Comments of the
United Steelworkers
on
Diesel Particulate Matter Exposure of Underground Metal and Nonmetal Miners
RIN 1219-AB29

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"He loaded the trucks, and he was in diesel…And he came to the unit one day, and he sat there, and he said, you know, I just came from the doctors. He said that doctor told me that I had to quit smoking. He said I told that doctor that I didn't smoke, and he says that that doctor called me a liar. He goes that doctor told him you don't have to lie to me. He says you have got to quit smoking. That's all there is to it. And he told the doctor where he worked at, and this doctor goes, well, I think you had better get out of that mine then. He never smoked, and he was there for thirty years, and his doctor called him a liar, and called him a smoker after he did X-rays on his lungs."

Wesley Smith, Ohio salt miner (Tr.35, 1/5/06)

"My main concern is, sure, the improvements…are being done now (but) since I've been in operations since 1981, how long was I exposed myself to these high diesel particulates? This is where it comes to health issues. Right now I'm going on twenty years mining…I've been exposed to these diesel particulates going on 20 years now."

Joseph Rael, New Mexico molybdenum miner (Tr.62, 1/11/06)

I. Introduction

On January 19, 2001, the Mine Safety and Health Administration published a final standard addressing the health hazards of uncontrolled diesel exhaust in underground metal and nonmetal mines. On the same day, MSHA published a companion rule for underground coal mines.

The standards had been a long time in coming. In 1988, the National Institute for Occupational Safety and Health (NIOSH) recommended that diesel exhaust be considered a potential carcinogen and controlled to the lowest feasible level. MSHA published an Advance Notice of Proposed Rulemaking on the use of diesel equipment that year, and a second ANPR in 1992 on DPM exposure. Over the next few years, MSHA held workshops and published voluntary guidance documents. Finally, in 1998, MSHA published proposed rules for DPM

exposure in underground coal and metal/nonmetal mines. It took two and a half more years for MSHA to complete its work and promulgate the final standards.

While the rules for coal and metal/nonmetal mines are different for technical reasons[1], the hazards to miners are the same wherever diesel equipment is used. Diesel particulate matter (DPM) causes lung cancer and other respiratory and cardiovascular diseases. The science behind both rules is the same. Taken together, they are among the most extensively researched and exhaustively documented in the agency's history. The preamble to the metal/nonmetal rule consumes 201 pages of fine-grained *Federal Register* text. The agency evaluated every available study on lung cancer and diesel exhaust – 47 in all, 11 of which dealt with miners. Forty-one of those studies, including 10 of the 11 in mining, showed elevated rates of lung cancer for workers exposed to DPM. MSHA also examined scores of additional studies on diseases other than cancer, and on the relationship between fine particles and a variety of health effects. MSHA found that persons exposed to high levels of DPM are "at excess risk of a variety of adverse health effects, including lung cancer." *(66 FR 5706)* MSHA also found that miners are exposed to DPM at levels far in excess of any other occupational group *(Figure III-4, 66 FR 5763)*, clearly establishing the necessity of the standard. The finding that DPM causes cancer rests on a very solid scientific foundation. EPA has also promulgated standards to protect the general public, based the risk of cancer from diesel exhaust.

Diesel exhaust is not a single chemical species; it is a stew of fine particles, gases and vapors. The diesel particle, the agent that most likely causes cancer, is mostly carbon with some other chemicals attached to it. To regulate such exposures, it is necessary to designate a "surrogate," essentially a single measurable component of diesel exhaust that can serve as a stand-in for the rest. MSHA chose "total carbon" as the surrogate. It is relatively easy to measure, forms a large fraction of DPM, and may be the component most responsible for the cancer risk. While some participants in the rulemaking argued in favor of "elemental carbon," which is a sub-fraction of total carbon, MSHA found total carbon to be the best available analytical surrogate, and determined it to be both feasible and practical to base the concentration limits on total carbon.

The final rule set an interim concentration limit of 400 micrograms per cubic meter ($ug/m^{3),}$ to become effective on July 19, 2002; and a final limit of 160 ug/m^3, to become effective on January 20, 2006. MSHA found both limits to be technologically and economically feasible, and capable of being implemented by their respective deadlines.

New safety and health regulations are almost always challenged by employers, and the metal/nonmetal rule was no exception. Several mine operators and trade associations filed suit in

[1] The analytical method for diesel exhaust is based on measuring carbon in the form of soot. Coal is mostly carbon, and it is impossible to distinguish between carbon from diesel exhaust and carbon from coal in the ambient air of a coal mine. Therefore, coal mines measure for diesel particles in the engine exhaust. Since there is generally more ventilation in coal mines in order to control methane and coal dust, that ventilation serves as the primary control for diesel exhaust as well.

the federal courts; the United Steelworkers of America (USW)[2] intervened. Meanwhile, the Administration changed hands. The parties began settlement negotiations, and agreed on several minor technical corrections that were published in February, 2002. The parties agreed that the interim concentration limit would go into effect as scheduled, with the understanding that MSHA would provide compliance assistance and not issue citations for the first year.

In August of 2003, MSHA proposed several changes to the standard. Some were agreed by the parties to the litigation; others were not. First, MSHA proposed to change the surrogate from total carbon (TC) to elemental carbon (EC). The resulting interim limit went from 400 ug/m^3 TC to 308 ug/m^3 EC based on a calculated conversion factor between the two. MSHA's intent was to ensure that miners receive the same level of health protection with an EC limit as they would with a TC limit. MSHA further proposed to enforce that limit as a "permissible exposure limit (PEL), to be measured in the breathing zone of the miner, instead of a "concentration limit," to be measured by area sampling. Because we believed that miner health would be adequately protected under the revised interim limit, the USW agreed to those changes.

MSHA also proposed to eliminate the requirement for compliance plans. The USW did not agree to that change. Finally, MSHA proposed a change in the language governing when respirators could used be for compliance. Under the original standard, respirators were limited to a small number of specifically described tasks. In the revision, MSHA proposed to return the "hierarchy of controls," allowing respirators wherever the mine operator can show that additional engineering and work practice controls are infeasible. The USW agreed to support this change only if the final standard contained a requirement that respirator users be medically evaluated to ensure that they can wear a respirator safely, and be afforded transfer within the mine and full earnings protection – as is required by the Mine Act – if unable to do so.

MSHA published its revisions to the interim standard in June 2005. The changes proposed by MSHA were implemented, including several opposed by the USW. Unfortunately, MSHA failed to require that miners required to wear respirators be medically evaluated and provided with transfer rights where necessary. As a result, we filed suit over that omission and other changes in the standard.

MSHA next turned its attention to the final PEL. On September 7, 2005, the agency proposed to postpone the final PEL by five more years, reducing it instead by small steps. The agency also suggested there might be difficulties converting the 160 ug/m^3 TC limit to an appropriate EC limit, and proposed to leave that determination to yet another rulemaking. The final standard has now been delayed until May 20, but MSHA clearly intends to delay it far longer[3], ostensibly on the grounds of feasibility, and based primarily on unsubstantiated claims from the mine operators. These proposed changes would significantly weaken the rule by

[2] In 2005, the United Steelworkers of America merged with the Paper, Allied-Industrial, Chemical and Energy Workers International Union. The resulting union is the United Steel, Paper and Forestry, Rubber, Manufacturing, Energy, Allied Industrial and Service Workers International Union, or simply the United Steelworkers or USW. Both parent unions represented underground miners.

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

permitting the continued exposure of miners to levels of DPM the agency has found to be unacceptable.

II. These Comments

These comments address four issues raised by MSHA in its September proposal:

- The lack of any legal justification for promulgating a weaker standard;
- The feasibility of the final limit of 160 ug/m^3 TC.
- The need for a respirator program which includes transfer rights for miners who cannot wear respirators; and
- The decision to initiate rulemaking to convert the final limit from total carbon to elemental carbon despite the lack of scientific evidence indicating such a limit will adequately protect miners at levels where reliable measurements can be made.

The comments supplement the USW's testimony at the hearings on MSHA's September proposal. We will not further address the health need for the diesel particulate standard, because twice before MSHA has found strong evidence that miners exposed to DPM above 160 ug/m^3 TC face significant risks of cancer, respiratory and heart disease, and other illnesses. MSHA has not reopened the record on health effects, and no new evidence has come to light since June 2005 which would change those prior conclusions.

III. The Standard Must Not Be Weakened

The USW objects vigorously to MSHA's ongoing efforts to weaken or eliminate worker protections against exposure to diesel particulate matter. Mine operators have already had five years to come into compliance with the final limit. MSHA now proposes to phase in the final limit over an additional five year period. There is no valid reason for extending the compliance deadline for the final limit. A decision by MSHA to delay the final limit violates the "no-less protection rule" of section 101(a)(9) of the Mine Act:

> *"No mandatory health or safety standard promulgated under this title shall reduce the protection afforded miners by an existing mandatory health or safety standard."*

The final limit of 160 total carbon is both technologically and economically feasible. MSHA should not change the deadline for complying with it.

The standard became law on its effective date, March 20, 2001. Under the standard adopted in 2001, the final limit was set to phase-in on January 19, 2006. These dates are substantive elements of the final rule, meant to ensure that miners are protected from DPM exposure no later than January 2006 (a deadline since stayed for several months). Any decision to delay the implementation of the final limit improperly reduces the health protections of miners.

The courts have ruled that any final new standard the "net effect" of which is to reduce protections to miners is not permitted under the Mine Act. (*UMW v. MSHA, 407 F.3d 1250 (D.C. Cir. 2005)* Under section 101(a)(9), the D.C. Circuit has held:

> *"…the rule to require that when new standards replace existing mandatory health or safety standards it is not sufficient that the new standards demonstrate a reasonable accommodation of the competing goals of safety and efficient ... mine operation. The statute expressly mandates that no reductions in the level of safety below existing levels be permitted, regardless of the benefits accruing to improved efficiency."*
> *(National Mining Association v. MSHA, 116 F.3d 520, 535 (D.C. Cir. 1997)*

The rule is a 'strict one" which imposes "an explicit constraint on the Secretary's authority" to weaken mandatory health standards. (*Id. at 536)*

Clearly, MSHA's proposal will weaken the protections it adopted in January 2001 in violation of section 101(a)(9). Even the lowest risk estimates used by MSHA to demonstrate the necessity of the rule show 44 excess lung cancer deaths per 1000 miners exposed over a working lifetime. The high estimates are an order of magnitude higher. *(Table III-7, 66 FR 5853)* [4] Forcing miners to endure this risk for five more years surely reduces their protection. Significant morbidity from respiratory and cardiovascular disease can also be expected during the five year delay MSHA proposes.

In its September 7, 2005 Notice of Proposed Rulemaking, MSHA attempted to do the impossible and explain how it wasn't really weakening the protection of miners, even though they would be facing an increased risk of cancer. Specifically, the agency raised two issues. First, MSHA indicated concern that the final limit "may be infeasible for the mining industry in 2006." Second, stated that, having changed the surrogate from total carbon to elemental carbon with respect to the interim level, it could not now calculate a conversion factor between the two applicable to the final level.

We will deal with both issues below. However, it is important to note that neither argument addresses the key issue of whether the delay will lower the protection of miners. Even if the lower level cannot be met in some jobs in some mines, it can be met in others. Those miners will be denied the protections afforded them by the original standard, in violation of the Mine Act.

[4] Table III-7 requires some interpretation. The DPM exposure associated with 44 excess deaths is 500 ug/m^3. However, that number represents total DPM. MSHA estimated that the corresponding carbon fraction of total DPM is 400 ug/m3 *(66 FR 5854)*, which in turn corresponds to the current elemental carbon level of 308 ug/m^3.

IV. The 160 ug/m^3 Exposure Limit is Feasible

MSHA and the mining industry will no doubt argue that many mines are not currently achieving control to levels as low as 160 ug/m^3 TC at all times in all jobs, and some are not even meeting the current exposure limit of 308 ug/m^3 EC. Yet that is why a compulsory standard is needed, along with strict enforcement. The rulemaking process is long, cumbersome and costly. There would be little point in invoking it to require the industry to do something it is already doing on its own. MSHA and the mine operators appear to believe that a standard is only feasible when it is unnecessary.

The courts have found that MSHA has a duty to push industry to achieve lower exposure limits, not to acquiesce in their failure to do so voluntarily. It is settled law that MSHA "can impose a standard which only the most technologically advanced [mines] have been able to achieve even if only in some of their operations some of the time." *(United Steelworkers v. Marshall, 647 F.2d 1189, 1264, D.C. Cir. 1980)* MSHA can demonstrate a standard is feasible if "modern technology has at least conceived some industrial strategies or devices which are likely to be capable of meeting the PEL and which the [mines] are generally capable of adopting. *(647 F.2d at 1266)*

The DPM standard is feasible if the record demonstrates "that the typical firm will be able to develop and install engineering and work practice controls that can meet the PEL in most of its operations. [MSHA] can do so by pointing to technology that is either already in use or has been conceived and is reasonably capable of experimental refinement and distribution within the standard's deadlines…Insufficient proof of technological feasibility for a few isolated operations within [a mine] or even [MSHA's] concession that respirators will be necessary in a few such operations will not undermine this general presumption in favor of feasibility." *(647 F.2d at 1272)*

The record before MSHA is clear that most mines, in most operations, for most miners can meet the final limit substantially sooner than 2011. Indeed, MSHA's own monitoring data show that many mines have already done so. Alternate fuels and other compliance technologies will allow the remaining mines to meet the final limit. No technological reason exists for granting industry an additional five years, on top of the five years they have already had, to install existing technology to protect workers.

We will briefly summarize this evidence below. However, the burden of proof is not on the USW to show that the standard is feasible. The burden of proof is squarely on those who wish to argue otherwise. The 160 ug/m^3 TC exposure limit was duly promulgated in 2001. At that time, MSHA found it to be feasible. As we will show below, the evidence since 2001 confirms and reinforces that finding. A conclusion by MSHA now that the standard is infeasible would be arbitrary, and based on political pressure, not evidence in the record. MSHA and the industry can only show that the presumption of feasibility created by the 2001 standard is unwarranted by using clear and convincing evidence that is new and different from that relied on in 2001. Such evidence does not exist.

