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September 11, 2023

Ms. Aromie Noe
Director, Office of Standards, Regulations, and Variances
Mine Safety and Health Administration
201 12th Street South, Suite 4E401
Arlington, Virginia 22202-5452

Re: RIN 1219–AB36; Docket No. MSHA–2023–0001, Lowering Miners' Exposure to Respirable Crystalline Silica and Improving Respiratory Protection, Comments of Vanderbilt Minerals, LLC

Filed via the Federal eRulemaking Portal: http://www.regulations.gov

Dear Ms. Noe:

Vanderbilt Minerals, LLC is a family-owned company that has for over 100 years produced various mineral products (such as Kaolin clay, smectite, and pyrophyllite) in the United States for use in many essential industries used by millions of individuals across the globe.

Mine workers must not be over exposed to respirable crystalline silica. Silicosis and other diseases caused by over-exposure respirable crystalline silica can and must be prevented. It is for this reason that Vanderbilt Minerals is in support of the overarching intent of MSHA's proposed rule; maintaining mine worker exposures to respirable crystalline silica such that the lifetime excess lung cancer risk is maintained at a concentration which would not likely result in lifetime excess risk of 1 in 10,000.[a]

While a case can be made that there has been an increase in the prevalence of pneumoconiosis and progressive massive fibrosis among coal miners in West Virginia, Eastern Kentucky, Western Pennsylvania (the "coal belt of the U.S."), no such increase has been seen within the metal/non-metal sector. Mine operators are required to report injuries and illnesses to MSHA via the Form 7000-1. Since January, 2013, while the coal mine sector has reported 1,160 cases of silicosis, there have been only 20 reported by the mental/non-metal sector.[b] This is despite the fact that there are more than three times the number of metal/non-metal miner workers versus coal mine workers.[1] While a single case of silicosis is one too many, the significantly lower prevalence of silicosis in the metal/non-metal sector (when compared to the coal sector) is evidence of an effective approach to protecting mine workers from respirable crystalline silica-induced disease. In recognition of this fact, Vanderbilt Minerals asks

[a] NIOSH no longer sets recommended exposure levels for occupational carcinogens and intends to develop risk management limits for carcinogens (RML-CA). An RML-CA limit is based an 8- hour TWA above which a worker should not be exposed. An RML-CA is established at the estimated 95% lower confidence limit on the concentration (e.g., dose) corresponding to 1 in 10,000 lifetime excess risk.

[b] 30 CFR 50.20-6(b)(7)(ii) states: "…If a chest x-ray for a miner with a history of exposure to silica or other pneumoconiosis-causing dusts is rated at 1/0 or above, utilizing the ILO classification system, it is MSHA's policy that such a finding is a diagnosis of an occupational illness, in the nature of silicosis or other pneumoconiosis and, consequently, reportable to MSHA…" This is done via the 7000-1.

that MSHA consider forgoing the application of an action level of 0.025 mg/m^3 to the metal/non-metal sector. The costs (directly and indirectly resulting from the associated administrative burden) of imposing an action level are not commensurate with the benefits. This is not to suggest a lower permissible exposure limit is in appropriate. It is instead a suggestion that the Administration should continue to enforce against ALL exposures in excess of ANY in-place permissible exposure limit (for respirable crystalline silica at the proposed new 0.05 mg/m^3 limit, or otherwise), making use of the Administrations power to invoke mine closure for repeat offenders.

As outlined below, if adopted, this proposed rule will cost significantly more, and require far more time than estimated by MSHA while having a number of significant impacts as follows:

- Render certain air sampling equipment currently in use by MSHA/operators obsolete.
- Further stress an already overwhelmed occupational health network.
    - Requiring metal/non-metal mine operators to utilize NIOSH-approved facilities.
    - Requiring medical surveillance for low-exposure miners.
    - Requiring ILO- B-readings too frequently (for low-exposure miners).
    - Requiring NIOSH to approve medical surveillance plans.
- Result in the misapplication of mathematical approaches used by industrial hygienists.
- Nullify / discount exposure monitoring data relied on by industry / health scientist.
- Increase labor cost by eliminating job rotation.
- Deny the health & cost-effective use of powered air purifying respirators.
- Impose excessive air sampling.
- Impose unnecessary administrative burden.
- Impose respiratory protection requirements without due process.
- Regulate minerals other than respirable quartz/ cristobalite / tridymite.

In the preamble to the proposed rule, the Administration has asked for comments in 43 areas. Where Vanderbilt Minerals has area-specific comments associated with any of these 43 areas, they are offered below organized topically be each of these areas.

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AREA 4

"*…… MSHA has preliminarily determined that it is technologically feasible for mine operators to conduct air sampling and analysis and to achieve the proposed PEL using commercially available samplers. MSHA has also determined that these technologically feasible samplers are widely available…… MSHA requests comments on these preliminary conclusions.*"

- **MSHA's "Go-To" Dorr Oliver Cyclone will be Eliminated While Other Remaining Cyclone / Breathing Zone Pump Configurations will be of Limited Utility.**

  On page 44863 of the preamble to the proposed rule, MSHA explains "*Once weighing of the samples is completed, samples are again screened based on mass gain and examined for validity. All valid samples that meet the minimum mass gain criteria per the associated MSHA analytical method are then analyzed for respirable crystalline silica and for the compliance determination... The minimum mass gain criteria used by the MSHA Laboratory for the different samples are: • MNM mine respirable dust samples: greater than or equal to 0.100 mg; …*" Why

is this the case? Doing so will eliminate the Dorr Oliver cyclone. Here is why. As indicated in the preamble to MSHA's proposed respirable crystalline silica rule, MSHA's currently uses the Dorr-Oliver cyclone operated at 1.7 liters per minute when sampling metal and nonmetal mines for respirable crystalline silica. At this flow rate, for an eight-hour shift, a maximum of 0.816 m^3 of air can be collected by the pump. If one were to assume a mine atmosphere being sampled to determine compliance with the new proposed MSHA action level of 0.025 mg/m^3 for respirable crystalline silica, was **pure quartz**, if the mass on the filter exceeded 0.0204 mg, the measured atmosphere would be deemed in excess of the proposed action level (0.0204 mg of respirable quartz mass / 0.816 m^3 of collected air = 0.025 mg/m^3). What this means is that of the mass were between 0.0204 mg and 0.100 mg (a mass below which MSHA would reject per in accordance with its analytical method), MSHA would be unable to assess for compliance. In reality, the atmosphere being sampled will not contain only pure respirable crystalline silica. Many other substances may be present. For example, over the past five years of sampling the atmosphere at one of Vanderbilt Minerals'[c] facilities for respirable crystalline silica by means of the Dorr Oliver cyclone operated at 1.7 liters per minute, it has been determined that the average respirable crystalline silica concentration of the measured respirable aerosol is approximately 30%. Consequently, for this real-world atmosphere (where the airborne respirable particulates were 30% respirable crystalline silica), if the mass on the filter exceeded 0.068 mg, the measured atmosphere would be deemed out of compliance (0.068 mg respirable dust x 30% respirable quartz = 0.0204 mg of respirable quartz mass. Thus 0.0204 mg of respirable quartz mass / 0.816 m^3 of collected air = 0.025 mg/m^3). By its own policy, whereby MSHA considers a sample to be invalid if the mass gain is less than 0.1 mg, there would many circumstances in which samples would be rejected using MSHA's long standing sampling train (the Dorr Oliver cyclone operated at 1.7 liters per minute) where the results were shown to be in excess of the action level. The impact of this limitation on the use of Dorr Oliver cyclone operated at 1.7 liters per minute will necessitate a complete change in sampling techniques used by MSHA staff. For all practical purposes, the Dorr Oliver cyclone will no longer be an acceptable cyclone due to the fact that the maximum volume of air it can collect during an eight-hour shift is 0.816 m^3, and this will not result in a sufficient mass (greater than 0.1 mg) for analysis of many samples in excess of 0.025 mg/m^3 but having a mass gain less than 0.100 mg. The highest flow rate specified for a widely-available **personal breathing zone** ISO[d]-conforming cyclone is 4.2 liters per minute realized by the GK2.69 cyclone. At this flow rate, here again, for an eight-hour shift, a maximum of 2.016 m^3 of air can be collected by the pump. If one were to assume a mine atmosphere being sampled to determine compliance with the new proposed MSHA action level of 0.025 mg/m^3 of respirable crystalline silica, was **pure quartz**, if the mass on the filter exceeded 0.0504 mg, the measured atmosphere would be deemed out of compliance. Again, by its own policy, whereby MSHA considers a sample to be invalid if the mass gain is less than 0.1 mg (the 0.0504 mg mass is well below that cutoff) and there would many circumstances in which samples would be rejected despite being in excess of the proposed action level of 0.025 mg/m^3.

[c] The specific identity of the facility and the material mined shall remain un-disclosed for purposes of this example to avoid disclosure of confidential business information.

[d] International Organization for Standardization (ISO) 7708:1995: Air Quality-Particle Size Fraction Definitions for Health-Related Sampling

In fact, the minimum mass gain of less than 0.1 mg would result unless to respirable quartz content were less than 50%. For any atmosphere of respirable particulates with 50% or more respirable quartz, there would never be an instance where a valid sample were produced (more than 0.1 mg of mass gained) using GK2.69 cyclone, which is said by MSHA and others to be the highest air flow ISO-conforming cyclone available. The impact of this limitation on the use of the GK2.69 at 4.2 liters per minute will be that there will be an insufficient mass gain for MSHA to deem a sample valid for atmospheres containing respirable quarts at or greater than 50% by weight.

