 months in all to reduce dpm concentrations in those areas to 160_{TC} μg/m³ (200_{DPM} μg/m³).

MSHA has established this phase-in period because it has concluded that it is economically infeasible for the underground metal and nonmetal mining industry as a whole to implement the requirements sooner. The costs of the rule would increase significantly were the final concentration limit to become effective significantly sooner. For example, the turnover of the fleet to less polluting engines would not be as complete by the time the final limit goes into effect; hence, operators would be required to purchase new engines ahead of schedule. Moreover, a substantial portion of the costs to implement these provisions were calculated using a 5-year discounting process to reflect the phase-in schedule.

Technological feasibility problems might also be more frequent with a quicker implementation schedule. The rule includes a provision for a special time extension to deal with unique situations; shortening the normal time frame available to this sector would tend to increase the frequency upon which operators would have to apply for such extensions.

Accordingly, MSHA has concluded that, for the underground metal and nonmetal sector as a whole, a significantly accelerated approach would not be feasible.

(3) *In addition to a concentration limit, require certain types of equipment to utilize an 80% efficiency filter.* This approach would help reduce dpm concentrations in localized areas of a mine, and ensure that problems with ventilation controls will have less of an impact on miner exposures. Most filters can meet the 80% requirement. The requirement could be applied: (a) just to loading and hauling equipment (*e.g.,* trucks and loaders); (b) to the equipment in (a) plus equipment used in the production process (*e.g.,* drills, powered trucks); (c) to the equipment in (a) and (b) and also direct support equipment (*e.g.,* scalers, lube trucks, generators, compressors and pumps); or (d) to all equipment except personnel carriers and supply trucks.

Such an approach would limit operator flexibility on controls—the broader the requirement, the less the flexibility. And it would increase expense, since the most efficient way to achieve compliance with the concentration limit might well be another type of control (*e.g.,* new engine, cab, ventilation, etc.). Accordingly, MSHA has determined that this approach would be infeasible for this sector at this time.

(4) *In lieu of a concentration limit, require certain types of equipment to reach tailpipe limits.* In the underground coal sector, MSHA is requiring various categories of equipment to meet specific tailpipe limits. Compliance with these limits is determined through laboratory tests of engines and control devices. This approach avoids questions about MSHA in-mine compliance sampling which have been the focus of much discussion in coal mining. Accordingly, MSHA considered requiring a similar approach in underground metal and nonmetal mines. However, the agency determined that this would not be practical, because the engines in the current fleet are not approved; hence, the agency lacks information on their emission rates, a key piece of information needed to implement a tailpipe standard. Moreover, in many cases a cab or ventilation change might be a more effective solution to a localized dpm concentration in an underground metal and nonmetal mine than a change in the engine or emission control device—and perhaps less expensive for equipment of this size. One of the advantages of a concentration limit is the flexibility of controls that the operator can apply to meet the limit.

Feasibility of the final rule for underground metal and nonmetal mining sector. The Agency has carefully considered both the technological and economic feasibility of the rule being promulgated for the underground metal and nonmetal mining sector as a whole.

Technological feasibility of final rule. There are arguably two separate issues with respect to technological feasibility—(a) the existence of technology that can accurately and reliably measure dpm concentration levels in all types of underground metal and nonmetal mines; and (b) the existence of control mechanisms that can bring dpm concentrations down to the proposed limit in all types of underground metal and nonmetal mines. Both have been addressed elsewhere in this preamble.

The first of these questions, concerning measurement, is reviewed in considerable detail in section 3 of Part II and in the discussion of section 57.5061 of the rule in Part IV. For the reasons set forth in those discussions, MSHA has concluded that with the use of a submicrometer sampler as required by the final rule, and with a sampling strategy that avoids the inteferences which can compromise individual samples in certain situations, it does have a technologically feasible measurement method that operators and the agency can use to determine if the limits established by the standard are in fact being met.

The second of these questions, concerning controls, is discussed earlier in this part [See ''(1) *Establish a lower concentration limit for underground metal/nonmetal mines*'']. MSHA has performed various studies which suggest that even in the most difficult situations, it is technologically feasible for operators to meet the rule's final concentration limit. In fact, these studies suggest it is technologically feasible for operators in this sector to reduce their dpm concentrations to an even lower concentration limit. In addition, as discussed in section 6 of Part II of this preamble, considerable progress has been made in recent years on the effectiveness of filters and cabs. MSHA very carefully reviewed this information with reference to the kinds of engines and equipment found in underground metal and nonmetal mines, and their ventilation, and is confident that the final rule is technologically feasible.

Although the agency has reached this conclusion, and moreover knows of no mine that cannot accomplish the required reductions in the permitted time, it has nevertheless retained in the final rule a provision that any underground metal or nonmetal mine may have up to an additional two years to install the required controls should it find that there are unforseen technological barriers to timely completion. A detailed discussion of the requirements for obtaining approval for such an extension of time to comply is provided in part IV of the preamble.

Economic Feasibility. MSHA estimates that the rule would cost the underground metal and nonmetal sector about $25.1 million a year even with the extended phase-in time. The costs per underground dieselized metal or nonmetal mine are estimated to be about $128,000 annually. The yearly cost of the final rule represents about 0.67 percent of yearly industry revenue. MSHA uses a one-percent ''screen'' of costs relative to revenues as a presumptive benchmark of economic feasibility. Therefore, since the cost of the rule is less than one percent of revenues, MSHA anticipates that (subject to contrary evidence) the rule is economically feasible for the dieselized underground M/NM mining sector as a whole. Note, however, that the costs are sufficiently close to one percent of revenues that the rule could threaten the economic viability of affected mines on the economic margin and that more costly regulatory alternative could conceivably threaten the economic viability of a substantial fraction of this mining sector.