A. Technological Feasibility

When MSHA promulgated the January 2001 final rule, the agency determined that control technologies would be available by January 20, 2006 to reduce DPM concentrations to 160µg/m3 TC in all types of underground metal and nonmetal mines. In the preamble to the 2001 final rule, MSHA included data from their studies where MSHA evaluated emissions generated by diesel powered equipment in several diverse mining operations, including an underground limestone mine, an underground salt mine, and an underground gold mine. In each mine, MSHA concluded that the necessary combination of controls was available to reduce DPM concentrations to well below the final concentration limit. MSHA also examined information regarding types of engines and equipment found in underground metal and nonmetal mines along with their various ventilation systems and concluded that the 2001 final rule was technologically feasible for the mining industry *(66 FR 5889).*

MSHA also distributed to the mining community their publication of *Practical Ways to Control Exposure to Diesel Exhaust in Mining – A Toolbox*, which addresses various categories of available controls. Those controls include the use of low emission engines, low sulfur fuel, aftertreatment devices, mine ventilation, enclosed cabs, engine maintenance, work practices and training, fleet management, and respiratory protective equipment *(66 FR 5712-13).*

Since the publication of the 2001 rule, additional evidence on feasibility has accumulated. None of it negates MSHA's original conclusion that the 160 ug/m^3 TC exposure limit is technologically and economically feasible. In fact, the evidence reinforces that conclusion.

1. The 31-Mine Study

Following promulgation of the 2001 final rule, MSHA agreed to engage in a joint MSHA/industry 31-Mine Study to, among other things, explore different alternative methods of compliance with the interim and final DPM concentration limits. The agency developed a mathematical tool called the Estimator. The analyses were based on the highest DPM sample result obtained at each mine and all major DPM emission sources at each mine plus spare equipment. On January 6, 2003, MSHA issued its final report titled, ``MSHA'S Report on Data Collected during a Joint MSHA/Industry Study of DPM Levels in Underground Metal and Nonmetal Mines." MSHA found no reason to change its original conclusions regarding feasibility.

NIOSH peer reviewed MSHA's final report of the 31-Mine Study *(70 FR 32870-73).* By letter to MSHA dated June 25, 2003, NIOSH stated that:

> *"Operators will need to make informed decisions regarding filter selection, retrofitting, engine and equipment deployment, operation, and maintenance, and specifically work through issues such as in-use efficiencies, secondary emissions, engine backpressure, DPF regeneration, DPF reliability and durability. NIOSH is of the opinion that these issues can be solved if the informed decisions mentioned above are made." (70 FR 32923)*

2. The NIOSH Review of DPM Reduction Technology

The NIOSH report, *Review of Technology Available to the Underground Mining Industry*[5], published in August of 2002, presents the potentials and limitations of control technology for reducing exhaust tailpipe emissions from diesel-powered equipment used in underground mining. The report discusses a number of commercially available products.

The control technology discussed in the report falls into six general categories: MSHA-approved engines with low emissions, derated engines, fuels, fuel additives, diesel oxidation catalytic converters (DOCCs), and diesel particulate filters (DPFs). The report explains that the use of low-emission, MSHA-approved engines can result in a significant reduction of PM emissions and, in some cases, a reduction of toxic gas emissions. For example, the direct substitution of the Isuzu C240 with a Deutz F4L1011 would result in a 64% reduction of emitted DPM based on the MSHA particulate index (PI) for each engine.

According to the report, it is possible, and sometimes practiced, to limit the maximum fueling rate of a particular engine to less than its rated maximum specifically to reduce emissions. This practice is called derating. Relatively minor reductions in rated power may result in significant reductions in PM emissions. For example, by reducing the maximum deliverable horsepower of the Isuzu C240 from 56 to 52, DPM emissions are reduced by 62% (from 9.35 to 4.25 g/hr).

The report further explains that the use of commercially available alternative fuels, such as biodiesel, synthetic diesel and water-fuel emulsions, can result in lower gaseous and PM emissions. The sulfur content of the fuel becomes a concern when considering the application of oxidation catalysts to the point that the use of ultra-low sulfur fuel is highly recommended.

According to the report, DPFs are extremely effective at removing DPM from engine exhausts. However, the DPM that is collected by the particle filter needs to be removed. One approach is to use high engine exhaust temperatures to burn off the collected soot, thus regenerating the filter. Catalysts can be used to lower regeneration temperatures. Alternatively, filters with built-in heaters can be connected to external power when the equipment is not in use. Another option is to exchange a DPM-loaded filter for a clean filter.

3. The Brunswick Mine Study

The Brunswick Mine Diesel Particulate Filter Study[6] was one of several research projects initiated by the Diesel Emissions Evaluation Program (DEEP) in Canada. The study was carried out at Noranda's Brunswick Mine in Bathurst, New Brunswick. The study began in early 2000. The report was submitted to DEEP in the Autumn of 2003.

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[5] *Review of Technology Available to the Underground Mining Industry for Control of Diesel Emissions, Information Circular 9462, George H. Schnakenberg, Jr., Ph.D, and Aleksandar D. Bugarski, Ph.D, NIOSH, Pittsburgh Research Laboratory, August, 2002.*

[6] *Final Report of Investigation to the Diesel Emission Evaluation Program (DEEP), Noranda Inc.- Brunswick Mine Diesel (DPF) Study, October, 2004*

The DEEP program had previously identified diesel particulate filter (DPF) systems as a promising technology to provide 90% or better reduction in DPM from underground mining vehicles. The purpose of the Noranda Brunswick Mine project was to determine the ffectiveness, durability, reliability, and economic viability of current generation DPF technology.

The project demonstrated that many DPFs were able to provide the projected 90% reductions. However, the study emphasized that successful implementation of a DPF program requires care in selecting the filtering system to be used, and designing the system for maintaining it.

The Isolated Zone Study conducted mid-way through the project examined the capability of the DPF technologies to meet proposed and existing Canadian limits for ambient DPM concentrations in an actual underground mining environment. With more than 2000 operating hours on the systems, all but one filter system showed DPM reductions close to 80%. The final report contains a wealth of conclusions and recommendations. As with the NIOSH study, Brunswick Mine study emphasized the need for careful selection, installation, verification and maintenance of the DPF system. Nevertheless, MSHA deleted the requirement for a compliance plan in its June 6, 2005 final rule for the interim standard. *(70 FR 32868)*

4. The Diesel Partnership

For the last several years, NIOSH has worked with industry trade associations and the USW in a Metal/Nonmetal Diesel Partnership. The purpose of the Partnership is to identify and test controls that can be retrofitted onto existing diesel equipment. The Partnership has conducted a number of studies at the Stillwater Mine in Montana. That research was useful in further exploring the relative advantages and disadvantages of different filter systems, but it did not show the 160 ug/m^3 level to be infeasible. In its conclusion to most recent study, NIOSH stated:

> *"This study did not address the important critical path of economic and technical aspects relating to implementation of the studied technologies into underground mines." ("The Effectiveness of Reformulated Fuels and Aftertreatment Technologies in Controlling Diesel Emissions: Phase III – A Study in an Isolated Zone at Stillwater Mining Company's Nye Mine, August 31 – September 11, 2004")*

It is instructive that, like the Brunswick Mine study, the 31-Mine Study, and the earlier work by NIOSH, the Stillwater studies emphasized the need for careful selection, installation, verification and maintenance of the DPF system and controls in general. Nevertheless, MSHA deleted the requirement for a control plan from the standard when it published the interim rule in June of 2005. It is hard to understand how a mine operator can meet his or her compliance obligations without any plan for doing so. The USW has challenged this aspect of the revised interim standard.

5. MSHA's Supposed Justification for the Delay

In 2001, MSHA found the final DPM concentration limit to be feasible by January, 2006. Nothing in the evidence summarized above challenges that conclusion. Nevertheless, in its September 7, 2005 Notice of proposed Rulemaking, MSHA stated why it is now questioning its

own 2001 determination that the standard is feasible. MSHA's reasons amount to little more than a series of unsubstantiated claims:

> *"…as a result of our compliance assistance efforts and through our enforcement of the interim limit, we have become aware that this assumption [the availability of retrofitted controls] may not be valid." (70 FR 53283)*

> *"…mines are currently experiencing problems with selection and implementation of DPF systems for complying with the interim limit." (ibid.)*

While these statements indicate that MSHA has gathered new information through enforcement, there are no inspection reports or other such evidence in the record. Some sampling data is available, but without the mine inspectors notes, there is no way of telling what any mine has done to try to comply with the standard. MSHA cannot use secret, off-the-record data as a basis for its decisions.[7]

> *"That conclusion [that compliance may not be feasible by January 2006] is supported by our current enforcement sampling results that indicate that many mining operations have exposures above the 160 TC concentration limit…" (70 FR 53285)*

It is not surprising that many mines have exposures above a limit that MSHA is not enforcing and has proposed to delay. If we have learned anything in the last 35 years of OSHA and MSHA regulation, it is that enforcement drives compliance. While some employers will voluntarily do the right thing, far too many will simply wait until compliance becomes a legal requirement. Now, of course, MSHA has proposed to allow them to wait five more years.

In fact, it is not clear that MSHA is properly enforcing the existing standard. The USW recently obtained data on ten underground metal mines. Those data are presented in Table 1, below:

[7] Recently, Dr. James Weeks, a consultant to the USW, attempted to obtain the raw inspection data from MSHA. He was told that the request would have to be submitted as a Freedom of Information request, and that the agency could not provide the data until well after the record closed. Even then, search and copying costs would be approximately $12,000.

Table 1: MSHA Enforcement Activity Concerning Exposure to DPM for Selected Underground Metal Mines*

Mine ID	N of Samples	N > PEL (< ε)#	N of Citations	N of Citations Terminated	N of Citations Extended
A	74	36	2	1	0
B	12	7	0	0	2
C	39	23	3	2	1
D	26	19 (9)	6	0	0
E	32	5 (6)	0	0	0
F	32	6 (8)	0	0	0
G	170	72 (1)	5	0	0
H	27	4 (9)	6	0	0
I	30	14 (5)	0	1	3
J	41	8 (6)	2	1	0
K	22	1 (12)	0	0	0
Totals	**505**	**195 (56)**	**24**	**5**	**6**

* Source: MSHA, Data Retrieval System
# Number of samples greater than the PEL but less than the error factor.

For this series of mines, 505 samples were taken and analyzed for diesel particulate matter. Of these, 195 (39%) were above the exposure limit and another 56 (11%) were above the exposure limit but less than the exposure limit plus an error factor. Citations were issued for only 24 of 251 samples (10%) above the exposure limit, 5 citations were extended and 6 were terminated. This sample of mines is small and not representative, but at least for these mines, MSHA is not issuing citations when exposure above the exposure limit is documented.

In short, having failed to enforce the existing standard, MSHA should not be surprised that some mine operators are not meeting it, let alone achieving levels that are 60% lower. Without a legal mandate to do so – one that is strictly enforced – many operators will never reduce exposures to the 160 ug/m^3 level.

MSHA's other explanations for delaying the final exposure limit are equally feeble. The fact that selecting and implementing mine-specific filter technologies takes careful analysis and experimentation, does not render them infeasible. MSHA only opines, and does not show, that some retrofitted controls are not as widely available as originally thought. Even if true, many other control options are available to operators, including one mentioned in the 2001 preamble but ignored in the 2005 Notice of Proposed Rulemaking – improved ventilation.

Later in the September 7, 2005 *Federal Register* notice, MSHA discusses two clearly feasible technologies – alternative fuels and environmental cabs. MSHA tested a number of alternative fuels such as biodiesel blends and water emulsion fuels. "In each application, the change to an alternative fuel had a positive impact on reducing engine emissions and miners'

exposures to DPM. In some cases, reductions of 50 to 80+ percent were measured."*(70 FR 53286)* MSHA noted that alternative fuels present some operational issues, such as the need for different fuel filters and careful management of fueling practices, but those are not feasibility issues, and as the agency noted, they can be overcome.

MSHA did indicate that "most" mines were some distance from a biodiesel fuel distributor, and that alternative fuels would have to be transported to mine sites at some expense. However, expense is not a feasibility issue unless it becomes so extreme as to threaten the viability of the industry as a whole. Furthermore, fuel distributors will undoubtedly set up distribution centers in mining areas as soon as the demand exists – as soon as MSHA provides operators with the incentive to buy alternative fuels by requiring compliance with a sufficiently protective DPM standard. [8]

MSHA found that environmental cabs "are a proven means to reduce worker exposure to DPM." *(70 FR 53287)*. MSHA suggested that some mines, particularly hardrock mines, may need additional time to design and retrofit such cabs. However, they have already had more than five years; it should not take a total of ten. MSHA should not reward mine operators who have failed to install feasible controls by giving them years of extra time, during which miners will be continue to be exposed to unacceptable levels of a carcinogen.

6. Compliance Assistance Visits

Although it in no way compensates for MSHA's failure to place all its inspection reports in the record, the USW was able to obtain some reports of MSHA compliance assistance visits to select operators. Typically, these visits are requested by the MSHA District office following a visit by a mine inspector that revealed excessive levels of diesel particulate matter. They are conducted by personnel from MSHA's Division of Technical Support with the purpose of evaluating an operator's emission control programs and offering suggestions on how it could be improved.

Inspectors from MSHA's Technical Support Division are well qualified and experienced mining engineers and they do not have the authority to issue citations for non-compliance. They amount to a high quality consultative advice to the mine operator at no cost. Recommendations are not binding. Altogether, we counted approximately thirty of these visits concerned with exposure to diesel particulate matter in underground metal and non-metal mines. We concentrated on metal mines.

