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July 1, 2003

Marvin W. Nichols, Jr., Director
Office of Standards, Regulations, and Variances
MSHA
1100 Wilson Boulevard, Room 2313
Arlington, Virginia 22209-3939
comments@MSHA.gov

RE: Comments to the proposed MSHA Rule for Verification of underground Coal Mine Operators' Dust Control Plans and Compliance Sampling for Respirable Dust, Federal Register Notice March 6, 2003 (Vol.68, Number 44, pg. 10783–10884)

Dear Mr. Nichols

3M Company through its Occupational Health and Environmental Safety (OH&ES) Division is a major manufacturer and supplier of respiratory protective devices throughout the world. 3M has invented, developed, manufactured and sold approved respirators since 1972. We have developed numerous training programs, videos, computer programs and technical literature to help our customers develop and run effective respirator programs. Our technical staff has performed basic research on the performance of respirators and their use, presented and published this data in numerous forums, and participated in the development of the ANSI Z88 standards on respiratory protection. We post a substantial amount of technical information on our internet site at http://www.3m.com/occsafety/. Our sales people have trained and fit tested hundreds of thousands of respirator wearers throughout the world. We have substantial experience in respiratory protection and all phases of its use.

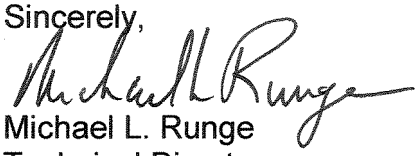
We are pleased to provide the Mine Safety and Health Administration with our comments on the proposed standard for Verification of Underground Coal Mine Operators' Dust Control Plans and Compliance Sampling for Respirable Dust, 68 FR 10783, dated March 6, 2003. We have unique interest in this proposal because we manufacture the Airstream powered air-purifying respirator prominently mentioned as a supplementary control measure. Our comments will be limited to those areas of the preamble and the proposal that address respiratory protection.

AB14-COMM-122□
AB18-COMM-118

To summarize our comments, we support the concept of permitting the use of respiratory protection in longwall mining operations where engineering or environmental controls are inadequate to control worker exposures. However, we must take exception to MSHA's apparent abandonment of acceptable respirator usage principles. This is illustrated by lack of clarity with respect to respirator use with facial hair and its endorsement of the practice whereby miners raise the visor of their PAPR while in contaminated areas. Of course this type of misuse is entirely inappropriate and must be clearly prohibited and jettisoned by MSHA as the basis for its conclusions concerning PAPR performance capabilities

We appreciate the opportunity to add our comments and knowledge to the rulemaking record and look forward to the promulgation of a fair, protective and useful standard.

Sincerely,



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Enclosures

3M Comments on specific areas of the MSHA Proposal

Preamble – Selection of Respirators: Powered Air Purifying Respirators (PAPR), pages 10800 and 10801:

We respectfully disagree with the scope and implication of the following statement regarding PAPRs with loose-fitting facepieces (LFF): "Because this style of respirator does not have a tight-fitting facepiece, miners are not required to be clean shaven in order to wear this respirator correctly." While MSHA does recognize that excessive facial hair that prevents the necessary partial seal of the LFF should be identified and prevented in a well-designed respirator protection program, it is 3M's position that this still falls short of good respirator practice. A well-designed respirator program would prevent any facial hair, not just excessive facial hair, that interferes in any way with a respirator's sealing (fully or partially) to the face.

In support of this principle, **3M** includes the following statement in the user instructions for its Airstream PAPR:

> "This respirator headpiece will accommodate limited facial hair without compromising the level of protection, *providing the facial hair does not protrude under the elasticized edge of the faceseal.*" (emphasis added).

In addition, the current Z88.2 *American National Standard for Respiratory Protection* states, "A respirator, either positive or negative pressure, equipped with a facepiece (*tight or loose fitting*) shall not be worn if facial hair comes between the sealing surface of the facepiece and the face. . ."[1] (emphasis added).

In both these examples, these statements are made because it cannot be demonstrated at this time that LFF offer the same level of performance on unshaven workers as on those who are clean-shaven. All workplace protection factor (WPF) studies have been conducted on clean-shaven workers.