Importantly, even if one seeks to make use of an alternative sampling train with a GK2.69, there are only a limited number of **personal breathing zone** air sampling pumps capable of collecting air at higher flow rates, such as the GilAir Plus Personal Air Sampling Pump.[2]

The following table illustrates the issue of concern if the Dorr Oliver continues to be used, and if the intent is instead to rely on the GK 2.69

Cyclone Type	Flow Rate	Shift Length	Air Volume Collected	Quartz Mass On Filter	Calculated Airborne Respirable Quartz Concentration	Issue of Concern
	Liters per minute	Minutes	Cubic Meters	Milligrams	Milligrams per cubic meter	
Dorr Oliver	1.7	480	0.816	0.0204†	0.025	**At** the proposed action level but **invalid**
				0.042†	0.051	Above the proposed PEL but **invalid**
				0.090†	0.110	
				0.100†‡	0.12	Minimum acceptable mass but **out of compliance**
				0.068¥	0.025	**At** the proposed action level but **invalid**
				0.100¥	0.037	Minimum acceptable mass but **above action level**
GK 2.69	4.2	480	2.016	0.0504†	0.025	**At** the proposed action level but **invalid**
				0.090†	0.044	**Above** the proposed action level but **invalid**
				0.100†	0.049	Minimum acceptable mass but **invalid**

† If pure quarts (which is almost never going o be the case)
‡ minimum mass gain criteria used by the MSHA Laboratory
¥ mass gain for respirable dust containing 30% quartz at a Vanderbilt Minerals facility

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AREA 5

"……MSHA has determined that the proposed medical surveillance requirements for MNM are technologically feasible. MSHA requests comments on this preliminary conclusion. Please provide supporting information, such as quantitative data if available."

- **There is a dearth of qualified occupational health physicians in the U.S.**

  While it is technologically feasible to impose medical surveillance requirements for metal/non-metal miners, there is a dearth of qualified occupational health physicians in the U.S. Point number 7 of the American College of Occupational and Environmental Medicine advocacy agenda indicates on its website that "*…there aren't enough OEM specialists to meet the need in the workplace. Federal policy should be strengthened to promote training programs, including residency training for future OEM physicians…*"[3] According to the most current information from the Association of American Medical Colleges, there were only 4,867 pulmonary specialists in the United States as of 2021.[4] That is one pulmonologist for every 67,099 individuals. Similarly, the American Board of Preventative Medicine reports that there are even fewer board-certified occupational medicine physicians – a total of approximately 3,103 as of January 2023.[5] With this limited number of qualified pulmonary specialists in the United States, this already under-staff profession will see additional pressure, leading to a reduction the ability to provide adequate care to those who truly need it. To alleviate this burden, MSHA should thus impose the requirement for medical surveillance only for those mine workers whose exposures are above the proposed respirable crystalline silica permissible exposure limit of 0.05 mg/m^3 for 30 or more days a year. This is in alignment with OSHA's approach to medical surveillance as set forth in its respirable crystalline silica rule.

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AREA 6

"*… MSHA developed estimated costs of compliance with the proposed rule and estimated monetized benefits associated with averted cases of respirable crystalline silica-related diseases. MSHA requests … any data or quantitative information that may be useful in evaluating the estimated costs and benefits associated with the proposed rule…*"

- **Compliance with the proposed respirable crystalline silica exposure limit of 0.05 mg/m^3 will be far more costly than MSHA has estimated.**

  Compliance cost associated with the proposed respirable crystalline silica exposure limit of 0.05 mg/m^3 will be significant for at least one of Vanderbilt Minerals mining / milling operations. Specifically, a preliminary estimate of the expenditures necessary if this mining / milling operation is to remain in compliance (though even if such items are deployed, there is no guarantee of compliance) is in excess of $7,000,000. This would include the purchase / installation of such items as a new bagging system for 50 pound bags, new dust collectors for drying/milling equipment, renovation of a laboratory, office, break room, mill control office, and crusher operator booth, purchase of larger water trucks and an increase in paved haul roads.

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AREA 7

7. MSHA considered two regulatory alternatives in developing the proposed rule discussed in Section IX. Summary of Preliminary Regulatory Impact Analysis and Regulatory Alternatives. In the regulatory alternatives presented, MSHA discussed alternatives to the proposed PEL, action level, sampling requirements, and semi-annual evaluations. MSHA requests comments on these and other regulatory alternatives and information on any other alternatives that the Agency should consider, including different average working-life spans and different average shift lengths. Please provide supporting information about how these alternatives could affect miners' protection from respirable crystalline silica exposure and affect mine operators' costs.

- **Use of the TLV Reduction Factor is mathematically incorrect and misapplied to respirable crystalline silica.**

  On page 44903 – 44904 of the Section-by-Section analysis of its proposed rule, MSHA states that "*Regardless of a miner's actual working hours (full shift), 480 minutes would be used in the denominator…. That … respirable crystalline silica collected over an extended period (e.g.,a 12-hour shift) would be calculated (or normalized) as if it were collected over 8 hours (480 minutes).*" This is mathematically incorrect, resulting in an artificially elevated expression of the actual concentration of respirable crystalline silica present. The Administration's basis for doing so is justified only by stating.

  a) this is the way it has always been done (in the M/NM sector),
  b) a miner working longer than 8 hours may not have sufficient time to eliminate the respirable crystalline silica,
  c) doing so would allow more time for physiological recovery, and
  d) this concept was discussed by Brief (1986) and Elias (2013).

  To base its justification on incorrectly calculating atmospheric concentrations of respirable crystalline silica on these 4 tenets is not sufficient. Specific to each point:

  a) Continuing to do something the way it has always been done lacks any basis in fact. Mathematically incorrect techniques should not be perpetuated.
  b) Using a mathematical equation because it **may** give a miner more time to recover (under the presumption that less is better) is simply speculation. An analysis of the literature on recovery rates for the pulmonary system upon exposure **specific to respirable crystalline silica** should be undertaken with the result informing policy in this area.
  c) See response to "b)" immediately above - doing so under the presumption it would allow more time for physiological recovery would require MSHA to undertake an analysis of the literature on recovery rates for the pulmonary system upon exposure **specific to respirable crystalline silica.**
  d) While this concept was discussed by Brief (1986) and Elias (2013), Neither was relevant to respirable crystalline silica.

- Specific to Brief (1986), the authors state "*The basis for the TLV of **<u>each</u>*** [emphasis added] *chemical must be considered in the application of the TLV Reduction Factor.*"[e] MSHA does not appear to have done so specific to respirable crystalline silica. Moreover, Brief clarified that this technique is valid when "the TLV is based on systemic effect (acute or chronic)." Silicosis is not a systemic effect. As such, even if MSHA had considered silica specifically in the context of derivation of a "TLV Reduction Factor," doing so is not valid.
- Specific to Elias, the substances contemplated were ethyl alcohol, perchloroethylene, acrylamide, pentachlorophenol – all of which are organic compounds and (with the exception of pentachlorophenol) vapors. All of these substances have completely different toxicodynamics and modes of action compared to respirable crystalline silica.

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AREA 10

"*MSHA is proposing that the final rule would be effective 120 days after its publication in the Federal Register.*"

- **Providing only 120 days to comply does not give the mine operator sufficient time to deploy engineering controls.**

  Providing a mine operator only 120 days to comply with the final rule is not feasible. For example, Vanderbilt Minerals has been in the process of scoping, and securing cost estimates for the installation of upgrades to the systems it uses to package one if its silicate minerals in 50-pound bags. This effort, undertaken in anticipation of MSHA's promulgation of amendments to its occupational exposure limits for respirable crystalline silica, began in September 2022. On August 18, 2023, a formal proposal was finally provided after 11 months of detailed scoping work. In providing the proposal, the selected third-party engineering / equipment supplier informed Vanderbilt Minerals that it will take no less than 12 months to install the equipment once approved. It is not possible for the organization to install these upgrades (which would be necessary to comply with the proposed MSHA action level of 0.025 mg/m^3) until no sooner than January, 2025. Importantly, additional time will be needed to secure the millions of dollars necessary to purchase the equipment upgrade. Many other upgrades (see Table 1 above) may also be necessary to ensure this facility is capable of complying with the proposed MSHA action level of 0.025 mg/m^3. Such upgrades may be necessary for several centralized dust collection systems, operator control booths, centralized cleaning equipment, and bulk product loading systems. It is not outside the realm of possibility that making all necessary upgrades to this facility will take several years.

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AREA 11

[e] Importantly, Brief applied the "TLV Reduction Factor" only to organic compounds (methanol, methyl ethyl ketone, hydrogen sulfide, and benzene), all of which are present chronic, **<u>systemic</u>** effects; silicosis is not.

"*MSHA requests comments on … the cost of monitoring respirable crystalline silica above the proposed action level, and other relevant information. Please provide supporting information.*"

- **MSHA has underestimated the per visit cost to complete an industrial hygiene survey.**

Vanderbilt Minerals deploys the services of its parent organization's in-house industrial hygienist in concert with a third-party analytical laboratory to characterize employee exposures to respirable crystalline silica, and other airborne contaminants. A recent sampling event (occurring May 1 to May 3, 2023) costed no less than $10,000 as itemized in the table below:

Item	**Cost**
Hygienists labor (10 hours / day x 3 days) = 30 hours	$3,679
Hygienists travel expenses (airfare / food / lodging)	$1,000
Analytical laboratory	$5,000
Annual air sampling equipment maintenance (6 pumps at $307 each)	$1,842
Total cost	$11,521

These cost estimates are considerably higher than those estimated by MSHA. If an organization must sample every three months when airborne respirable crystalline silica concentrations are in excess of an action level of 0.025 mg/m^3, it is conceivable that it would have to do so four times per year for a cost in excess of $40,000. MSHA should re-evaluate its economic impact analysis making use of larger numbers than those currently relied upon. Doing so will likely demonstrate a significant underestimation of the economic burden for this provision of the proposed rule.

