POST-HEARING BRIEF OF

AMERICAN FEDERATION OF LABOR

AND CONGRESS OF INDUSTRIAL ORGANIZATIONS

(AFL-CIO)

ON THE

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION'S

PROPOSED RULE ON

OCCUPATIONAL EXPOSURE TO RESPIRABLE CRYSTALLINE SILICA,

DOCKET NO. OSHA-2010-0034

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I. INTRODUCTION

The AFL-CIO, a federation of 56 national unions, representing 12.5 million working people in this country, submits this post-hearing brief in strong support of OSHA's proposed rule on Occupational Exposure to Respirable Crystalline Silica.

The AFL-CIO strongly supports OSHA's proposed respirable silica standard. This proposed rule is long overdue. The proposal will significantly reduce workers' exposures to deadly silica dust and prevent thousands of deaths and diseases each year. The proposal is based on extensive scientific and medical evidence and incorporates well-established proven measures and practices for protecting workers. Several provisions of the proposal could and should be strengthened to provide workers further protection to reduce the risk of disease and death from workplace exposure to silica. The AFL-CIO urges OSHA to move expeditiously to complete this rulemaking and to issue final silica standards for general industry and construction to protect workers from unnecessary disease and death.

II. NEW STRONGER OSHA SILICA STANDARDS ARE NEEDED TO PROTECT WORKERS

A. Respirable Silica Is a Serious Workplace Hazard

Occupational exposure to silica is a well-recognized, serious workplace hazard. The lung damaging harms caused by exposure to silica have been recognized for centuries.[1] In recent decades, it has been confirmed that in addition to silicosis, exposure to silica causes other lung diseases – including lung cancer – kidney disease and other toxic effects.

Millions of workers in a wide range of industries and occupations are exposed to this deadly hazard, including workers in construction, foundry operations, shipyards, glass making, and dental laboratories. Recently, workers in hydraulic fracturing operations in the oil and gas industries – in which employment is rapidly expanding – were found to be exposed to extraordinarily high levels of silica dust.[2]

[1] Rosner, D and Markowitz, G (1991). *Deadly dust: Silicosis and the politics of occupational disease in twentieth century America (*pp. 15-48). Princeton, NJ: Princeton University Press.
[2] OSHA-NIOSH Hazard Alert- *Worker Exposure to Silica During Hydraulic Fracturing*, June 2012 (Ex. 1534).

B. The Current OSHA Standards to Limit Workplace Exposures to Respirable Silica Dust Are Woefully Out of Date

The OSHA standards for silica – for general industry, construction and maritime – were adopted in the early 1970's immediately following the passage of the Occupational Safety and Health Act. They represent the American Conference of Government Industrial Hygienists (ACGIH) standards that were in place at the time for these industries – standards that allowed approximately 100 µg/m^3 of exposure in general industry and 250 µg/m^3 in construction. While these standards were adopted nearly 45 years ago, the silica construction standard is based on a recommendation from the Public Health Service made in 1929 – 85 years ago.[3] According to Public Health Service scientists, the 1929 recommendation was based on feasibility considerations of 1920's control technology and measurement methods, and was not set at a level to protect workers from silicosis:

> The conclusion was reached that a maximum of dust exposure falling somewhere between 10 and 20 million particles per cubic foot of air [mppcf] is a desirable limit for dust containing about 35 per cent free silica in the form of quartz. It was also concluded, on the basis of a study made in other plants having local exhaust ventilation systems, that this limit could be reached by the use of economically practicable ventilating devices of this character… It should be pointed out that the limit established was not found to prevent the occurrence of silicosis.[4]

Industry composition and technologies have changed dramatically since the 1920's. The construction standard is so out of date that the measurement technology the standard is based on no longer even exists (Ex. 0388).[5]

The current OSHA silica standards only require a permissible exposure limit (PEL). There are no requirements for exposure monitoring, medical exams or job specific training on silica hazards and control measures – measures that are widely endorsed or recommended for the protection of workers exposed to silica, including by the National Industrial Sand Association (NISA) (Ex. 3577); National Stone, Sand and Gravel Association (NSSGA) (Ex. 3583); Industrial Minerals Association – North America (IMA-NA) (Ex. 3583); American Foundry Society (AFS) (Ex. 3733) and others.

Citing the long history of silica research, public health recommendations and personal experience with workers in the trades, Gerry Scarano, Executive Vice

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[3] Russell, A.E., Britten, RH., Thompson, R.L., Bloomfield, J.J., The Health of Workers in Dusty Trades. II. Exposure to Silicosis Dust. Washington DC, United States Treasury Department, Public Health Service, PP. 1-28, Public Health Bulletin No. 187, 1929 (referenced in Ex. 0647).

[4] *id.*

[5] All of the exhibit numbers that are cited as "Ex." are exhibits from the silica docket OSHA-2010-0034 as posted on www.regulations.gov. The AFL-CIO is using only the last four digits of the posted exhibit numbers to cite these exhibits in this post-hearing brief.

President of the Bricklayers and Allied Crafts (BAC) called for a standard with a lower PEL but also one that does more than just set a PEL:

> What does this 70-plus-year timeline tell us? Simply that without a comprehensive standard, silica will continue to be a seriously, even deadly, hazard for working men and women… (Tr. 1559).[6]

Since the current standards were developed and adopted, evidence on the adverse health effects of silica exposure has mounted, and it has been determined that existing standards are not sufficient to protect workers. In 1974, in its *Criteria for a Recommended Standard: Occupational Exposure to Crystalline Silica*, NIOSH recommended that the permissible exposure limit for respirable silica be reduced to 50 µg/m^3 and that additional measures, including exposure monitoring and medical examinations, be incorporated into OSHA's silica standards (Ex. 0388). In 1986, the International Agency for Research on Cancer (IARC) classified silica as a "probable human carcinogen" and upgraded this classification to "known" human carcinogen in 1997 (Exs. 1437, 1301). The National Toxicology Program reinforced silica's cancer hazard in 1991, concluding that silica was "reasonably anticipated to be a human carcinogen" (78 Fed. Reg. 56293, Sept. 12, 2013). In 2000, the NTP updated this determination, finding that silica was "known to cause cancer in humans" (Ex. 1417). In 2000, ACGIH listed respirable crystalline silica as a suspected human carcinogen and lowered the TLV to 0.05 mg/m^3 (50 µg/m^3) and in 2006 further lowered the level to 0.025 mg/m^3 (25 µg/m^3) (Ex. 2257, Attachment 2).

In response to clear and growing evidence that exposure to crystalline silica poses a serious health risk to workers, authorities in other countries and jurisdictions have strengthened standards and reduced permissible exposures to workers. Japan, Italy, Mexico and the Canadian provinces of Alberta, British Columbia, Manitoba, Newfoundland, Nova Scotia, and Saskatchewan have all set standards reducing legal permissible limits for respirable crystalline silica to 25 µg/m^3 (Exs. 3985; 4072, Attachments 38, 39, 40, 41, 42, 43, 44, 45 and 46).

It is time for OSHA to act to reduce permissible exposures of silica for workers in the United States.

C. OSHA's Proposed Silica Standard is Long Overdue. Lengthy Delays in the Rulemaking Have Cost Thousands of Workers Their Lives[7]

As the AFL-CIO outlined in its written comments to the docket, efforts by OSHA to protect workers from the hazards of silica are by no means new. Silica was one of the first hazards addressed by the Agency after the passage of the OSHAct. In 1974, OSHA issued an advance notice of proposed rulemaking in response to NIOSH's

[6] Citations in this brief noted as "Tr." refer to the transcript page numbers from the transcripts of the public hearings conducted from March 18 to April 4, 2014, as posted on regulations.gov.)
[7] See Ex. 2257, Attachment 1 for a chronology on OSHA's silica standard and related activities.

recommendations (Ex. 0388). In the late 1970's, OSHA developed a draft rule to control silica exposures in abrasive blasting. Neither of those rulemaking efforts led to an updated final rule. Similarly, efforts in the late 1980's and early 1990's to update the existing silica permissible exposure limits, as well as exposure limits for other air contaminants, were also unsuccessful. But reducing occupational exposures to silica remained a priority. In the 1990's, OSHA undertook a number of major enforcement and educational initiatives to address the hazard (Ex. 4072, Attachments 29 and 30).

Seventeen years ago, in 1997, the Clinton administration placed silica on OSHA's regulatory agenda, and the present rulemaking began. In the Federal Register notice setting forth the agenda, OSHA explained that it planned to publish a proposed rule on crystalline silica "because the agency has concluded that there will be no significant progress in the prevention of silica related diseases without the adoption of a full and comprehensive silica standard, including provisions for product substitution, engineering controls, training and education, respiratory protection and medical surveillance. A full standard will improve worker protection, ensure adequate prevention programs, and further reduce silica-related diseases" (62 Fed. Reg. 57755, 57758, Oct. 29, 1997).

Contrary to industry claims that OSHA has rushed the development of this rule and has failed to provide adequate opportunity for input by interested parties, nothing could be further from the truth. Indeed, the record clearly shows that the development of this critical rule has been long and tortuous, with industry groups intervening at every stage attempting to delay or block its issuance (Ex. 2257).

Unfortunately, these delay tactics were successful. After a draft rule and accompanying preliminary economic analysis were completed, and the required small business review process under the Small Business Regulatory Enforcement Fairness Act (SBREFA) was conducted in 2003, business opponents successfully derailed the proposed rule for the five remaining years of the Bush administration.

Under the Obama administration in 2009, OSHA's proposed silica rule was again designated a regulatory priority and work on the standard resumed, with the peer review of the risk assessment completed and the economic and technological feasibility analysis updated.[8]

On February 14, 2011, the draft proposed standard was submitted to the Office of Information and Regulatory Affairs at the Office of Management and Budget for review as required by Executive Order 12866. Despite the requirement of the EO that reviews be completed within 90 days with one possible extension of 30 days, due to the intervention and objections of industry opponents, the rule was held by OMB for more than two and one half years. During this time dozens of industry groups met behind closed doors with OMB urging them to block the proposed rule.[9]

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[8] http://www.reginfo.gov/public/jsp/eAgenda/StaticContent/200910/Statement_1200.html

[9] Office of Information and Regulatory Affairs, Meeting Records – Occupational Safety and Health Administration http://www.whitehouse.gov/omb/oira_1218_meetings/

Finally on August 23, 2013, OMB released the draft rule and OSHA announced the proposed rule and made it publicly available on the agency's website. On September 12, 2013, the proposed rule was formally issued in the Federal Register, (78 Fed. Reg. 56274, Sept. 12, 2013) and the rulemaking on this serious workplace hazard finally commenced. Ninety days were initially given for the submission of public comments, which was later extended by more than 45 days until February 12, 2014. During this period, on January 14, 2014, the Agency hosted a public web chat to respond to clarification questions regarding the proposed rule. Three weeks of public hearings began on March 18, 2014 and concluded on April 4, 2014. Participants were given 45 days to submit additional post-hearing evidence and comments, which was extended an additional 15 days. The deadline for post-hearing briefs, initially set for July 18, 2014 was extended in response to industry requests for additional time, until August 18, 2014 – almost a year to the date that the proposed rule was announced, one of the longest public comment periods in the history of the agency.

If anyone has a legitimate basis to object to the process, it is the workers exposed to silica who have continued to face significant risk of developing disease or dying due to the government's failure to promulgate a new protective silica standard in a timely manner. Indeed, by OSHA's own estimates the new standard will prevent an additional 688 silica deaths and 1,585 cases of silica related disease annually compared to the current rules (78 Fed. Reg. 56277, Sept. 12, 2013, Table S1-1). By these estimates, since 1997, when OSHA began this present rulemaking, 11,600 workers have died and 27,000 workers have become ill due to silica exposures that could have and should have been prevented.

It's time for OSHA to move forward without further delay to complete this rulemaking and issue new final silica standards for general industry and construction that will protect workers from unnecessary disease and death.

D. Millions of Workers Are Exposed to Deadly Silica Dust

According to OSHA's Preliminary Economic Analysis (PEA), nearly 2.2 million workers are exposed to silica on the job (Ex. 1720). The majority of these exposures are in the construction industry where more than 1.8 million workers are exposed in a wide variety of construction activities including masonry work, jack hammering, milling, earthmoving and tunneling operations.

Many of these workers face extraordinarily high levels of exposure. According to OSHA's estimates, more than 200,000 of these workers have exposures that exceed the current OSHA construction silica standard of 250 $\mu g/m^3$, and nearly 650,000 construction workers are exposed to levels in excess of the proposed 50 $\mu g/m^3$ permissible exposure limit (PEL) (78 Fed. Reg. 53650, Sept. 12, 2013). In general industry and maritime, 295,000 workers are exposed, with more than 80,000 workers exposed above the 100 $\mu g/m^3$ PEL and 122,000 above the proposed PEL (78 Fed. Reg. 56352, Sept. 12, 2013). Foundries, glass making, and shipbuilding account for a large

number of exposures, but as noted, high silica exposures have been recently identified as a significant hazard in the burgeoning hydraulic fracturing industry where massive amounts of sand are used in the extraction process (Ex. 1628).