Although MSHA is correct that OSHA regulation 29 CFR 1910.134 appears to exclude LFF from its requirement that respirator wearers be clean-shaven. However, OSHA provides a letter of interpretation of this issue on its web site:[2]

> ". . . The purpose of the elastomeric band **is** to draw the edge of the bib snugly against the skin. If your company used this respirator to protect an employee with a beard containing hair growing or extending under the elastomeric edge of the bib, then your company would violate the stipulation in [29 CFR 1910.134(g)(1)(i)] of the respiratory protection standard that reads. . ."

It is important to emphasize that, although this letter was written in 1993, it was updated to incorporate the correct paragraph citations in the 1998 revised regulation.

Finally, the continuing discussion of PAPRs on page 10801 is not only somewhat ambiguous but most disturbing. Here, MSHA indicates that because miners have a tendency to wear facial hair and normally raise their PAPR faceshields to communicate,

they should be allowed to do so, even though such practices violate well-accepted respirator usage regulations. It is 3M's position that if these practices are not clearly prohibited, they would negatively impact the health and safety of miners. The solution is simple since the issues involved, facial hair and proper respirator use, are addressed and corrected through the administration of a required respirator program. In this regard, miner operations are not unique: every employer who uses respirators must deal with these management issues. As we will discuss further below, no level of respiratory protection can be assumed unless ALL the elements of an acceptable respirator program are in place. Based on the above, 3M urges that the final regulation clearly state that all elements of a respirator protection program required by 30 CFR 72.710, including the requirements to be clean shaven and to properly wear the respirator at all times in the contaminated environment, must be in place and enforced when PAPRs are used.

Preamble – PAPR Protection Factor 10802-10804:

This section of the preamble is a steady progression of perceived support for MSHA's conclusion to give LFF PAPRs an assigned protection factor of 2 to 4. As discussed below, however, 3M strongly disagrees with this conclusion and the supportive steps enumerated and relied on by MSHA to reach their conclusion. First, MSHA references NIOSH's Respirator Decision Logic from 1987 as assigning a protection factor to PAPRs of 25. MSHA then quotes from the NIOSH Guide to Industrial Respiratory Protection that PAPR "...assigned protection factors are inappropriately high". The step that is left out, however, is that the protection factor referenced here is 1000 as originally recommended by Hyatt et.al.[3], and not the protection factor of 25 implied by MSHA. NIOSH has never stated that a protection factor of 25 for PAPRs is "...inappropriately high". It is inappropriate to imply that NIOSH does not support a protection factor of 25 for LFF PAPRs.

MSHA's next "step" toward a protection factor of 2-4 is based on the statement that there is "virtually no" positive pressure in LFF PAPRs which, MSHA claims, allows respirable dust into the wearer's breathing zone through holes around the visor. 3M respectfully contends that this "step" is not supported by data or workplace performance studies. 3M commented on these workplace studies in response to MSHA's July 7, 2000 proposal and relevant portions of that submission are in Attachment A.

In addition, a recent simulated workplace protection factor (SWPF) study reported in the AIHA Journal in 2001 addresses issues of air flow and pressure within the inlet covering as well as measuring SWPF.[3] In this study, eleven models of loose-fitting PAPR and supplied air respirators (SAR) were evaluated. One of the PAPR had a loose-fitting facepiece inlet covering. The authors estimated an APF for each device by dividing the lower fifth percentile SWPF value by a safety factor or 25. Using this procedure, APFs for the PAPR ranged from 3400 to 10,000. These APFs were achieved even though every device that was tested had two or more negative pressure measurements within the inlet covering during the testing. In addition, two of the PAPR, including the device

with a LFF, were found to have occasional airflow measurements below the NIOSH minimum 6 CFM. This study indicates that pressure within the inlet covering and airflow are only two of a complex set of factors that determine the protection provided by PAPR and should not be considered by themselves. The authors noted that their APF for the LFF PAPR was much higher than the value of 25 derived from workplace testing. They speculated that "facepiece design of these devices has improved in the last 15 years in response to these (i.e., the workplace) findings." 3M urges MSHA to take all these studies into consideration as it deliberates promulgation of the final rule.