As explained in the REA, nearly all ($24.1 million) of the anticipated yearly costs would be investments in equipment to meet the interim and final concentration limits. While operators have complete flexibility as to what controls to use to meet the concentration limits, the Agency based its cost estimates on the assumption that operators will ultimately need the following to get to the final concentration limit: (a) Fifty percent of the fleet will have new engines (these new engines do not impact cost of the rule). It is expected that the new engines will be more expensive and technologically superior to the ones that they replace. One aspect of this technological superiority will be substantially lower DPM emissions. It does not follow, however, that the

greater expense of these engines is an impact of this rule. Mine operators will not replace existing engines with the same type or model of engine. New engine technology makes engines much more efficient and productive than existing older engines. Particularly on larger equipment, greater productivity makes new engines an attractive investment that will pay back the greater costs. Moreover, due to EPA 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. Underground mine operators will thus purchase high tech, cleaner engines because they will be the only engines available for purchase.

(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 will 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.

The Agency is taking a number of steps to mitigate the impact of the rule for the underground metal and nonmetal sector, particularly on the smallest mines in this sector. These are described in detail in the Agency's Regulatory Flexibility Analysis, which the Agency is required to prepare under the Regulatory Flexibility Act in connection with the impact of the rule on small entities. (The regulatory flexibility analysis can be found in part VI of this preamble, or packaged with the Agency's REA.)

Based on its cost estimates, the Agency has concluded that this sector would not find it economically feasible to reduce dpm concentrations to a lower limit at this time. These assumptions and the rationale behind them are discussed in greater detail in the beginning of Chapter IV of the Regulatory Economic Analysis.

After a careful review of the information about this sector available from the industry economic profile, and the other obligations of this sector under the Mine Act, MSHA has concluded that a reasonable probability exists that the typical firm in this sector will be able at this time to afford the controls that will be necessary to meet the proposed standard.

Conclusion: metal and nonmetal mining sector. Based on the best evidence available at this time, the Agency has concluded that the final rule for the underground metal and nonmetal sector meets the statutory requirement that the Secretary attain the highest degree of health and safety protection for the miners in that sector, with feasibility a consideration.

VI. Regulatory Impact Analyses

This part of the preamble reviews several impact analyses which the Agency is required to provide in connection with its final rulemaking. The full text of these analyses can be found in the Agency's Regulatory Economic Analysis (REA).

(A) Costs and Benefits: Executive Order 12866

In accordance with Executive Order 12866, MSHA has prepared a Regulatory Economic Analysis (REA) of the estimated costs and benefits associated with the final rule for the underground metal and nonmetal mining sector.

The key conclusions of the REA are summarized, together with cost tables, in part I of this preamble (see Item number 7). The complete REA is part of the record of this rulemaking, and is available from MSHA.

The Agency considers this rulemaking ''significant'' under section 3(f) of Executive Order 12866, and has so designated the rule in its semiannual regulatory agenda (RIN 1219–AA74). However, based upon the REA, MSHA has determined that the final rule does not constitute an ''economically significant'' regulatory action pursuant to section 3(f)(1) of Executive Order 12866.

(B) Regulatory Flexibility Act (RFA)

Introduction

In accordance with section 605 of the Regulatory Flexibility Act of 1980 as amended, MSHA has analyzed the impact of the final rule on small businesses. Further, MSHA has made a determination with respect to whether or not it can certify that this final rule will not have a significant economic impact on a substantial number of small entities that are affected by this rulemaking. Under the Small Business Regulatory Enforcement Fairness Act (SBREFA) amendments to the Regulatory Flexibility Act (RFA), MSHA must include a factual basis for this certification. If the final rule does have a significant economic impact on a substantial number of small entities, then the Agency must develop a final regulatory flexibility analysis.

The Agency has, as required by law (5 U.S.C. 605), developed a final regulatory flexibility analysis which is set forth Chapter V of the REA. In addition to a succinct statement of the objectives of the final rule and other information required by the Regulatory Flexibility Act, the analysis reviews alternatives considered by the Agency with an eye toward minimizing the economic impact on small business entities.

Definition of a Small Mine

Under the RFA, in analyzing the impact of a rule on small entities, MSHA 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. MSHA has not taken such an action, and hence is required to use the SBA definition.

The SBA defines a small entity in the mining industry as an establishment with 500 or fewer employees (13 CFR 121.201). Of the 196 underground M/NM mines that use diesel powered equipment and are therefore affected by this rulemaking, 189 (or all but 7) fall into this category and hence can be viewed as sharing the special regulatory concerns that the RFA was designed to address.

Traditionally, the Agency has also looked at the impacts of its rules on a subset of mines with 500 or fewer employees ¾ those with fewer than 20 employees, which the mining community refers to as ''small mines.'' The way these small mines perform mining operations is generally recognized as being different from the way larger mines operate. These small mines differ from larger mines not only in the number of employees, but also, among other things, 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 MSHA rules and the impact of MSHA rules on them will also tend to be different. It is for this reason that ''small mines,'' as traditionally defined by the mining community, are of special concern to MSHA.