Some reports of compliance assistance visits reveal that mine operators have made little or no effort to control diesel particulate matter and they reveal many instances of mismanagement and poor engineering. Some reports were located in the docket and others were

[8] Unfortunately, MSHA is now providing a disincentive for manufacturers to develop alternative fuels. Lubrizol, the company that provides the technology and the emulsifiers for PuriNOx, a highly promising fuel-water blend, is leaving the business, in part because they believe that MSHA's proposed delay significantly shrinks their market. *(Phone conversation between Michael Wright and a Lubrizol representative)* If regulation spurs innovation, deregulation stifles it.

obtained from MSHA. Excerpts follow. (Those documents not already in the docket are included with these comments.)

During a visit to the Fletcher Mine of the Doe Run Company in July, 2003, the MSHA personnel evaluated the ventilation system and noted several fundamental deficiencies. *(MSHA Docket Number AB29-BKG-122)*

> *"In the work area of the powderman, air current and quantity readings were attempted but no accurate measurements could be obtained. Movement of smoke from a chemical smoke-tube [a traditional method of measuring air flow] indicated air was circulating in the work area with minimal fresh air being delivered to the workstation."*

In another location of the same mine the operator used another ventilation method that appeared to be ineffective and inefficient. The problem was complex and requires an extended excerpt from the report (emphasis added):

> *"This section of the mine…was ventilated by a flexible 54-inch tubing blowing air from an auxiliary fan. The end of this tubing was located <u>two blocks outby and one crosscut over</u> from this work location. . .Mine management attempts to ventilate work areas, such as this one, by installing auxiliary fans in series. The blowing discharge of one fan tubing blows into the intake of the next fan. The initial pick-up point for the first fan should be in fresh intake air. The fans continually pick-up and discharge the fresh air to and from each other until fresh air is delivered to the work area. For this type of ventilation system to be effective, it must first obtain fresh air at its initial pick-up area. At each transfer point from the tubing to the next fan, the exhaust has to be sufficiently close to the inlet of the next fan. An inspection of this fan system indicated that an excessive amount of air recirculation was occurring. When this occurs, exhaust air from the working faces are blown back up to the work areas and DPM concentrations will continue to increase. These pick-up and discharge points need to positioned (sic) in closer proximity to each other. During the survey, a loading crew was in the face adjacent to the powderman. This crew was mucking out of a previously shot face. A loader and several trucks were working one crosscut away from the powderman causing increased DPM concentrations from all of the equipment working."*

A more systemic deficiency, potentially affecting ventilation throughout the mine was evident at the bottom of one of three ventilation downshafts:

> *"A ventilation shaft was located approximately 4,000 feet from [a work area]. A fan was located at the bottom of the shaft. It was placed near a steel bulkhead and its intent was to blow intake air from the shaft up to the intake brattice line. The series of fans would then use this intake air to ventilate the work area. Several deficiencies were observed at this shaft location. The fan was located approximately two feet from the steel bulkhead. Additionally, a door in this bulkhead was in the open position. These conditions resulted in recirculated air entering the intake of this fan, and decreasing the volume of air delivered by this fan. This fan should be placed in the bullhead (sic) and the bulkhead should be maintained in a reasonable air tight position with the door closed. The brattice curtains at the bottom of this intake shaft were also inspected. Leakage was occurring through these brattices. The combination of these conditions resulted in a very ineffective fresh air intake system. . . "*

This operator also had some old and poorly maintained engines that produced high levels of DPM, had not used alternative fuels, did not use particulate filters, and had not used environmental cabs. The result was very high DPM levels with some exceeding 1,000 $\mu g/m^3$.

A report on the Sweetwater Mine, also operated by The Doe Run Company, and inspected in July, 2003 showed similar problems. *(MSHA Dockett AB29-BKG-134)* The investigators, on entering a work area, noted that employees were installing a brattice curtain in a haphazard and ineffective manner. Specifically:

> *"The curtain was approximately 200 feet from the intake ventilation shaft. Prior to the work performed to this curtain, there was a least a 6-foot opening underneath the curtain. Additionally, there was approximately a 2-foot gap at the top of the brattice, even after repairs had been performed to the brattice. The size of these openings, plus their close proximity to the air shaft, would have resulted in a short circuit situation of the ventilation system. Adequate intake air would not have been provided to the work area. Employees stated that this curtain had been in poor condition for a long period of time, prior to this inspection. . .*
>
> *This brattice line is used to direct fresh intake air to the intake of the series of auxiliary fans [providing fresh air to the work area]. This brattice line ended approximately 500 feet outby the intake for these fans. Air that is directed up the intake brattice line has at least two open cross-cuts to short circuit itself back to the return. The brattice line should be extended to the auxiliary fans or the intake of the fans should be extended outby to the end of the brattice line. Mine management was also shown how this intake brattice line could be changed, so that the intake air is moved deeper into the mine."*

The MSHA inspectors on this visit evidently gave the operator an elementary course in mine ventilation. The experience as these two mines, based on these reports, do not illustrate infeasibility, they illustrate incompetence. They illustrate the need to train *mine operators* in addition to the need to train miners.

A compliance assistance visit to the Carlin E 04 Mine operated by the Newmont Mining Co. was conducted in September, 2004. At this mine, the operator had apparently made several changes aimed at reducing miners' exposure with some reduction in exposure. These efforts included improving mine ventilation, purchasing cleaner burning engines, using environmental cabs, installing diesel particulate filters, using alternative fuels, and making changes in work practices. Use of cleaner burning engines, selective use of environmental cabs, use of particulate filters, and changes in work practices seemed to achieve the greatest benefit. One procedure was to put haul trucks in the exhaust airway and put drivers in environmental cabs. This isolated a major source of DPM and protected drivers at the same time.

Even so, measurements still exceeded the (then) exposure limit of 400 $\mu g/m^3$. However, the MSHA inspector still had several recommendations for increasing or introducing controls known to be feasible and effective. Specifically, the MSHA inspectors recommended increasing the use of particulate filters and increasing mine ventilation which they estimate would reduce exposures to below160 $\mu g/m^3$. In this case, some feasible controls had not been implemented. *(Memorandum for Lee Ratliff from Robert Haney, October 19, 2004. Mine ID 26-02271; attached).*

A compliance assistance visit to the Miekle Mine operated by Barrick Goldstrike Mines, Inc. was conducted in October, 2004. A fundamental problem at this mine – one that hindered the investigation and suggested the operator had not systematically analyzed the sources of DPM – is that the operator *"…did not have an equipment list that indicated engine horsepower and usage."* Such a list is a basic management tool and is required by MSHA regulations (30 CFR 57.5062 (b)). Like the Carlin Mine, the operator at this mine seems to have tried several methods for controlling exposure to DPM, relying heavily on ventilation, designed to be twice the Particulate Index. Results were unimpressive with many exposure measurements above 400 $\mu g/m^3$. However, MSHA made several specific recommendations that they estimate would bring exposure down to an acceptable level, demonstrating, as above, that some feasible controls had not been implemented. *(Memorandum for Lee Ratliff from Robert Haney, November 23, 2004, Mine ID 26-02246; attached)*

A compliance assistance visit to the Midas Mine operated by Newmont was conducted on October 24, 2004. At this mine, diesel controls included attention to mine ventilation, use of clean burning engines, environmental cabs, particulate filters, alternative fuels, and changes in work practices. Results were unimpressive, with most measurements remaining above 400 $\mu g/m^3$. As before, MSHA made several recommendations including increased use of particulate filters and better ventilation controls.

In summary, these compliance assistance visits demonstrate that the lack of compliance with the DPM exposure limits results from lack of trying, not the lack of feasibility.

7. Evidence from the Hearings

A number of mine operators and mine workers appeared at the January 2006 hearings on the proposed revisions to the standard. Their testimony shows that some mines are currently in compliance with the 160 ug/m^3 limit. Other mines could reach it with little additional effort, were it to be enforced.

For example, Jim Sheridan, Manager of Underground Mining Operations at JM Huber Corporation in Quincy, Illinois, testified at the Louisville, Kentucky hearing on January 13. *(Tr. 164-172; 01/12/06)* He reported that, in an inspection conducted in August of 2005, MSHA found his mine to be fully in compliance with the final limit of 160 ug/m^3 TC.

> *"We run a large underground limestone operation. We produce about 3,000 tons per day. That's with an 18 person workforce, split into two shifts. Our equipment fleet consists of a CAT 980 Loader; CAT haul trucks, the 769's; one Getman Scaler; one Fletcher two-boom jumbo; and one Getman End Fill Loader. With the exception of the Getman End Fill Loader, all of our equipment fleet has enclosed cabs.*
>
> *"We recently had an MSHA inspection, in August, and the representative that came out outfitted the day shift crew with the DPM monitors on their person and he collected a sample for that day.*

"Now, all of these readings not only bested the 400, they bested the 308 and they bested the 160. But it's important to recognize why and how these readings got to where they are. And so I started looking at the different situations that the operators were in during that day that they were being tested."

Mr. Sheridan went on to describe his control strategy:

"What we've done to take action, take steps to mitigate these readings and bring them down even further are switching to a bio-diesel fuel, which we recently did. We're on our third shipment. And the reason that we were not able to move to that mix before was Catapillar (sic), who supplies our loader and our haul trucks, was reluctant to let us use the bio-diesel fuel in their equipment. It wasn't a warranty issue, it was just reasons that they just didn't want us to use it yet. They hadn't done some complete testing or whatever.

"After a little bit of arm twisting, they said it was okay if we went to a bio-diesel mix. As long as it didn't exceed a 15 percent blend. Well, the mix that we're using is an 11 percent. It's B-11. All the other equipment manufacturers, they did not have an issue with using bio-diesel fuels in their equipment.

"And the other thing that we did was we improved our ventilation. In large room and pillar operations there's a basic formula in fluid dynamics, Q=VA, quality equals velocity times cross-sectional area. Now, if you're moving 700,000 CFM through the mine and you've got a tremendous cross-sectional area in that mine, that means your velocity has to drop off significantly. So -- and that's the big problem that I see in our operation is just -- if we could improve the velocity of the air itself, we could remove some of these exhaust materials out of there. And so that's steps that I want to improve on at our particular operation. And we do that with putting curtains in strategic areas to create venturi effects with ventilation stream, and to block off unnecessary mine workings and just channel the air into the active work area.

"And in places where we have these particular pieces of equipment like the drill and the end fill loader that are in there for a couple hours before they move on to the next heading and perform their operation on that heading, these portable fans, auxiliary fans. You can mount them on skids or on rubber tire, set them up, turn them on and provide an air stream in that work head."

Wesley Smith, a miner at the Morton Salt mine in Fairport, Ohio, and president of USW Local Union 5-996, testified at the January 5 hearings in Arlington, VA. He noted that his mine was in full compliance with the 308 ug/m^3 TC level, but that some jobs were not yet meeting the 160 ug/m^3 level. *(Tr. 36-37; 1/5/06)*

"…I got the information from our safety director two days ago, and he showed me the paperwork that Mike has that says that we are meeting all the requirements, and that's

good. And that makes me proud, and I thank my company for doing that. So we are in good hands.

MR. WRIGHT: There are some occupations though where they are not getting the 160 limit; is that correct?

MR. SMITH: Yes.

MR. WRIGHT: And to the best of your knowledge are they in those areas using sort of using modern filter technologies to eliminate diesel?

MR. SMITH: No. No, the machinery is older, and I honestly believe we could make those goals in those areas that we have followed proper safety procedures. We have Goiters running around there, diesel [gators] that people won't shut off. We have lube trucks that service other machinery that they won't turn the key off on them. They leave them there to idle. And I think that is just us teaching our employees how important it is to shut that machinery off. That is an educational thing that we have to work on for safety for our employees in our plant, and something that we have to work with the company and union-wise.And we can get rid of those diesel [gators]. There is no reason for us to have those [gators]. And I think once we get rid of those and change our thinking patterns with our employees, we are really going to make those goals.

MR. WRIGHT: And are they using any alternative fuels underground instead of diesel to your knowledge?

MR. SMITH: Not to my knowledge. I don't think so. I am pretty sure that they are not."

Unfortunately, the record shows also that efforts to stringently control diesel exhaust at some mines has been half-hearted at best. David Graham, Manager of Safety and Health for General Chemicals Soda Ash Partners in Green River, Wyoming was questioned by MSHA panelist James Petrie at the January 9 Salt Lake City hearings. Mr. Graham also serves as chairman of the MARG Diesel Coalition, an industry association that is challenging the entire rule.

"We tried the biodiesel too, we looked at that. But similar to what Steve Wood indicated, we're a little bit remote also. We're a little bit aways from anywhere. We're three and a half hours, three hours from Salt Lake; four or five hours from Casper, Wyoming; four hours, five hours from Twin Falls, Idaho. And these are places that have the capabilities for us to get biodiesel. Like I said, we used it before. One of the problems we had, we didn't have the expertise at the time to do the testing to see if it really helped any. Some of the guys liked it. For whatever reason, said it smelled better, if that's any indication of what we should use it for, then we'll use it. But we really didn't do the testing that we probably should have done to determine if it had an effect." (Tr. 163; 1/9/06)

Other mines have not tried feasible controls because they are not yet required. For example, John Griesemer, Vice President of Springfield Underground, testified at the January 11 Kansas City hearings. He expressed his concern about the supposed lack of technology currently available to comply with the standard, but subsequently admitted that, because his company is in compliance with the 308 limit, they have not tried filter technologies.