During the hearings, workers and union representatives described that on many job sites, employers fail to implement any controls, leaving workers to literally work in a cloud of toxic dust:

> With this dust, we couldn't even see 10 feet in front of us. And I worked in the foundry for 14 years… (Juan Ruiz, former foundry worker; Tr. 2328)

> I remember that as an apprentice and a young bricklayer, if there was something wrong with a wall, the foreman's come to me and say, Cahill, get your hammer and chisel and follow me. Well, a hammer and chisel doesn't make very much dust. But a young apprentice today in a similar situation, foreman comes to him and says, Cubby, get that Quickie saw and follow me. And he follows him right into a cloud of dust (Dennis Cahill, BAC retiree and contractor, Tr. 3041)

In some cases, not even rudimentary respiratory protection is provided, with workers resorting to using wet handkerchiefs or bandanas to try to protect themselves:

> I'll wet a handkerchief, and I'll tie it onto my face over my nose and my mouth, especially, you know, sometimes when I'm working cutting brick. There will be just lots and lots of dust, a cloud of dust, brick dust around us (Jose Granados, laborer, Fe y Justicia – Houston; Tr. 2479).

In other cases, controls may be present, such as water hook-ups on equipment or local ventilation, but are not utilized or maintained by employers:

> … it looks like a Zamboni machine that's used in hockey, but it has a sweeper on the bottom of it. And it has a capability to either dry clean or wet clean, but they usually run it through the foundry dry. So wherever it goes, it has a big cloud behind it (Alan White, Tr. 2598)

> And I'll tell [other workers]… you should put water on that. And they'll say, no, you be quiet, because if the boss hears us, then he's just going to fire all of us (Jose Granados, laborer, Fe y Justicia – Houston; Tr. 2480)

> Workers cut concrete with handheld saws standing in clouds of dust. The saws have a water spray option, but the option is

> often not used. I see dry cutting more often than cutting with water suppression, even though the engineering controls are available (Keith Murphy, IUOE Local 478; Tr. 2376-77)
>
> My [employers] didn't provide me with a safe workplace, nor did they care to. They did not provide me with the equipment properly maintained. They wouldn't allow me to maintain it (Sean Barrett, BAC member; Tr. 3039)

Some workers experienced the shift between the days when silica controls were not available, and when controls started being implemented in the workplace, but still not maintained:

> I was there when they converted over from the old fashioned primarily hand labor to the new automated machinery… And most of the machinery all came with tight fitting hoods and they had exhaust ventilation built into them and all this.
>
> But very shortly that disappeared, the various conveyors and shakers and all these different machines, they would get plugged up with sand and/or castings. We'd have to take all these covers off in order to get in there to work on them, and they wanted to start production up right away. …So over a short period of time, they didn't have all the proper covers and guards and air collection devices weren't all reused. They were set aside, and then after a little while, they'd be in the way and they'd just get thrown away and all these things would be running so-called naked I guess you could say.
>
> …most of those [manufacturer machines] came with all of these things… when they designed them and built them. They did have some apparatus for trying to keep the dust contained within the machine and into the baghouses and other collection machinery, but they just weren't maintained that way (Alan Schultz, WisCOSH, Tr. 3210-3211).

Workers described how the dust permeates their hair, skin and lungs, and contaminates their clothes. They carry the dust home and expose their children and family members putting them at risk as well.

> Some years back, one of my members walked into my office with a very unusual object: a plumbing trap. Handed it to me. First thing I noticed, it was pretty heavy, two to three pounds. He said that's from my shower at home.

> At the time, he had been in the tile industry, cutting tile for about 10 years. He said, my drain kept getting clogged. No matter what I put in there, I couldn't get it unclogged. I called the plumber. He couldn't get it unclogged. He took it off. I looked inside. It was filled with one-eighth -- one-quarter of an inch of being completely closed with what I would call reconstituted cement. This came off of his body.
>
> And I think it's important to note, he didn't do his laundry in the shower. He only washed the exposed areas of his body: his hands, his arms in the summertime if he was wearing a short-sleeve shirt, his face, and his hair. Fifty percent of those examples I gave are his breathing zone. Not in his breathing zone; they are his breathing zone (Dan Smith, United Union of Roofers, Waterproofers and Allied Workers, Tr. 1599)

E. Current OSHA Standards Do Not Protect Workers. Enforcement of the Existing Standards Will Not Prevent Disease and Death

Numerous industry groups including the U.S. Chamber of Commerce, American Chemistry Council Crystalline Silica Panel and the Construction Industry Safety Coalition (CISC) have argued that the current OSHA silica standards are sufficient to protect workers from silica-related diseases, and all that is needed is better enforcement of existing rules (Exs. 3578, 2308, 3580). The AFL-CIO strongly disagrees.

OSHA has undertaken enhanced silica enforcement and outreach programs in conjunction with NIOSH and MSHA in 1997, and as a National Emphasis Program in 2008, and workers are still getting sick (Ex. 4072, Attachments 29 and 30). Enhancing enforcement efforts alone does not work. It’s time for a more comprehensive standard. As explained later in this brief, exposure profiles are also changing with industry shifts and technology advancement; and under requirements of the current standard, workers do not have enough protection. Industry recognizes this shift:

> I'd like to quote from a December 2009 article for *Masonry Magazine*, the official publication of the Mason Contractors Association of America. The article states, "With the advent and increased use of dry cutting, drilling, and grinding of concrete masonry materials and construction, we often see workers operating in a cloud of dust with no respiratory protection or safety measures to prevent airborne dust, which poses a significant risk to workers” (Gerry Scarano, BAC, Tr.1559)

As outlined later is this brief, the record clearly demonstrates that exposures at the current permissible levels allowed by both the general industry and construction

silica standards pose a significant health risk to workers. The standard in construction is particularly inadequate, allowing between 250 µg/m^3 and 500 µg/m^3 of exposure – two and one half to five times the levels permitted in general industry. According to OSHA's risk assessment, and to OSHA's Acting Director of Standards and Guidance, William Perry, workers exposed over a working lifetime to levels permitted under the construction standard face a 100 percent certainty of developing silica-related disease (Tr. 94).

The existing standards only set a permissible exposure limit. There are no requirements for exposure monitoring, medical surveillance, or job specific training, all of which can provide further protection. Nor are there any specific measures included to limit the generation of dust, such as the use of wet methods or prohibition of dry sweeping.

Enforcement of the existing standards is challenging, particularly in the construction industry. With the standards limited to a PEL, OSHA must document over-exposures through personal full-shift sampling. This is usually done by an industrial hygienist. Many construction activities or operations that generate silica exposure are short-term in nature. To identify and enforce against overexposures to silica under the current standards, OSHA must be at a job site when exposures are occurring, and document those over-exposures, which is rare. Even if exposures are found to exceed the PEL, by the time OSHA receives sampling results and issues citations, many construction jobs are completed. The workers have already been exposed and the contractor and workers have moved on to another job.

OSHA has had a national emphasis enforcement program (NEP) for silica since 2008 (Ex. 4072, Attachment 29). But even with silica designated as an enforcement priority, only a relatively small number of inspections are conducted. According to OSHA inspection data, between 2008 and 2012, federal OSHA conducted 3,693 inspections for silica exposure (Ex. 3960). This compares to 553,597 workplaces where OSHA estimates that workers are potentially exposed to silica (78 Fed. Reg. 56346, Sept. 12, 2013, Table VIII-3). While the inspection data submitted by OSHA to the record does not break out those silica inspections conducted in construction and general industry, overall inspection data shows that very few health inspections are conducted in the construction industry, where the vast majority of silica exposures occur.

OSHA's capacity to conduct inspections is extremely limited, particularly for health hazards. As of January 2014, federal OSHA had 297 staff industrial hygienists, and the OSHA state plans combined had 365 staff industrial hygienists (Ex. 4072, Attachment 28). Given the current budget situation, there are unlikely to be any significant increases in OSHA's enforcement budget or staff in the foreseeable future. Indeed, some of the industry groups advocating for increased OSHA enforcement of the existing silica standard, including the U.S. Chamber of Commerce, are the same groups that have advocated that less of OSHA's budget be devoted to enforcement activities.

One industry group – the National Industrial Sand Association – made clear in their comments and testimony that they do not agree with the position of the U.S. Chamber of Commerce that simply enhancing enforcement of the current silica standard is sufficient to protect workers.

> Right now, the overwhelming majority of OSHA self-regulated employers with silica exposure in their workplaces elect not to measure silica in the air that their employees breathe. Due to OSHA's resource constraints, most of these employers are unlikely to see an OSHA inspector within any given year, within any given decade, or perhaps ever. While those employers have the legal obligation to comply with the PEL for respirable crystalline silica rather than wait for OSHA to arrive and enforce applicable regulations, they are probably not violating regulations by simply remaining ignorant of their employees' silica exposures. As OSHA compliance data has shown, many of them are exposing their employees to levels of respirable crystalline silica on excess of the current PEL (Ex. 2195)

Simply enforcing the current PELs is inadequate to protect workers from material health risks attributable to silica. A new, comprehensive standard is needed. The new silica standards will greatly facilitate enforcement, particularly in the construction industry, where it will be possible for all compliance officers – both safety and health- to determine whether dust controls are being implemented, even in the absence of exposure monitoring. Immediate action can be taken where the proper control measures have not been implemented.

But it must be pointed out, that the responsibility to comply with standards and protect workers from harm is the employer's, not OSHA's. The new standards will help employers meet this responsibility by not only setting a lower permissible limit, but also by outlining the measures that are needed to control workers exposure to dust and prevent disease and death.

III. SIGNIFICANT RISK: WORKERS FACE A SIGNIFICANT RISK OF HARM FROM SILICA EXPOSURE AT THE CURRENT PERMISSIBLE EXPOSURE LIMITS (PELs)

In proposing a health standard, OSHA must first determine that the toxic substance or harmful physical agent of concern poses a significant health risk and that the standard it is proposing will reduce the significant risk. *Indus. Union Dep't, AFL-CIO v. Am. Petrol. Inst.,* 448 U.S. 607, 614-615 (1980). OSHA's burden to establish significant risk results from 29 U.S.C. § 651, which requires that workplace safety and health standards be "reasonably necessary or appropriate to provide safe or healthful employment." 29 U.S.C. § 652(8). Courts have granted OSHA considerable discretion in carrying out its responsibility to minimize significant risk on the job. In *Indus. Union*

Dep't, AFL-CIO v. Am. Petrol. Inst., 448 U.S. 607, 655 n.62 (1980), the Court stressed OSHA's discretion in determining what constitutes significant risk, stating that OSHA's "determination that a particular level of risk is 'significant' will be based largely on policy considerations." *Id.* Moreover, OSHA is not "required to support its finding that a significant risk exists with anything approaching scientific certainty." *Id*. at 656.

Where OSHA has determined that a significant health risk exists, it must adopt the "most stringent standard to protect against material health impairment." *Bldg. & Constr. Trades Dep't* v. *Brock,* 838 F.2d 1258, 1272 (D.C. Cir. 1988). (quotation marks omitted). OSHA's standard setting is subject only to the technological and economic feasibility of the standard it adopts. *Am. Textile Mfrs. Inst., Inc. v. Donovan (Cotton Dust)*, 452 U.S. 490, 503 (1981). In *Brock*, OSHA failed to adopt a lower PEL for "certain major industrial subgroups" although OSHA had acknowledged that "a significant risk of contracting asbestos-related diseases would remain at a PEL of 0.2 f/cc or even at the lower standard of 0.1 f/cc." 838 F.2d at 1262 & 1264. The Court determined that OSHA's decision not to adopt the lower PEL was likely based on OSHA's view that "industry could not attain a lower level" using "current controls and practices." *Id.* at 1272 (quotation marks omitted). However, the unions were able to show that the lower PEL (0.1 f/cc) was achievable in certain operations. Because the 0.2 PEL would still leave a significant health risk, the court questioned why OSHA concluded that protection at the 0.2 f/cc level should be considered sufficient. *See id.* at 1272-73. The court included the issue as one that needed to be reconsidered on remand indicating that where a significant risk remains, OSHA should take further action to reduce the risk if it is feasible to do so. *Id.* at 1262.[10]

A. There Is Overwhelming Evidence In the Record that Exposure to Respirable Crystalline Silica Poses a Significant Health Risk to Workers

OSHA's preamble to the proposed standard and the full record thoroughly document that silica exposure causes silicosis, other non-malignant respiratory diseases (NMRD), lung cancer, kidney disease, and other adverse health effects. To date, there are hundreds of epidemiology studies linking silica with these debilitating diseases, among a variety of worker populations – in different industries, in different countries, with different job tasks, with different lifestyles, and of different ages. OSHA based its proposal on more than adequate evidence, but more recent publications have described further the risk posed by silica exposure, and further justify the need for new silica standards.