This analysis complies with the legal requirements of the RFA for an analysis of the impacts on ''small entities'' while continuing MSHA's traditional look at ''small mines.'' MSHA concludes that the final rule would not have a significant economic impact on small entities, as defined by SBA, *when considered as a group.* However, MSHA has determined that the final rule arguably would have a significant economic impact on a subset of small entities that are covered by this

rulemaking. That subset is small underground M/NM mines as traditionally defined by MSHA, those mines with fewer than 20 employees. This subset of affected mines constitutes a substantial number of small entities.

Screening Analysis

General Approach. The Agency'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 those small entities. When estimated compliance costs are less than 1 percent of the estimated revenues (for the size categories considered), 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 1 percent of revenues, it tends to indicate that further analysis may be warranted.

Derivation of Costs and Revenues. The compliance costs presented here were previously introduced in Chapter IV of the REA along with an explanation of how they were derived. Table VI–1 summarizes the total yearly cost of the final rule by mine size.

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TABLE VI-1: Total Yearly Compliance Costs for M/NM Mine Operators by Mine Size Class

Requirement	Total Yearly Industry Cost By Mine Size Class		
	Under 20 Employees	20 to 500 Employees	Over 500 Employees
Section 57.5060(a)&(b) DPM Concentration Limits	$3,909,865	$17,068,073	$3,215,869
Section 57.5067 Newly Introduced Engines	$ -	$ 2,848	$ 712
Section 57.5060(c) Extension Application	$ 148	$ 401	$ 36
Section 57.5060(d) Respirator Protection	$ 67,247	$ 285,690	$ 17,855
Section 57.5062 DPM Control Plans	$ 1,408	$ 6,336	$ 704
Section 57.5066(c) Maintenance Training	$ 894	$ 2,384	$ 468
Section 57.5066(b) Tagging and Examination	$ 1,769	$ 6,178	$ 1,948
Section 57.5070 Miner Health Training	$ 5,226	$ 74,189	$ 42,005
Section 57.5071 Environmental Monitoring	$ 106,425	$ 297,213	$ 31,008
Section 57.5075 Diesel Particulate Records	$ 204	$ 1,639	$ 943
TOTAL COST	$4,093,186	$17,744,951	$3,311,548
COST PER MINE	$ 53,158	$ 158,437	$ 473,078

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Data on underground M/NM mines published by the U.S. Geological Survey [1] were used for tonnage and value of underground M/NM mines. These data, however, are not disaggregated by mine size class. MSHA collects data, by mine size, on both average employees and employee hours.[2] MSHA has used these data to estimate revenues by mine size class.

MSHA has assumed that tonnage is proportional to employee hours. This assumption (rather than proportionality with employees) implicitly adjusts for different shift lengths associated with different sizes of mines. MSHA has also assumed that all underground M/NM mines use diesel powered equipment.[3] Using these assumptions, MSHA has computed the percentages of employee hours of all underground M/NM mines that are accounted for by each size class. MSHA estimates that these percentages of total revenues are accounted for by the different mine size classes.

Results of the Screening Analysis. The final rule applies to underground M/NM mines that use diesel-powered equipment. Table VI–1 shows that the estimated yearly cost of the final rule as a percentage of yearly revenues is about 0.8 percent for the affected underground M/NM mines with 500 or fewer employees.

However, for a subset of affected underground M/NM mines, those with fewer than 20 employees, estimated yearly costs are equal to about 2.16 percent of yearly revenues for this subset of mines. The economic impact on these small mines, which constitute a substantial number of small entities affected by the final rule, is larger than one percent of their revenues. MSHA therefore cannot certify that the final rule would not have a significant impact on a substantial number of small entities.

The Agency has prepared a final regulatory flexibility analysis, as required by law, which explains the steps MSHA has taken to minimize the burden on these small entities and justifies the costs placed on them.

TABLE VI–2.—ESTIMATED YEARLY COSTS OF FINAL RULE RELATIVE TO YEARLY REVENUES FOR UNDERGROUND COAL MINES THAT USE DIESEL-POWERED EQUIPMENT

Mine size	Final rule yearly costs (In thousands)	Revenues[a] (In thousands)	Costs as Percentage of revenues
<20 emp.	$4,093	$189,305	2.16
≤500 emp.	21,837	2,745,137	0.80

[a] Source: Mine Safety and Health Administration, Office of Injury and Employment Information, Denver, Colorado. 1999, and U.S. Department of Energy, Energy Information Agency, *Annual Energy Review 1998,* DOE/EIA0384(98), July 1999, p.203.

Final Regulatory Flexibility Analysis

As indicated above, the estimated yearly cost of the final rule on a subset of small entities, those with fewer than 20 employees, is 2.16 percent of yearly revenue. This percentage is just over twice the value (1.0 percent) below which MSHA could say with reasonable confidence that the final rule does not have a significant economic impact on a substantial number of small entities. Accordingly, MSHA has prepared a final regulatory flexibility analysis.

Need for, and Objectives of, the Rule

Need. The rule is needed because underground miners in mines that use diesel powered equipment are currently exposed to extremely high concentrations of diesel particulate matter (DPM). Based on MSHA field studies, median DPM concentrations to which underground miners are exposed range up to 200 times as high as average environmental exposures in the most heavily polluted urban areas and up to 10 times as high as median exposures estimated for the most heavily exposed workers in any occupational group other than underground miners.