> *"Our general concern is the lack of technology currently available to comply with the levels. As I already stated, the current methods to achieve compliance are not economic feasible or present other hazards to employees, specifically some of the filtration technology that we've investigated. I would state that we have not tried those technologies as of yet.*
>
> *MR. PETRIE: Is your mine currently in compliance with the 308 milligram limit?*
>
> *MR. GRIESEMER: Yes, sir, we are.*
>
> *MR. PETRIE: Do you foresee any problem in meeting that limit in the future?*
>
> *MR. GRIESEMER: No, we do not.*
>
> *MR. SUSEEN: And you said you haven't looked into any filter technologies.*
>
> *MR. GRIESEMER: Just the data available from MSHA and the data available from NIOSH and from our trade associations. From what we've seen it's not a process that we want to try at this point, because we are in compliance today. But in looking in the long-term, as the levels are driven down, we may have to look at it."*

Mike Neason, Safety Manager for Hanson Mines testified at the January 13 hearing in Louisville. *(Tr. 25-59; 1/13/06)* He stated that his operations had reduced DPM levels from around 1200 ug/m^3 to below 300 ug/m^3, primarily through ventilation improvements, equipment upgrades, better engine maintenance and the use of biodiesel. But he too admitted that his mine had not used any filter technology.

> *"We've talked about what filters mean and what filters do and how they work and what they are. We've closely watched how that technology has moved forward. As of this point, even the employees don't see a benefit in doing that. Mainly because the maintenance that they're going to be required to do to change filters, to move filters around, is going to cause them to pull out the ladder and climb the ladder and work around the hot exhaust and move the heavy thing back down, you know, the ladder, put it where it needs to go." (Tr. 49-50; 1/13/06)*

Mr. Neason's objections to filters are based on operational convenience, not feasibility. Hot exhaust systems can be allowed to cool. Workers are sometimes required to climb ladders and put them back where they need to go. The maintenance procedure for changing filters can certainly be designed so that it is not hazardous. And miners might well see a benefit in changing

filters if the alternative was lung cancer. While Mr. Neason and Hanson Mines are to be commended for reductions they have already made, additional controls could well reduce exposures below the 160 ug/m^3 level.

Ed Elliot, Director of Health and Safety for Rogers Group, Inc. also testified at the Louisville hearing, and stated that his company had not tried diesel particulate filters:

> *"We have not gone to diesel particulate filters. In our hierarchy of controls, quite honestly diesel particulate filters would be our last choice. So we looked at diesel particulate filters as the last resort. It certainly may be one that we want to take, but it's not one that we would choose to go at early." (Tr. 86; 1/13/06)*

Mr. Elliott objected to filters on several grounds. He stated that they might be "difficult to deal with" if used on an inefficient engine. *(ibid.)* He also noted that offboard regeneration systems might cause an increase in labor costs. *(Tr. 87; 1/13/06)* However, engines can be tuned to maintain their efficiency, and an increase in labor costs does not render a control infeasible.

The fact that some operators have not vigorously tried to comply with the final limit is not a valid reason for delaying its implementation. Operators cannot avoid compliance by complaining that their efforts would be futile. The courts, instead, have held that employers must use their best efforts to implement all available, feasible controls, even if those efforts do not reduce exposures to the legal limit.

> *"So long as [OSHA] present substantial evidence that companies acting vigorously and in good faith can develop the technology, OSHA can require industry to meet PELs never attained anywhere." (USWA v. Marshall, 647 F.2d at 1264-65)*

And:

> *"A company could not simply refuse to pursue engineering or work practice controls by asserting their infeasibility. Rather, it would have to attempt to install controls to the limits of contemporary technical knowledge and of its own financial resources." (647 F.2d 1269).*

And finally, MSHA:

> *"cannot let workers suffer while it awaits the Godot of scientific certainty." (647 F.2d at 1266).*

B. Economic Feasibility

The five year delay is not justified on economic grounds. In January 2001, MSHA estimated that compliance with the rule would cost approximately $25.1 million on an annual basis *(66 FR 5889).* MSHA estimated that 73% of those costs would be expended to comply with the interim level and 27%, or just $6.6 million annually, to comply with the final limit. MSHA found these costs to be economically feasible. They represent less than one percent of industry revenues.

Nothing in the record suggests that these compliance costs have increased. If anything, advances in technology and the availability of substitute fuels means the likely costs of compliance have decreased since the 2001 estimates were completed.

In fact, MSHA now estimates that delaying compliance with the final limit will save industry only $1.8 million annually *(70 FR 53290).* Neither the $6.6 million overall estimate, or the $1.8 million annual estimate over five years approaches a level where the rule might be said to be infeasible.

C. The Special Extension Provision

The special extension procedure adopted by MSHA removes any remaining doubts about the feasibility of the standard. The provision ensures that individual mines which cannot currently meet the final limit – either because the technology to do so is not available or readily adaptable or because it is too costly – can extend the time for compliance. Thus, the fact that MSHA believes some mines may encounter feasibility problems for some jobs in some areas is not a valid basis for the very long proposed compliance delay.

Any mine which can produce evidence of actual compliance difficulties is eligible for a special extension either to extend or modify the mine's compliance obligation. The courts have recognized that such "flexible devices" as variance proceedings or special extensions can resolve individual problems with feasibility. *(647 F.2d at 1266)*

D. MSHA's Obligations

MSHA is obligated to protect workers who risk significant impairment of their health to the extent feasible. It has recognized that a final limit as low as 160 ug/m^3 TC is necessary to do so. The agency's risk assessment shows that each year of delay means miners will die of cancer or respiratory disease. In *Building and Construction Trades Dept v. Brock*, 838 F.2d 1258 (D.C. Cir 1986), the Court found fault with an OSHA rule setting an asbestos limit of 0.2 f/cc when for most of the asbestos industry an asbestos limit of 0.1 f/cc was feasible. The reasoning of *BCTD v. Brock* requires MSHA to abandon its unreasonably extended phase-in schedule in favor of immediate implementation of the final limit. The justification for the phase in is that some mines may have compliance difficulties. But, as the D.C. Circuit recognized in *BCTD v. Brock*, the problems of the few are not a valid reason to excuse compliance efforts of the majority of mine operators who can comply. This is particularly true where a special extension is available to those few mines with documented feasibility problems.

V. MSHA Must Require Medical Evaluations and Transfer Rights for Respirator Users

The most significant omission from both the 2001 and 2005 rules is the absence of a requirement that miners receive medical evaluations of their fitness to wear respirators prior to being assigned to work requiring respirator use, and transfer and wage retention benefits if they

are not medically able to wear a respirator. The 2001 standard did not include such a provision. That oversight was partially mitigated by the fact that the standard limited respirator use to a small number of specific tasks, like doing maintenance work in a return air shaft, and only with advance approval from the Secretary.

When it revised the interim standard in June 2005, MSHA deleted the requirement for advance approval, and changed the provision to reflect the traditional "hierarchy of controls," allowing respirator use whenever the mine operator can show that engineering and work practice controls are infeasible. The USW did not object to this change, but noted that respirator use might become more widespread. We requested that MSHA correct the defect in the original standard, and provide medical evaluation and transfer rights for miners required to wear respirators. *(Comments of Michael Wright, 10/7/03)*

Sadly, MSHA refused to amend the standard to include medical evaluations and transfer rights, even though, in the preamble to the revised standard, MSHA opined that transfer in such limited circumstances represented sound policy and would have a negligible cost impact on mine operators. *(70 Fed. Reg. 32957)*

The USW believes MSHA's June response to its repeated calls for a respirator program which includes transfer rights for miners who cannot wear respirators is arbitrary and inconsistent with the Mine Act. Accordingly, the union petitioned the D.C. Circuit challenging MSHA's decision.

In its September 7 proposed standard, MSHA again failed to include medical evaluations and transfer rights. However, MSHA did indicate its willingness to reconsider the issue, and it sought comments from the mining community. That specific request for comments gives all parties adequate notice that MSHA might add a respirator program with transfer rights to the DPM standard. We urge MSHA to do so.

A. Medical Evaluations

The USW has previously testified on the need for a detailed respiratory protection program which parallels OSHA's respirator standard, 29 C.F.R. §1910.134. *(Comments of Michael Wright, 10/7/03)*. Indeed, MSHA has recognized, quoting OSHA's respirator standard:

> *"[s]pecific medical conditions can compromise an employee's ability to tolerate the physiological burdens imposed by respirator use, thereby placing the employee at increased risk of illness, injury, and even death." (70 FR 32957)*

Since a mine operator who assigns a miner to work in a respirator without a medical evaluation puts that workers life at risk, MSHA has an obligation to protect miners from such harm.

MSHA's failure to require medical evaluations before miners are assigned to work in respirators is particularly shameful in light of the fact that most other workers already have such protections. OSHA requires such programs of all employers whose workers are exposed to excessive levels of regulated toxins. *(29 C.F.R. §1910.134)* [9] MSHA should provide diesel-exposed workers with no less. If respirators are permitted at all, the standard must include a requirement that a physician evaluate the miner's ability to wear a respirator before that miner is assigned to work requiring one.

MSHA should also require that the evaluation be comprehensive enough to detect conditions which might put a respirator user at risk. While a medical history is an important part of the evaluation, pulmonary function testing is also critical. Attached to these comments is a brief submission by Dr. David Parkinson, a consulting physician to the USW, and the retired director of occupational medicine at the State University of New York at Stoney Brook, and the Long Island Occupational Health Clinic.

B. Transfer Rights

The medical evaluations we urge MSHA to adopt will determine that some miners will be unable to wear negative pressure respirators. Pulmonary and cardiovascular conditions are the most common reasons why workers cannot wear ordinary respirators. The problem is breathing resistance – the extra strain of pulling air through the filters of negative pressure respirators. However, these workers can be protected by positive pressure respirators, which eliminate breathing resistance. Only a tiny percentage of miners will be unable to wear either type of respirators. (Examples include those who suffer from extreme claustrophobia, but few claustrophobics are likely to become underground miners. Severe facial injuries can also preclude respirator use.) Gene Elwell of American Medical Testing testified in the January 5 Arlington hearings that in the ten years his company has done respirator evaluations, he has never had a case where a worker was unable to wear a positive pressure respirator *(Tr. 54; 1/5/06).* MSHA has estimated the total cost of an evaluation and transfer provision at $40,000 annually. *(70 FR 53290)*

Although the number of affected miners will be small, MSHA is obligated to include transfer rights in health standards by section 101(a)(7) of the Mine Act which provides that:

> *Where appropriate, the mandatory standard shall provide that where a determination is made that a miner may suffer material impairment of health or functional capacity by reason of exposure to the hazards covered by such mandatory standard, that miner shall be removed from such exposure and reassigned. Any miner transferred as a result of such exposure shall continue to receive compensation for such work at no less than the regular rate*

[9] See also the comments of Dr. Steven Markowitz, an occupational physician at Queens College, attached.

of pay for miners in the classification such miner held immediately prior to his transfer. . . .

MSHA has violated this section of the Mine Act, by its failure to include medical evaluations and transfer rights for respirator users in the standard.

Sound public policy also supports a requirement that mine operators provide transfer rights for workers unable to wear respirators. Transfer rights are necessary to ensure that workers fully and voluntarily participate in medical evaluations. Many OSHA standards, such as the standards for lead *(29 CFR 1910.1025)* and formaldehyde *(29 CFR 1910.1048)* include provisions for medical removal protection, including full earnings retention, for precisely this reason, even though the OSH Act does not contain a provision similar to section 101(a)(7) of the Mine Act.

When OSHA included earnings protection provisions in the lead standard, it observed that "[t]he economic disincentive to participation [in medical surveillance] are severe and must be removed if the medical surveillance provisions of the lead standard are to substantially advance the goals of the Act." *(43 Fed. Reg. 54442)* In *United Steelworkers v. Marshall* the D.C. Circuit agreed with OSHA that wage retention was "a preventive device crucial to the standard" and that wage protection was needed to ensure worker participation in medical surveillance. *(647 F.2d at 1237)* Years later, in reviewing OSHA's formaldehyde standard, the D.C. Circuit rejected OSHA's decision not to adopt wage retention provisions when the record demonstrated that workers would not fully participate in medical surveillance without it. *(UAW v. Pendergrass, 878 F.2d 389, 400).* Of course, MSHA is under an even greater legal obligation legal to include these protections, given section 101(a)(7) of the Mine Act.

The record is unequivocal that miners who fear loss of their job if they are medically determined not able to wear a respirator are unlikely to fully and honestly participate in medical evaluations. At the January 5 Arlington hearings, Michael Wright discussed this issue with Wesley Smith and Edward Bowman, who work at the Morton Salt mine in Fairport, Ohio:
(Tr. 39-41; 1/5/06)

MR. WRIGHT: Do you think people would be tempted to either try to refuse the physical, or might be tempted to maybe cheat to save their jobs?

MR. SMITH: Oh, they will cheat on it, sure.

MR. WRIGHT: If your members thought that maybe if they flunked the physical that they might lose their job do you think they would be tempted to cheat, and to maybe hide the fact that they had some symptoms?

MR. BOWMAN: Yes, absolutely.

At the January 9 Salt Lake City hearings, Brad Shorey, a miner at the Stillwater Mining Company, described his employer's program: *(Tr. 184-5, 1/9/06)*

MR. ORTLIEB: Does the mine provide medical evaluations for miners required to wear respirators?

MR. SHOREY: They do.

MR. ORTLIEB: Would you describe that, describe the program?

MR. SHOREY: Well, it's actually not new. I mean…this is just good business practice…We have yet to run into an issue of dealing with an individual that didn't pass, but I have been reassured through talks with the human resource manager that if that situation was to arise, that every effort would be made to ensure the individual would be moved into another capacity…

No valid reason has been articulated by MSHA or mine operators for denying miners medical evaluations before being assigned to wear a respirator or transfer rights in the event they cannot. The fact that some operators have voluntarily granted miners these rights does not explain why others should continue to be denied them. Instead, it shows that mine operators, acting in good faith, can easily implement a respirator program, including transfer rights, without practical or financial difficulty. The failure of recalcitrant mine operators who have refused to do so should not be rewarded. MSHA should not allow these mine operators to profit by failing to provide basic rights to miners. Similarly, no mine operator can credibly claim that it is infeasible to conduct medical evaluations for miners required to wear respirators and transfer those who cannot do so.