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AREA 12

"*MSHA requests comments on the proposed definition for 'objective data.' Is it appropriate to allow mine operators to use objective data instead of a second baseline sample? Please provide supporting information.*"

- **MSHA must allow the use of objective data instead of ANY baseline sample and allow such data to be more than 12 months old.**

The use of objective data instead of **<u>any</u>** baseline sample (including the proposed second baseline sample) should be allowed. Furthermore, its age (i.e.: older than 12 months) should not be a de facto disqualifier of its use. On page 44902 of the preamble to the proposed rule, MSHA states that "*……Some examples of information that would qualify as objective data under this definition include historical MSHA sampling data, NIOSH Health Hazard Evaluations and other published scientific reports, and industry-wide surveys compiled from mines with similar mining conditions, geological composition, work processes, miner tasks, and the same*

commodities." Historical data that is more than 12 months old may be relevant. Consequently, this portion of the definition of objective data should be reworded as indicated in strike-out / underlined text below:

"*……Some examples of information that would qualify as objective data under this definition include historical MSHA sampling data (which may be more than 12 months old) , NIOSH Health Hazard Evaluations and other published scientific reports, and industry-wide surveys compiled from mines with similar mining conditions, geological composition, work processes, miner tasks, and the same commodities.*"

Just because data is more than 12 months old does not mean it is irrelevant. Such data has and continues to be used by health scientists[f], and mine operators in evaluating the health status of miners. If the mine operator can show that the data were collected during work operations and conditions that are consistent with the processes, types of material, control methods, work practices, and environmental conditions in the mine operator's current operations, such data remains representative, and its use must be allowed. This would be in alignment with what OSHA allows pursuant to its respirable crystalline silica rule.[g]

Failure to do so will result in the loss of a great deal of valuable data that has been generated at considerable expense.

- **Direct read instruments provide potentially valuable data.**

  Employers subject to OSHA's respirable crystalline silica can use direct-reading instruments to measure real-time levels of respirable dust in the air. If the employer has information on the percentage of respirable crystalline silica in that dust (for example, from the analysis of a bulk sample or information from a safety data sheet), he or she can then calculate the level of respirable crystalline silica in air. Like OSHA, MSHA must allow the use of data generated from direct-read instruments as objective data.

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AREA 15

"*MSHA requests comments on the proposed prohibition against rotation of miners as an administrative control…*"

- **MSHA must not prohibit the use of job rotations as an administrative control.**

  In justifying that mine operators should not be permitted to make use of job rotations to reduce miner exposure to respirable crystalline silica, MSHA states that *"[p]roposed paragraph Section 60.11, (b) would prohibit mine operators from using rotation of miners… Based on NIOSH's publication entitled 'Current Intelligence Bulletin 68: NIOSH Chemical Carcinogen Policy', MSHA*

[f] Including those on whom MSHA relied for is basis in proposing the reduced PEL for respirable crystalline silica.
[g] It is worth noting that during the development of the OSHA rule for respirable crystalline silica, many commenters found the 12-month limit on the use of monitoring results for initial exposure assessments using existing data to be too restrictive. OSHA was persuaded by these commenters not to establish time limitations for monitoring results used to assess exposures under the performance option, as long as the employer can demonstrate the data accurately characterize current employee exposures to respirable crystalline silica.

believes that the primary way to prevent occupational cancer is to reduce worker exposure to chemical carcinogens as much as possible through elimination or substitution at the source and through engineering controls (NIOSH 2017b)." This is a misapplication of Current Intelligence Bulletin 68. Namely, Current Intelligence Bulletin 68 neither states nor implies that job rotation cannot be relied on in the effort to reduce or eliminate over-exposure to a carcinogen. In fact, Current Intelligence Bulletin 68 is silent on job rotations. To quote NIOSH on page v in Current Intelligence Bulletin 68 "*NIOSH will continue to recommend reduction of exposure to an occupational carcinogen according to the hierarchy of controls through elimination or substitution and implementation of engineering controls, if practical, and the use of* ***administrative controls***[h] [emphasis added] *before use of personal protective equipment (PPE)."*[6] NIOSH further indicates on page 20 of Current Intelligence Bulletin 68 that "Administrative controls, such as work practice controls, are also an important way to minimize workers' exposures."

- **Adherence to a TWA is adherence to a TWA.**

  If an operator is exposing a miner to excess respirable crystalline silica in a given hour, to adhere to the TWA, the operator must move the worker out. MSHA has no mandate to protect the workplace, only the worker. Denial of the use of this NIOSH – endorsed tool, is to disregard the mathematical concept of the TWA, and its resulting proper use to maintain worker exposure below mandated exposure limits. This is not only unfair, it ignores NIOSH Current Intelligence Bulletin 68, and the long-standing use of the TWA in the protection worker health.

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AREA 16

"*MSHA requests comments on the proposed requirement that mine operators must install, use, and maintain feasible engineering and administrative controls to keep miners' exposures to respirable crystalline silica below the proposed PEL.*"

- **MSHA should take the same approach as OSHA regarding use of respirators.**

  In its respirable crystalline silica standard, OSHA allows the use of respiratory protection in conjunction with engineering and work practice controls if feasible engineering and work practice controls are not able to reduce employee exposures to or below the PEL. In doing so, OSHA makes clear that employers must still use feasible controls to reduce exposures to the lowest possible level.

  MSHA should take this same approach, allowing the use of respirators indefinitely if feasible engineering and work practice controls are not able to reduce employee exposures to or below

[h] Job rotation is one of a number of administrative controls recognized by NIOSH.

the PEL. Refer to comments in regard to "AREA 37" below for additional information in support of allowing continued use of respiratory protection to protect mine workers.

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AREA 20

"*MSHA is proposing that each mine operator perform baseline sampling within 180 days after the rule becomes effective to assess the respirable crystalline silica exposure of each miner who is or may reasonably be expected to be exposed to respirable crystalline silica.*"

- **MSHA must not presume that all mine sites give rise to the potential for over exposure to respirable crystalline silica.**

  Proposed section 30 CFR § 60.12 (a) (1) would require the mine operator *"perform baseline sampling within the first 180 days after* [the effective date of the rule] *to assess the full shift, 8-hour TWA exposure of respirable crystalline silica for each miner who is or may reasonably be expected to be exposed to respirable crystalline silica.*"
  MSHA must not presume that all mine sites give rise to the potential for over exposure to respirable crystalline silica. If the mine operator has historic air sampling data indicating exposures for a given job function results in no exposures in excess of 0.05 mg/m^3, the mine operator should be permitted to forego baseline sampling. Use of historic data that is more than 12-month-old should be permitted if the mine operator can demonstrate that it remains representative (limiting such data to that which is no older than 12 months is not necessary). In addition, subsequent sampling should only be required if conditions of the mine change such that the potential arises for a miner in the referenced job function to become overexposed.

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AREA 21

"*MSHA is proposing a requirement that mine operators qualitatively evaluate every 6 months any changes in production, processes, engineering controls, personnel, administrative controls, or other factors, beginning 18 months after the effective date.*"

- **MSHA should not require an arbitrary semi-annual qualitative evaluation.**

  MSHA should not impose an arbitrary semi-annual qualitative evaluation to determine if in production, processes, engineering controls, personnel, administrative controls, or other factors may reasonably be expected to result in new or increased respirable crystalline silica exposures. It is more appropriate that operators evaluate whether any such changes result in new / increased exposures, **at the time such changes occur**. In fact, metal/nonmetal miner operators must already undertake **quantitative** exposure monitoring efforts in accordance with 30 CFR §56.5002/57.5002 "as frequently as necessary to determine the adequacy of control measures." Consequently, the arbitrary semi-annual qualitative evaluation is redundant, unnecessary, and thus should be omitted from the proposed regulations. Notably, OSHA has no such requirement within its respirable crystalline silica exposure control regulations. It is unclear why MSHA would deviate from the approach taken by OSHA.

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AREA 22

"*MSHA solicits comments on the assumption that most miners are exposed to at least some level of respirable crystalline silica, and on the proposed requirement that these miners should be subject to baseline sampling.*"

- **Not all miners are exposed to respirable crystalline silica.**

  It is not reasonable to assume that most miners are exposed to at least some level of respirable crystalline silica. In fact, many are not. The Administration's Mine Data Retrieval System (MDRS) makes clear that many locations whose atmosphere has been assessed by MSHA result in no detectible exposure to respirable crystalline silica.

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AREA 23

"*MSHA is proposing that mine operators would not be required to conduct periodic sampling if the baseline sampling result, together with another sampling result or objective data, as defined in proposed§ 60.2, confirms miners' exposures are below the proposed action level. MSHA seeks comments on this proposal.*"

- **MSHA should permit a mine operator to rely on <u>any</u> sample data, collected by the operator or the Secretary in the 12 months** <u>or more</u> **preceding the baseline sampling, that also shows exposures below the proposed action level.**

  The use of objective including **<u>any</u>** baseline sample (including the proposed second baseline sample) should be allowed. MSHA should permit a mine operator to rely on sample data, collected by the operator or the Secretary in the 12 months preceding the baseline sampling, that also shows exposures below the proposed action level. Furthermore, its age (i.e.: older than 12 months) should not be a de facto disqualifier of its use. Pursuant to the already-in-effect 30 § 56.5002 / § 57.5002 "Exposure monitoring" the mine operator must conduct "*dust, gas, mist, and fume surveys … as frequently as necessary to determine the adequacy of control measures.*" With this provision already in effect, reliance thereon will speed efforts to demonstrate compliance and prevent the need for additional costly industrial hygiene monitoring. MSHA should also permit the mine operator to rely on objective data confirming that a miner's exposure to respirable crystalline silica would remain below the proposed action level as well.

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AREA 24

"*MSHA is proposing that mine operators conduct periodic sampling within 3 months where the most recent sampling indicates miner exposures are at or above the proposed action level but at or below the proposed PEL and continue to sample within 3 months of the previous sampling until two consecutive*

samplings indicate that miner exposures are below the action level. MSHA solicits comments on the proposed frequency for periodic sampling, including whether the consecutive samples should be at least 7 days apart."

- **OSHA found monitoring every 3 months impractical – so must MSHA.**

  MSHA indicates on page 4907 of the preamble to its proposed silica rule that it believes that the proposed frequency for periodic sampling - repeating the sampling within 3 months- is practical for mine operators and protective of the health and safety of miners. OSHA did not find this periodicity practical, neither should MSHA. In establishing the periodicity of sampling pursuant to its respirable crystalline silica rule, OSHA concluded that the frequencies of six months for subsequent periodic monitoring for exposures in between the action level and the PEL, and three months for exposures above the PEL, provide intervals that are both practical for employers and protective for employees. This finding is supported by OSHA's experience with comparable monitoring intervals in other standards, including those for chromium (VI) (1910.1026), cadmium (29 CFR 1910.1027), methylenedianiline (29 CFR 1910.1050), methylene chloride (29 CFR 1910.1052), and formaldehyde (29 CFR 1910.1048). MSHA must adopt this periodicity as well. However, where mine operators find that a different frequency of monitoring is sufficient to accurately characterize employee exposure to respirable crystalline silica, they must be permitted to use that air monitoring data to meet their exposure assessment obligations.