MSHA's next "step" embarks on a discussion of effective protection factors (EPF) and program protection factors (PPF). Although MSHA displays a basic understanding of what these terms mean, there appears to be a lack of understanding of their limitations in that neither can be used, as MSHA did, to establish a protection factor for any respirator type. An assigned protection factor conveys the estimated performance capability of a respirator. EPFs and PPFs, however, do not assess performance alone, but rather mix in patterns of use and misuse. Thus, for example. To conclude that the assigned protection factor should be lowered based on MSHA's observation that "...it is not reasonable to expect underground coal miners to always wear the visor down..." is tantamount to conceding that misuse of a safety product is acceptable rather than taking measures to correct the misuse to gain the greatest performance capability the respirator has to offer. Even to the casual observer, this appears to be an abdication of the responsibilities delegated by Congress to MSHA. As 3M noted in its comments to the July 7, 2000 record, the best performing respirators will offer little, if any, protection if not worn at all times in the contaminated area (See Attachment B). Any well reasoned, acceptable respirator program mandates that the respirator be used properly at all times the user is in the contaminated environment. Based on this sound industrial hygiene principle, it is well understood that assigned protection factors are only valid "...when the employer has established a minimal acceptable respirator program..."[3].

MSHA's next "step" is to ignore WPF studies not conducted in longwall mines because the air velocities where these WPF studies were conducted were less than those in longwall mines. The data used to reach this conclusion are not discussed. It should be noted that the air velocities MSHA incorporates into its proposal (400-800 fpm) are equivalent to wind speeds of only 5 to 10 mph. Many industries have workers in PAPR who spend at least part of their time outdoors. This was the case, for example, in the WPF study conducted by Collia et. al.[4] While wind speeds were not recorded, it is likely that workers in this and other workplaces frequently use their PAPR when wind speeds exceed 10 mph.

In particular, MSHA focuses on the 1981 Cecala EPF study to show that for mining applications, where air velocities are higher, an APF of 2-4 is appropriate. While Cecala did test an Airstream helmet, the 1981 version of that product no longer represents the Airstream product of today. For example, the plastic faceshield sealing pads have been replaced with a shroud that covers a significantly larger portion of the face, and filter efficiency in today's product far exceeds that of the device tested by Cecala.

Further, Cecala's laboratory results are suspect because the PAPR was mounted on a mannequin and methane gas was used as a challenge. No data is offered to support the assumption that methane behaves in the same manner as a particulate challenge. Further, laboratory performance measurements on *human* subjects do not correlate with workplace respirator performance. Cecala provided no data to confirm that the data collected on the mannequin would correlate with the workplace. The mine testing results are also useless as a measure of respirator performance. Cecala commented, "It should be noted that the field tests measured the effective protection factor of the helmet, which includes times when the shield was lowered and times when it was raised according to normal underground use. This lowers the field efficiency."[5] Clearly, the dust concentration measured in the wearers' breathing zones (C_i) are valid only for the specific conditions and practices existing at the time of the study. Any change in the amount of "shield up" time or variation in environmental dust concentration would dramatically change the C_i measurement.

Finally, the APF interpolation procedure proposed on page 10803 for air velocities between 400 and 800 fpm indicates a fundamental misuse of APFs. All APFs are based on limited data collected in a laboratory or a workplace, and a degree of professional judgment. As such, they are estimates of the performance of a given type of respirator when properly selected, worn and used. Co-mingling this estimate, based on proper respirator use, with estimated performance when misused (EPF) and adding decimal points from a formula, does not improve the accuracy or precision of estimated performance. MSHA, however, is proposing to do just this and allow misuse of respirators to support an APF of 2-4 depending on air velocities between 400 and 800 fpm.

MSHA's proposal to assign protection factors of 2 to 4 for the Airstream PAPR is not supported by appropriate or credible data. An APF of 25 is supported by ANSI, NIOSH, OSHA and several workplace and laboratory studies. Moreover, the European total inward leakage test for LFF PAPRs, which includes airflow impingement on the front, side and rear of the device at a rate of 2 m/sec (394 fpm should be considered.[8] *Based on this test a nominal protection factor of 500 would apply to the Airstream with HEPA filter. In the United Kingdom, this results in an APF of* ***40.*** *Therefore, based on all the presented information, 3M recommends an APF of 25 be used in the final regulation, and the respirator be used in the context of a complete respiratory protection program*

Proposed Regulatory Text

70.2 Definitions:

Protection factor: Change the term to Assigned Protection Factor (APF). Delete definition and use this one, adapted from the American Industrial Hygiene Association (AIHA):

> The level of respiratory protection that a properly functioning PAPR would be expected to provide to properly trained users in the workplace. The APF takes into account all expected sources of facepiece penetration (e.g., face seal penetration and filter penetration). It does not take into account factors that

degrade performance such as poor maintenance, failure to follow manufacturer's instructions, and failure to wear the respirator during the entire exposure period. For the purpose of this part, the APF for powered air-purifying respirators is 25 when all the requirements of 72.710 are met.