The available scientific information indicates that miners exposed to the extremely high DPM concentrations found in underground mines are at significant excess risk of experiencing three kinds of material impairment to their health:

- Increased risk of lung cancer has been linked to chronic occupational DPM exposure.
- Increased acute risk of death from cardiovascular, cardiopulmonary, or respiratory causes has been linked to short or long term DPM exposures.
- Sensory irritations and respiratory symptoms can result from even short term DPM exposures. Besides being potentially debilitating, such effects can distract miners from their responsibilities in ways that could pose safety hazards for everyone in the mine.

Although definitive dose-response relationships have not yet been established (especially for the acute effects), the best available evidence indicates that the risks are substantial.

Objective. The objective of the rule is to lower DPM exposures in underground M/NM mines to concentrations similar to the worst levels to which other occupational groups are exposed. By doing so, the rule is designed substantially to lower the health risks associated with DPM. Expected benefits include an estimated minimum of 8.5 lung cancer deaths avoided per year.

Significant Issues Raised in Response to the Initial RFA

Comments. The principal issue raised in comments on the PREA was that, for a variety of reasons, MSHA had substantially understated the costs of controlling DPM. The implication of these comments was that the rule was economically infeasible. The most comprehensive comments along these lines were by Head,[4] who argued (among other things) that MSHA had made the following errors and omissions in its analysis:

- MSHA had (according to Head) understated the numbers of machines and mines affected, including:

[1] U.S. Geological Survey, ''Mineral Industry Surveys: Mining and Quarrying Trends, 1998 Annual Review, April 2000.

[2] U.S. Department of Labor, MSHA, 1998 Final MIS data CM441 cycle 1998/198.

[3] This assumption ignores the fact that some very small mines do not use diesel powered equipment. MSHA believes, however, that these mines are generally very small (even among the mines with fewer than 20 employees) and that many of them operate only intermittently. Thus they account for employee hours proportionately far less than their numbers. Accordingly, MSHA believes that the most accurate way to interpret the data is to disregard the fact that these mines do not use diesel powered equipment.

[4] H. John Head, Principal Mining Engineer, Harding Lawson Associates, ''Review of Economic and Technical Feasibility of Compliance Issues Related to: Department of Labor—MSHA, 30 CFR Part 57—Proposed Rule for Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners,'' Report prepared under contract with the National Mining Association, July 21, 1999.

• Understatement of the number of diesel units in underground M/NM mines by more than 50 percent, and
• Understatement of the number of ventilation upgrades needed by 20 percent to 40 percent
• MSHA had understated a number of costs, including:
• Understatement of the cost of replacement engines by up to one third,
• Understatement of the costs of filters on larger engines by 20 percent, and
• Understatement of the costs of vehicle cabs by about 60 percent.
• MSHA had omitted some costs entirely, including:
• Installation costs of retrofitting new engines in old equipment, which ran as high as three times the costs of the engines themselves, and
• Major ventilation improvements needed by about one third of the mines.

Based on his own numbers, Head estimated compliance costs to be three times as high as MSHA's estimate of the cost of the proposed rule of $19.2 million.

Analytical Assessment of Issues. MSHA considered the comments and reviewed its assessment of costs very carefully. The assessment focused on Head's comments, since his exposition was detailed enough for analysis of the basis of his estimates. MSHA responded in a variety of ways, which are summarized below.

The key to the issue of the number of diesel units affected by the rule was how one interpreted the number. MSHA resolved this issue by recognizing that not all diesel powered equipment would be affected in the same manner. In fact, the machines in Head's total count should be grouped into three categories: active, spares, and disused. Active diesel powered equipment (essentially MSHA's original count) needs to be fitted for everyday use. Spare equipment needs to be controlled for occasional use as back-up. Disused equipment is essentially not affected by the rule. A shift in the principal control strategy from engine replacement to ceramic filters (discussed further below) made these distinctions operational. With ceramic filters, both active and spare equipment can be fitted with filters (a relatively inexpensive operation), but filters need to be regenerated and changed (which encompasses most of the costs) only to the extent that the equipment is actually used.

MSHA believes that Head was simply wrong about the number of mines needing upgrades to their ventilation systems. Head appeared to believe that MSHA's count was arbitrary, and the basis for his proposed number was obscure. In fact, MSHA has based its count on mine-specific data on the existence and rate of air flow of ventilation systems. Thus, MSHA retained its original count.

MSHA's review of comments on costs produced different conclusions for different specific costs:

• MSHA accepted and used Head's estimate of costs of ceramic filters.
• MSHA does not entirely agree with Head's estimates of costs of new engines. Moreover, expensive new engines are technologically advanced and tend to produce substantial gains in productivity and savings in operating costs, which Head did not consider. The issue of engine costs became irrelevant, however, under a strategy of filters as the first-used control device.
• MSHA's re-examination of the costs of cabs indicated that MSHA's cost estimate is appropriate for equipment for which equipment manufacturers can provide off-the-shelf kits for retrofitting equipment, and Head's cost estimate is appropriate for equipment for which cabs have to be custom designed and retrofitted. Since the rule does not mandate cabs and MSHA expects cabs to be used on a relatively small proportion of equipment, however, MSHA believes that mine operators will not retrofit equipment for which cabs would need to be custom designed. Accordingly, MSHA has retained its original cost estimate.
• Head concurred with MSHA on the costs of ventilation improvements. While these costs appear to be an appropriate average estimate for M/NM mines as a whole, there is a distinct possibility that they may be too high for very small M/NM mines.[5] In the context of regulatory flexibility analysis, MSHA considers these cost estimates to be fairly conservative.