- **MSHA failed to seek comments on corrective action sampling.**

  Among the 43 areas MSHA has indicated in the preamble to its proposed rule, it did not ask for comments on Section 60.12(c)-Corrective Actions Sampling. Under the proposed rule, Section 60.160.12(c)-Corrective Actions Sampling would require mine operators to take corrective actions when any sampling shows exposures above the proposed PEL. After such corrective actions, proposed § 60.12(c) would require mine operators to conduct corrective action sampling to determine whether the control measures taken under proposed § 60.13 have reduced miner exposures to respirable crystalline silica to at or below the proposed PEL. If not, the mine operator would be required to take additional or new corrective actions until subsequent corrective actions sampling indicates miner exposures are at or below the proposed PEL. Once corrective actions sampling indicates that miner exposures have been lowered to levels at or below the proposed PEL, one of two scenarios could occur. First, if corrective actions sampling taken under proposed § 60.12(c) indicate that miner exposures are at or below the proposed PEL, but at or above the proposed action level, the mine operator would be required to conduct periodic sampling as described in proposed§ 60.12(b). The periodic sampling requirements would require mine operators to continue to conduct sampling every three months until two consecutive sampling results indicate miners' exposures are below the action level. Second, if corrective actions sampling taken under proposed § 60.12(c) indicate that miner exposures are below the proposed action level, the mine operator would be required to conduct a subsequent sample within 3 months as described in proposed § 60.12(b); if those results show

miners' exposures are below the action level, the mine operator could discontinue periodic sampling. **OSHA did not find this periodicity practical**, neither should MSHA. In establishing the periodicity of sampling pursuant to its respirable crystalline silica rule, OSHA concluded that the frequencies of six months for subsequent periodic monitoring for exposures in between the action level and the PEL, and three months for exposures above the PEL, provide intervals that are both practical for employers and protective for employees. This finding is supported by OSHA's experience with comparable monitoring intervals in other standards, including those for chromium (VI) (1910.1026), cadmium (29 CFR 1910.1027), methylenedianiline (29 CFR 1910.1050), methylene chloride (29 CFR 1910.1052), and formaldehyde (29 CFR 1910.1048). MSHA must adopt this periodicity as well for its Section 60.12(c)-Corrective Actions Sampling. Where mine operators find that a different frequency of monitoring is sufficient to accurately characterize employee exposure to respirable crystalline silica, they must be permitted to use that air monitoring data to meet their exposure assessment obligations.

Certainly, if an operator conducts two consecutive samplings which are below the action level, further air sampling should no longer be required.

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AREA 25

"*MSHA is proposing that mine operators may discontinue periodic sampling when two consecutive samples indicate that miner exposures are below the proposed action level. MSHA requests comments on this proposal.*"

- **Operator sampling obligations would be perpetual if between 0.025 mg/m^3 and 0.05 mg/m^3.**

Proposed§ 60.12(b) would require periodic sampling of miners' exposures to respirable crystalline silica whenever the most recent sampling indicates that exposures are at or above the proposed action level but at or below the proposed PEL. It is conceivable that an operator might have to continue to sample despite miner exposures being below the PEL. After a defined number of samples, if the measured exposure levels remain below the proposed permissible exposure limit of 0.05 mg/m^3, but above the proposed action level of 0.025 mg/m^3, the operator should be permitted to cease sampling. If MSHA does not allow periodic sampling to cease when consistently measured between the proposed action level and the proposed PEL, the proposed action level of 0.025 mg/m^3 will become a de facto PEL, rendering the mine operator in a perpetual state of having to re-sample (at considerable cost as described above in comments on AREA 11) despite exposures having been shown to consistently be below the proposed PEL. Such a requirement will divert time and resources away from other hazard reduction / safety improvement efforts with no benefit.

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AREA 26

"*MSHA is proposing that mine operators conduct semi-annual evaluations to evaluate whether any changes in production, processes, engineering controls, personnel, administrative controls, or other factors may reasonably be expected to result in new or increased respirable crystalline silica exposures.*"

- **MSHA should not require an arbitrary semi-annual qualitative evaluation.**

  MSHA should not impose an arbitrary semi-annual qualitative evaluation to determine if in production, processes, engineering controls, personnel, administrative controls, or other factors may reasonably be expected to result in new or increased respirable crystalline silica exposures. It is more appropriate that operators evaluate whether any such changes result in new / increased exposures, **at the time such changes occur**. In fact, metal/nonmetal miner operators must already undertake **quantitative** exposure monitoring efforts in accordance with 30 CFR §56.5002/57.5002 "as frequently as necessary to determine the adequacy of control measures." Consequently, the arbitrary semi-annual qualitative evaluation is redundant, unnecessary, and thus should be omitted from the proposed regulations. Notably, OSHA has no such requirement within its respirable crystalline silica exposure control regulations. It is unclear why MSHA would deviate from the approach taken by OSHA.

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AREA 28

"MSHA is proposing the use of representative sampling. Where several miners perform the same task on the same shift and in the same work area, the mine operator may sample a representative fraction of miners to meet the proposed exposure monitoring requirements."

- **It should be at the discretion of the mine operator to determine whether sampling for one miner is representative for that of another.**

  §60.12 Exposure monitoring paragraph (f) sampling requirements (3) states that "*…Where several miners perform the same tasks on the same shift and in the same work area, the mine operator may sample a representative fraction (at least two) of these miners…*" Many job functions at a mine are performed only by a limited number of individuals (two or three individuals). Requiring that subsequent sampling be undertaken on "at least two" of these miners will result in a doubling in the amount of time and effort involved. This is un-necessary when there are only a limited number of such individual performing the task. In such instances where only a limited number of individuals perform the job function in question, MSHA should consider sampling of a single worker acceptable.

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AREA 32

"*MSHA is proposing to require medical surveillance for MNM miners…. [it] is not currently required for MNM miners… MSHA's proposal would require MNM mine operators to provide each miner new to the mining industry with an initial medical examination and a follow-up examination no later than 3 years after the initial examination, at no cost to the miner. It would also require MNM mine operators to*

provide examinations for all miners at least every 5 years…. Is there an alternative strategy or schedule, such as voluntary initial or follow-up examinations, tying the medical surveillance requirement to miners reasonably expected to be exposed to any level of silica or to the action level that would be more appropriate for new MNM miners? Should the rule make each 5-year examination mandatory?..."

- **Medical surveillance strategies or schedules must align with those of OSHA.**

Requiring medical surveillance to miners reasonably expected to be exposed to **any level** of silica is not necessary. In establishing the periodicity of medical exams in association with it's respirable crystalline silica standard, OSHA determined that employers must make an initial or periodic medical examination available to employees who meet the exposure trigger. The triggers for medical surveillance are:

1. Exposures above the PEL for 30 or more days a year from June 23, 2018 through June 22, 2020;
2. Exposures at or above the action level for 30 or more days a year beginning June 23, 2020.

OSHA published its final rule on March 25, 2016. With this date of finalization, and these subsequent declared dates expressed as elapsed times, the triggers for medical surveillance would be as follows in MSHA's rule:

1. Exposures above the PEL for 30 or more days a year from "***27 months after publication of MSHA's final rule***" through "***51 months after publication of MSHA's final rule.***"
2. Exposures at or above the action level for 30 or more days a year beginning "**51 months after publication of MSHA's final rule.**"

As such, in establishing the periodicity of medical exams in association with it's respirable crystalline silica standard, MSHA too should make the determination that employers must make an initial or periodic medical examination available to employees who meet the exposure trigger. The triggers for medical surveillance should be:

1. Exposures above the PEL for 30 or more days a year from "27 months after publication of MSHA's final rule" through "51 months after publication of MSHA's final rule."
2. Exposures at or above the action level for 30 or more days a year beginning "51 months after publication of MSHA's final rule."

In establishing its on-going frequency of medical examinations, in its respirable crystalline silica rule, OSHA requires that employers offer medical examinations:
Within 30 days of initial assignment (the day the employee starts working in a job/task in which he or she will be exposed at the trigger point for 30 or more days per year), unless the employee has had an examination that meets the requirements of the silica standard within the last three years.
Every three years from the employee's last examination that met the requirements of the silica standard, or more frequently if recommended by the PLHCP, if the employee will continue to perform tasks that result in exposures at the trigger for 30 or more days per year
An added benefit of this approach would be to reduce the burden on the already extremely limited number of qualified occupational health physicians available in the U.S. Section 60.15 Medical surveillance for metal and nonmetal miners (a) Medical surveillance (2) states that "*Medical examinations shall include (iii) A chest X-ray …… classified according to the*

International Labour Office (ILO) International Classification of Radiographs of Pneumoconioses by a NIOSH-certified B Reader." According to NIOSH, there are currently only 189 NIOSH certified B readers.[7] According to the National Institute of Occupational Safety and Health (NIOSH), there were a total of 301,240 mine workers in the U.S. as categorized by sector in the following table.[8]

Sector	Number of Employees
Noncoal contractor	69,305
Stone operator	68,793
Coal operator	41,124
Metal operator	40,638
Sand & gravel operator	37,757
Nonmetal operator	23,408
Coal contractor	20,215
Total	**301,240**

Of those 301,240 mine workers, 64,046 were employed in the metal/nonmetal sectors. If each of these individuals is to receive a B-read, each NIOSH-certified B-reader would have to read more than 330 x-rays per year. This would be a significant increase in the number of B-reads completed by an ever-shrinking and already over-burden group of health scientists. MSHA should adopt the same frequency schedule as OSHA.