VI. MSHA Cannot Deny Miners the Protection of the Standard Simply Because the Agency Cannot Convert the Total Carbon Limit to an Elemental Carbon Limit

The 2001 rule requires MSHA to determine compliance with the final limit by measuring the amount of total carbon (TC) in mine atmospheres. The 2001 preamble includes a thorough evaluation of the evidence supporting reliance on both TC and EC and concludes that TC represented the "best available" analytic technique. Nevertheless, to settle challenges to the 2001 rule, MSHA agreed to consider interim and final limits based on elemental carbon (EC), despite its earlier finding that TC was a preferred method of measuring DPM exposures in mines, in exchange for a promise from industry to hold its challenge the 2001 rule in abeyance, and dismiss that challenge at the conclusion of the new rulemakings.

MSHA's September 2005 *Federal Register* notice proposing a delay in the effective date for the final limit specifically indicated that it would conduct a different rulemaking to set a final EC limit. The USW has relied on MSHA's announcement that it will initiate another rulemaking and is not commenting on technical conversion issues at this time.

It must be noted, however, that the new rulemaking to set a final limit based on EC is no longer required by the settlement agreement. The MARG Diesel Coalition recently asked the D.C. Circuit expeditiously to allow briefing on its 2001 challenge to the final 160 ug/m^3 TC limit, thereby violating the agreement. As a result, MSHA is under no continuing obligation to go forward with a rulemaking it agreed to undertake as part of that settlement.

Nevertheless, the USW has no objection to a final standard based on elemental carbon, so long as that standard provides the same protection to miners as does the final 160 ug/m^3 total carbon limit. MSHA's desire to change the surrogate must not be used to delay giving miners the protection of the 2001 standard.

When the USW agreed, as part of the overall settlement, to support the switch from TC to EC, we were assured that there was, or soon would be, scientific evidence supporting a conversion between the two at all levels relevant under the 2001 standard. In fact, NIOSH quickly provided such a conversion factor with respect to the 400 ug/m^3 TC interim level, and when it revised the interim standard, MSHA converted that level to 308 ug/m^3 EC.

However, MSHA has now stated that it does not at this time know how to determine the numerical relationship between TC and EC at the 160 ug/m^3 TC level that had been scheduled to go into effect in January. The only proper course of action is to leave the standard at 160 ug/m^3 TC until the proper conversion can be calculated. Leaving the standard at 308 ug/m^3 EC, or going to an EC level not equivalent to 160 ug/m^3 TC, under the guise of improving analytic techniques, would violate the "no-less protection" rule of section 101(a)(9) of the Mine Act.

A standard based on EC may well be easier to implement. TC is subject to interferences in some circumstances, for example where cigarette smoke is present. However, an EC based sampling method is valid only where it can be used at the levels of concern. MSHA is legally bound to follow its evidence-based determination that the interference problems can be readily overcome through the TC sampling strategy explained in the preamble to the 2001 rule. The standard should remain at 160 ug/m^3 TC unless and until an equally protective standard based on EC can be established.

VII. Conclusion

MSHA made a promise to underground metal and nonmetal miners in 2001. It told them that help was on the way – that they would someday be protected from choking levels of diesel exhaust. Relief would come slowly, and exposures would be reduced in steps, but by January 2006, a protective standard would be in place. MSHA now proposes to break that promise.

Instead, MSHA should withdraw the proposal to delay the 160 ug/m^3 TC limit, and revise its effective date to no later than July 20, 2006. The USW has no objection to converting the standard to one based on EC at some time in the future, when the data exists to do so. For the time being, TC and EC measurements should be taken simultaneously, so that MSHA or NIOSH can calculate a proper conversion factor when the time comes.

In addition, MSHA should immediately revise the standard to provide medical testing and transfer rights for potential respirator wearers.

MSHA has faced the issue of delaying the standard once before, in the 2001 rulemaking. At that time, several commenters urged MSHA to delay the standard until the results of a joint National Cancer Institute/NIOSH study were available.

Instead, MSHA quoted two miners who spoke eloquently of their need for protection now. The agency concluded:

> *"MSHA shares these sentiments. That is why it is imperative to protect miners based on the weight existing evidence, rather than wait for the results of additional studies. (66 FR 5855)*

The delay under consideration in this rulemaking is for different reasons, but the effect would be the same. MSHA's answer in 2001 is equally valid today. Metal and nonmetal miners deserve protection now.

Respectfully submitted on behalf of the United Steelworkers,

Michael J. Wright, Director of Health, Safety and Environment

David Ortlieb, Assistant Director

Randy Rabinowitz, Counsel

James L. Weeks, Sc.D., Consultant

U.S. Department of Labor

Mine Safety and Health Administration
Pittsburgh Safety & Health Technology Center
P.O. Box 18233
Pittsburgh, PA 15236

Dust Division

October 28, 2004

MEMORANDUM FOR LEE D. RATLIFF
District Manager, Metal and Nonmetal Mine Safety and Health,
Western District, Vacaville, California

THROUGH: EDWARD J. MILLER
Chief, Pittsburgh Safety and Health Technology Center

FROM: ROBERT A. HANEY
Chief, Dust Division

SUBJECT: Diesel Particulate Matter Compliance Assistance Visit, Queenstake Resources, U.S.A., Inc., Murray Mine (I.D. No. 26-02211), Elko, Nevada

INTRODUCTION

On September 15, 2004, a diesel particulate matter (DPM) compliance assistance visit was made at Queenstake Resources U.S.A., Inc., Murray Mine (I.D. No. 26-02211), Elko, Nevada. The study was requested by the Metal and Nonmetal Mine Safety and Health (MNMS&H) Headquarters, Arlington, Virginia. The purpose of the visit was to provide compliance assistance in assessing the Company's progress in developing a control strategy for diesel particulate matter in their underground mining operations. The compliance assistance visit was made by Robert Haney, Chief, Dust Division; and William Pomroy, Mine Safety and Health Specialist, North Central District. The Company was represented during the visit by Mr. Brent Chamberland.

BACKGROUND

Queenstake Resources, U.S.A., Inc., operates four underground mines near Elko, Nevada. The mines include Murray Mine (I.D. No. 26-02211), SSX Mine (I.D. No. 26-02299), MCE Mine (I.D. No. 26-02370), and Lee Smith Mine (I.D. No. 26-02397). The mines are developed through a series of intake and return headings. Stopes are mined from the main headings. The stopes and headings are drilled, shot-bolted, and

loaded. LHDs transfer ore onto haul trucks or to ore bays where it is loaded onto haulage trucks, which transport the ore to surface stock piles. The haulage trucks bring waste rock back into the mine, where completed stopes are backfilled. On the surface, ore is loaded into trucks and taken to the mill for processing. All underground mobile equipment is diesel powered. Miners typically work a 12-hour shift.

The Company's efforts to implement DPM controls were reviewed. DPM controls include: ventilation, clean engines, environmental cabs, after-filters, alternative fuels and fuel additives, and work practices.

Ventilation: Murray Mine has three exhaust shafts, with a fan on each one. The intake is provided through the common haulage. The Company has considered upgrading the ventilation system but has not made any commitments at this time.

Clean engines: The Company has instituted a program to replace high emission engines with clean engines. At Murray Mine, most of the engines in the high use equipment were Detroit Diesels. These engines typically have emissions less than 0.10 gm/hp-hp.

Environmental cabs: The Company is exploring the use of environmental cabs. They are in the process of retrofitting a haul truck at SSX Mine with an environmental cab. Once this cab it installed and tested, they will prepare engineering drawings and have it installed on future rebuilt equipment. In order to be effective, a cab must be properly constructed and sealed. The positive pressure should be approximately 0.25 inches of water. Additionally, the filtered air supply system should provide one air change per minute. These requirements for pressurization and airflow were discussed with the Company.

After-filters: The Company has installed various brands of passively regenerative ceramic DPM after-filters. They have had the most success with the ECS platinum-catalyzed passive regeneration filters; however, because ECS filters are no longer available, the company has no plans for additional purchases. The mine had not observed problems with elevated NO2, when using the highly platinum-catalyzed DPM filters.

Alternative fuels and fuel additives: The Company has tried various fuel additives without any measurable reduction in DPM. They are interested in using a water emulsion fuel, but are reluctant due to the low ambient temperatures during the winter months; elevation and grades that the equipment are operated on. It was suggested that the Company obtain enough PuriNOx to conduct a test on a single piece of equipment to evaluate the potential for mine-wide use of the water emulsion fuel.

Following the visit, at the Company's request, a representative from PuiNOx was contacted. He agreed to contact Queenstake and arrange for a test. MSHA will also be making arrangements to conduct high elevation dynamometer tests on the water emulsion fuel at its Approval and Certification Center in Triadelphia, West Virginia. If the single unit test appears promising, MSHA agrees to conduct the sampling for a mine-wide evaluation of the fuel.

Work practices: The primary work practice to reduce DPM observed at the Murray Mine was to move equipment frequently from work area to work area during the shift. Because the mine has three exhaust shafts with fans, the equipment starts to operate in fresh air when it moves to a new location. Another possible administrative control would be to reverse the mine airflow direction and operate haul trucks in the exhaust air. This practice keeps the diesel emissions from the haul trucks from traveling to the loader intake. In order to protect the truck drivers, trucks should be equipped with environmental cabs when hauling in the mine exhaust airways. This option was discussed with mine personnel, but no commitment was made for implementation.

During the visit, area DPM samples were collected on a Zone 7, a waste backfill unit in the Murray Mine. Samples were taken to identify the various sources of diesel particulate. Samples were collected upwind of the jammer (bottom of the intake raise), on-board the jammer, at the mouth of the waste stope, and downwind of the truck loading operation. During the 5-hour sample period, ten trucks of backfill material were jammed into the waste stope.

All samples were collected with SKC, Inc. diesel particulate sampling cassettes. This cassette includes a submicron impactor and two quartz fiber filters. All samplers used a 10-millimeter nylon preseparator cyclone. All samples were collected with SKC pumps precalibrated at 1.7 liters per minute (Lpm) and post calibration checks were made on all pumps used. Personal samples were collected full shift and area sample collection times ranged from 292 minutes to 318 minutes per shift.

The diesel samples were analyzed using a thermal optical carbon analyzer (NIOSH Method 5040). Elemental carbon (EC), organic carbon (OC), and total carbon (TC) values were determined from the samples collected. Concentrations of carbon were calculated from the following formulas:

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

and

$$TC = OC + EC \qquad \text{or} \qquad TC = EC \times 1.3$$

Where:

C = The corrected OC or EC concentration measured in the thermal/optical carbon analyzer.

A = The surface area of the filter media used. The surface area of the filter is 8.04 cm^2.

TWA values are calculated from the total carbon concentration formula using the actual time sampling pumps operated. To approximate the full shift equivalent concentration, the TWA values would be multiplied by 1.5 (12 hours/8 hours).

RESULTS AND DISCUSSION

Table 1 shows the results of the area DPM samples collected on the waste backfill operation in Zone 7. During the sample period, Truck 46, with a 250-hp Detroit Series 40 engine, hauled ten loads of waste material from the surface. An LHD was used to spread the waste material and a Jammer (RJ-3019), with a 250-hp Detroit Series 50 engine, was then used to pack the waste material into the mined-out stope. Approximately 14,600 cfm of air was entering the waste stope area through a ventilation raise. Figure 1 shows a schematic of the sampling area.

Table 2 shows the calculations for the diesel particulate estimator for the Zone 7 waste stope. The estimator was calibrated using the samples collected during the visit. Even with the clean burning engine, the primary source of DPM emissions was the Jammer. However, the intake contribution was also significant. Even though the mine had three air splits, they shared a common intake that was contaminated by equipment traveling into and out of the mine, particularly loaded haulage trucks traveling up the ramp. As a result, the administrative practice of moving the equipment did eliminate having one operation working downwind of another, but the emissions from truck haulage were directed to all three air splits.

The airflow into the waste stope was estimated at 6,000 cfm. This was below the estimated 8,100 cfm Particulate Index (PI) for the Jammer. The estimator shows that by increasing the airflow into the stope to approximately 10,000 cfm and installing an after-filter on the Jammer exhaust, the 400 $\mu g/m^3$ limit would be meant (outside cab). The installation of an environmental cab would then reduce the level on the Jammer to below 160 $\mu g/m^3$ (inside cab).

If you have any questions regarding this study, please contact this office at (412) 386-6859.