In addition to studies already cited and relied upon by OSHA in its risk assessment, recent studies have found silicosis in quartz conglomerate workers (2014), radiographic progression of silicosis in tunnel workers (2013), chronic obstructive

[10] Upon reconsideration, OSHA found that it was feasible to reduce the risk by lowering the permissible exposure limit, and in 1994 published a final rule reducing the permissible exposure limit for asbestos to 0.1 f/cc. (59 Fed. Reg. 40968, Aug. 1994).

pulmonary disease (COPD) and pulmonary function changes in uranium miners (2013), silicosis in artificial stone workers (2012), all-cause and cause-specific mortality in metal mine and pottery factory workers (2012), lung cancer in silica exposed men (2013), silicosis-related connective tissue disease in Michigan workers (2011), chronic kidney disease in silica exposed workers (2012), and reviewed findings of silica-related autoimmune disease (2012 and 2013), to name a few (Ex. 2178). This is only a fraction of the total literature continuing to establish silica as a very serious hazard to workers.

In some studies, silica-exposed workers who develop lung cancer are often the same workers who develop silicosis. This is not surprising since workers with the type of exposures required to develop silicosis are also workers in the same dirty jobs with the type of silica exposures that induce lung cancer, but industry has used this overlap to cast doubt on the link between silica exposure and lung cancer. Industry groups have also claimed that lung cancer findings are actually a result of workers' individual smoking histories, rather than silica exposure. While it is not necessary to separate these factors further, a recent study by Steenland et al. concluded that workers without silicosis were also at risk for lung cancer from silica exposure; and demonstrated that non-smokers with high silica exposure also had significantly increased lung cancer risk (Silica: A lung carcinogen, Ex. 2162). Industry funded studies describing a null effect of lung cancer have their own limitations, as described later in this brief.

In her testimony, Dr. Christine Oliver noted that silica was recognized as a health hazard dating back to the 16th century (Tr. 3838). In 1974, the National Institute for Occupational Safety and Health (NIOSH) recommended that OSHA develop a stronger silica standard (Ex. 0388) – practically the same standard being proposed now by OSHA with the same proposed PEL. At the time, NIOSH's recommendation was based only on development of silicosis because over 50 years of quality disease and exposure studies existed at the time and "these studies do not demonstrate a safe concentration of silica." Forty years later, workers are still suffering from preventable silicosis and other debilitating diseases. The International Agency for Research on Cancer (IARC), part of the World Health Organization, now has labeled respirable crystalline silica a definite human carcinogen, or Category 1 (Ex.1301); and the U.S. National Toxicology Program (NTP), part of the National Institute of Environmental Health Sciences, also has classified silica as a human carcinogen (Ex. 1417).

Dr. David Goldsmith, occupational health professor at the George Washington University School of Public Health and Georgetown University, outlined the strong evidence on the carcinogenicity of silica:

> It is important to recognize that evidence for silica's carcinogenicity has been reviewed three times by the International Agency for Research on Cancer, once in 1987, 1997, and 2012. It has been evaluated by California's Proposition 65 in 1988, by the National Toxicology Program in 2000 and reaffirmed in 2011, and by the National Institute for Occupational Safety and Health in 2002… Furthermore,

> silica dust is considered carcinogenic in the following EU nations: Belgium, Denmark, and the Netherlands (Tr. 860).

Brian Miller, one of the independent peer reviewers for OSHA's risk assessment, stressed that "there is no doubt that silica is causal for silicosis, and regulating to eliminate that disease is the sensible starting point. It is to be expected that reducing exposure to that end will have side-benefits in reducing cancer risks" (Ex. 3574).

B. The Risk of Death from Silica Exposures Permitted Under the Current Standards Is Clearly Significant, and a New Standard Will Reduce this Risk

Mortality risk from silica is well in excess of the benchmark of 1/1,000 excess risk over a working lifetime that OSHA has used for other health standards. According to OSHA's risk assessment, exposures at the current silica standard for general industry will result in 22-29/1,000 excess lung cancer deaths, 11/1,000 excess silicosis deaths, 83/1,000 excess deaths from other non-malignant respiratory diseases (NMRD), and 39/1,000 excess kidney disease deaths (Table VII-2, 78 Fed. Reg. 56333, Sept. 12, 2014). The risks in construction, where much greater levels of exposure are currently permitted, are even higher: 27-38/1,000 excess deaths from lung cancer, 17-22 excess silicosis deaths, 188-321/1,000 excess deaths from NMRD, and 52-63/1,000 excess kidney disease deaths. It is important to note that these numbers represent additional deaths compared to background levels in the population, not total cases of disease, and that silicosis is no longer the only health concern associated with silica exposure.

In addition, these estimates do not include the risk of disease that does not result in death. In its risk assessment, OSHA calculated estimates for silicosis morbidity: At the current PEL in general industry, the risk of developing lung fibrosis is 60-773 per 1,000 workers; and in construction, this risk approaches 1,000 per 1,000 workers. These estimates do not include other NMRD, which may be greater based on NMRD mortality risks associated with silica exposure.

At the current PEL, silicosis can even develop in workers who have not been exposed to silica for an entire working lifetime, the metric OSHA normally uses to conduct its risk assessments:

> Recent studies show a clear danger from exposures at the current PEL. Studies in Holland, which have been submitted to the record, show early signs of silicosis among 10 percent of 1,339 construction workers screened who had only 19 years of exposure at an average age of 42. Among these construction workers, 2.9 percent had 1/1 x-rays. The Dutch exposure limit is only 75 µg/m. (Scott Schneider, Tr. 4181)

The proposed silica standards will reduce the significant risk faced by workers, as OSHA is required to do under the OSH Act. At the proposed PEL for general industry and construction, risks are greatly reduced, although still high: 18-26/1,000 excess deaths from lung cancer, 7/1,000 excess silicosis deaths, 43/1,000 excess deaths from NMRD, and 32/1,000 excess kidney disease deaths. In all industries the risk of developing lung fibrosis is expected to be 20-170 per 1,000 workers. As OSHA states in its preamble, "These risk estimates indicated the promulgation of the proposed PEL would result in a reduction in risk by about two-thirds or more, which the Agency believes is a substantial reduction of the risk of developing abnormal chest x-ray findings consistent with silicosis" (78 Fed. Reg. 56336, September 12, 2013). OSHA estimates the proposed rule to save nearly 700 lives and prevent 1,600 cases of moderate-to-severe silicosis each year.

1. <u>There is broad agreement among occupational medical and public health experts that silica-related disease remains a serious occupational health problem, and that a stronger OSHA standard is needed</u>

Many medical and scientific organizations and experts testified at the hearings that silica-related disease and silica exposure are serious problems, and advocated strongly for OSHA to issue new silica standards. A stronger silica standard is supported by professional organizations, including the American College of Occupational and Environmental Medicine (ACOEM) (Ex. 2080), American Thoracic Society (ATS) (Ex. 2175), Association of Occupational and Environmental Clinics (AOEC) (Ex. 2175), American Public Health Association (APHA) (Ex. 2178), American Industrial Hygiene Association (AIHA) (Ex. 2169), American Society of Safety Engineers (ASSE) (Ex. 2339); occupational physicians, including Dr. Kenneth Rosenman (Ex. 3425), Dr. James Cone (Ex. 2157), Dr. Laura Welch (Tr. 1577), Dr. Jim Melius (Tr. 4201), Dr. Steven Markowitz (Tr. 2517); and by occupational health and safety public health experts, Dr. Celeste Monforton from the George Washington University (Ex. 3424)and Dr. David Goldsmith from Georgetown University (Ex. 3426). Recommendations of the ATS were co-signed by its sister organizations: the American College of Chest Physicians (ACCP), representing over 18,000 chest physicians, and The Council of State and Territorial Epidemiologists (CSTE), representing all 50 states and territories (Ex. 2175).

The American Medical Association House of Delegates – the principal policy-making body of the American Medical Association that represents state, local and specialty medical societies around the nation – adopted a policy statement in November 2013 supporting a stricter silica standard (Ex. 2178 AMA policy resolution). It states:

> SUPPORT STRICTER OSHA SILICA PERMISSIBLE EXPOSURE LIMIT STANDARD
>
> RESOLVED, That our American Medical Association support the Department of Labor's Occupational Safety and Health Administration's (OSHA's) proposed rule to establish a stricter permissible exposure limit (PEL) for respirable crystalline silica; and be it further

RESOLVED, That our AMA support OSHA's proposed rule to establish a stricter standard of exposure assessment and medical surveillance requirements to identify adverse health effects in exposed populations of workers; and be it further

RESOLVED, That our AMA submit comments, in collaboration with respiratory and occupational health medical societies, in support of a stricter silica PEL.

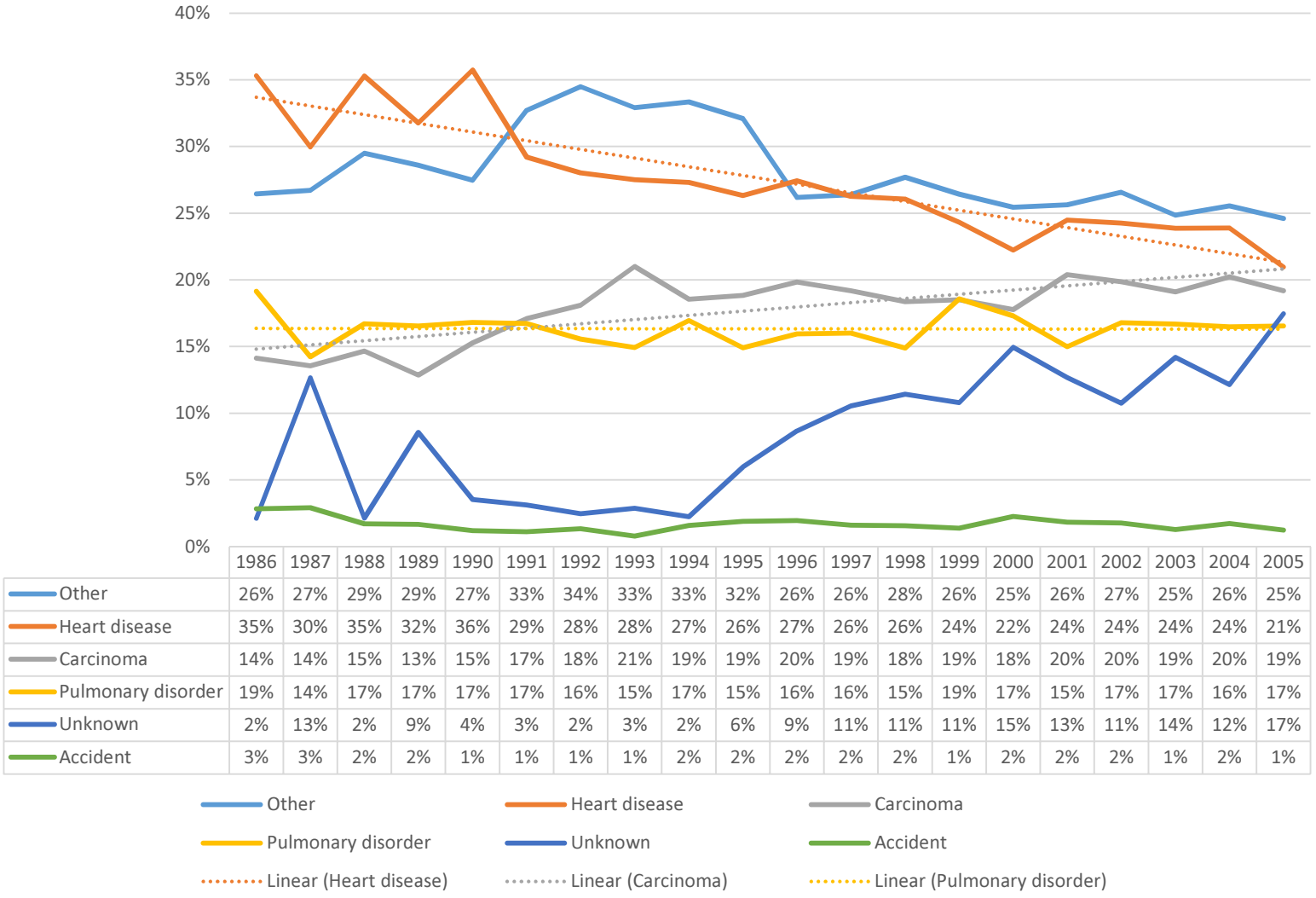
2. Silica-related diseases are not disappearing: Reported mortality and morbidity data underestimate the true scope of the poblem

Industry's claim that silicosis is disappearing in this country is wrong. Industry groups believe the current standard is sufficiently protective, and that no further action is required. The AFL-CIO strongly disagrees.