- **MSHA has underestimated the cost of medical surveillance.**

Vanderbilt Minerals has a medical surveillance program, through which each of its mine site employees undergoes a physical annually and receives a chest x-ray & pulmonary function test every-other year. The test regime is similar to that which is currently in effect for OSHA-subject facilities and thus presumably to that which would be proposed pursuant to the proposed MSHA silica rule. The direct cost for the administration of this program at one of its sites (which is typical of them all) is approximately $9,400. In addition, each employee undergoing the tests will spend approximately 3 hours of time. The combined cost is approximately $13,400 (per site). This is higher than the cost estimated by MSHA. MSHA should re-evaluate the economic impacts associated with the proposed medical surveillance program requirements.

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AREA 33

"*MSHA's proposed medical surveillance requirements for MNM miners do not include some requirements that are in MSHA's existing medical surveillance requirements for coal mine operators in 30 CFR 72.100. For example, § 72.100 requires coal mine operators to use NIOSH-approved facilities for medical examinations. Should MNM operators be required to use NIOSH-approved facilities for medical examinations? Coal mine operators also are required to submit for approval to NIOSH a plan for providing miners with the examinations specified… Should the plan requirements be extended to MNM operators?*"

- **MSHA should not require metal/non-metal mine operators to utilize NIOSH-approved facilities.**

  The list of NIOSH-approved facilities for medical examinations identifies only 151 facilities credentialed to collect chest x-Rays. These facilities exist only in twenty-three states (Alabama, Arizona, Colorado, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Minnesota, Mississippi, Montana, North Dakota, New Mexico, Ohio, Oklahoma, Pennsylvania, Tennessee, Texas, Utah, Virginia, West Virginia, and Wyoming). No such facilities have been identified by NIOSH in the remaining 27 states.[9] There are no NIOSH-approved health facilities in the states in which Vanderbilt Minerals operates mining operations (North Carolina, South Carolina, New York, Nevada, and California). Refer to ATTACHMENT A for a download of the list of NIOSH-approved health facilities.

- **Metal / non-metal mine operators should not be required to submit for approval to NIOSH a plan for providing miners with the examinations specified.**

  While NIOSH may have staff with the technical expertise to evaluate information generated from medical surveillance performed on the mining community, the Institute is resource constrained. Prior to imposing a requirement that mine operators submit the results of medical surveillance efforts conducted on its miners, MSHA must confer with NIOSH and ensure there is sufficient funding for NIOSH's staff to do something with the data upon receipt. Failure to ensure NIOSH has adequate funding may very well result in an un-funded mandate whereby NIOSH receives data for which it lacks the financial resources to use.

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AREA 34

"*MSHA's proposed medical surveillance requirements for MNM miners would require operators of MNM mines to provide miners with periodic medical examinations performed by PLHCP or specialists, including a history and physical examination focused on the respiratory system, a chest X-ray, and a spirometry test. MSHA seeks comment on whether use of any new diagnostic technology (e.g., high-resolution computed tomography) for the purposes of medical surveillance should be used.* "

- **The "chest x-ray" and pulmonary function test should remain preferred means of assessing pulmonary status.**
  Due to their ease of administration and affordability, the "chest x-ray" should remain preferred imagery used in assessing the impact of exposure to respirable crystalline silica. Coupled with a properly administered pulmonary function test by a NIOSH-certified technician they remain a highly effective means of maintaining an awareness of a given mine workers pulmonary status.

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AREA 35

"*MSHA's proposed medical surveillance requirements would require that the MNM mine operator provide a mandatory follow-up examination to the miner no later than 3 years after the miner's initial medical examination. If a miner's 3-year follow up examination shows evidence of a respirable crystalline silica-related disease or decreased lung function, the operator would be required to provide the miner with another mandatory follow-up examination with a specialist within 2 years…." For examinations that show evidence of disease or decreased lung function, MSHA seeks comment on how, and to whom, test results should be communicated.*"

- **Decreased lung function must not automatically be assigned to the mine working environment.**

  §60.15 Medical surveillance for metal and nonmetal miners (c) Mandatory medical examinations (3) requires "*A follow-up medical examination … if the spirometry examination indicates evidence of decreased lung function.*"
  Compelling the mine operator to take action based on "decreased lung function" alone is in-appropriate. Decreased lung-function in any given individuals can be a result of a wide variety of factors, including life-style choices such as the use of tobacco (via smoking and/or "electronic cigarettes" – a.k.a. "vaping"), exposure to other environmental contaminants (ambient ozone, inhaled ultra-fine particulate matter due to one's proximity to public roadways / transit, etc…). The American Lung Association states that COPD (often the result of smoking tobacco), asthma (caused by a vast number of agents such as pollen, dander, mold, stress and genetics) and pulmonary fibrosis (at times caused by medication and genetics) can all be a cause for decreased lung function.[10] To presume an observed decrease is a result of one's work at a mine site is thus not appropriate. This provision must be removed from the proposed regulation, else the mine operator may be required to incur additional expense, and the miner experience alarm over fear of silicosis when the decreased lung function is the result of any of a number of the other aforementioned causes.
- **HIPPA already imposes record management obligations on the mine operator.**

  Any medical records collected in association with the treatment of an individual are required by the Health Insurance Portability and Accountability Act (as codified at 45 CFR § 164.524) to be retained and managed under strict criteria . An imposition of such a requirement by MSHA is duplicative and unnecessary.

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AREA 37

"*MSHA requests comments concerning the temporary, non-routine use of respirators and whether there are other instances or occupations in which the Agency should allow the use of respirators as a supplemental control. Please discuss any impacts on particular mines and mining conditions and the cost of air-purifying respirators, if applicable. MSHA also solicits comments on the proposed requirement that*

affected miners wear respiratory protection to maintain protection during temporary and non-routine use of respirators."

- **MSHA should take the same approach as OSHA regarding use of respirators – allow them to be used indefinitely.**

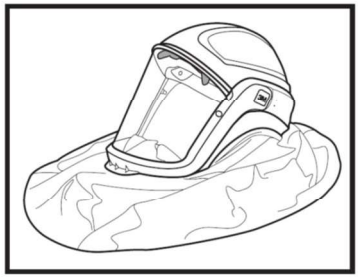
  In its respirable crystalline silica standard, OSHA allows the use of respiratory protection in conjunction with engineering and work practice controls if feasible engineering and work practice controls are not able to reduce employee exposures to or below the PEL. In doing so, OSHA makes clear that employers must still use feasible controls to reduce exposures to the lowest possible level.

  MSHA should take this same approach, allowing the use of respirators indefinitely if feasible engineering and work practice controls are not able to reduce employee exposures to or below the PEL.

  Such an approach, and the resulting reduction in exposure levels would benefit mine workers by reducing the required protection factor of the respirator, and thus increasing the choices of respirators that can be used. As described by OSHA in its Small Entity Compliance Guide, if feasible engineering controls reduce exposures from 50 times to less than 10 times the PEL, employers could provide approved half-mask respirators with an APF of 10 that may be lighter and easier to use compared to full-facepiece respirators.[11]

- **Loose-fitting powered air purifying respirators reduce exposures and are preferred by users.**

  Loose-fitting powered air purifying respirators, though not intrinsically safe / permissible for use in gassy mines, can be used in many aboveground mines where an intrinsically safe respirator is not required. These units allow the user to enjoy a significant reduction in the concentration of airborne particulate matter to which they are exposed without the limitations associated with a tight-fitting respirator (low comfort & medical clearance requirements). For example, a 3M TR-300 equipped with a M-400 series respiratory helmet offers an assigned protection factor of up to 1000. In addition, because it is not tight-fitting, the demand on the pulmonary system of the use is minimal, and thus does not require a physician's clearance, nor the user to be clean shaven. Moreover, recent studies have indicated that individuals prefer the use of such respiratory protection (to tight-fitting and filtering face piece respirators).[12] In these studies, "only a minority of users found the PAPR uncomfortable and the majority preferred to use a PAPR rather than an N-95 respirator."[13]



M-400 Series Respiratory Helmets

  Due to the relatively high assigned protection factor (up to 1,000), and absence of a need for medical clearance, this type of unit should be permitted in settings where the mine operator can

demonstrate that it is technologically infeasible to reduce ambient airborne respirable crystalline silica concentrations below 0.05 mg/m^3.

- **Loose-fitting powered air purifying respirators reduce compliance cost <u>dramatically.</u>**

The 3M® TR-300® equipped with a M-400® is an in-use powered air purifying respiratory (PAPR). The cost of a 3M® TR-300® equipped with a M-400® series respiratory helmet (which offers an assigned protection factor of up to 1000) is $2,200. The annual operating costs for such a unit is approximately $270. As indicated from the following data excerpted from Table III-1 on page 44860 of the preamble to MSHA's proposed silica rule, a typical non-metal mine site may employ in the range of 5 to 29 individuals.

Table III-1: Number of Mines and Miners by Commodity in			Miners Per Mine	PAPR COST	
MNM Mines	Number of Mines	Number of Miners		PAPR STARTUP COST†	PAPR ANNUAL MAINTENANCE COST††
Nonmetal	549	15,736	29	$63,059	$7,739
Stone	2,320	33,031	14	$31,323	$3,844
Crushed	1,866	23,691	13	$27,932	$3,428
Sand and Gravel	6,232	33,296	5	$11,754	$1,443
† $2,200 per PAPR x number of miners per mine †† $270 per PAPR x number of miners per mine					

Even if one assumes that all of these mine workers were to wear such a unit (which is highly unlikely), the total initial / "start up" cost would range from be $11,754 to $63,059, with an annual operating cost ranging from $1,443 to $7,739. As indicated above (see Table 1 under Area 6), it is estimated that one of the Vanderbilt Minerals locations will incur in excess of $7,000,000 in cost to fully retrofit its facility with the degree of engineering controls (with no guarantee of success). The cost saving is dramatic (1/100th of the cost), particularly in consideration of the fact that in studies on user comfort and preference, "only a minority of users [find] the PAPR uncomfortable and the majority preferred to use a PAPR rather than an N-95 respirator."[14]

MSHA is strongly encouraged to re-consider the costs and benefits of mandating only engineering controls with these facts in mind. With their assigned protection factor of 1,000 and preference by users, the allowance of the use of a PAPR can play an important role in protecting in an economically feasible way.