Attachment

cc: MNM (C. Jones)
TS (L. Zeiler)
MNM (J. Alvarez)
MNM (W. Pomroy)
TS (E. Miller)
TS (R. Haney)
TS (G. Saseen)
Chron. Files
Report No. DD-05-508

MSHA:TS: RHaney:cmm:10/06/04:Rm106:038:412-386-6858
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Table 1. Results of Diesel Particulate Matter Sampling Waste Stope, Zone 7

Location	Description	TWA Total Carbon EC + OC, µg/m3	TWA Total Carbon 1.3 x EC, µg/m3	Full Shift Equivalent* Total Carbon EC + OC, µg/m3	Full Shift Equivalent* Total Carbon 1.3 x EC, µg/m3
1	Intake Bottom of Raise	94	97	141	146
2	Stope Exhaust	430	502	645	753
3	Mouth of Stope	434	505	651	758
4	Jammer	923	1069	1385	1604

* = TWA x 1.5

Table 2. Results of Diesel Particulate Estimator Calculations for Waste Stope, Zone 7

Murray Mine
I. D. 26-02211

DPM Emission Calculator

	Current		Future		
Mine Air Flow	14600	**cfm**	14,600	**cfm**	**Section Air Increase**
Section Airflow	6000	**cfm**	10,000	**cfm**	167%

Unit	Type	Engine	Horsepower	Lab Emissions gm/hp-hr	Lab Particulate Index	Lab Emissions gm/min	Operation Time-hrs.	Actual Emissions gm	Engine Efficiency Percent	Treated Emissions gm
1	Jammer	D-50	250	0.10	8093	0.42	9	225	90	23
2	Truck	D-40	250	0.10	8093	0.42	1	25	0	25
3	Loader	D-50	250	0.10	8093	0.42	1	25	0	25
4					0	0.00	0	0	0	0
5					0	0.00	0	0	0	0
Totals			**750**	**0**	**24279**	**1.25**		**275**		**73**
								34	**gm/hr**	**9**

cfm/hp:	
Mine	19
Section	8

TC Concentrations:	**Baseline**	**Treated**	
Intake	146	146	ug/m3
Exhaust	756	307	ug/m3
Outside Cab	1630	381	ug/m3
Inside Cab	1630	152	ug/m3
	Cab Efficiency %		
	0	60	

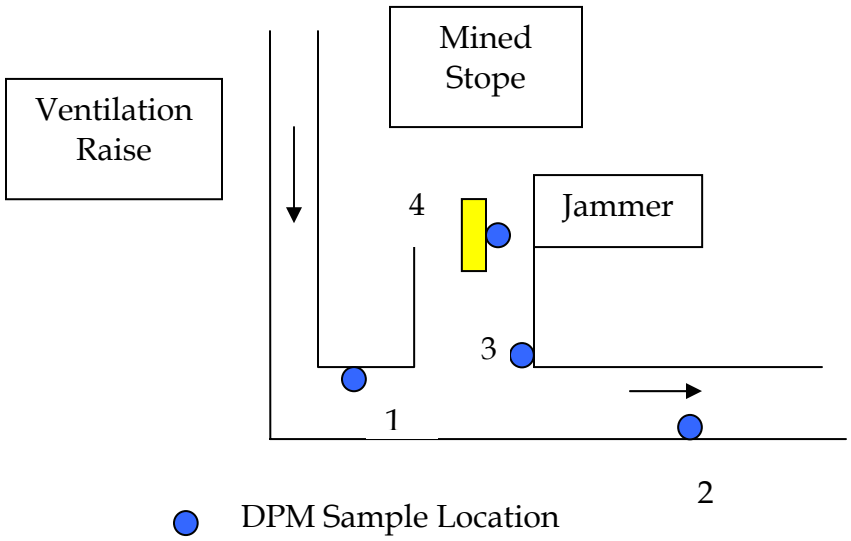

Figure 1. Schematic of Typical Waste Stope, Zone 7.

Figure 2. Cab Retrofit at SSX Mine.

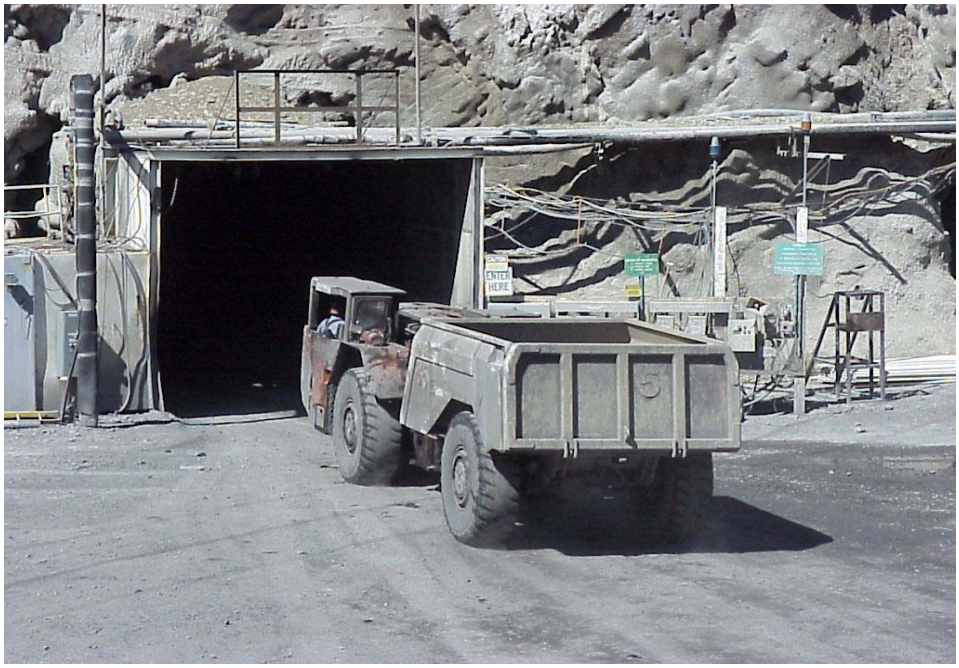

Figure 3. Haul Truck entering Murray Mine.

U.S. Department of Labor

Mine Safety and Health Administration
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Pittsburgh, PA 15236

Dust Division

October 19, 2004

MEMORANDUM FOR LEE D. RATLIFF
District Manager, Metal and Nonmetal Mine Safety and Health,
Western District, Vacaville, California

THROUGH: EDWARD J. MILLER
Chief, Pittsburgh Safety and Health Technology Center

FROM: ROBERT A. HANEY
Chief, Dust Division

SUBJECT: Diesel Particulate Matter Compliance Assistance Visit, Newmont Mining Corporation, Carlin East Mine (I.D. No. 26-02271), Carlin, Nevada

On September 14, 2004, a diesel particulate matter (DPM) compliance assistance visit was made at Newmont Mining Corporation, Carlin East Mine (I.D. No. 26-02271), Carlin, Nevada. The study was requested by the Metal and Nonmetal Mine Safety and Health (MNMS&H) Headquarters, Arlington, Virginia. The purpose of the visit was to provide compliance assistance in assessing the Company's progress in developing a control strategy for DPM in their underground mining operations. The compliance assistance visit was made by Robert Haney, Chief, Dust Division; and William Pomroy, Mine Safety and Health Specialist, North Central District. The Company was represented during the visit by David Starbuck, Lee Melrose, and Wes Leavitt.

BACKGROUND

Newmont Mining Corporation operates four underground mines near Carlin, Nevada. The mines include Carlin East Mine (I.D. No. 26-02211), Deep Post Mine (I.D. No. 26-02374), Chukar Mine (I.D. No. 26-02481), and Leeville Mine (I.D. No. 26-02512). The primary producer is the Deep Post Mine, Carlin East and Chukar Mines have limited reserves, and the Leeville Mine is in development. Ore is mined from the Carlin Trend. The mines are developed through a series of intake and return headings. Stopes are mined from the main headings. The stopes and headings are drilled, shot- bolted and loaded. Loaders transfer ore onto haul trucks or to ore bays where it is loaded onto

haulage trucks, which transport the ore to surface stock piles. The haulage trucks bring waste rock back into the mine, where completed stopes are backfilled. On the surface, ore is loaded into trucks and taken to mills for processing. All underground mobile equipment is diesel-powered. Miners typically work a 12-hour shift, with approximately 35 underground employees per shift at Deep Post Mine and 15 underground employees per shift at Carlin East Mine.

The Company's efforts to implement DPM controls were reviewed. DPM controls include: ventilation, clean engines, environmental cabs, after-filters, alternative fuels and fuel additives, and work practices.

Ventilation: The Company has no plans for further ventilation upgrades at the Carlin East or Deep Post Mines. The recent connection, from the Leeville Mine into the Carlin East Mine, reportedly improved airflow in the Carlin East Mine. The air flow in the auxiliary fan and tubing for a stope in the Deep Post Mine (approximately 100 feet from the fan) was 41,700 cfm. The airflow in a production stope in the Carlin East Mine was approximately 15,200 cfm.

Clean engines: The Company has instituted a program to replace high emission engines with clean engines. They have already replaced several engines. Over the next 5 years, they plan to replace approximately 25 additional engines. The cost of an engine replacement was reportedly $25,000.

Environmental cabs: The Company is exploring the use of environmental cabs. They have retrofitted one truck and plan to extend the cab program to other equipment. During the visit, the measured pressure on a contractor's cab was 0.0 inches of water. In order to be effective, a cab must be properly constructed and sealed, and a filtered air supply system should provide one air change per minute.

After-filters: The Company has installed various brands of both passive and active regenerative after-filters. They have had the most success with the ECS platinum-catalyzed passive regeneration filters; however, because ECS filters are no longer available, the company has no plans for additional purchases. During the visit, two after-filters were observes at the Deep Post Mine. Neither piece of equipment was in operation during the visit. After-filters had reportedly been installed on six pieces of equipment at Carlin East Mine. One of the trucks was observed in operation. Several additional filters were observed in the shop at Deep Post Mine. The mine had not observed problems with elevated NO2, when using the highly platinum-catalyzed DPM filters.

Alternative fuels and fuel additives: The Company has tried various fuel additives without any measurable reduction in DPM. They are interested in using a water

emulsion fuel, but are reluctant due to the low ambient temperatures during the winter months, elevation and grades that the equipment operated on.

Work practices: The primary work practice to reduce DPM observed at the Carlin East Mine was to operate haul trucks in the exhaust air. This practice keeps the diesel emissions from the haul trucks from traveling to the loader intake. In order to protect the truck drivers, trucks should be equipped with environmental cabs when hauling in the mine exhaust air ways.

During the visit, area DPM samples were collected on a production unit in the Carlin East Mine, loading ore from an open stope using a remotely controlled LHD. These samples were taken to identify the various sources of DPM. Samples were collected up-wind of the loader (top of the stope on the intake side), down-wind of the loader (up-wind of truck loading) and down-wind of the truck loading operation. During the approximate 2½ -hour sample period, 6 ore trucks were loaded. On a typical 12-hour shift, approximately 20 trucks are loaded.

Area samples were collected with SKC, Inc. diesel particulate sampling cassettes. This cassette includes a submicron impactor and two quartz fiber filters. All samplers used a 10-millimeter nylon preseparator cyclone. All samples were collected with SKC pumps precalibrated at 1.7 liters per minute (Lpm) and post calibration checks were made on all pumps used. Personal samples were collected full shift and area sample collection times ranged from 120 to 160 minutes per shift.

The diesel samples were analyzed using a thermal optical carbon analyzer (NIOSH Method 5040). Elemental carbon (EC), organic carbon (OC), and total carbon (TC) values were determined from the samples collected. Concentrations of carbon were calculated from the following formulas:

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

and

$$TC = OC + EC \qquad \text{or} \qquad TC = EC \times 1.3$$

Where:

C = The corrected OC or EC concentration measured in the thermal/optical carbon analyzer.

A = The surface area of the filter media used. The surface area of the filter is 8.04 cm^2.

TWA values are calculated from the total carbon concentration formula using the actual time sampling pumps operated. To approximate the full-shift equivalent concentration, the TWA values would be multiplied by 1.5 (12 hours/8 hours).

RESULTS AND DISCUSSION

Table 1 shows the results of the area DPM samples collected on the ore loading operation in the 5545 - 327 area of the mine. A Wagner 6-yard LHD with a Detroit Series 60 engine was loading onto three trucks (#24 – 26 ton; #6 – 26 ton; and #33 - 30 ton). The #24 – 26 ton truck was equipped with an after-filter. The duty cycle for the truck, allowed for passive regeneration of the filter. Figure 1 shows a schematic of the sampling area.

Due to the length of shift, the estimated full-shift concentration exceeded the 400μg/m^3 level even though the TWA was less than the 400μg/m^3 level. The longer shift necessitates a higher level of control.

The results of the sampling showed that even though the LHD had a clean burning engine, it was still the primary source of DPM emissions. An after-filter on the LHD would have significantly reduced the diesel emissions and corresponding exposures.

Table 2 shows the results of the calculations from the DPM Estimator for the stope. The estimator was calibrated using the samples collected during the visit. A 90 percent efficient after-filter would have reduced the 518 μg/m^3 level down-wind of the LHD to 157 μg/m^3. The airflow into the stope would need to be increased from 15,200 cfm to 24,000 cfm (intake reduced to 100 μg/m^3) to dilute the 518 μg/m^3 to 400 μg/m^3 and increased to 110,000 to dilute this level to 160 μg/m^3. An environmental cab would not have a significant impact because the LHD was remote control operated and the operator spent much of his time away from the LHD cab.

If you have any questions regarding this study, please contact this office at (412) 386-6859.