MSHA agrees that certain costs were omitted, but the conclusions of MSHA's reconsideration of these costs also vary with the cost:

• MSHA has accepted Head's estimates for major ventilation improvements and has included them in the analysis of costs.
• Head's comment that MSHA had omitted the costs of retrofitting new engines in old equipment is correct, although MSHA does not agree with the size of Head's cost estimates. The key issue, however, is that the strategy of relying primarily on filters does not entail retrofitting engines. Thus Head's comment is not germane.

Concentration Limits and the Toolbox. This standard for underground M/NM mines is a performance standard, with an interim DPM concentration limit of 500 micrograms/m^3, followed by a final DPM concentration limit of 200 micrograms/m^3. The rule encourages mine operators to use any combination of a ''toolbox'' of measures to meet these concentration limits. For cost estimation purposes, however, it is necessary to assume a specific set and sequence of control measures. Specifically, in the PREA MSHA assumed that:

• The interim standard would be met by replacing engines, installing oxidation catalytic converters, and improving ventilation; and
• The final standard would be met by adding cabs and filters.

Both the general strategy and the specific proportions of diesel powered equipment to be controlled by each measure were based on an optimizing approach, in which the most cost-effective additional measures were selected for additional DPM reductions at each stage.

In his comments, Head exactly replicated MSHA's assumptions about how many pieces of each kind of diesel equipment would be controlled, how they would be controlled, and the sequence in which controls would be used. Although his cost estimates differed substantially from MSHA's, Head made no attempt to optimize the use of DPM control ''tools'' from the toolbox.

Substantially the most important of Head's changes is to make filters much cheaper, relative to engine replacement. At the same time, data collected by MSHA since publication of the PREA indicate that filters are more effective than was previously understood. This finding has further enhanced the cost-effectiveness of filters, relative to engine replacement. These changes in information have caused MSHA to go back to the toolbox and rethink the optimized compliance strategy. The revised compliance strategy, upon which MSHA bases the revised estimates of compliance costs, reverses the two most widely used measures from the toolbox. MSHA now anticipates that:

• The interim DPM standard of 500 micrograms/m^3 will be met with filters, cabs, and ventilation; and
• The final DPM standard of 200 micrograms/m^3 will be met with more filters, ventilation, and such turnover in

[5] The issue is further complicated by the fact that mines that are ''small'' in terms of employment vary considerably among commodities and mining techniques in their physical size and ventilation requirements. Accordingly, MSHA has not attempted to make a separate cost estimate of ventilation improvement costs for ''small'' M/NM minas as a group.

equipment and engines as will have occurred in the baseline.

This new approach uses the same toolbox and optimization strategy that was used in the PREA. Since relative costs are different, however, the tools used and costs estimated are quite different. The effects on costs is substantial. Most of the difference between Head's cost estimate and the cost estimate in the REA is attributable to this change in strategy.

Changes in the Rule. Because the rule is a performance standard that uses a tool-box approach, most modifications that MSHA made in response to comments involved changes in the mix of tools within the framework of the rule, rather than changes in the rule per se. MSHA did make one significant change in the rule itself, however, by allowing compliance with listed EPA standards as a substitute for MSHA approval of new engines. Because most engines used in underground M/NM mining equipment are essentially the same engines used on the surface, which fall under EPA regulations, MSHA believes that virtually all new engines used in mining equipment will meet EPA standards. Therefore, this change resulted in eliminating a cost of approval that was estimated in the PREA to average $2,500 per new engine.

Small Entities to Which the Rule Will Apply

For the purposes of this regulatory flexibility analysis, the working definition of ''small'' is MSHA's definition of fewer than 20 employees. (Although SBREFA requires use of the SBA's definition, the impacts on mines with 500 or fewer employees as a whole are not economically significant.) Correspondingly, one element of a regulatory flexibility analysis involves developing a more focused definition of ''small.''

There are 77 M/NM mines that are ''small'' by this definition. These mines fall in four commodity groups:

- Stone is the largest group, accounting for 54 small underground M/NM mines that use diesel equipment (70 percent). These mines include limestone (46 mines), marble (5 mines), lime (2 mines), and granite (1 mine).
- Precious metals account for 10 small underground M/NM mines that use diesel equipment (13 percent). Most of these (9 mines) are gold mines; one mines both gold and silver.
- Other metals account for 4 small underground M/NM mines that use diesel equipment (5 percent). These mines include zinc (2 mines), copper (1 mine), and a combination of copper and zinc (1 mine).
- The other 9 small underground M/NM mines that use diesel equipment (12 percent) are a miscellany that includes shale (3 mines) as well as calcite, clay, gemstone, perlite, sand (industrial), and talc (1 mine each).

Collectively, these 77 mines have estimated revenues of $189.3 million, or an average of $2.46 million per mine. The estimated total costs of the rule are $4.1 million, or an average of $53,160 per mine. Estimated costs of the rule are 2.16 percent of estimated revenues.

Costs by Commodity Group and Mine Size. Table VI–3 shows the estimated yearly cost by size class for each commodity group in M/NM mines. Costs for Section 57.5060(a) and Section 57.5060(b) were recalculated for each commodity group, based on the diesel powered equipment and air flow of the mines in each commodity group. All other costs were very small, probabilistically distributed among mines, and/or essentially constant for all mines or for all mines in a size class. For these costs, the average cost per mine in each size class (from Table VI–1) was used, as very little precision was lost through this simpler estimation procedure. Table VI–3 shows a fair degree of variation among commodity groups.