- **MSHA must defer to NIOSH, regarding appropriate filter efficiencies.**

§60.14 Respiratory protection (c) respiratory protection requirements (1) (i) states that "*…Particulate protection classified as 100 series…"* NIOSH has a long-standing and well-established criteria that 95 series particulate protection classification is adequate. MSHA must defer to NIOSH as the certifying authority for respiratory protection and require 95 series particulate protection, not 100 series.

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AREA 38

"*MSHA is proposing to incorporate by reference ASTM F3387-19, published in 2019. Whenever respiratory protective equipment is needed, mine operators would be required to follow practices for program administration, standard operating procedures, medical evaluations, respirator selection, training, fit testing, and maintenance, inspection, and storage in accordance with the requirements of ASTM F3387-19. Beyond these elements, MSHA is proposing to provide operators the flexibility to select the elements in ASTM F3387-19 that are applicable to their practices of respirator use at their mines. Should mine operators have the flexibility to choose the ASTM F3387-19 elements that are appropriate for their mine-specific hazards because the need for respirators may vary due to the variability of mining processes, activities, airborne hazards, and commodities mined? What, specifically, do you think should factor into the determination of what is applicable? MSHA seeks comments on its proposed approach and the impact it would have on mine operators and on miners' life and health.*"

- **Incorporation of ASTM F3387-19 ad nauseam by reference would be done in the absence of Congressional authority.**

  There are a number of clauses and sections within ASTM F3387-19 that, if mandated via incorporation by reference into an MSHA respirable crystalline silica standard, would be done in the absence of Congress' intent, pursuant to the MSHAct.[i] While there are many instances within ASTM F3387-19 where the term "shall" is used to convey requirements already in effect via the various MSHA regulations, there are certain examples where this is not the case. Certain examples are as follows:

  - Definition 3.1.44 states "*occupational exposure limit, OEL, n-maximum allowable concentration of a contaminant in the air to which an individual may be exposed over a period of time*." For metal/nonmetal mines, pursuant to the MSHAct, MSHA has promulgated 30 CFR § 56.5001 Exposure limits for airborne contaminants (for surface metal and nonmetal mines) and 30 CFR § 57.5001 Exposure limits for airborne contaminants (for underground metal and nonmetal mines). Incorporation of definition 3.1.44 is overly broad and beyond Congress' intent, pursuant to the MSHAct. If incorporated by reference this definition may be construed to mean **all** occupational exposure limits, whether mandated by federal statute or by a non-regulatory entity (such as the case with NIOSH recommended exposure limits, AIHA workplace exposure environmental exposure levels, or ACGIH'2023 threshold limit values) would compel the mine operator to adhere to ASMT F3387-19.

[i] "Shall" is defined in clause 3.1.58 as "denoting a mandatory requirement." ASTM F3387-19 was authored by proceedings and process outside of the Administrative Procedures Act of 1946, USC §551 et seq.

Current MSHA regulations establish **enforceable** OELs in accordance with 30 CFR § 56.5001 (a) and 30 CFR § 57.5001 (a) for asbestos, and "*the American Conference of Governmental Industrial Hygienists, as set forth and explained in the 1973 edition of the Conference's publication, entitled ''TLV's Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1973.*'' In accordance with its July 13, 2023 notice of proposed rulemaking, MSHA is seeking to amend **its** OEL for respirable crystalline silica alone, not the vast number of other substances for which any entity (such as AIHA, NIOSH, etc…) has established such limits. If MSHA wishes to amend one of its existing regulatorily-enforceable occupational exposure limits, or add a regulatorily-enforceable occupational exposure limit for a currently un-regulated substance, if must do so by means of a proposed rulemaking in accordance with the Administrative Procedures Act of 1946, USC §551 et seq. Definition 3.1.44 must be modified as follows:

- "*occupational exposure limit, OEL, n-maximum allowable concentration of a contaminant* ***for which MSHA has promulgated a regulatorily-enforceable occupational exposure limit*** *in the air to which an individual may be exposed over a period of time.*"

- Section 3.3 states "Where regulations or guidelines exist that are specifically applicable to some bioaerosols, they shall be considered during." It is beyond MSHA's scope to enforce guidelines. As such this clause must be modified as follows: "Where regulations ~~**or guidelines**~~ exist that are specifically applicable to some bioaerosols, they shall be considered during the respirator selection process. These ~~**guidelines**~~ may come from agencies such as Centers for Disease Control and Prevention (CDC) or OSHA."
- Section 4.2 "Users of this practice shall be aware that regulatory agencies may have requirements that are different from this practice." This section should be modified to state, "*Users of this practice* ***should*** ~~***shall***~~ *be aware that regulatory agencies may have requirements that are different from this practice.*"
- Section 5.5.3 states "*A physician or other licensed healthcare professional (PLHCP) shall determine whether or not an employee has any medical conditions that would preclude the use of respirators, limitations on use, or other restrictions.*" This section should be modified to state "*5.5.3 Medical Evaluation- A physician or other licensed healthcare professional (PLHCP)* ***should*** ~~***shall***~~ *determine whether or not an employee has any medical conditions that would preclude the use of respirators, limitations on use, or other restrictions.*"
- Section 5.5.3.1 states "*The program administrator shall advise the PLHCP of the following conditions to aid in determining the medical evaluation required:*" This section should be modified to state "*The program administrator* ***should*** ~~***shall***~~ *advise the PLHCP of the following conditions to aid in determining the medical evaluation required:*"
- Section 5.5.3.3 refers the user to ANSI Z88.6 for further information on medical evaluations. This must not be construed to mean that ANSI Z88.6 is incorporated by reference into MSHA regulations regarding respiratory protection programs.
- Section 6.3.1.3 states that "The administrator… shall ensure… Selection of the appropriate type or class of respirator that will provide adequate protection for **each** [emphasis added] contaminant, present or anticipated;". Compelling a mine operator to select a respirator for

each contaminant present is beyond the statutory authority of MSHA pursuant to the MSHAct. There is the potential for a vast number of contaminants to be present in all atmospheres. Not only are many without an MSHA OEL, their presence may not constitute a hazard, particularly if present ad concentrations below their toxic concentration. This clause thus must be omitted. An alternative clause might be as follows:

- "The administrator… shall ensure… Selection of the appropriate type or class of respirator that will provide adequate protection for **regulated** [emphasis added] contaminant, present or anticipated **at a concentration in excess of that contaminants MSHA-enforceable OEL** [emphasis added];"

- Section 6.3.2 Respirator Program Audit states "*The most comprehensive respirator program is of little value if it is not maintained and implemented as designed and corrected when deficiencies are identified. Therefore, in addition to ongoing surveillance, the program administrator shall annually audit the respirator program to ensure that the program procedures reflect the requirements of current applicable regulations and industry-accepted standards and the program as implemented reflects the written procedures.*"

  Compelling a mine operator to select and annually audit the respiratory protection program to ensure that the program procedures reflect the requirements of current **industry-accepted standards** may be appropriate, it is beyond the statutory authority of MSHA pursuant to the MSHAct. This clause thus must be omitted. An alternative clause might be as follows:
  "*The most comprehensive respirator program is of little value if it is not maintained and implemented as designed and corrected when deficiencies are identified. Therefore, in addition to ongoing surveillance, the program administrator* ***should*** ~~***shall***~~ *annually audit the respirator program to ensure that the program procedures reflect the requirements of current applicable regulations* ~~***and industry-accepted standards***~~ *and the program as implemented reflects the written procedures.*"

- Section 6.3.2.1 states that "*To aid objectivity, an additional audit shall be conducted by a knowledgeable person not directly associated with the program, rather than the respirator program administrator. The frequency of this outside audit should be determined by the size and complexity of the respirator program and previous audit findings. An audit checklist, or equivalent, shall be prepared and updated as necessary*." Compelling a mine operator to undertake a third-party audit will result in a cost which has not been contemplated within MSHA's economic impact assessment. Moreover, it is beyond the statutory authority of MSHA pursuant to the MSHAct. This clause thus must be omitted. Similarly, supporting clauses 6.3.2.2 and 6.3.2.3 must also be omitted. Also, the following supporting clause in Section 7.1 should be omitted "The procedures shall be reviewed in conjunction with the annual respirator program audit and revised by the program administrator as necessary."

- Section 7.3.2 of ASTM F3387-19 states that "*Personnel Assigned to Work Areas Where Escape Respirators Are Required – Personnel assigned to areas where respirators may be required for escape shall be enrolled in the complete respirator program, including medical evaluations and training in the use and limitations of escape respirators.*" While it is

appropriate to train such individuals on the proper use of an escape respirator, due to the very brief and rare instance when such a respirator is needed, requiring the miner to undergo a complete medical evaluation is unnecessary, and redundant. For example, 30 CFR Part 49 – Mine Rescue Teams, sets for requirements for the proper use of respirators in escape situations. Moreover, the intent of the subject revisions to MSHA's regulations regarding respirable crystalline silica are not intended to address emergency situations where escape from conditions which are immediately life-threatening (and requiring an escape respirator). Consequently, this section of ASTM F3387-19 should be omitted.