Attachment

bcc: MNM (C. Jones)
TS (L. Zeiler)
MNM (J. Alvarez)
MNM (W. Pomroy)
TS (E. Miller)
TS (R. Haney)
TS (G. Saseen)
Chron. Files
Report No. DD-05-507

MSHA:TS: RHaney:cmm:10/06/04:Rm106:038:412-386-6858
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Table 1. Results of Diesel Particulate Matter Sampling Carlin East Mine

Location	Description	TWA Total Carbon EC + OC, µg/m3	TWA Total Carbon 1.3 x EC, µg/m3	Full Shift Equivalent* Total Carbon EC + OC, µg/m3	Full Shift Equivalent* Total Carbon 1.3 x EC, µg/m3
1	Intake Top of Raise	---	76	---	114
2	Stope Outby Loader	306	345	459	518
3	Stope Outby Truck	198	219	297	329

* = TWA x 1.5

Table 2. Results of DPM Emission Estimate for Stope at Carlin East Mine

Carlin East
I. D. 26-02271

DPM Emission Calculator

	Current		Future		
Mine Air Flow	26000	**cfm**	27,000	**cfm**	**Section Air Increase**
Section Airflow	15200	**cfm**	15,200	**cfm**	100%

Unit	Type	Engine	Horsepower	Lab Emissions gm/hp-hr	Lab Particulate Index	Lab Emissions gm/min	Operation Time-hrs.	Actual Emissions gm	Engine Efficiency Percent	Treated Emissions gm
1	LHD	D-50	250	0.10	8093	0.42	8	200	90	20
2	Truck	D-60	335	0.02	2169	0.11	1	7	0	7
3					0	0.00	0	0	0	0
4					0	0.00	0	0	0	0
Totals			**585**	**0**	**10262**	**0.53**		**207**		**27**
								26	**gm/hr**	**3**

cfm/hp:	
Mine	44
Section	26

TC Concentrations:	**Baseline**	**Treated**	
Intake	114	100	ug/m3
Exhaust	371	132	ug/m3
Outside Cab	554	157	ug/m3
Inside Cab	554	157	ug/m3
	Cab Efficiency %		
	0	0	

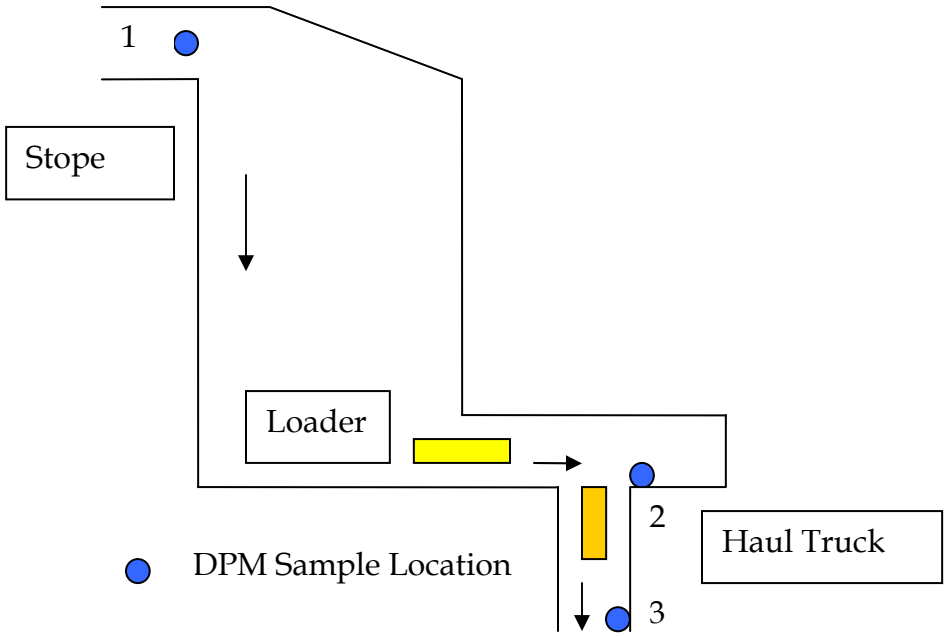

Figure 1. Schematic of Stope 5545-327.

Figure 2. Passive DPF Mounted on LHD at Deep Post Mine.

Figure 3. Active Regeneration Station at Deep Post Mine.

Comments on Need for Medical Evaluation Prior to Respirator Use
Steven Markowitz MD

The current accepted standard of occupational medical care is the conduct of an appropriate medical evaluation prior to respirator use. This requirement is codified in the OSHA Respiratory Protection Standard (1910.134)(1). It is supported by at least one major textbook in occupational medicine (2). The need for such an evaluation is substantiated by numerous publications in the peer-reviewed medical literature (3-7). While these remains some uncertainty about what such a medical evaluation should consist of, there is widespread consensus that such a medical evaluation is required.

The purpose of a medical evaluation prior to respirator use is primarily to ensure that the worker does not have any medical conditions that might be significantly impacted by expected respirator use. Notably, respirator use in general does not appear to pose a major physiologic challenge to the human body. However, for some respirators and for some users, the added physical and mental challenges inherent in respirator use may be significant. Some of these challenges include: 1) increased work of breathing due to increased inspiratory resistance and increased dead space, 2) increased cardiac work when the respirator is heavy or due possibly to increased work of breathing, 3) difficulty speaking and hearing, 4) claustrophobia, 5) compromised vision due to fogging of full face respirators, and 6) heat stress if the respirator is used with impermeable clothing. For workers who have medical conditions that might be affected by these challenges, respirator use can be hazardous and requires close assessment.

Medical evaluation for respirator use should focus on identifying workers who have medical conditions that might be compromised by respirator use. In its 1998 Respiratory Protection Standard, OSHA emphasizes use of a standardized questionnaire with review by a qualified health care provider who is informed about the use of a respirator at the workplace in question. Selected questionnaire responses then trigger further examination and testing, as needed, including physical examination, pulmonary function tests, etc. Re-evaluation occurs when the worker reports relevant symptoms, when the health care provider requires it, or when the need for respirator use at the workplace changes.

No evaluation of the OSHA requirement for a medical evaluation for respirator use is available in the peer-reviewed literature. Questions include 1) whether a self-administered questionnaire is sufficient (e,g. – sufficiently sensitive) to identify medical conditions of interest, 2) whether the questionnaire required by OSHA (1910.134 Appendix C: OSHA Respirator Medical Evaluation Questionnaire) has the correct questions, 3) how often the questionnaire triggers a hands-on medical evaluation, and 4) whether and when re-evaluations occur in the real world.

References

1. OSHA Respiratory Protection Standard (29 CFR 1910.134)

2. Harber P. Chapter 133 Respirators. Rom W (Ed.) Environmental and Occupational Medicine, 3rd Edition, Chapter 3, pp 19-29, 1998.

3. Szeinuk J, Beckett WS, Clark N, Hailoo WL. Medical evaluation for respirator use. Am J Ind Med. 2000 Jan;37(1):142-57

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6. Harber P. Medical evaluation for respirator use. J Occup Med. 1984 Jul;26(7):496-502

7. Harber P, Barnhart S, Boehlecke BA, Beckett WS, Gerrity T, McDiarmid MA, Nardbell E, Repsher L, Brousseau L, Hodous TK, Utell MJ. Respiratory protection guidelines. This official statement of the American Thoracic Society was adopted by the ATS Board of Directors, March 1996. Am J Respir Crit Care Med. 1996 Oct;154(4 Pt 1):1153-65

U.S. Department of Labor

Mine Safety and Health Administration
Pittsburgh Safety & Health Technology Center
P.O. Box 18233
Pittsburgh, PA 15236

Dust Division

November 23, 2004

MEMORANDUM FOR LEE D. RATLIFF
District Manager, Metal and Nonmetal Mine Safety and Health,
Western District, Vacaville, California

THROUGH: EDWARD J. MILLER
Chief, Pittsburgh Safety and Health Technology Center

FROM: ROBERT A. HANEY
Chief, Dust Division

SUBJECT: Diesel Particulate Matter Compliance Assistance Visit, Barrick Goldstrike Mines, Inc., Meikle Mine (I.D. No. 26-02246), Carlin, Nevada

Attached is a report of the diesel particulate compliance assistance visit at Barrick Goldstrike Mines, Inc., Meikle Mine (I.D. No. 26-02246), Carlin, Nevada on October 28, 2004.

If you have any questions regarding this study, please contact this office at (412) 386-6859.

Attachment

bcc: TS (L. Zeiler)
MNM (J. Alvarez)
MNM (D. Thome)
MNM (W. Pomroy)
MNM (D. Cash)
TS (E. Miller)
TS (R. Haney)
TS (G. Saseen)
Chron. Files
Report No. DD-05-512

MSHA:TS: RHaney:cmm:11/15/04:Rm106:038:412-386-6858
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UNITED STATES
DEPARTMENT OF LABOR
MINE SAFETY AND HEALTH ADMINISTRATION

Diesel Particulate Matter Compliance Assistance Investigation

PS&HTC-DD-05-512

Meikle Mine
Barrick Goldstrike Mines, Inc.
Carlin, Nevada
Mine I.D. No. 26-02246
October 28, 2004

by

Robert A. Haney
Supervisory General Engineer
Chief, Dust Division

and

George P. Saseen
Physical Scientist
Mechanical Safety Division

Objective

To provide compliance assistance in assessing the Company's progress in developing a control strategy for DPM in their underground mining operations.

Originating Office

Pittsburgh Safety and Health Technology Center
Robert A. Haney
Chief, Dust Division
Cochrans Mill Road, P. O. Box 18233
Pittsburgh, Pennsylvania

INTRODUCTION

On October 28, 2004, a diesel particulate matter (DPM) compliance assistance visit was made at Barrick Goldstrike Mines, Inc., Meikle Mine (I.D. No. 26-02246), Carlin, Nevada. The study was requested by the Metal and Nonmetal Mine Safety and Health (MNMS&H) Headquarters, Arlington, Virginia. The purpose of the visit was to provide compliance assistance in assessing the Company's progress in developing a control strategy for DPM in their underground mining operations. The compliance assistance visit was made by Robert Haney, Chief, Dust Division; and George Saseen, Physical Scientist, Mechanical Safety Division, Approval and Certification Center. The Company was represented during the visit by Woody Stelly and Richard Acheson.

BACKGROUND

Barrick Goldstrike Mines, Inc. operates an underground gold mine near Carlin, Nevada. Ore is mined from the Carlin Trend. The mine is divided into three interconnected production zones: Meikle, Rodeo, and Griffin. The zones are developed through a series of intake and return headings. Stopes are mined from the main headings. The stopes and headings are drilled, shot-bolted, and loaded. Loaders transfer ore onto haul trucks or to ore bays where it is loaded onto haulage trucks and then an ore skip, which transports the ore to surface stock piles. The haulage trucks bring waste rock back into the mine, where completed stopes are backfilled. All underground mobile equipment is diesel-powered. Miners typically work a 12-hour shift, with approximately 80 underground employees per shift at the mine. Respirators were worn by employees.

The visit was focused on the Meikle area of the mine. During the visit, the Mine's efforts to implement DPM controls were reviewed. DPM controls include: ventilation, clean engines, environmental cabs, after-filters, alternative fuels and fuel additives, and work practices.

Ventilation: The Company ventilation plan indicated that over 1,000,000 cfm of airflow was being circulated through the mine (Meikle, Griffin, and Rodeo) complex. There were no reported plans for major ventilation upgrades at the Meikle Mine. An airflow of double the engine Particulate Index (PI) is needed to dilute the emissions to 400_{TC} µg/m^3. For engines with an emission rate of 0.06 gm/hp-hr, double the PI would be 40 cfm/hp. For engines with an emission rate of 0.20 gm/hp-hr, double the PI would be 130 cfm/hp. At the time of the visit, the Company did not have an equipment list that indicated engine horsepower and usage. The airflow being supplied through the tubing into a production stope was 21,100 cfm. In this stope a single 285-hp loader with a PI of 4600 cfm (double PI would be 9,200 cfm) was operating. Figure 1 shows a schematic of the stope sampled.

Clean engines: The Company has instituted a program to replace equipment with high emission engines with clean engines. The primary engines used are 250 to 285-horsepower, Detroit Diesel Series 40, 50, and 60 engines. These engines have emissions of approximately 0.05 to 0.09 gm/hp/hr.

Environmental cabs: The Company had purchased one Toro loader equipped with an environmental cab. Workers reportedly responded favorably to the cab. The Company is considered the purchase of additional equipment with environmental cabs.

After-filters: At the time of the visit, the Company did not have after-filters installed on diesel equipment. They had previously installed and removed a filter installed on a loader. Typically, loaded trucks hauling up a grade are likely candidates for passive regenerative after-filters.

Alternative fuels and fuel additives: The Company has tried various fuel additives without any measurable reduction in DPM.

Work practices: The Company did not report any work practices, specific to reducing DPM exposures. However, they did use electric drills that only used diesel power to tram the vehicle.

In addition to reviewing controls, during the visit, area DPM samples were collected and engine temperature traces were taken. DPM samples were collected on a production unit, loading ore from a stope. These samples were taken to identify the various sources of DPM. Samples were collected up-wind of the loader (fan inlet), down-wind of the loader (stope exhaust) and on the loader. A DPM sample was also collected on the 601 Jammer. Additionally, an engine temperature trace was made on 601 Jammer and the 610 Loader (mucking and hauling ore).

Area samples were collected with SKC, Inc. diesel particulate sampling cassettes. This cassette includes a submicron impactor and two quartz fiber filters. All samplers used a 10-millimeter nylon preseparator cyclone. All samples were collected with SKC pumps precalibrated at 1.7 liters per minute (Lpm) and post calibration checks were made on all pumps used. Sample collection times ranged from 180- to 270- minute shifts.

The diesel samples were analyzed at the MSHA, Pittsburgh Laboratory using a thermal optical carbon analyzer (NIOSH Method 5040). Elemental carbon (EC), organic carbon (OC), and total carbon (TC) values were determined from the samples collected. Concentrations of carbon were calculated from the following formulas:

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

and

$$TC = OC + EC \qquad \text{or} \qquad TC = EC \times 1.3$$

Where:

C = The corrected OC or EC concentration measured in the thermal/optical carbon analyzer.

A = The surface area of the filter media used. The surface area of the filter is 8.04 cm^2.

TWA values are calculated from the total carbon concentration formula using the actual time sampling pumps operated. To approximate the full-shift equivalent concentration, the TWA values would be multiplied by 1.5 (12 hours/8 hours).

RESULTS AND DISCUSSION

Table 1 shows the results of the area DPM samples collected on the ore loading operation in the 1250 Level Stope area and on the 601 Jammer working in the 4450 area of the mine. The 6-yard, 610 loader was equipped with a Detroit Diesel Series 60, 285-hp engine with estimated emission of 0.06 gm/hp-hr. The 601 Jammer was equipped with a Detroit Diesel Series 50, 250-hp engine with estimated emission of 0.05 gm/hp-hr.

Based on TC = EC x 1.3, the stope intake estimated full-shift DPM sample was 303_{TC} $\mu g/m^3$, the stope exhaust was 1544_{TC} $\mu g/m^3$ and the DPM sample collected on the loader was 464_{TC} $\mu g/m^3$. The estimated full-shift DPM sample collected on the 601 Jammer was 878_{TC} $\mu g/m^3$. Due to the length of shift, the estimated full-shift concentration, for the 6-Yard Loader exceeded the 400_{TC} $\mu g/m^3$ level, even though the TWA was less than the 400_{TC} $\mu g/m^3$ level. The results of the sampling in the stope showed that the intake air was the primary source of DPM emissions.