- For mines with fewer than 20 employees, the average cost per mine is estimated to be $53,158, and estimated costs per mine for commodity groups range from $31,500 to $60,500, with:
- Costs above average for stone mines ($60,500) and base metal ($54,400), and
- Costs below average for other M/NM mines ($31,500) and gold mines ($34,600).
- For mines with 20 to 500 employees, the average cost per mine is estimated to be $158,437, and estimated costs per mine for commodity groups range from $102,100 to $201,700, with:
- Costs above average for base metal mines ($201,700) and gold mines ($171,900),
- Costs roughly average for stone mines ($150,900) and evaporates mines ($149,100), and
- Costs below average for other M/NM mines ($102,100).
- For mines with over 500 employees, the average cost per mine is estimated to be $473,078, and estimated costs per mine for commodity groups range from $291,800 to $660,300, with:
- Costs above average for gold mines ($660,300) and base metal mines ($592,300), and
- Costs below average for evaporates mines ($291,800) and stone mines ($298,000).

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Table VI-3: Yearly Compliance Costs by Commodity Group and Mine Size

Commodity Group	Mine Size	Total Yearly Industry Cost	Yearly Cost per Mine
Stone[a]	Under 20	$ 3,258,360	$ 60,340
	20 to 500	$ 6,330,996	$ 150,738
	Over 500	$ 297,691	$ 297,691
	All Mines	$ 9,887,047	$ 101,928
Precious Metals[b]	Under 20	$ 345,240	$ 34,524
	20 to 500	$ 3,263,782	$ 171,778
	Over 500	$ 659,978	$ 659,987
	All Mines	$ 4,269,000	$ 142,300
Other Metals[c]	Under 20	$ 217,104	$ 54,276
	20 to 500	$ 5,039,700	$ 201,588
	Over 500	$ 1,775,991	$ 591,997
	All Mines	$ 7,032,795	$ 219,775
Evaporates[d]	20 to 500	$ 3,724,100	$ 148,964
	Over 500	$ 582,990	$ 291,495
	All Mines	$ 4,307,090	$ 159,522
Other[e]	Under 20	$ 282,357	$ 31,373
	20 to 500	$ 101,950	$ 101,950
	All Mines	$ 384,307	$ 38,431

[a] Granite, lime, limestone, marble, and sandstone.

[b] Gold, Platinum, and silver.

[c] Copper, iron ore, lead, molybdenum, uranium, and zinc.

[d] Gypsum, potash, salt, and trona.

[e] Borate, calcite, clay, gemstones, perlite, sand (industrial), shale, and talc.

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Thus by overall commodity group:

- Compliance costs are relatively high in gold mines (except for small mines) and base metal mines,
- Compliance costs are relatively low in evaporates mines and other M/NM mines, and
- Compliance costs of stone mines show no consistent pattern relative to average costs for all M/NM mines.

The differences in cost per mine appear to be attributable to the interaction of three characteristics of the mines, which are included in Table VI–4:

- The percentage of mines that need new ventilation systems;
- The number of diesel powered machines per mine; and
- The proportion of diesel powered equipment that is large production equipment.

Table VI-4: Factors Contributing to Variability of Yearly Compliance Costs Across Commodity Groups

Commodity Group	Mine Size	Machines per Mine				Percent Needing Ventilation Improvements	
		Production		Sup.	Total		
		>150 h.p.	≤150 h.p.			New System	New Motor
Stone	Under 20	4.3	0.5	4.4	9.2	44%	30%
	20 to 500	8.5	1.0	7.6	17.1	33%	31%
	Over 500	16.0	1.0	23.0	40.0	0%	100%
	All Mines	6.3	0.7	6.0	12.9	39%	31%
Gold	Under 20	0.4	1.2	0.8	2.4	40%	40%
	20 to 500	6.6	5.8	11.7	24.1	0%	68%
	Over 500	26.0	12.0	95.0	133.0	0%	0%
	All Mines	5.2	4.5	10.9	20.5	13%	57%
Base Metal	Under 20	3.5	1.0	6.2	10.7	25%	50%
	20 to 500	10.3	2.8	16.6	29.8	0%	48%
	Over 500	17.3	29.3	68.0	114.7	0%	33%
	All Mines	10.1	5.1	20.2	35.3	3%	47%
Evaporate	20 to 500	5.2	4.6	21.1	30.9	4%	40%
	Over 500	1.5	11.5	80.0	93.0	0%	0%
	All Mines	4.9	5.1	25.5	35.5	4%	41%
Other	Under 20	1.2	0.8	0.2	2.2	11%	67%
	20 to 500	0.0	15.0	0.0	15.0	0%	100%
	All Mines	1.1	2.2	0.2	3.5	10%	70%

These three characteristics interact in somewhat different ways in the different mine size classes:

• For mines with fewer than 20 employees, the cost per mine is:

• Relatively high (or just above average) in commodity groups where two or all three of these factors have relatively high values, and

• Relatively low when two of these factors have relatively low values.

• For mines with 20 to 500 employees, the cost per mine is:

• Relatively high in commodity groups where the number of machines per mine and the proportion of machines that are large production equipment are both relatively large,

• Average when one of these two factors is relatively high and the other is relatively small, and

• Relatively low when all three of the factors have relatively low values.

• For mines with over 500 employees (none of which need new ventilation systems), the cost per mine is:

• Relatively high in commodity groups where the number of machines per mine is relatively large, and

• Relatively low when the number of machines per mine or the proportion of machines that are large production equipment is relatively small.