70.210 Powered air-purifying respirators (PAPR); requirements for approval:
Delete existing (a)(2)(i). Change to read: (a)(2) A written PAPR protection program which: (a)(2)(i) meets all the requirements of 72.710; and (ii) . . .

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[1] **American National Standards Institute**: *American National Standard for Respiratory Protection* (ANSI Z88.2). New York: American National Standards Institute, 1992.
[2] U.S. Department of Labor/OSHA: Use of the Racal "Breath-Easy 6 ' powered air purifying respirator with beards. July 27, 1993 [Letter to John Rosenberg].
[3] **Cohen, H.J., L.H. Hecker, D.K. Mattheis, J. S. Johnson, A.H. Biermann, and K.L Foote:** Simulated workplace protection factor study of powered air-purifying and supplied air respirators. *Am. Ind. Hyg. Assoc. J* 62:595-604 (2001)
[4] **Collia, D.V., P.E. Giles, S.L. Edwards, C.S. Freeman, C.E. Colton, and J.O. Bidwell:** "The Workplace Performance of a Loose-fitting Facepiece Powered Air Purifying Respirator With High Efficiency Filters." Paper presented at the American Industrial Hygiene Conference and Exposition, Orlando, FL, May 2000.
[5] **Cecala, A.B., J.V. Volkwein, E.D. Thimons, and C.W. Urban**: Protection factors of the Airstream helmet. U.S. Bureau of Mines RI 8591, 1981.
[8] British Standards Institution: *Respiratory Protective Devices-Powered Filtering Devices Incorporating a Helmet or a Hood-Requirements, Testing, Marking* (BS EN 12941). London: British Standards Institution, 1999.

Attachment A
Discussion of WPF Studies Supporting an APF of 25 for the Airstream PAPR
(From 3M Comments to the July 7, 2000 MSHA Proposed Rule)

The assigned protection factors recommended in ANSI Z88.2-1992 were based on WPF data when it was available. For this reason, they represent the best available guidance on APFs. The following discussion is taken from an article by Nelson, which describes the logic the ANSI committee used to set the APF for loose-fitting facepieces.[1]

> *Meyers et al. studied the performance of the 3M Airhat® and the Racal model AH3 loose-fitting facepiece type PAPRs equipped with dust/mist filters in a battery manufacturing facility.[2] Twelve workers participated in the study with samples collected for the full 8-hour shift with the sampling pumps turned off during the times the PAPR was not being worn. The inside the facepiece probe was located approximately 1-2 inches from the mouth. The inside the facepiece samples was analyzed by graphite furnace atomic absorption with a detection limit of 0.3 µg lead per sample. The outside samples were analyzed by atomic absorption with a detection limit of 3 µg lead per sample. The particles in the workplace had a mass mean aerodynamic diameter of 17 µm. The geometric mean WPF was 127 and the best estimate of the 5th percentile WPF was 32.*
>
> *Gosselink et al. studied the performance of the 3M Airhat® with HEPA filters in a brake manufacturing facility.[3] The asbestos fibers were analyzed by phase contrast microscopy, with a modification to increase the number of fields counted to increase sensitivity. The detection limit was 1 fiber/filter. The geometric mean WPF was 199 and the best estimate of the 5th percentile WPF was 41.*
>
> *Myers et al. studied the performance of a Racal AH3 and a 3M Airhat® loose fitting facepiece PAPRs equipped with high efficiency filters in a secondary lead smelter.[2] Twelve people participated and each was given a quantitative fit test before being included in the study. A fit factor of 1000 was required, and since no one had a fit factor less than 1000, the fit test was not a factor in the study outcome. Samples were collected during the entire shift while the respirator was worn. The inside the facepiece samples were analyzed by graphite furnace atomic absorption with a detection limit of 0.3 µg lead per sample, the outside samples by atomic absorption with a detection limit of 3 µg lead per sample. The particle size of the aerosol varied by area of the plant. At the furnace and caster, approximately 35% of the aerosol was greater than 17 µm, and 30% smaller than 0.68 µm. At the blast furnace, 60% was greater than 17 µm and 8% smaller than 0.68 µm. The geometric mean WPF was 182 and the best estimate of the 5th percentile WPF was 32.*
>
> *Since the committee completed its work, two more studies have been reported. First, Gaboury and Burd measured the work place performance of a Racal Breathe-Easy PAPR equipped with HEPA filters.[4] They measured benzo-alpha-*