Death records for the International Union of Bricklayers and Allied Craftworkers (BAC) members indicate that work-related lung disease has anything but disappeared. Crude numbers show that pulmonary disorders are about as prevalent as they were almost thirty years ago, with little fluctuation (Death Certificate audits, Ex. 4053), as shown in Graph 1 on the following page. Lung disease continues to be a problem in this occupation with silica exposure as a major contributor.

Graph 1. Mortality cause among BAC members (crude), 1986-2005.

(Data Source: Death certificate audits, Ex. 4053)



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Other	26%	27%	29%	29%	27%	33%	34%	33%	33%	32%	26%	26%	28%	26%	25%	26%	27%	25%	26%	25%
Heart disease	35%	30%	35%	32%	36%	29%	28%	28%	27%	26%	27%	26%	26%	24%	22%	24%	24%	24%	24%	21%
Carcinoma	14%	14%	15%	13%	15%	17%	18%	21%	19%	19%	20%	19%	18%	19%	18%	20%	20%	19%	20%	19%
Pulmonary disorder	19%	14%	17%	17%	17%	17%	16%	15%	17%	15%	16%	16%	15%	19%	17%	15%	17%	17%	16%	17%
Unknown	2%	13%	2%	9%	4%	3%	2%	3%	2%	6%	9%	11%	11%	11%	15%	13%	11%	14%	12%	17%
Accident	3%	3%	2%	2%	1%	1%	1%	1%	2%	2%	2%	2%	2%	1%	2%	2%	2%	1%	2%	1%

Industry has relied primarily on a graph published by NIOSH, showing silicosis mortality rates and numbers from 1968-2004 (*e.g.,* Ex. 2376) to claim that silicosis is no longer a problem. However, this graph does not reflect or represent the full extent and severity of the problem of silica-related disease. The data presented in the graph are only silicosis data, and only mortality data: The data are collected from death certificates where silicosis is listed as the primary or contributing cause of death. Further, the rates presented in this graph are misleading: They are calculated as cases of silicosis compared to the general population, whereas risk estimates are calculated as cases of silicosis compared to a workplace silica-exposed population. Despite any apparent decline in silicosis over decades, the risk rates are still very high.

The record contains extensive and robust evidence to show that silicosis is not the only outcome caused by silica exposure and further, not all silicosis patients die of silicosis. This graph completely ignores all other causes of death related to silica exposure and related to silicosis, and ignores cases that did not have silicosis written on their death certificate. In his testimony, Dr. Kenneth Rosenman described six deficiencies of relying on silicosis mortality data as collected and reported by the CDC and national statistics as the measurement of silica's toxicity burden:

- *Silicosis is not often written on death certificates:* "…silicosis is only found on the death certificate of 14 percent of individuals with confirmed silicosis. So most people who have been diagnosed with silicosis, you will never see the word "silicosis" on their death certificate when they die (Tr. 853).

  If you look at their death certificate when they die, only 18 percent mention the word "silicosis." I mentioned before the overall was 14 percent. Now, I am just breaking it down by severity of disease. If you look at people with Category 3, which is clearly obvious advanced silicosis, only 10 percent of have silicosis mentioned on their death certificate. But why are these people dying? Well, they're dying from pneumoconiosis, COPD, lung cancer. There are lots of them that say unspecified and interstitial fibrosis or respiratory failure of unknown origin… if you actually total up let's say Category 3, what percentage of people are dying from respiratory disease, 63 percent. And what percentage of people with PMF, 53 percent. What would you expect in the general population, around 10 percent? So although silicosis is not being seen on the death certificate, these people are dying from respiratory disease. Silica is a major contribute to these pneumonias, to these unrecognized respiratory failures (Tr. 855-6)."

- *More people are living with silicosis, than those who are dead:* "…the overall ratio of individuals with new onset silicosis who are living is sevenfold times greater than what is found on death certificates. The living to dead ratio that we reported in our published study in 2003 was 6.44. This ratio has actually increased in recent years to 15.2. A similar ratio, an increase in the

ratio of living to dead, were found in the New Jersey surveillance data, which went from 5.97 to 11.5 times (Tr. 854)."

- *Hospitalizations for silicosis have not changed:* "…the number of hospitalizations for silicosis in the country have not been going down. In 1993, there were 2,028 hospitalizations nationwide with silicosis as one of the discharge summaries. In 2011, which is the most recent data available, there were 2,082 hospitalizations with silicosis, actually about 60 more. This data is available from the nationwide inpatient sample of the Agency for Healthcare Research and Quality, on their website (Tr. 854)."

- *Those who fill out death certificates are not familiar with silicosis and other occupation related diseases:* "…ratio of living to dead people with silicosis is not a function of silicosis being a benign disease. Rather, it reflects the lack of familiarity. It reflects how we fill out death certificates in the United States and reflects the lack of familiarity by your general physician about silicosis. And it reflects who actually fills out the death certificates, which many times is not the person who knows the patient best (Tr. 855)"

- *Silicosis is not the only problem:* "…silicosis is just one of multiple adverse outcomes of silica exposure… from our own data, we have reported on 44 individuals with silicosis who developed rheumatoid arthritis… We are in the process of showing that 40 percent of our silicotics have renal disease (Tr. 856-7)."

- *Apparent decrease in disease parallels employment trends:* "…My final reason for not liking mortality as a measure of burden is that there are two things that affect disease occurrence. One is what are people exposed to. And the second is, which you will never hear and people contend, well, the mortality is going down and, therefore, there is less of a problem, is how many people are being exposed. And actually what has happened is there has been a significant decrease in the people at risk, not because of the exposure level, but because they are no longer exposed. So sharing with you some Michigan data, the number of workers in Michigan foundries peaked in 1973 and in 1991 the number of workers decreased by 75 percent. And lo and behold, if you look at the Michigan surveillance system and lag it by 23, 20 years, the number of cases we are seeing has decreased by 83 percent, parallel to the decrease in workers at risk. If you look at the number of abrasive blasting companies in Michigan using silica, the number went from 125 to just 36, and that's a 71 percent decrease, again paralleling the decrease in disease (Tr. 857-8)."

Dr. Rosenman's findings of under recognized silicosis in Michigan are not random. Despite a case-based surveillance system in New Jersey, undetected silicosis was found to be very high (Ex. 1030). After counting previously unrecognized cases of silicosis, researchers found silicosis in 8.5% of workers whose cause of death was

originally classified as chronic obstructive pulmonary disease (COPD), tuberculosis, or pulmonary heart disease. Silicosis also has been overlooked by clinicians signing death certificates for granite workers in Vermont (Ex. 0999), sandblasters in New Orleans (Ex. 0362), and gold miners in South Africa (Ex. 1103). Silicosis is also being mistaken for other diseases that are becoming more prevalent, such as sarcoidosis, as pointed out by Dr. Tee Guidotti from the Association of Occupational and Environmental Clinics (Tr. 821).

3. Silica-related diseases are still destroying workers' lives and livelihoods

Non-controlled silica exposures are still very high. During the hearings, workers from the United Auto Workers (UAW) (Ex. 1881) and the Wisconsin Committee on Occupational Safety and Health (Ex. 3513, 3586) described severely dusty conditions in modern foundries and submitted photographs to OSHA, illustrating these conditions (Ex. 3512). Many construction workers similarly described dusty tasks, describing the amount of dust on their clothing, inside their noses and dust masks, inside their vehicles and in their homes; and many of them are concerned about secondary exposures to their family (Ex. 3581), as explained elsewhere in this brief.

Industry claims that current cases of silicosis are a result of exposures before the current silica standard took effect. But young workers are getting sick, too. According to Dr. Steenland, "… new cases of silicosis continue to be diagnosed, some among younger individuals who entered the workforce well after the existing standard was in place" (Ex. 2162). Sean Barrett and Dale McNabb from BAC, and Alan White from USW, are all young workers who testified about their personal experiences with silica-related disease:

- Alan White was diagnosed with silicosis at the age of 44, after working in a foundry for 16 years, and described the normal conditions of the foundry as "dirty, filthy and dusty" with a negative culture towards respiratory protection (Tr. 2505).

- Dale McNabb noticed breathing problems in his twenties, wheezing in his thirties and at 42 years old, after working for only 20 years, was diagnosed with silica-related disease. He acknowledged that the debilitating effects of the disease were not just physical: "The stress of the health condition, of the uncertain prognosis, of the financial burden, and the loss of my income was unbearable. In the end, silica exposure cost me my job, my health, and also my marriage." (Tr. 3025).

- Sean Barrett, diagnosed with silica-related disease as a 41-year-old terrazzo worker, was measured at having only half of normal breathing capacity, can no longer do the job he loves and was concerned about young apprentices who want to continue his craft as a career (Tr. 3038, 3040).

All of these diseases were preventable. These exposures are making workers sick. These workers now face diminished livelihoods, further health problems, and possibly death. Their diseases are not always measured or recorded. There is no cure for silicosis. Even those workers who do not develop silicosis suffer severe, debilitating diseases that impair them for the rest of their lives.

Some worker populations are more vulnerable to high silica exposures and have less means of protection so they are at greater risk of health conditions. These workers also are underrepresented. Eric Frumin from Change-to-Win testified to the disproportionate death rates among Hispanic workers and their vulnerability to coercive practices by employers (Tr. 1785). Dr. Sokas and Dr. Rosenman shared serious reservations about silica exposure in vulnerable working populations:

> Dr. Sokas mentioned that silica disease is a health related disease, is a health disparity issue. So the disease is not evenly distributed across the United States population. Minority populations are at higher risk. So, in Michigan, the incidence of silicosis in African Americans is six-fold greater than in Caucasians (Tr. 858).

And the landscape within industries is changing: Already vulnerable populations are being placed in the dustiest jobs. Hispanic or Latino workers now constitute 24% of the workforce in foundries, and almost 26% of the workforce in construction (Ex. 4072, Attachment 57). Looking forward, construction laborers are projected to have the tenth greatest number of jobs of all occupations in the next ten years (Ex. 4119).

C. OSHA's Risk Assessment Modeling Methods Are Transparent, Consistent with Recommended Practice and Appropriate for Evaluating Risk Related to Silica Exposures

OSHA's risk assessment methodologies are consistent with recommended practices, including those made by the National Research Council in 1983, *Risk Assessment in the Federal Government: Managing the Process* (Ex. 4071), and in 2009, *Science and Decisions: Advancing Risk Assessment* (Ex. 4052); and the Environmental Protection Agency's Guidelines for Carcinogenic Risk Assessment (Ex. 3867). OSHA's risk assessment was peer reviewed by independent experts who strongly endorsed its methodology and findings.

OSHA utilized a 45-year working lifetime metric to calculate risk. This assumption is appropriate under Section 6(b)(5) of the OSH Act, which states:

> The Secretary, in promulgating standards dealing with toxic materials or harmful physical agents under this subsection, shall set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence,

> that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard *for the period of his working life.* (emphasis added)

Testimony at the hearings illustrated that workers are exposed to silica for a working lifetime, many for decades of their lives (Tr. 2255, 3053, 2571). This included testimony from workers who spanned industry sectors with high silica exposures: The International Union of Bricklayers and Allied Craftworkers (BAC), United Steelworkers (USW), International Union of Operating Engineers (IUOE), United Auto Workers (UAW), United Association of Plumbers and Pipefitters (UA), International Brotherhood of Teamsters (IBT), Laborers International Union of North America (LIUNA), and the Building and Construction Trades Department (BCTD) of the AFL-CIO.

Industry groups have argued that surveillance data, such as the NIOSH graph described previously, should be used to estimate risk. As already explained, surveillance data – cases of death or disease only when they are reported or counted – are very limited in nature, incomplete, and do not take into account any exposure information.

In a recent report (2014) by the U.S. Government Accountability Office (GAO) which reviewed the basis of MSHA's proposed coal dust standard, experts from the National Academy of Sciences (NAS) concluded that risk assessments based upon epidemiological data, not surveillance data, was an appropriate means to assess risk for coal-dust exposure. According to the GAO report:

> The Department of Labor's Mine Safety and Health Administration (MSHA) appropriately did not use recent trend data on coal workers' pneumoconiosis (CWP) as a basis for its proposal to lower the permissible exposure limit for respirable coal mine dust. These recent data from the Department of Health and Human Services' National Institute for Occupational Safety and Health (NIOSH) are inappropriate for this purpose because they do not include the types of detailed information about individual miners needed to estimate the likelihood that miners would develop CWP at different exposure levels, such as historical dust exposures (Ex. 4072, Attachment 48).