Impacts on Small Mines by Commodity Group. The available data are not adequate to support a realistic estimate of impacts on small underground M/NM mines by commodity group, since revenues of individual commodities cannot be allocated to different size classes of mine. The analysis of costs per mine suggests, however, that stone is the only commodity group with impacts much above average. The costs per small stone mine are 13.6 percent higher than the average for all small underground M/NM mines. Impacts on small underground mines in other M/NM commodity groups appear to be about average or less.

Projected Reporting, Recordkeeping, and Other Requirements of the Rule

The rule requires several types of records and reports. Plans are required in conjunction with respirator use and DPM control if the concentration levels are violated, and these must be posted and provided to various parties. An extension may be applied for. Maintenance training, miner health training, and respirator training must be logged. Environmental monitoring results must be recorded and provided to miners upon request. While there are a number of reporting and recordkeeping requirements, however, each one is straightforward, and most are no more than the simplest form of documentation. Thus the total cost of recordkeeping is only about 0.35 percent of the compliance costs for small mines.

The principal source of costs of the rule is controls to reduce the DPM concentrations in underground mines. MSHA has adopted a flexible ''toolbox'' approach that allows mine operators to select the controls that will be most cost-effective for their mines. MSHA has based its cost estimates on extensive use of ceramic filters, less widespread use of cabs on equipment, and ventilation upgrades. MSHA also assumes that new diesel engines introduced into the mines as part of the baseline turnover of the fleet and its engines will be relatively clean and will contribute to reduced DPM levels. These control costs account for an estimated 95.6 percent of the yearly compliance costs of small mines. Of these costs, ventilation costs (47.1 percent) and filter costs (46.3 percent) account for nearly half each, while the cost of cabs (6.6 percent) is relatively minor.

Only two other requirements impose costs of any size. Environmental monitoring accounts for about 2.6 percent of the estimated compliance costs of small mines. Occasional use of respirators (equipment, training, inspection, etc.) accounts for about 1.6 percent of estimated compliance costs. Maintenance training and miner health training account for less than 0.2 percent of compliance costs. The non-control requirements of the rule are quite modest.

Steps Taken to Minimize Impacts on Small Entities

Constraints of the Mine Safety and Health Act. The Federal Mine Safety and Health Act of 1977 was enacted to protect miners. MSHA has always read the Act to prohibit discriminating among miners by providing different degrees of protection that varied systematically with the size of the mine in which they worked. Accordingly, the Mine Safety and Health Act rules out certain classes of regulatory flexibility alternatives, particularly exemption of small mines, but also any alternative that would result in systematically higher allowable DPM concentration levels in small mines. Because over 95 percent of the yearly costs to be incurred by small mines are directly related to protection, there is little scope for distinct provisions for small mines.

Built-In Flexibility. To minimize impacts on small entities, MSHA has taken steps to build as much flexibility into the rule itself as possible. The rule itself is a performance standard that allows mine operators to meet the DPM concentration limits with their own choice of ''tools.'' While MSHA has selected a specific set of tools for the cost analysis, MSHA expects that operators of specific mines probably will often be able to come into compliance at lower costs by using a mix of techniques tailored to that specific mine.

Other parts of the rule provide similar flexibility. Training and recordkeeping requirements indicate the information to be imparted or retained, for example, but they do not spell out how this is to be done. Much of the reporting is required only upon request, rather than routinely. Where a requirement (*e.g.,* MSHA approval of new engines) appeared to be relatively expensive, MSHA added an alternative (compliance with listed EPA standards).

Phasing in over five years is another element that MSHA has incorporated to minimize impacts (albeit for all mines, not just for small ones). This not only defers costs, it allows impacts to be reduced in a number of ways. Mine operators can spread major expenses out to avoid a capital crunch. To a great degree, mine operators will be able to take advantage of the natural turnover of their fleets, rather than doing extensive (and more expensive) retrofitting. In extreme cases, if a mine is quite marginal and/or is likely to shut down in a few years anyway, the five-year phase-in allows an orderly closure that minimizes impacts.

Low Risk of Short-Term Closures. Ultimately, the issue of concern related to impacts whether mines may be forced to close. When costs are a significant but relatively small fraction of revenues (or profits), however, it is especially difficult to determine whether closure is an impact resulting from the rule or a baseline event that would have happened anyway. Given the fact that profits fluctuate widely over time, even the presence of losses is not necessarily a good indicator of whether businesses will recover or fail. In many cases where a business does fail, the true impact of a regulation is not causing its failure but rather hastening its failure. Because of the phasing of this rule, it affords an opportunity to consider the potential for hastening the failure of a small mine.

If a mine is likely to close within five to seven years without the regulation, the impacts of the rule are different from the above analysis. In order to stay open for five years, a mine need only comply with the interim DPM concentration level. To this end, it needs to incur the costs of:

- Control costs necessary for Section 57.5060(a); [6]
- Respirator protection costs of Section 57.5060(d); [7]
- DPM control plan costs of Section 57.5062; [8]
- Maintenance training, tagging, and examination costs of Section 57.5066(b) and Section 57.5066(c);[9]
- Miner Health Training costs of Section 57.5071; [10]
- Environmental monitoring costs of Section 57.5071; [11] and
- DPM record costs of Section 57.5075. [12]

Thus the yearly costs for small mines, amortized over 5 years at an annual discount rate of 7.0 percent, would be $1,554,086, or an average of $20,183 per mine. This is 0.82 percent of annual revenue, which is below the threshold for a significant economic impact. This is not the type of impact that would force a mine to close sooner rather than later. The conclusion is that any closure impacts would be mild and would occur foreseeably over time, rather than abruptly.