pyrene, which is contained in the benzene soluble materials present in the particulate in the aluminum smelting process. Benzo-alpha-pyrene was detected at 0.003 µg/m^3. Seventy-five percent of the benzo-alpha-pyrene was contained in an aerosol with an aerodynamic diameter of 0.93 µm. Samples were collected outside the respirator at a point above the visor. Because of the heat load in the production areas, workers spent one half hour each hour in a cool environment, for this time period, the sampling was stopped. Therefore, each data point equals the WPF for multiple wearings in each work shift. Both bearded and clean-shaven people were included in the study. The geometric mean WPF was 1410, the best estimate of the 5th percentile was 306.

Stokes et al. studied the 3M Airhat® loose fitting facepiece PAPR equipped with dust/mist or HEPA filters and a version of the equipment with a Tyvek® shroud.[5] ?he study was conducted in a roofing granule production plant and measured silica dust. Five people participated. Samples were collected for 30 minutes to I hour. Only samples with inside concentration greater than 25 or 100 times the mean blank concentration were included in their analysis. The geometric mean WPF was 1530, and the best estimate of the 5th percentile was 85.

Since Nelson's paper was published, there has been one additional WPF study of loose-fitting facepiece performance. Collia et al. measured workplace performance of a 3M Breathe Easy™ PAPR equipped with HEPA filters and a Tyvek® QC loose-fitting facepiece.[6] The study was conducted in a nickel-cadmium battery plant and measured cadmium exposures. Samples were analyzed for cadmium by flame and flameless atomic absorption spectroscopy using a heated graphite furnace analyzer. The geometric mean WPF was 2523, with a fifth percentile of 315 or 280, depending upon the statistical model used.

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[1] **Nelson, T.J.:** The assigned protection factor according to ANSI. ***Am.*** *Ind. Hyg.* Assoc. *J.* **57:** 735-740 (1996).

[2] **Myers, W.R., M.J. Peach, K. Cutright, and W.Iskander:** Field test of powered air purifying respirators at a battery manufacturing facility. *J. Int Soc. Respir. Prot. 4(1):*62-89 **(1986).**

[3] **Gosselink, D.W., D.P. Wilmes, and H.E. Mullins:** "Workplace Protection Factor Study for Airborne Asbestos." Paper presented at the American Industrial Hygiene Conference, Dallas, **TX,** May **1986.**

[4] **Gaboury, A., D.H. Burd, and R.S. Friar:** Workplace protection factor evaluation of respiratory protective equipment in a primary aluminum smelter. *Appl. Occup. Environ. Hyg. 8(1):* 19-25 (1993).

[5] **Stokes, D.W., A.R. Johnston, and H.E. Mullins:** "Respirator Workplace Protection Factor Studies – Powered Air Loose Fitting Helmet." Paper presented at the American Industrial Hygiene Conference, Montreal, Canada, June 1987.

[6] **Collia, D.V., P.E. Giles, S.L. Edwards, C.S. Freeman, C.E. Colton, and J.O. Bidwell:** "The Workplace Performance of a Loose-fitting Facepiece Powered Air Purifying Respirator With High Efficiency Filters." Paper presented at the American Industrial Hygiene Conference and Exposition, Orlando, FL, May 2000.

Attachment B
Effective Protection Factors for Respirators with Various Levels of Performance

Effective Protection Factors

		Time Worn During Shift	
	APF	90%	80%
Half Facepiece	10	5	4
Full Facepiece	100	9	5
Airline (PD)	1000	10	5
SCBA	10,000	10	5