As Dr. Steenland pointed out, "Epidemiologic quantitative exposure-response data enables one to estimate the risk of disease per unit of exposure, and allows the standard setting to be based on determining what risk of disease is acceptable for workers. In the last 20 years improved quantitative exposure-responses data has become available for silicosis, and for the first time has also become available for lung cancer." He acknowledged that many more high quality studies are now available, which have good quantitative exposure-response data for lung cancer; and further, that this is useful for standard setting. He went on to state "A measure of cumulative exposure is generally the most desirable for assessing lifetime risk of disease" (Ex. 2162).

Peer-reviewed epidemiological, toxicological and industrial hygiene evidence has been used to inform public health policy for decades. The standards for researching, publishing and relying on this information are rigorous now more than ever. Standard setting and scientific consensus do not require every study to show an association before a scientific conclusion can be drawn. This has never been standard practice in any scientific arena. Where bias exists in epidemiology studies, it usually mutes an actual effect rather than creates an effect where it does not exist. As Dr. Frank Mirer and others who testified throughout the hearing stated, it is difficult to conclude positive findings in epidemiology studies because differential factors usually bias results towards the null. (Tr. 1012, 1013) The nature of epidemiology is to detect the existence of an effect, not the absence of one, as Mike Wright from the USW described in the hearing:

> … so-called negative studies, which we actually define as inconclusive studies, because they don't prove the absence of the risk. They only get to the point where they cannot prove its presence (Tr. Page 2514)

Industry primarily relied on two studies to dispute the fact that lung cancer is associated with silica exposure. OSHA explains soundly in its Health Effects Supplement the reasons these studies are inadequate in design in order to detect true health effects that may exist (Ex. 1711, Attachment 1). In Vacek et al, 2011 (Ex. 1486), a study funded by the American Chemistry Council, the authors compared exposures of lung cancer victims to victims of all other causes, which were all observed to be associated with high silica exposures, and which would also possibly affect workers before lung cancer would emerge. This would bias the study to not finding an exposure response if it were truly there. The study design in Mundt et al, 2011 (Ex. 1478) contains exposure misclassification, absence of lagged exposures for lung cancer only, and reclassification of exposure reference groups, which would all result in decreased exposure-response findings. The authors conclude that a lack of lung cancer finding was preliminary and that consistent observations could not be made from this research; however, industry has used this study as a backbone for arguing a negative association between silica exposure and lung cancer.

Both studies show a very strong healthy worker effect, where occupational cohorts are expected to enjoy reduced mortality compared to the general population; and the healthy worker survivor effect, which attenuates exposure response experience because of early health related termination of employment. And both of these studies are few in a long series of epidemiology studies considered by OSHA, most of which conclude an association between silica exposure and lung cancer.

Industry has argued in favor of a threshold effect for previous OSHA health standards, as they have for silica as an attempt to establish a “safe” level of silica exposure. The peer reviewers do not support the threshold argument, as Bruce Allen explained:

> … it is essentially impossible to distinguish between dose-response patterns that represent a threshold and those that do not… it makes little sense to suppose that every individual would be identical with respect to a threshold exposure level (Ex. 3574).

There is no safe level of silica exposure. The record indicates that workers exposed to low levels of silica still develop silicosis; and that both old and young workers develop silicosis. It is appropriate for OSHA to take these factors into account when designing a risk assessment for silica exposure.

D. Significant Risk Remains at the Proposed PEL and Action Level

Workers continue to be at high risk from silica exposure. A large number of workers are exposed to silica across industries, and a large number of these exposures are uncontrolled. Some industries have demonstrated their ability to reduce silica exposures, but some modern exposures can be worse due to tool technology changes. A stricter standard is needed. Even at the proposed PEL of 50 µg/m^3, workers will still face a significant risk of death from silica exposure: 18-26/1,000 excess deaths from lung cancer, 43/1,000 excess deaths from NMRD and 32/1,000 excess deaths from kidney disease (Preliminary Quantitative Risk Assessment Table II-12, Ex -1711). As OSHA set forth in the preamble, the levels of risk at the proposed 50 µg/m^3 PEL are much greater than the estimates of residual risk from exposure permitted by other health standards issued by OSHA (78 Fed. Reg. 56335, Sept. 12, 2013). Notably, OSHA estimated that under the 1986 asbestos standard of 0.2 fibers/cc, the excess risk of cancer was 6.7/1,000 workers, and under the 1992 cadmium standard the remaining excess risk at the PEL was 3-15/1,000 workers. As explained previously, as a result of a court challenge to the 1986 asbestos standard, OSHA was directed to take action to further reduce the significant risk from asbestos exposure, which was done in a final rule in 1994 (59 Fed. Reg. 40968, August 10, 1994).

OSHA's Acting Director of the Directorate of Standards and Guidance, William Perry, confirmed this high level of residual risk during the hearings (Tr. Page 71).

> MS. SEMINARIO: And so the residual risk that exists for silica at the proposed PEL of 50 is greater than the residual risk that has remained after regulation for many other OSHA regulated substances. Is that correct?
>
> MR. PERRY: Yes, Table VII-4 does show that for a number of other substances we've regulated in the past. Their residual risks were lower than what we're currently estimating for silica.

Charles Gordon, a retired Department of Labor solicitor for OSHA, went on to point out that:

> … the OSHA standard leaves much too high a remaining risk… OSHA must issue a 25 µg PEL, which is feasible… that will save hundreds of extra lives per year, along with much tougher industrial hygiene and medical provisions. … the remaining risk at the proposed 50 µg limit is … 94 excess deaths per 1,000 workers exposed over a working lifetime of 45 years.
>
> That's an incredibly high remaining risk. It's 100 times greater than the risk that the Supreme Court said was significant in the benzene decision. It's 10 times higher than the remaining risks that OSHA ever left before, except in the case of chromates under the Bush Administration, where it left the remaining risk of 10 to 50. So it's still much higher than that.
>
> And it's actually higher than the combat risk of death for American soldiers in Afghanistan. … that risk is 90 per 1,000 over 45 years.
>
> … it is wrong for OSHA to leave a remaining risk of 50 µg when much can be done to lower that risk. (Tr. 3785)

OSHA has an obligation to reduce risk further. In fact, significant risk still exists at 25 µg/m^3, the action level. According to OSHA's risk assessment, a further reduction in the permissible exposure limit to 25 µg/m^3 would significantly reduce these risks, but still leave residual risk of mortality greater than the benchmark (1/1,000) excess risk level. At the action level, OSHA estimated lung cancer mortality risk to be 9-23/1,000 excess deaths, silicosis mortality risk to be 4/1,000 excess deaths, chronic lung disease (NMRD) risk to be 22/1,000 excess deaths, renal disease mortality risk to be 25/1,000 and silicosis morbidity risk to be 5-40/1,000 (Preliminary Quantitative Risk Assessment Table II-12, Ex. 1711).

OSHA's expert witness, Dr. Kyle Steenland concluded:

> The data indicated to me that the [current] standard would have to be lowered ten times to 0.01 mg/m^3 [10 µg/m^3] to decrease risk of silicosis to 1 in 1000. (Tr. 2162)

OSHA has acknowledged that the residual risk at the proposed 50 µg/m^3 PEL is significant, but has proposed a 50 µg/m^3 PEL due to feasibility constraints (78 Fed. Reg. 56281, Sept 12, 2013). While it may not be feasible to set a PEL lower than 50 µg/m^3, given the high level of residual risk that remains, it is incumbent upon OSHA to implement additional measures to protect workers from silica-related diseases and death, as the agency has done in other health standards.

IV. OSHA'S PROPOSED CRYSTALLINE SILICA STANDARD IS TECHNOLOGICALLY FEASIBLE

Under the Occupational Safety and Health Act, according to 29 U.S.C. § 655(b)(5), when promulgating standards dealing with toxic materials or harmful physical agents, the Secretary of Labor is required to:

> set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with by such standard for the period of his working life.

These standards must be technologically and economically feasible. *United Steelworkers v. Marshall,* 647 F.2d 1189, 1264 (D.C. Cir. 1980) ("*Lead I*"). The Supreme Court has defined feasibility as "capable of being done, executed or effected." *Cotton Dust,* 452 U.S. at 508-09. In the assessment of feasibility, the Secretary is not required to conduct a cost-benefit analysis but is free to place the benefits of worker health above all other considerations save those making the "benefit" unachievable. *See Cotton Dust*, 452 U.S. at 508-09.

OSHA can establish technological feasibility by demonstrating, based on the "best available evidence," 29 U.S.C. § 655(b)(5), a reasonable possibility that the typical firm will be able to develop and install engineering and "work practice controls that can meet the PEL in most of its operations." *Lead I*, 647 F.2d at 1272. In other words, "[t]o establish technological feasibility, OSHA, after consulting the best available evidence, must prove a reasonable possibility that the typical firm will be able to develop and install engineering and work practice controls that can meet the standard in most of its operations." *Am. Iron & Steel Inst. v. OSHA*, 939 F.2d 975, 980 (D.C. Cir. 1991) (internal quotation marks omitted). The OSH Act is viewed as a technology-forcing statute and OSHA has great latitude in establishing the technological feasibility of a proposed standard. Indeed, "the Secretary [of Labor] would not be justified in dismissing an alternative to a proposed health and safety standard as infeasible when the necessary technology looms on today's horizon." *AFL-CIO v. Brennan*, 530 F.2d 109, 121 (3d Cir. 1975). As long as OSHA "presents substantial evidence that companies acting vigorously and in good faith can develop the technology, OSHA can require industry to meet PEL's never attained anywhere." *Lead I*, 647 F.2d at 1264-65. For example, in determining whether the proposed standard for maximum PELs of airborne arsenic for workers in the smelting industry is technologically feasible, the Secretary of Labor "is not restricted to the state of the art in the regulated industry" so long as evidence is presented "that companies acting vigorously and in good faith can develop the technology" to do so. *Asarco, Inc. v Occupational Safety & Health Admin.*, 746 F.2d 483, 496 (9th Cir. 1984). OSHA can require industry to meet standards never attained anywhere. Even a showing by an agency of infeasibility in a few operations does not necessarily undermine the general presumption in favor of feasibility. *Id.* at 1272.

A. OSHA's Preliminary Economic Analysis Has Demonstrated That the Proposed Silica Standard is Technologically Feasible

OSHA has conducted an extensive preliminary feasibility analysis of the proposed standard that documents that the proposed standard of 50 µg/m^3 is both technologically and economically feasible (Ex. 1720). The feasibility analysis is comprehensive, thorough, detailed and based on the best available evidence.

The analysis is actually two separate reviews – a review of the feasibility of the standard in general industry and maritime, and a review of the feasibility of the standard in construction. The majority of these comments will focus on the feasibility of the standard as it applies to general industry and maritime. The Building and Construction Trades Department is providing separate comments on the feasibility of the standard as it applies to construction.

For general industry and maritime, OSHA assessed the feasibility of the standard in 25 sub-industry sectors potentially affected by the proposed silica standard, analyzing the impact and feasibility of the standard at the 6 digit NAICS level.[11] For each sub-industry, OSHA conducted an exhaustive analysis of available evidence to develop exposure profiles of at-risk jobs in each industry and control measures for these jobs. All available exposure data from OSHA's inspection database, NIOSH health hazard evaluations, published studies and other available information were reviewed. Thousands of studies and evaluations and other types of evidence were evaluated in the analysis.

The baseline assessment of exposures in general industry and maritime estimated that currently 294,886 workers are at risk in these 25 sub-industries (Table VIII-5, 78 Fed. Reg. 56350-2, Sept. 12, 2013). Among those workers at risk, OSHA estimated that 58 percent (172,414) are currently exposed to levels below the 50 µg/m^3 PEL; and that 42 percent (122,472) are exposed above the 50 µg/m^3 level. Of those exposed, the agency estimated that 80,731 general industry and maritime workers are exposed above the present 100 µg/m^3 standard, with nearly 50,000 workers facing exposures of greater than 250 µg/m^3, underscoring that many workers face high exposures that put them at significant risk of silica related disease and death.[12]

While current exposures put hundreds of thousands of workers in general industry and construction at risk, OSHA's preliminary economic analysis demonstrates

[11] A separate analysis was subsequently conducted to evaluate the impact and feasibility of the proposed standard in the oil and gas extraction industry (Ex 1628).

[12] In construction, the exposures and risk is even greater. OSHA estimates that there are currently 1,849,175 workers at risk, with 647,807 exposed over 50 µg/m^3, 420,278 exposed over 100 µg/m^3 and 216,003 exposed above 250 µg/m^3 (Table VIII-3, 78 Fed. Reg. 56350).

that engineering and work practice controls will reduce exposures to less than 50 µg/m^3 for the vast majority of workers.