- Clause (5) of Section 8.2.2.1 states that "…*The nature of the inhalation hazard shall be established by determining … Whether there is an occupational exposure limit for each contaminant.*" Incorporation of this clause may be construed to mean **all** occupational exposure limits, whether mandated by federal statute or by a non-regulatory entity (such as the case with NIOSH recommended exposure limits, AIHA workplace exposure environmental exposure levels, or ACGIH threshold limit values) would compel the mine operator to complete a hazard assessment. Compelling a mine operator to complete a hazard assessment on a substance with recommended / advisory limit such as an AIHA WEEL, or NIOSH recommended exposure limit is beyond the statutory authority of MSHA pursuant to the MSHAct. This clause thus must be omitted.
- Section 8.2.2.3 requires one to "*Determine the physical state and chemical properties of **all** [emphasis added] airborne contaminant*" Requiring such for **all** airborne contaminants, whether mandated by federal statute (the MSHAct) or otherwise (i.e.: for substances not identified pursuant to the MSHAct) is beyond the statutory authority of MSHA. This clause thus must be omitted.
- Section 8.2.2.9 requires one to "*Determine whether there is an occupational exposure limit for each contaminant.*" Incorporation of this clause may be constructed to mean **all** occupational exposure limits, whether mandated by federal statute or by a non-regulatory entity (such as the case with NIOSH recommended exposure limits, AIHA workplace exposure environmental exposure levels, or ACGIH threshold limit values) would compel the mine operator to complete a hazard assessment. Compelling a mine operator to complete a hazard assessment on a substance with recommended / advisory limit such as a NIOSH recommended exposure limit is beyond the statutory authority of MSHA pursuant to the MSHAct. This clause thus must be omitted.
- Section 8.2.2.11 states "*Determine if there is an applicable OSHA substance-specific standard for the contaminant(s). Determine if there is an applicable substance-specific standard by reviewing applicable standards, for example, OSHA, MSHA. If so, there may be specific respirators required that will influence the selection process.*" If incorporated by reference, this clause would be a de facto incorporation of OSHA regulations, which are not under the jurisdiction of MSHA. This clause should instead state "*Determine if there is an applicable **MSHA** ~~**OSHA**~~ substance-specific standard for the contaminant(s). Determine if there is an applicable substance-specific standard by reviewing applicable standards, for example, ~~**OSHA,**~~ MSHA. If so, there may be specific respirators required that will influence the selection process.*"

- Section 8.3.2.3 states "If an OSHA substance-specific standard or regulation exists for the contaminant, those guidelines or requirements for respirator selection shall be followed." If incorporated by reference, this clause would be a de facto incorporation of OSHA regulations, which are not under the jurisdiction of MSHA. This clause should instead state "*If an **MSHA** ~~**OSHA**~~ substance-specific standard or regulation exists for the contaminant, those guidelines or requirements for respirator selection shall be followed.*"
- Section 8.3.2.5 states "*If no exposure limit is available or can be determined, the atmosphere shall be considered IDLH…*" There are a vast number of substances for which no exposure limit exists. Application of logic by an industrial hygienist, making use of structural-activity relationships can often lead to the conclusion that a substance is benign. Usurping this ability would lead to the treatment of certain benign substances as IDLH – a costly approach diverting limited resources away from activities vital to the maintenance of worker health. This clause thus must be eliminated.
- Section 8.3.2.6 states "If the contaminant concentration is unknown, the atmosphere shall be considered IDLH." This is not a rational approach to the protection of workers. Contaminant is defined at clause 3.1.20 as "…potentially harmful, irritating, or nuisance airborne material." Virtually any material, of present at a high enough concentration, can be potentially harmful, irritating or a nuisance." Compelling the mine operator to treat the vast number of materials present in unknown concentrations as IDLH imposes a large, yet unquantifiable expense. For example, ozone is always present in the mine atmosphere at unknown concentrations due to human activities unassociated with the mine operators' specific actions. Is the mine operator to assume the concentration is IDLJH? This single example illustrates the lack of practical feasibility (and/or necessity) of this clause. Moreover, this clause imposes a requirement beyond the statutory authority of MSHA pursuant to the MSHAct. This clause thus must be omitted. An alternative clause might be as follows:
  - "If the contaminant concentration **for which there is an MSHA-enforceable OEL** is unknown, **and for which an industrial hygienists is unable to estimate,** the atmosphere shall be considered IDLH."
- Section 8.3.2.14 states "If the material can be absorbed through the skin or is a skin or eye i1ritant, other appropriate PPE, which is compatible with the respirator, shall be used." The work "material" is un-defined in ASTM F3387-19. This clause instead should use the defined term "contaminant" and clarify that it is applicable only to substances for which MSHA has an established enforceable OEL. An alternative to this clause might read as follows:
  - "If the **contaminant** ~~**material**~~ **for which there is an MSHA-enforceable OEL** can be absorbed through the skin or is a skin or eye irritant, other appropriate PPE, which is compatible with the respirator, shall be used."
- Section 8.3.3 states "Where regulations or guidelines exist that are specifically applicable to some bioaerosols, they shall be considered during." It is beyond MSHA's scope to enforce guidelines. As such this clause must be modified as follows:
  - "Where regulations ~~**or guidelines**~~ exist that are specifically applicable to some bioaerosols, they shall be considered during the respirator selection process. These

~~**guidelines**~~ may come from agencies such as Centers for Disease Control and Prevention (CDC) or OSHA."

- Section 10.1 states "*Personnel with facial hair … between the face and face seal area of the respirator shall not be fit tested.*" However, "facial hair" is not defined. Moreover, in its May 9, 2016 letter of interpretation to Mr. Sands of the Altus Airforce base, OSHA explains "*Facial hair is allowed as long as it does not protrude under the respirator seal, or extend far enough to interfere with the device's valve function. Short mustaches, sideburns, and small goatees that are neatly trimmed so that no hair compromises the seal of the respirator usually do not present a hazard and, therefore, do not violate paragraph 1910.134(g)(1)(i).*"[15] Imposing a requirement that there be no facial has is inconsistent with OSHA policy, which in the context of 29 CFR 1910.134 (the OSHA respiratory standard), informs MSHA's approach to the administration of its requirements regarding respiratory protection. Consequently, Section 10.1 should not be adopted is written in ASTM F3387-19. The following alternative language might instead be adopted:
  - "*10.1 A qualitative or quantitative respirator fit test shall be used to determine the ability of the individual respirator wearer to obtain a satisfactory fit with a tight-fitting respirator. Personnel with facial hair or facial jewelry between the face and face seal area of the respirator* ***may be fit tested as long as it does not protrude under the respirator seal, or extend far enough to interfere with the device's valve function*** ~~***shall not be fit tested***~~ [emphasis added]. *If a fit factor greater than 100 is required, a quantitative fit test (QNFT) method shall be used. The results of fit tests, among other criteria, shall be used to select specific models, sizes, and styles of respirators for use by individual respirator wearers.*"
- Section 10.6.3 states "Fit testing of tight-fitting respirators shall be done in accordance with ANSI Z88.10." The concerns identified above with the incorporation by reference of ASTM F3387-19 are the same as with ANSI Z88.10, which has been incorporated by reference into ASTM F3387 herein. This clause should be modified to state "Fit testing of tight-fitting respirators **should** ~~**shall**~~ be done in accordance with ANSI Z88.10."
- Section 10.7.1 states "*Respirator fit test records shall follow the guidance in ANSI Z88.10.* " The concerns identified above with the incorporation by reference of ASTM F3387-19 are the same as with ANSI Z88.10, which has been incorporated by reference into ASTM F3387 herein. This clause should be modified to state "*Respirator fit test records* ***should*** ~~***shall***~~ *follow the guidance in ANSI Z88.10.*"
- Annex A1 contains 31 instances as highlighted in yellow in ATTACHMENT B hereto in which the word shall is used. "Shall" is defined in clause 3.1.58 as "*denoting a mandatory requirement.*" In all such instances, the term "shall" should be replaced with "should."[j]

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[j] "Shall" is defined in clause 3.1.58 as "denoting a mandatory requirement." ASTM F3387-19 was authored by proceedings and process outside of the Administrative Procedures Act of 1946, USC §551 et seq.

OTHER CONSDIERATIONS

- **MSHA Must More Fully Contemplate Surface Characteristics of Quartz-Containing Smectite / Bentonite / Montmorillonite**

  On page 44902 under item 2 of VII. Section-by-Section Analysis, it states "*Respirable crystalline silica" would mean quartz, cristobalite, and/or tridymite contained in airborne particles that are determined to be respirable by a sampling device designed to meet the characteristics for respirable-particle size- selective samplers that conform to the International Organization for Standardization (ISO) 7708:1995: Air Quality-Particle Size Fraction Definitions for Health-Related Sampling.*" However, on page 44871, it states "*Physical characteristics relevant to the toxicity of respirable crystalline silica primarily relate to its size and* ***surface characteristics*** [emphasis added]. *Researchers believe that the size and* ***surface characteristics*** [emphasis added] *play important roles in how respirable crystalline silica causes tissue damage. Any factor that influences or modifies these physical characteristics may alter the toxicity of respirable crystalline silica by affecting the mechanistic processes (OSHA, 2013b; ATSDR, 2019).*" Amorphous forms of silica such as opal are excluded from coverage within the proposed rule. This is due to the fact that such forms of silica do not present the same degree of toxicity as respirable crystalline silica (likely as a result of surface characteristics of these substances). It is important to recognize that certain clay minerals, such as smectite / montmorillonite / bentonite, which may contain silica, similarly fail to possess the same degree of toxicity as respirable crystalline silica. In 1996, Odom reported on his study of "*the physical and chemical nature of silica minerals found as natural impurities in bentonites and montmorillonitic Fuller's earth clay products as well as in <10 micron dust from eight processing plants.*"[16] The results showed that the silica minerals present in these clay materials were encapsulated or encased in clay. No "free" silica minerals were found in dust samples collected for MSHA crystalline silica analysis. "*Silica minerals, such as quartz, were observed by scanning electron microscope and energy dispersive spectroscopy only after removing the clay coatings by vigorous washing. After washing it all crystalline quartz grains displayed diagenetic overgrowths – likely opaline silica. No cases of silicosis had been observed at the sites from which the samples were collected.*" In 2008, two peer-reviewed publications were published in Inhalation Toxicology, discussing in vivo testing, which illustrated this fact. The authors of the first study concluded that "*there are significant differences in the characteristics and the severity of the biological responses from quartz with occluded surfaces that had been isolated from sodium bentonite and those of crushed quartz known to cause substantial toxicological effects.*" [17, 18] In 2007, researchers from the Colorado School of Mines and the University of Manchester (U.K), analyzed a large number of minerals, including bentonite, and reported that the entire grain surface of the quartz granules present in the assemblages were coated with chemically-resistant montmorillonite.[19] They asserted that this coating may limit the potential for the quartz to present toxicity beyond that expected of a nuisance dust.