Compliance Assistance

The Agency plans to provide extensive compliance assistance to the mining community. MSHA intends to focus these efforts on smaller metal and nonmetal operators, including training them to measure DPM concentrations, providing technical assistance on available controls, and establishing a system for addressing compliance inquiries from small businesses. The Agency will also issue a compliance guide, continue its current efforts to disseminate educational materials and software, and hold workshops to inform the mining community.

In conclusion, MSHA believes that it has taken all of the steps consistent with the Mine Safety and Health Act that could substantially reduce the impacts of this rule on small entities.

(C) Alternatives Considered

MSHA did explore a variety of alternatives in its Initial Regulatory Flexibility Analysis. See 63 FR 58212. For example, it looked at a regulatory approach that would have focused on limiting workers exposure rather than limiting particulate concentration. Under such an approach, operators would have been able to use administrative controls and respiratory protection equipment to reduce diesel particulate exposure. For the reasons explained in that Initial Analysis, the Agency declined to take such an approach. For MSHA's response to comments on the specific topics of administrative controls and respiratory protection equipment, see Part IV's discussion of 57.5060(e) and 57.5060(f).

(D) Unfunded Mandates Reform Act of 1995

For purposes of the Unfunded Mandates Reform Act of 1995, the final rule does not include any Federal mandate that may result in increased expenditures by State, local, or tribal governments, or increased expenditures by the private sector of more than $100 million.

(E) Paperwork Reduction Act of 1995

The final rule contains information collections which are subject to review by the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 (PRA95). The final rule will impose two types of paperwork burden hours on underground M/NM mine operators that use diesel powered equipment. First, there are burden hours that will occur *only* in the first year the rule is in effect (hereafter known as first year burden hours). Second, there are burden hours that will occur *every* year that the rule is in effect, starting with the first year (hereafter known as ''annual'' burden hours).

In the first year, mine operators will incur 3,571 burden hours and associated burden costs of about $171,926. After the first year, mine operators will incur 526 burden hours annually and associated costs of about $21,871.

We have submitted a copy of this final rule to OMB for its review and approval of these information collections. Interested persons are requested to send comments regarding this information collection, including suggestions for reducing this burden, to the Office of Information and Regulatory Affairs, OMB New Executive Office Building, 725 17th St., NW, Rm. 10235, Washington, DC 20503, Attn: Desk Officer for MSHA. Submit written comments on the information collection not later than 60 days after date of publication in the **Federal Register**.

Our paperwork submission summarized above is explained in detail in the REA. The REA includes the estimated costs and assumptions for each final paperwork requirement related to this final rule. A copy of the REA is available from us. These paperwork requirements have been submitted to the Office of Management and Budget for review under section 3504(h) of the Paperwork Reduction Act of 1995. Respondents are not required to respond to any collection of information unless it displays a current valid OMB control number.

(F) National Environmental Protection Act

The National Environmental Policy Act (NEPA) of 1969 requires each Federal agency to consider the environmental effects of final actions and to prepare an Environmental Impact Statement on major actions significantly affecting the quality of the environment. MSHA has reviewed the final rule in accordance with NEPA requirements (42 U.S.C. 4321 et. seq.), the regulations of the Council of Environmental Quality (40 CFR Part 1500), and the Department of Labor's NEPA procedures (29 CFR Part 11). As a result of this review, MSHA has determined that this rule will have no significant environmental impact.

(G) Executive Order 12360 Governmental Actions and Interference With Constitutionally Protected Property Rights

This final rule is not subject to Executive Order 12360, Governmental Actions and Interference with Constitutionally Protected Property Rights, because it does not involve implementation of a policy with takings implications.

(H) Executive Order 13045 Protection of Children From Environmental Health Risks and Safety Risks

In accordance with Executive Order 13045, MSHA has evaluated the environmental health and safety effects of the final rule on children. The Agency has determined that the rule will not have an adverse impact on children.

(I) Executive Order 12988 (Civil Justice)

The Agency has reviewed Executive Order 12988, Civil Justice Reform, and determined that the final rule will not unduly burden the Federal court system. The rule has been written so as to provide a clear legal standard for affected conduct, and has been reviewed carefully to eliminate drafting errors and ambiguities.

[6] These controls include ceramic filters and cabs, but not ventilation (which MSHA did not estimate to be necessary for the interim DPM level. These costs, amortized over 5 years at an annual discount rate of 7.0 percent, are $1,119,800 for filters and $150,437 for cabs.

[7] These costs, amortized over 5 years at an annual discount rate of 7.0 percent, are $164,845.

[8] Annual costs are $1,408.

[9] These costs, amortized over 5 years at an annual discount rate of 7.0 percent, are $5,681.

[10] Annual costs are $5,226.

[11] Annual costs are $106,425.

[12] Annual costs are $204.

(J) Executive Order 13084 Consultation and Coordination With Indian Tribal Governments

MSHA certifies that the final rule will not impose substantial direct compliance costs on Indian tribal governments.

(K) Executive Order 13132 (Federalism)

MSHA has reviewed the final rule in accordance with Executive Order 13132 regarding federalism and has determined that it does not have ''federalism implications.'' The final rule 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.''

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