Indeed according to the PEA, in general industry and maritime, the application of engineering and work practice control measures will reduce exposures below 50 µg/m^3 for 95 percent of the workers with potential exposure to silica.[13] The PEA, which has assessed exposures and available control measures on a job-by job basis in the 25 sub-industries, has found that the identified control measures can reduce exposures below the proposed 50 µg/m^3 exposure level in most operations, most of the time in all of the sub-industries in general industry and maritime (78 Fed. Reg. 56337, Sept. 12, 2013).

The engineering and other control methods that OSHA has identified in the PEA are well known and widely utilized industrial hygiene control measures. These include substitution, isolation of operations and/operators, local exhaust ventilation, general ventilation, vacuum systems and wet methods. All of these control methods are commercially available. The fact that high exposures remain in so many industries and operations is not due to the lack of available controls. It is because employers have failed to implement these control measures.

Evidence in the record demonstrates that these control measures are very effective. When implemented these controls significantly reduce exposures. For example, OSHA's publication *Controlling Silica Exposures in Construction* (2009) reports many case studies and published research studies that found reductions in silica exposure of more than 90 percent through the use of wet methods, local exhaust ventilation and vacuum systems (Ex. 1533).

At the same time, evidence in the record demonstrates that without these control measures, exposures to silica are often highly above the existing control limits, putting workers at great risk of harm. For example, NIOSH's recent investigations of silica exposures in hydraulic fracturing operations found that without control measures, silica exposures were factors in excess of the current PEL (Ex. 1578).

Many of the employer groups that testified claimed that it was not technologically or economically feasible to reduce exposures to the proposed 50 µg/m^3 standard. However, most of these industries failed to produce any data concerning current exposure levels or control measures in their respective industry's workplaces to support these claims. For example, the American Chemistry Council (ACC) Silica Panel submitted comments and presented testimony on OSHA's Preliminary Economic Analysis which argued that OSHA had underestimated the cost of control measures

[13]Table V-11 of the PEA estimates that 15,172 out of the 294,886 workers in general industry and maritime potentially exposed to silica will be exposed above 50 µg/m^3 and require respiratory protection after the full implementation of the standard meaning that 279,714 workers will face exposures below the 50 µg/m^3 proposed PEL (PEA, Table V-11, page v-58 – 64).

required to comply with the proposed 50 µg/m^3 standard (Ex. 2307).[14] These comments and testimony were based on opinions of industry representatives that were surveyed by the ACC consultant URS (Tr. 2044).

The ACC also conducted a survey of its members to gather existing exposure information (Tr. 2044). However, the ACC did not submit this information to OSHA in its initial comments. During the hearings, requests were made to the ACC to submit the exposure information collected from the survey:

> MS. SEMINARIO: Okay. Thank you. Just returning back to the survey, I understand that these were sent out confidentially and returned confidentially. But if it would be possible to provide the results of the survey with the identities masked, so that there's some sense of what the underlying information that was used to make this assessment, I think that would be very helpful. You folks did an awful lot of work. And so getting at that level of information, I think, would just be helpful to all of us (Tr. 2049).

As far as the AFL-CIO can ascertain from our review of the docket, that information has not been submitted by ACC.

Many other industry groups were also asked to provide data on exposures and control measures to the record to assist the agency in completing its final technological and feasibility analysis and making a final feasibility determination for the final rule. Requests were made of the American Petroleum Institute (API) (Tr. 4077), American Foundry Society (AFS) (Tr. 2178), Brick Industry Association (Tr. 3474), National Automobile Dealers Association (NADA) (Tr. 3723-4) and others. Some of the participants provided copies of surveys that were used to collect information from employers, including the ACC, AFS and NAM (Exs. 4011, Attachment 6, 4035, 4075). But only a few industry participants provided any exposure information. Those participants that provided exposure information for general industry operations that the AFL-CIO was able to identify based on a review of the docket are:

- The American Foundry Society, which provided estimates of exposure, but not actual exposure results, based on a survey of its members as part of its initial comments (Ex. 2379) and a spreadsheet with individual facility responses in post-hearing comments (Ex. 4035).

- The Asphalt Roofing Manufacturers (ARMA), which submitted a detailed analysis of exposure information from its ARMA silica data base, which according to ARMA contains 1,616 samples reported by ARMA members (Ex. 2291).

[14] American Chemistry Council - Critique of OSHA's Cost Models for the Proposed Crystalline Silica Standard and Explanation of the Modifications to Those Cost Models Made by URS Corporation (February 7, 2014) (Ex. 2307)

- The North American Insulation Manufacturers Association (NAIMA), which in pre-hearing comments described the development of a silica exposure data base, provided an overview of the findings and outlined control measures utilized to limit exposures (Ex. 2348). In post-hearing comments, NAIMA submitted summary results of its data for the period 2004 – April 2014 (Ex. 3999).

- The Pre-Cast/Prestressed Concrete Institute (PCI), which submitted exposure data from a number of PCI producer's facilities spanning the time period 1997-2013 (Ex. 4029).

- The National Automobile Dealers Association (NADA), which provided silica sampling results from some of its members (Exs. 4019, 4197).

- Sandbox Logistics, a firm which has developed a system for the transport and transfer of silica sand for hydraulic fracturing operations, which submitted a summary of interim results from an exposure study in post-hearing comments (Ex. 4020).

Contrary to claims by the industry that the proposed standard in not feasible, it is the AFL-CIO's view that exposure information that has been provided shows just the opposite – that the proposed 50 µg/m^3 is feasible.

The exposure information provided by the ARMA shows that the mean exposure in all but one of the jobs in routine manufacturing in that industry are already below the proposed 50 µg/m^3 exposure level (Ex. 3999, Table B-2). The information also shows that 91 percent of the samples in these jobs were below 50 µg/m^3, with a median exposure less than 15 µg/m^3.

Similarly the exposure estimates provided by the AFS from its survey of members show that 67 percent of workers in jobs with potential silica exposure have exposures of less than 50 µg/m^3 (Ex. 2379, Table 6).[15] The AFS also submitted a detailed summary of air sampling data of selected jobs at 12 facilities (Ex. 3488). For 8 of the 12 jobs, the median exposure was less than 50 µg/m^3.

The NAIMA exposure data shows that average exposures in glass wool, rock and slag wool manufacturing were all well below the proposed 50 µg/m^3 PEL and below the 25 µg/m^3 action level, but there were some exposures in infrequent non-routine operations that exceeded the proposed PEL (Ex. 3999). In its pre-hearing comments NAIMA summarized this information stating:

> A preliminary review of the samples approved for database inclusion by NAIMA indicates that: 1) on average, exposures for routine, day-to-day manufacturing operations are below the

[15] The AFS data are based on estimates of exposure submitted by member companies. It is not known how many of these estimates are based upon actual exposure monitoring as opposed to estimates made by company representatives).

> proposed PEL; and certain infrequent job positions and tasks have exposures which may exceed the PEL (Ex. 2348).

The exposure data submitted by the Precast/Prestressed Concrete Institute, which covers a 16 year time period also shows that vast majority of samples taken are below the current PEL and the proposed 50 µg/m^3 PEL (Ex. 4029) There are a few jobs where exposures exceed the current PEL where respiratory protection is needed.

The exposure data provided by NADA showed no exposures above the proposed PEL (Ex. 4019, 4197). According to the post-hearing comments submitted by NADA:

> "[A]ll our [NADA's] data present how the nature of the automotive repair business does not lend itself to excessive respirable silica exposure. Where appropriate, the industry has taken steps to reduce this exposure even further through engineering controls and product substitution" (Ex. 4197).

The unions also provided exposure information showing that in a number of facilities, current exposures to silica are already below the 50 µg/m^3 proposed exposure limit.

The USW submitted exposure information from a number of USW represented facilities that was requested by the USW under the OSHA Access to Exposure and Medical Records rule (Ex.4032, Attachment 3).[16] The exposure information is from foundries, glass plants and other types of industries. The USW submitted exposure data shows that the vast majority of silica exposures reported by these employers were below 50 µg/m^3 (Ex. 4032, Attachment 7).

The UAW also submitted extensive silica exposure information from UAW represented facilities, both sampling conducted by UAW IH technicians as provided for under their collective bargaining agreements, as well as company representatives (Ex. 4031). The UAW data includes historical data for silica exposures at the GM Defiance foundry operation, which was discussed in detail in testimony by the UAW. That testimony and data show that by identifying silica exposure generating jobs and applying ventilation and other control measures, GM has been able to reduce exposures in most of the jobs well below the proposed 50 µg/m^3 exposure level (Ex. 4031, Attachments A and B).

As we will discuss later below, it is our view that industry groups in arguing that the standard is not feasible, have applied a definition of feasibility that is totally different from, and much stricter than the definition of feasibility as defined by the courts and implemented by OSHA since the 1970's. Specifically, industry groups seem to contend that to establish technological feasibility, OSHA must demonstrate that the standard can

[16] Unfortunately, a number of employers, including the Newport News Shipyard, refused to provide the USW the requested information (Ex. 4032, Attachment 2).

be achieved in all industries, in all jobs, all of the time – a definition which in the view of the AFL-CIO is incorrect.

B. OSHA's PEA Overstates the Difficulty of Compliance Because the Assessment Fails to Take Into Account the Impact of Cross Contamination on the Measured Exposures

There is extensive evidence in the record documenting that many of the exposures to workers occur as bystander exposures due to cross contamination.[17] Indeed OSHA's PEA identifies many jobs in different industries where workers are not engaged in silica generating jobs or processes, but are exposed due to silica dust generated in adjacent or nearby operations, including foundries, asphalt pavement products, concrete products and cut stone (Ex.1720).

As both AFL-CIO expert Dr. Frank Mirer, and witnesses for the AFS testified, fugitive emissions are a major source of exposure in the indoor production environment, especially foundries (Tr. 947, Tr. 2694). Evidence in AFS' publication, *Control of Silica Exposure in Foundries*, explains how this contamination occurs (Ex. 3733).

Once emitted, respirable silica particles will float in the air until captured. A 5 µ particle will fall only a foot in 2.5 minutes, a 2 µ particle will fall this distance in 14 minutes and a 1 µ particle will take over 50 minutes to fall a foot. These particles are not visible to the eye except as part of substantial releases which include larger particles. If these respirable particles escape containment by local ventilation, they are carried wherever air currents take them, including upward if there are thermal updrafts which are prevalent in foundries. The movement of particles would typically be in plumes, generating higher local concentrations at considerable remove rather than uniform dispersal. "Quiet" factory is assumed to include 50 feet per minute (fpm) drafts, while a walking person could entrain dust up to 350 fpm. Thus a 5 µ particle could travel 125 feet in air with minimal draft and hundreds of feet entrained by a walking person before it fell a foot.

As Dr. Frank Mirer explained in his testimony, exposure at an operation is generated by both near field local emissions and far field fugitive emissions (Ex. 3429). Enclosure and local exhaust ventilation which generates a capture velocity of 150 fpm or even less will reduce emissions near zero; this would reduce or eliminate the near field operator exposure and also the fugitive emissions to other operations.

OSHA's feasibility assessment has identified cross contamination as a major source of exposure, but has failed to take these exposures into account when assessing feasibility. Specifically, the agency has developed exposure estimates and exposure distributions based on current exposures which include cross- contamination. The required controls, cost of controls and number of controls needed are all based on exposure estimates that include cross-contamination. There is no accounting of

[17] Cross contamination means that fugitive silica emissions from one process add to the exposure in other processes in the workplace, even processes at considerable distance from the emitting process.

contributions of exposure from other jobs. By failing to account for cross contamination, the agency has overestimated the levels of exposure that are generated in a particular job, and in need of control, and also overestimated the number of controls that are needed. The AFL-CIO believes that the appropriate strategy for assessing feasibility would be to identify operations which are unlikely to general silica emissions, or background and bystander exposure measurements, and subtract those measured exposure levels from those operations which do emit silica.

C. Comments on Feasibility in Specific Industries

1. Foundries

Dr. Frank Mirer, an industrial hygienist and toxicologist with extensive experience in the foundry industry, submitted comments and presented expert testimony on behalf of the AFL-CIO on the feasibility of the standard in the foundry industry (Ex. 3429, 3584). As Dr. Mirer testified in the hearings, based upon the evidence presented by OSHA in its PEA and available evidence, he had "high confidence" that the proposed 50 µg/m^3 PEL was feasible in the foundry industry and found that in many foundry operations a 25 µg/m^3 level was feasible (Ex. 2257).

The American Foundry Society also presented comments and testimony on the feasibility of the standard in the foundry sector. It was the position of the AFS that the standard was not feasible in this sector, even though as noted above, AFS's submission indicates that 67 percent of all foundry jobs are already below the proposed 50 µg/m^3 PEL (Ex.2379, Table 6). Dr. Mirer has conducted a review of the AFS submission as it relates to exposures and feasibility, which is included in Appendix 1 of these comments.