  In 2018, a workshop was held in Torino, Italy to assess silica toxicity with a focus on surface characteristics, and particle toxicology, the results of which were reported on in 2019.[20] The workshop concluded that the toxicological properties of silica were variable and dependent on the physical and chemical features of the particles. The capacity to generate free radicals at the

surface of a particle, such as quartz is now recognized as relevant to the toxicity of silica and other particles (the surface of particles such as silica plays an important role in their toxicity). MSHA is strongly encouraged to contemplate the bibliographical citations from Pavan's 2019 summary of the above-referenced 2018 Torino, Italy workshop (See ATTACHMENT C). Pavan, et al., have continued to advance understanding into silica's mode of action and how silicates impart their mode toxicity. In their work reported on in 2020, they coin a new term – "nearly free silanols" or NFS's. They showed that the localized density of silanols is a key determinate in the degree of a silicate's toxicity.[21]

In their work reported on in 2023, they demonstrated that differences in "crystal packing" of the crystalline silica polymorphs gives rise to differing silanol configurations on particle surfaces.[22] Ultimately, they showed that by treating silicate surfaces with heat, they could alter their impact on cell membrane activity. They concluded that "*Overall, these findings contribute to the molecular understanding of the toxicity mechanism of silica-based minerals, and might be helpful for predicting and controlling the hazard associated to quartz and cristobalite, which are included in the IARC classification of human carcinogens.*"

Occluded quartz contained within smectite / bentonite / montmorillonite is clearly different from freshly fractured quartz – which has been shown to cause silicosis and other serious adverse health outcomes in the over-exposed. The occluded quartz has a surface connected at the molecular level to these clays that is inseparable. Chemically, the surface is not crystalline silica dioxide but aluminosilicate. It is demonstrably less toxic than crushed respirable crystalline silica. There is precedent supporting the treatment of molecularly different silica (MSHA currently regulates other silica species such as opal differently than quartz). Based upon this precedent and the demonstrably different toxicological properties of smectite / bentonite / montmorillonite, they should be regulated similarly to amorphous silica rather than crystalline silica.

- **Automatic Citations Of Mine Operators Based on Operator Exposure Monitoring Is Inappropriate**

  During the August 21, 2023 public hearing on the proposed respirable crystalline silica rule, MSHA officials stated that "…if an operator's sample is above the proposed PEL, the mine operator would be required to .. make the record of the overexposure…. And if the miners' exposures exceed the PEL, MSHA would issue a citation…"

  MSHA's proposed rule states neither that the mine operator would be required to notify MSHA of an exceedance, nor that MSHA would automatically issue a citation based on an operator sample. The text of the rule is clear that "when an operator's sample is over the PEL, that operator [shall] send the record of that overexposure to the MSHA district manager. This exposure data will allow MSHA to immediately take appropriate enforcement action." It is our understanding that MSHA's current enforcement approach in the metal/nonmetal sector is to issue a citation only following a subsequent (second or third) sample that shows an exceedance. Furthermore, immediate enforcement action before providing "any necessary compliance assistance to operators" immediately places MSHA in an adversarial position, eroding past practice on the part of MSHA to assist operators with achieving compliance through Mine Safety

& Health Enforcement, Technical Support, or Educational Field and Small Mine Services before dogmatically issuing a citation where the operator has demonstrated a good-faith effort. MSHA is encouraged to re-consider the potential adversarial position contemplated by this philosophy and consider its significance on the collaborative relationship built over the decades between mine operators and the Administration.

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IN CLOSING

Vanderbilt Minerals remains committed to the health and safety of its workforce and is hopeful that the Administration will seriously consider these comments as it evaluates how best to ensure the United States continues to enjoy prosperity in mining that is not at the expense of the mining community. Silicosis and other diseases caused by over-exposure respirable crystalline silica can and must be prevented, and Vanderbilt Minerals will continue to do its part to ensure such is the case.

Thank you for considering these comments as you undertake this rule making.

Sincerely,

Jamie Knowlden

President
Vanderbilt Minerals, LLC

Matt Stewart, CIH

Director, Health, Safety and Environmental Risk
R.T. Vanderbilt Holding Company, Inc.
On Behalf of Vanderbilt Minerals, LLC

[1] The Mine Safety and Health Administration. (2023). MSHA at A glance. Retrieved from https://www.msha.gov/msha-glance
[2] GilAir plus personal air sampling pump (1 - 5,100 cc/min). (2023). Retrieved from https://www.sensidyne.com/air-sampling-equipment/gilian-air-sampling-pumps/gilair-plus/?gclid=EAIaIQobChMIqbOw77OWgQMVhfrICh13nw_mEAAYASAAEgJK_fD_BwE
[3] American College of Occupational and Environmental Medicine. (2023). Advocacy. Retrieved from https://acoem.org/Advocacy/Agenda-for-Change
[4] Association of American Medical Colleges. (2023). Number of people per active physician by specialty, 2021. Retrieved from https://www.aamc.org/data-reports/workforce/data/number-people-active-physician-specialty-2021
[5] Ondrula, C. (2023). ABPM program director summit. Unpublished manuscript. Retrieved from https://www.theabpm.org/wp-content/uploads/2023/08/2023-PD-Summit-Presentation-Mar-Apr-2023-FINAL.pdf
[6] Whittaker, C., Rice, F., McKernan, L., Dankovic, D., Lentz, T., MacMahon, K., . . . Schulte, P. (2017). Current intelligence bulletin 68: NIOSH chemical carcinogen policy. (No. 2017–100). Cincinnatti, Ohio: Department of Health and Human Services, Centers for Disease Control and Prevention. Retrieved from https://www.cdc.gov/niosh/docs/2017-100/pdf/2017-100.pdf?id=10.26616/NIOSHPUB2017100revised
[7] National Institute of Occupational Safety and Health. (2023). NIOSH certified B readers. Retrieved from https://wwwn.cdc.gov/niosh-rhd/cwhsp/ReaderList.aspx?formid=USReaders&lastname=&state=&sortkey=state&format=table&btnSubmit_US=Submit
[8] National Institute of Occupational Safety and Health. (2021). Mine operator and independent contractor employees by sector, 2021 (N=301,240). Retrieved from https://wwwn.cdc.gov/NIOSH-Mining/MMWC/Employee/Count
[9] National Institute of Occupational Safety and Health. (2023). NIOSH-approved health facility search & map. Retrieved from https://wwwn.cdc.gov/niosh-rhd/cwhsp/FacilityMap.aspx
[10] American Lung Association. (2023). What is spirometry and why it is done. Retrieved from https://www.lung.org/lung-health-diseases/lung-procedures-and-tests/spirometry
[11] Occupational Safety and Health Administration. (2017). Small entity compliance guide for the respirable crystalline silica standard for general industry and maritime (1st ed.) Occupational Safety and Health Administration.
[12] Hines, S. E., Brown, C., Oliver, M., Gucer, P., Frisch, M., Hogan, R., . . . McDiarmid, M. (2019). User acceptance of reusable respirators in health care. American Journal of Infection Control, 47(6), 648-655. doi:10.1016/j.ajic.2018.11.021
[13] Khoo, K., Leng, P., Ibrahim, I. B., & Lim, T. (2005). The changing face of healthcare worker perceptions on powered air-purifying respirators during the SARS outbreak. Respirology (Carlton, Vic.), 10(1), 107-110. doi:10.1111/j.1440-1843.2005.00634.x
[14] Khoo, K., Leng, P., Ibrahim, I. B., & Lim, T. (2005). The changing face of healthcare worker perceptions on powered air-purifying respirators during the SARS outbreak. Respirology (Carlton, Vic.), 10(1), 107-110. doi:10.1111/j.1440-1843.2005.00634.x
[15] Galassi, T. (2016). In Sands M. (Ed.), Clarification on OSHA's respiratory protection standard, 29 CFR 1910.134, which addresses facial hair
[16] Odom, I. (1996). Clay mineral encapsulation of silica minerals in bentonites and some other clays. Paper presented at the Society for Mining, Metallurgy, and Exploration Annual Meeting, March 11 -14, 1996,
[17] Creutzenberg, O., Hansen, T., Ernst, H., Muhle, H., Oberdörster, G., & Hamilton, R. (2008). Toxicity of a quartz with occluded surfaces in a 90-day intratracheal instillation study in rats. Inhalation Toxicology, 20(11), 995-1008. doi:10.1080/08958370802123903
[18] Creutzenberg, O., Hansen, T., Ernst, H., Muhle, H., Oberdörster, G., & Hamilton, R. (2008). Toxicity of a quartz with occluded surfaces in a 90-day intratracheal instillation study in rats. Inhalation Toxicology, 20(11), 995-1008. doi:10.1080/08958370802123903

[19] Wendlandt, R. F., Harrison, W. J., & Vaughan, D. J. (2007). Surface coatings on quartz grains in bentonites and their relevance to human health. *Applied Geochemistry, 22*(11), 2290-2306. doi:10.1016/j.apgeochem.2007.04.019

[20] Pavan, C., Delle Piane, M., Gullo, M., Filippi, F., Fubini, B., Hoet, P., . . . Turci, F. (2019). The puzzling issue of silica toxicity: Are silanols bridging the gaps between surface states and pathogenicity? Particle and Fibre Toxicology, 16(1), 32. doi:10.1186/s12989-019-0315-3

[21] Pavan, C., Santalucia, R., Leinardi, R., Fabbiani, M., Yakoub, Y., Uwambayinema, F., . . . Fubini, B. (2020). Nearly free surface silanols are the critical molecular moieties that initiate the toxicity of silica particles. Proceedings of the National Academy of Sciences - PNAS, 117(45), 27836-27846. doi:10.1073/pnas.2008006117

[22] Pavan, C., Escolano-Casado, G., Bellomo, C., Cananà, S., Tomatis, M., Leinardi, R., . . . Turci, F. (2023). Nearly free silanols drive the interaction of crystalline silica polymorphs with membranes: Implications for mineral toxicity. Frontiers in Chemistry, 10, 1092221. doi:10.3389/fchem.2022.1092221