Table 2 shows the engine emissions and PI (airflow to dilute emissions to 800_{TC} $\mu g/m^3$) for the primary engines used at the Meikle Mine. Emissions were based on a 10-hour operating time. An airflow, of double the PI, is needed to dilute the DPM emissions to 400 $\mu g/m^3$. This rate of airflow should be provided for equipment operating in a stope where ventilation is being supplied by fan and tubing systems. The Table indicated that primary engines had low emissions. Two times the PI for these engines ranges from 32 to 58 cfm/hp.

Table 3 shows the results of the calculations from the DPM Estimator for the stope. The estimator was calibrated using the samples collected during the visit. The right column gives a projection of the DPM level for the loader operator with an environmental cab installed. The estimated DPM concentration inside the cab would be 233 $\mu g/m^3$. This projection is based on the airflows measured in the stope and in the stope tubing. Significant reductions in DPM levels could also be obtained by reducing intake DPM level and/or utilizing a DPM filter.

Figure 2 and Figure 3 show the engine temperature traces for the 601 Jammer and the 610 Loaders, respectively. Based on temperature analysis the T 30% (temperature that is exceeded 30% of the time) for the Jammer was 320^{o}C and the T 30% for the Loader was 370^{o}C. Table 4 provides criteria for after-filter selection. Based on the selection criteria, the Jammer engine would need an actively regenerative filter system. The loader engine could use a heavily Pt-catalyzed trap or lightly Pt-catalyzed trap plus fuel-borne catalyst for passive regeneration or would need an actively regenerative filter system. Active regenerative systems can be on-board plug-in, removal of filter and off-board cleaned in an oven or an on-board fuel-burning system. Before any filter selection is made, additional temperature traces should be made by the filter manufacturer to assure that the brief temperature traces obtained during this visit are representative of the equipment's actual duty cycles, and that the filter chosen is compatible with the application.

Table 1. Results of Diesel Particulate Matter Sampling Meikle Mine.

Location	Description	TWA Total Carbon EC + OC, µg/m3	TWA Total Carbon 1.3 x EC, µg/m3	Full Shift Equivalent* Total Carbon EC + OC, µg/m3	Full Shift Equivalent* Total Carbon 1.3 x EC, µg/m3
1	Stope Intake Fan Inlet	179	202	269	303
2	Stope Exhaust Outby Loader	888	1029	1332	1544
3	8 Yd. Loader - 1250 Level	283	309	425	464
	601 Jammer – 4450 Level	504	585	756	878

* = TWA x 1.5

Table 2. Results of DPM Emission Estimate for Meikle Mine.

Equipment Type	Manufacturer	Engine	Horsepower	Operating Hours	Emissions gm/hp-hr	Emissions gm/min	Particulate Index, cfm	2 x PI cfm	cfm / hp at 2 x PI
Loader	Tamrock Toro	DD Series 60	285	10	0.05	143	4613	9226	32
Jammer	Tamrock EJC	DD Series 50	250	10	0.09	225	7284	14567	58
20T Truck	DUX	DD Series 50	250	10	0.09	225	7284	14567	58
30T Truck	DUX	DD Series 60	400	10	0.07	280	9064	18128	45

Table 3. Results of DPM Emission Estimate for 1250 Level Stope at Meikle Mine.

Meikle Mine **DPM Emission Calculator**
I. D. 26-02246

	Current		Future	
Mine Air Flow	21100	**cfm**	21,100	**cfm**
Section Airflow	21100	**cfm**	21,100	**cfm**

Unit	Type	Engine	Horsepower	Lab Emissions gm/hp-hr	Lab Particulate Index	Lab Emissions gm/min	Operation Time-hrs.	Actual Emissions gm	Engine Efficiency Percent	Treated Emissions gm
1	Loader	DD S - 60	285	0.05	4613	0.24	7.5	107	0	107
2				0.00	0	0.00	0	0	0	0
Totals			**285**	**0**	**4613**	**0.24**		**107**		**107**
								13	**gm/hr**	**13**

cfm/hp:	
Mine	74
Section	74

TC Concentrations:	**Baseline**	**Treated**	
Intake	303	303	ug/m3
Exhaust	467	467	ug/m3
Outside Cab	467	467	ug/m3
Inside Cab	467	233	ug/m3
	Cab Efficiency %		
	0	50	

Table 4. After-Filter Selection Criteria.

Engine Temperature Profile	Type of Filter Regeneration	Type of After-Filter
T30% >550°C	Passive	Uncatalyzed "bare" trap
T30% >420°C	Passive	Base-metal catalyzed trap
T30% >365°C	Passive	Heavily Pt-catalyzed trap
T30% >330°C	Passive	Lightly Pt-catalyzed trap plus fuel borne catalyst
T30% <330°C	Active	Uncatalyzed "bare" trap

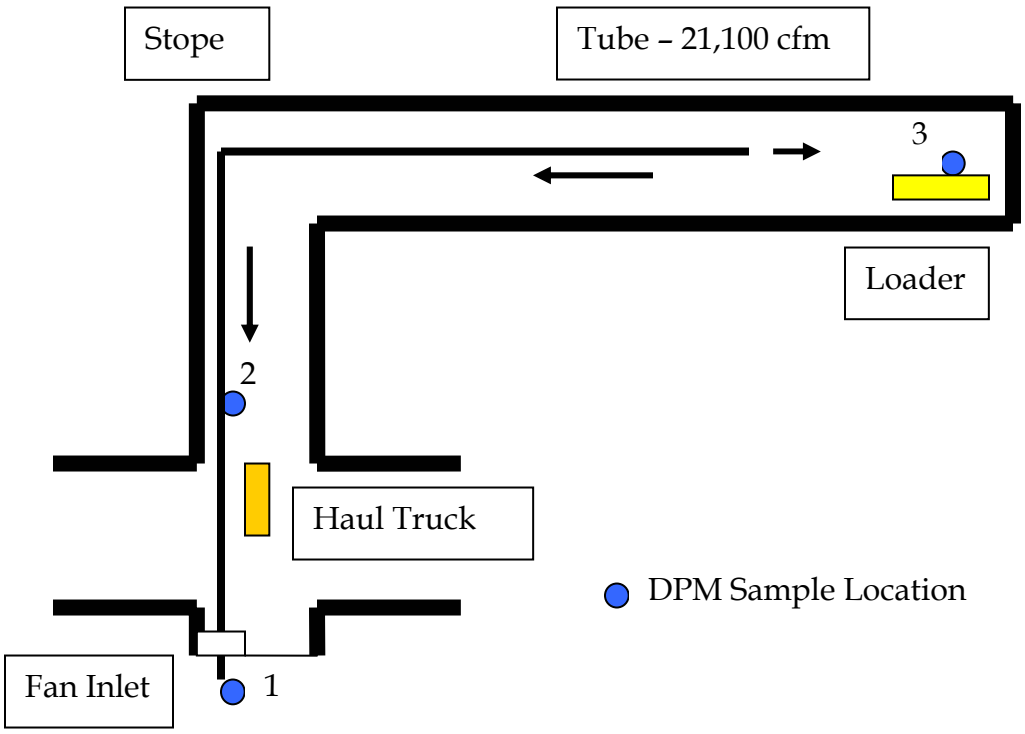

Figure 1. Schematic of 1250 Level Stope.

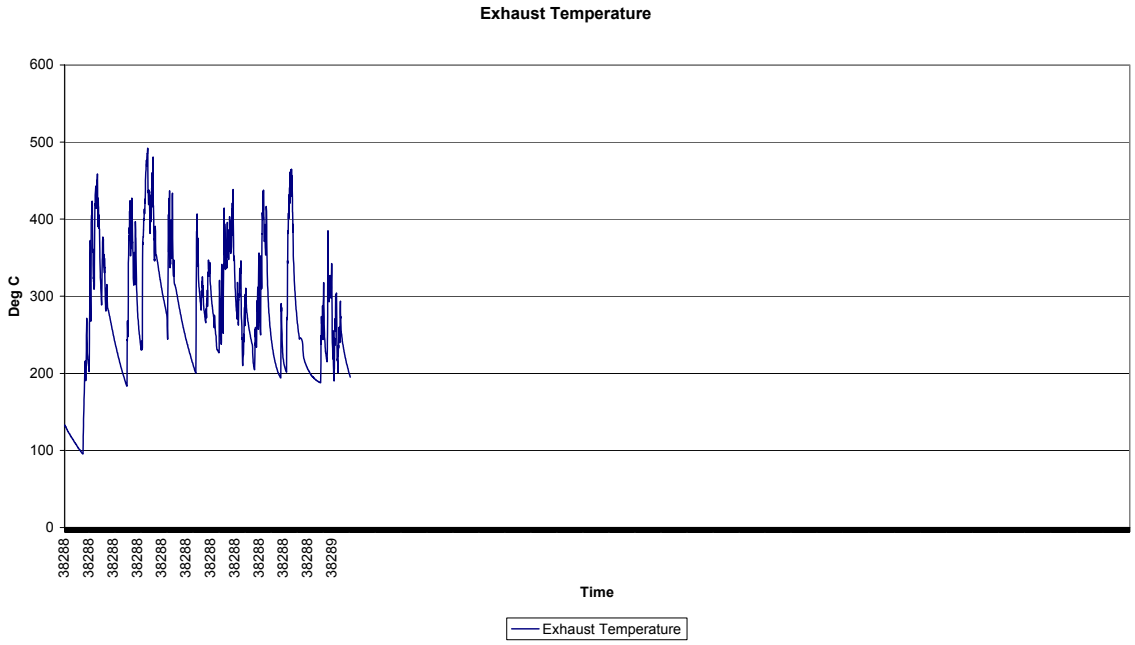

Figure 2. R833 Engine Temperature Trace 601 Jammer, T 30% = 330°C.

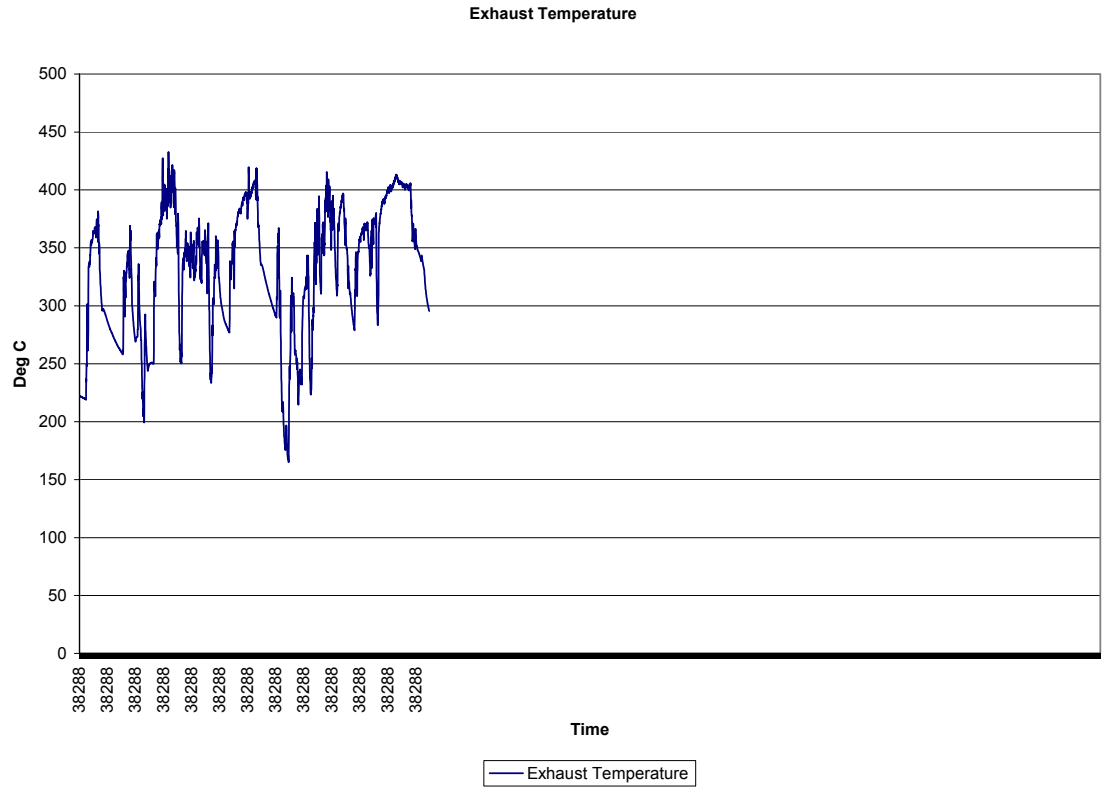

Figure 3. Engine Temperature Trace 610 Loader, T 30% = 370°C.

OSHA Respiratory Questionnaire and Spirometry

Based upon my clinical experience and a review of the relevant literature I believe that the use of the OSHA question without spirometry allows some workers to be assigned to jobs requiring respirator usage for which they all unaffected without attention to their medical problems.

In my position as Director of an occupational and environmental health clinic we have performed respirators certification testing for some thousands of workers. In all of our certification programs we have included blood pressure and spirometry measurements. In respirators certification for a group of electrical workers we identified 7.5% who had abnormal spirometry and were not given respiratory certificate until they had received further medical evaluation and a repeat of the spirometry.

This observation wars supported in a study of nurses working at a hospital close to the World Trade Center at the time of the disaster. Although exhibiting no respiratory symptoms on their questionnaires 10 of 110 nurses had abnormal spirograms and were referred to a Pulmonologist for further evaluation.

In our evaluation of World Trade Centre Rescue workers we have found similar discrepancies between the questionnaire and spirometry.

A report by S. Levine et al. (MMWR Sept.10 2004) notesthat33% had abnormal spirometry but wheeze [was only reported in 0.9%.

In our programs we have also always measured blood pressure and have rejected persons with BP above 170mm Systolic. Until treated.

In summary I believe that the measurement of Pulmonary Function and Blood Pressure is an important addition to a questionnaire.

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