Dr. Mirer has found that the AFS analysis found that the proportion of foundry workers currently exposed above 50 µg/m^3 and 100 µg/m^3 is substantially less than that estimated by OSHA in the PEA. In addition, the AFS analysis, like OSHA's PEA, fails to take into account exposures caused by cross-contamination, thereby double-counting sources of exposure and overstating the exposures that must be controlled. According to Dr. Mirer's analysis, the AFS submission provides further strong evidence that it is possible to control exposures below the proposed 50 µg/m^3 PEL in most of the foundry operations, most of the time, and demonstrates that the standard is feasible.

2. Hydraulic fracturing

Hydraulic fracturing, a process used to extract oil and gas, and that has experienced explosive growth in recent years, has been identified as another sub-industry with potential for high worker exposures to silica that would be subject to OSHA's proposed silica standard. According to industry comments and testimony, massive amounts of sand are used as a proppant in combination with water and chemicals injected into the earth during the hydraulic fracturing process to free gas and oil for extraction (Ex. 2264).

For several years NIOSH has worked in partnership with the oil and gas industry to identify and address safety and health hazards in this industry, through the National STEPS Network.[18]

A project in this partnership on the health hazards in hydraulic fracturing conducted in 2010-2011, discovered that several operations in hydraulic fracturing generated high levels of silica dust, exposing workers to respirable silica well in excess of the current and proposed OSHA PELs (Exs. 1548, 1578). Sampling conducted by NIOSH identified sand moving, truck refilling, loading and transfer as high exposure operations. Reported silica levels in these operations were extraordinarily high. Over half of the samples (51.4%) taken by NIOSH exceeded the current OSHA PEL and 68.5% exceeded the NIOSH REL of 50 µg/m^3 (Ex. 1548).

Some of the exposures were in many times the OSHA PEL, with the highest exposures measured reaching levels of 137 times the NIOSH REL (or 6.85 mg/m3) (Ex. 1578). According to NIOSH few controls had been implemented to reduce these exposures. These levels of exposure put workers in this industry at very high risk of silica related disease.

When the hydraulic fracturing industry was identified as an industry with potential for high exposures to silica, OSHA conducted an assessment of exposures, control measures and costs for the proposed silica standard in this industry. This assessment was added as a supplement to the Preliminary Economic Analysis as Appendix A. (Ex.1628). Because of the recent identification of silica as a problem in the industry, and limited information publicly available about silica exposures and control measures in hydraulic fracturing, there was less available information for this industry than other sectors where silica exposures have been identified for decades. OSHA relied upon the available evidence available from NIOSH, vendors and exposures and control measures in other industry with major sand handling operations to a baseline exposure profile and feasible control measures in this industry.

The exposure profile for hydraulic fracturing developed by OSHA is based on NIOSH sampling data, which was the only exposure data available for this industry. The profile estimates that 54% percent of workers are exposed above the current PEL and another 19% above 50 µg/m^3. The NIOSH data show that 37% of workers have exposures exceeding 250 µg/m^3 (Ex. 1628, Table A-10).

In its assessment of technological feasibility, OSHA gathered data and information that was available from NIOSH and the STEPS network on possible control measures. These measures include a mini-bag house developed and patented by NIOSH to collect dust on sand transport equipment (Ex. 1578), and a sand handling

[18] The National Service, Transmission, Exploration and Product Safety (STEPS) Network was founded by OSHA and the industry in 2003 to work on safety and health issues in oil and gas http://www.nationalstepsnetwork.org/about_us.htm).

system developed by J&J Truck Bodies and Trailers to control silica exposures in the transport and transfer of sand (Ex.4072, Attachment 36). OSHA also looked at control measures in other industries that involve movement and transport of large volumes of sand including sand transfer in foundries and transfer and transport in mining operations (Ex. 1578). Finally the agency looked to the published literature to identify experience with exposures and control measures in analogous operations.

Based upon the available evidence, OSHA has made a preliminary determination that it is feasible to control exposures in hydraulic fracturing to the proposed PEL for 94 percent of fracturing sand workers, but has also solicited information to gain a fuller understanding of exposures and control measures in this developing industry.

Industry groups that filed comments related to hydraulic fracturing and participated in the rulemaking, including the U.S. Chamber of Commerce and American Petroleum Institute (API), have criticized OSHA's analysis of the feasibility of the proposed silica standard in hydraulic fracturing. They have claimed that it is not feasible for the industry to comply with the 50 µg/m^3 PEL and asserted that the extrapolations that OSHA has made from exposures and control measures in other operations are not valid (Exs. 2288, 2301).

But the industry has provided no other information or data on exposure levels or possible control measures on silica in hydraulic fracturing to the record, despite the fact that the industry is collecting such information and developing control measures, as are other suppliers and vendors to the industry.

For example, API conducted a survey of members of the STEPS Network, to collect exposure data and create an exposure data base – but declined to provide any of the exposure data collected (Tr. 4077). An expert witness who testified for the Chamber of Commerce, Gerhard Knutson, API, criticized OSHA's analysis, but declined to provide any information or data from his work on control measures citing confidentiality agreements with the industry (Tr. 500).

At the hearings, at least one witness, Sandbox Logistics, presented testimony on efforts to reduce silica exposures in hydraulic fracturing. The company has developed an innovative system to transport, deliver and transfer silica sand in an enclosed system to hydraulic fracturing operations which is now being utilized at several locations (Ex. 3554). In its post-hearing comments, Sandbox Logistics provided initial summary results on the effectiveness of their control measures (Ex. 4020). They reported that in sand transfer operations, system had reduced exposures by 73 percent over those measured by NIOSH. Sandbox Logistics also stated that with further refinements to their system, the engineers believed that it would be possible to reduce the high exposures to T-Bely operators in the sand transfer operations identified by NIOSH by more than 95 percent, which would reduce these exposures to approximately 16 µg/m^3 (Ex. 4020).

At the same time that industry groups are criticizing the proposed OSHA standard, many in industry are working collaboratively with NIOSH, OSHA and others to develop control measures to reduce these exposures. Much of this work is being shared

through the STEPS network, an initiative of OSHA, industry groups and others to address safety and health hazards in the oil and gas industry.

Specifically, the STEPS Network Silica Focus Group is facilitating efforts to identify control measures for silica exposures in hydraulic fracturing. The website of the group has posted minutes of meetings which include detailed presentations on a number of efforts to control exposures to silica in the industry.[19]

These control measures include presentations on control skirts for dust control, liquid dust suppressant, and a dust control system (Dynasander) developed by J&J Truck bodies and Trailers. The AFL-CIO submitted this information to the record as part of our post-hearing comments and evidence (Ex. 4072, Attachments 34, 35 and 36). These technologies show great promise in significantly reducing exposures to silica dust in fracking. Available information also shows that they are feasible, and being used in current applications. According to the presentation by J&J Truck Bodies and Trailers, the functional utility of the sander is the same with or without the dust control, and the cost of the sanders with the integrated dust control manifolds is comparable to existing sanders on the market (Ex. 4072, Attachment 36).

Recently, additional information and presentations have been posted on the National STEPS Network Website from the June 19, 2014 meeting of the Respirable Crystaline Silica Focus Group showing that significant progress is being made in controlling silica dust exposures in hydraulic fracturing. These include a presentation by the American Refining Group – *Liquid Dust Suppressant Update* – that reported that treatment of fracking sand with a dust suppressant reduced the concentration of respirable silica by 99.43% in the laboratory and by 90% in a field trial.[20]

KSW Environmental provided an update of their efforts to develop a vacuum system to control silica exposures. They reported that current testing found the control technology reduced exposures in one test with all 12 samples below the NIOSH REL of 50 µg/m^3, and other tests showed exposures all reduced below the current PEL. According to their presentation, their goal is "to meet or exceed ACGIH standard (less than 25 µg/m^3)."[21]

Sandbox Logistics provided a presentation on their sand handling and transport system developed for the hydraulic fracturing industry. This presentation reported that the Sandbox Logistics System was more efficient than a typical pneumatic system. It also included information on the initial silica hygiene study conducted by Sandbox (and

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[19] http://www.nationalstepsnetwork.org/initiatives_respirable.htm

[20] Presentation by Helen M. Cummiskey – American Refining Group, Inc. Liquid Dust Suppressant Update, http://nationalstepsnetwork.org/docs_respirable_silica/june_19_2014/ARGSTEPS-presentation-Helen-June2014.pdf).

[21] KSW Environmental Update – STEPS – RCSFG Meeting, June 19, 2014 http://www.nationalstepsnetwork.org/docs_respirable_silica/june_19_2014/KSWE-STEPS-Meeting-6-19-14-REV-A.pdf).

submitted to OSHA) that found that their system reduced exposure levels by 73 percent.[22]

Without question, the silica exposures in hydraulic fracturing are extensive and pose a challenge. But experience from other sectors which involve transport and movement of large volumes of large volumes of sand including foundries and mining demonstrate that it is indeed possible to control exposures in these types of operations.

It has only been a short time since NIOSH publicly reported silica exposures as presenting a major health risk to workers in the hydraulic fracturing industry in 2012 in a presentation at the Institute of Medicine (Ex. 1578). Since that time, there have been rapid developments of innovative dust control measures in the industry. Those technologies are now being implemented and additional technologies are being developed.

In determining whether a standard is technologically feasible, OSHA is not limited to the status quo of what is available. The courts have ruled that an OSHA standard may be technology forcing.

> [T]he Secretary is not restricted by the status quo. He may set standards which require improvements in existing technologies or the development of new technology.... (SOCMA, 509 F. 2d at p. 1309).

Hydraulic fracturing itself is the result of major technological innovations. There is no question that this industry has the skills and resources to develop and implement control measures to protect workers from silica dust. As Kenny Jordan, Executive Director, Association of Energy Service Companies, testified at the hearings, he has every confidence that this will occur:

> MS. SEMINARIO: No, I appreciate that comment. But one other, just to explore, within the industry and the technology of hydraulic fracturing or fracking and the real growth in the industry, that has really come through the application and innovations of technology to enable the extraction of the gas or the oil from the earth; is that correct? So there has been new technologies and innovations to be able to develop these very productive means of energy production.

[22] SandBox Logistics – SandBox Introduction, RCS Focus Group, June 19, 2014. http://www.nationalstepsnetwork.org/docs_respirable_silica/june_19_2014/SBX-Intro-RCS-Focus-Group-6-19-14.pdf).

MR. JORDAN: That's correct. Kenny Jordan, again, sorry. Fracking has been around for 60 years. But what really started it all was the Barnett Shale in Fort Worth, you know, 10, 15 years ago when the fracking operation started there. And the technology has grown quite a bit over that period of time. But we're looking at really a 60-year migration of fracking, too, in terms of technology.

On this side here, we're only looking at a couple of years. I believe there will be a solution found eventually. Can I give you a time frame? I don't know.

MS. SEMINARIO: When you say a solution, a solution to the silica exposure?

MR. JORDAN: Some of the engineering controls, I think. Somebody is going to be innovative enough to find out a way to get us at an acceptable level where we can work without relying on respirators as long as we're doing the monitoring and the other things beforehand. We'll depend on good old American ingenuity (Tr. 4086-87).

D. The Definition of "Feasibility" That Industry Groups Are Relying on Does Not Conform to the Statute or Case Law and Would Result in a Much Less Protective Standard and Greater Risk to Workers

In both comments and testimony, a number of industry groups, including the AFS and ARMA, have argued that OSHA has failed to take into account exposure variability in assessing feasibility (Exs. 2379, 2291). They contend that OSHA has based its assessment of feasibility on average exposure levels, and argue that to demonstrate feasibility OSHA must take into account exposure variability. They go on to argue that since OSHA compliance is based on a single exceedance of the PEL that employers must keep average exposures levels much lower to be 95 percent or even 100 percent certain that they are in compliance. They therefore contend that to demonstrate feasibility, OSHA must show that the standard can be met with engineering or work practice controls in all operations, in all industries all of the time with 100 percent certainty.

The AFL-CIO strongly disagrees with the industry's contention that in order to demonstrate feasibility, OSHA has an obligation to demonstrate that the standard can be met in all operations, in all industries, 100 percent of the time. This definition

of feasibility does not conform to the statute or case law on the burden OSHA bears in establishing feasibility. OSHA's burden is to demonstrate that the standard can be met in most industries, in most operations most of the time. There may still be a few jobs where engineering controls are not sufficient to reduce exposures, in which case respiratory protection is permitted. As OSHA has explained in the preamble to the proposed standard:

> "The Court of Appeals for the D.C. Circuit has clarified the agency's obligation to demonstrate technological feasibility of reducing occupational exposure to a hazardous substance:
>
> OSHA must prove a reasonable possibility that the typical firm will be able to develop and install engineering and work practice controls that can meet the PEL in most of its operations….The effect of such proof is to establish a presumption that the industry can meet the PEL without relying on respirators….Insufficient proof of technological infeasibility for a few isolated operations within an industry, or even OSHA's concession that respirators will be necessary in a few such operations, will not undermine this general presumption in favor of feasibility. Rather in such operations firms will remain responsible for installing engineering and work practice controls to the extent feasible, and for using them to reduce...exposure as far as these controls can do so. *United Steelworkers of America, AFL-CIO-CLC v. Marshall,* 647 F.2nd 1189, 1272 (D.C. Cir. 1980).
>
> Additionally the D.C. Circuit has explained that "[f]easibility of compliance turns on whether exposure levels at or below [the PEL] can be met in most operations most of the time…." *American Iron and Steel Inst. V. OSHA,* 939 F.2nd 975, 990 (D.C. Cir. 1991)."

The issue of exposure variability in workplace exposures is not new, nor is it unique to silica. As industry representatives themselves have pointed out, exposure variability is a well-established industrial hygiene principle. All workplace exposures are variable. Most exposure variability comes from the failure to maintain controls already in place, or operated processes as designed. The whole point of the standard is to control overexposures or excursions. The control of the excursions will reduce variability, and more importantly, reduce workers exposure and risk of disease.

OSHA addressed the issue of exposure variability at length in the preamble of the 1987 benzene standard for which industry groups had made a similar argument (52 Fed.Reg. 34534-41). OSHA rejected the industry's arguments that OSHA should set a

higher PEL or average exposures over 40 hours to account for exposure variability. As OSHA explained at that time all of the employer's proposals to address variability would allow workers to be exposed to much higher levels and increase workers risk of developing disease. In rejecting industry calls for a PEL for benzene of 2 ppm instead of the 1 ppm proposed, OSHA stated, "This approach suffers from a major defect. It would permit much higher average exposures than can be feasibly achieved and is likely to lead to increased risk" (52 Fed. Reg. 34538).

Industry's current proposal in the silica standard – to maintain the 100 µg/m^3 current PEL – would have the same effect. It would result in much higher levels of exposure that can be feasibly achieved and leave workers at great risk of silica related disease and death. The whole point of the standard is to control and limit exposures by reducing variability and high exposures, not to allow continued high uncontrolled exposures that put workers at increased risk of disease and death.

The approach OSHA is using in the proposed silica standard – setting a PEL of 50 µg/m^3 as an 8-hour TWA and enforcing single sample exceedances, is the same approach that OSHA has used in its substance exposure standards for more than 40 years. It's also the same approach that OSHA has used in enforcing the current silica PEL. Similarly, OSHA's approach to a definition of feasibility is similar to what they have done under other OSHA health standards. There is nothing in OSHA's experience or evidence in the record to support that this approach is not reasonable and appropriate.

Contrary to industry's suggestions, there is no requirement in the standard that employers demonstrate that they are achieving the PEL at all times with 95 percent confidence. Like all other health standards, the standard includes an action level of 25 µg/m^3 which triggers the requirement to conduct monitoring (except in construction when Table 1 is used). The results of monitoring are used to determine which jobs/operations need further control.

OSHA's policies actually shield employers from citations and may subject workers to higher exposures (52 Fed. Reg. 34534). First, uncertainty in sampling and analysis is taken into account; OSHA won't issue a citation on a single sample unless the sample exceeds the PEL by more than the sample analytical error effectively raising the PEL for purposes of citation. Second, only the time sampled is taken into account, the result is reduced by any duration less than 480 minutes, with unsampled time considered to be zero. Finally, OSHA's industrial hygienists are permitted to take employer collected data showing lower exposures into account in issuing citations. We note that OSHA sampling, like all small sample sets, will almost certainly underestimate average exposure. Thus, any high exposures that are identified are particularly significant and warrant action. In the event that an OSHA inspection finds an exposure greater than the PEL, the employer would correctly be required to identify exposure sources, install controls and demonstrate compliance, just as they are required to do under all other OSHA health standards.

E. The Variability of Exposure Levels Presented in the Record Supports the Feasibility of Control to 50 µg/m^3 and Below In Most Operations. The Data Also Show the Need for an Action Level for Exposure Monitoring at 25 µg/m^3

Contrary to industry claims that due to variability in exposure levels, OSHA's proposed PEL is infeasible, it is the view of the AFL-CIO that the available data when analyzed according to established industrial hygiene principles show the opposite – that the variation demonstrates the feasibility of control and the need for an action level. As noted earlier, close to half the unit operations in most general industry sectors are operating below 50 µg/m^3; as many as one-fifth or more are operating below 25 µg/m^3. In the foundry sector overall, exposures in nearly 20% of sampled operations were less than 25 µg/m^3, and 45% below 50 µg/m^3.

Industrial hygienists know that virtually all exposure measurement data sets show a substantial range and a skewed distribution. The average result (arithmetic mean) is substantially higher than the median of the distribution. For the silica data in the record, the large majority of samples were below average and in compliance with 50 µg/m^3.

However, the average exposure breathed in by workers over time is the cause of COPD, lung cancer and silicosis. Therefore, a small number of samples is very likely to underestimate the health risk in an environment.

Industrial hygienists are also well aware that a range of exposures is observed between workers in the same process on a given day, and for the same worker in the same process on different days. As has been noted, this variation is not random, it has causes (sampling and analytical error, which is random, is a minor contributor to variability). The worker-to-worker variation is explainable and controllable: workers use different methods, they may take different positions relative to ventilation systems, they may use different work practices, and they may be subject to fugitive emissions (carryover from adjacent silica emitting processes). These differences in conditions can be observed by the industrial hygienist collecting the air sample, compared to exposure levels, and changed. Day-to-day variation for the same worker is caused by variation in materials, ventilation systems, production rate, and adjacent sources showing such variation. Sometimes these variations can be large, based on breakdowns of ventilation, process upsets and blowouts.

The low end of the range of variation of exposures during normal production rates should be considered the capability of the control system. Excursions that are higher are due to substandard conditions which can and should be corrected. As Dr. Frank Mirer explained during the hearings in response to questioning by Liz Nadeau from the IUOE, controlling high exposures and excursions will reduce variability, but it will also reduce average and median exposures (Tr. 971):

MS. NADEAU: …Your testimony notes potentially large variability of exposure and advocates an action of level of less than 50 percent of the PEL. Does this variability make compliance more difficult?

DR. MIRER: The variability combined with knowing about the variability through an ongoing monitoring program is the opportunity to reduce exposure. Exposures go up and down not by magic but by particular conditions, differences in work methods, differences in control efficiency, differences in adjacent operations.

So just as the brick people said yesterday, and I think the sand people said yesterday, if you follow up -- if you have continuing monitoring and you follow up the high levels, you reduce the exposure average and onward.

These exposure distributions are usually treated as "log-normal." Such distributions are better characterized by a geometric mean (GM) (usually very close to the median) and a geometric standard deviation (GSD) rather than the arithmetic mean (average) and standard deviation. Most importantly, the worker's chemical dose is characterized by the arithmetic mean air level, but most individual samples are expected to be less than the average exposure. The most likely sampling result is the median, a small number of samples will likely cluster near the median and therefore underestimate the average and therefore the health hazard of the exposure circumstance.

This type of variation is clearly illustrated in the air sampling data for assessing feasibility in the PEA. For example, in foundries for all operations combined, 19% of exposures were less than 25 µg/m^3, and an additional 24% less than 50 µg/m^3. This demonstrates the capabilities of the control system, with the higher median, average and maximum exposure levels being driven by excursions. For cleaning-finishing, considered the most difficult to control, 16% of exposures were less than 25 µg/m^3, with an additional 22% less 50 µg/m^3. Again, the higher median, average and maximum values are being driven by system failures. At the facility level, good industrial hygiene practice would include observing conditions at the time of the air samples being collected, and noting sources of exposure and reasons for excursions, so the excursions could be collected.

The same ratios were demonstrated by the AFS submission, which included detailed exposure estimates (Ex. 2379).

These observations demonstrate the need for an action level, in particular for exposure monitoring. An action level below the PEL, is needed to trigger continuing monitoring so that workers could be confident that exposures above the PEL, and average exposures don't pose a health hazard. An action level of 25 µg/m^3 or less is needed to have any confidence that workers are not exposed above the PEL.

F. It is Feasible to Measure Silica Exposures at the Proposed Permissible Exposure Limit and Action Level

A number of industry groups have argued that it is not feasible to measure silica exposures at the proposed 50 µg/m^3 or 25 µg/m^3 action level with required accuracy and precision using current methods (Exs. 2288, 2307, 2319).

The AFL-CIO strongly disagrees with these assertions. In its PEA, OSHA clearly demonstrated that it is feasible to reliably and accurately measure exposures of 25 µg/m^3 (PEA IV -13-47). Hearing testimony and evidence presented further supports and demonstrates that it is possible to measure silica exposures at the proposed levels.

As NIOSH stated during the hearings:

> The current proposal by OSHA of a comprehensive respirable silica standard, including the proposed permissible exposure level, the PEL of 50 µg/m^3, is consistent with the NIOSH recommended exposure limit, the REL. This standard is measured by techniques that are valid, reproducible, attainable with existing technologies, and available to industry and government agencies (Tr. 126)

The feasibility of measuring silica at the proposed 50 µg/m^3 PEL and 25 µg/m^3 action level was endorsed by the American Industrial Hygiene Association Laboratory Accreditation Programs (AIHA-LAP), the expert organization that certifies laboratories for proficiency in measuring silica:

> AIHA-LAP has reviewed OSHA's analysis in the proposed rule on sampling and analytical methods that can be used to measure airborne crystalline silica and agrees with OSHA that the X-Ray Diffraction (XRD) and Infrared Spectroscopy (IR) methods of analysis are both sufficient to quantify levels of quartz and cristobalite that would be collected on air samples taken from concentrations at the proposed PEL and action levels. We have also reviewed the data from OSHA's Salt Lake Technical Center (SLTC) on lower filter loadings, which has shown an acceptable level of precision analyzing samples at 40 µg and 20 µg (Ex. 3154).

OSHA, NIOSH, the AIHA-PAT program and commercial laboratories have all reported improvements in silica analytical techniques that have improved the ability to detect and measure silica, with greater accuracy and precision.

According to testimony and evidence presented by NIOSH, most laboratories no longer use the colormetric method to analyze samples (Tr. 211-12, 216, Ex. 3398, Attachment 8). Along with other improvements, this has greatly reduced variability, increased precision and improved limits of quantification in silica analytical methods (Ex. 3398, Attachment 8).

OSHA testified that with improvements in their methods, the sampling and analytical error for silica analysis is now around 17 percent (Tr. 95). Bill Walsh, testifying for the AIHA-LAP reported that their review of OSHA's laboratory data found acceptable precision and accuracy at lower levels.

> We have also reviewed the data from OSHA's Salt Lake City Technical Center on lower filter loadings which has shown an acceptable level of precision analyzing samples at 40 µg and 20 µg (Tr 3284-5).

OSHA also testified that a statistical analysis of their sampling data showed that there was less variation at lower levels (Tr. 516).

Evidence from commercial laboratories also demonstrates that it is possible to measure silica at levels well below the proposed PEL and action level. Bureau Veritias, the lab which is the contractor to NIOSH reported a Limit of quantification of 5 micrograms (µg) per sample (Ex. 4073, Attachment 10c). The RJ Lee group reports a limit of detection of 5 µg (Ex. 4073, Attachment 6b). According to testimony from Galson Labs representative Bill Walsh, who testified on behalf of the AIHA- LAP, his lab has a limit of quantitation of 5 µg, which they have statistically verified (Tr. 3302). This 5 µg limit of quantitation would correspond to an airborne concentration of approximately 7 $\mu g/m^3$ for a full shift sample collected by current low-flow pumps.

The silica concentration in air is measured by drawing a volume of air through a filter trapping the silica dust, then determining the weight of the silica dust trapped on the filter. The concentration of silica in air is calculated by dividing the weight on the filter (in micrograms) by the volume of air collected (in cubic meters). The limitation of quantitation in air is determined by the limit of quantitation of weight of silica on the filter. The limit can be improved by increasing the volume of air drawn by improving the pump, or improving the sensitivity of the analysis. For at least 45 years, respirable silica has been sampled at 1.7 liters/minute. The laboratory limit of quantitation has improved over time. The PEA correctly states that present analytical sensitivity will accurately measure silica at concentrations of 25 $\mu g/m^3$ and below with a full shift air sample collected at this low flow rate (Ex. 1720). With the current low-flow sampling method, approximately 20 µg of silica will be collected over a full shift if the air concentration is 25 $\mu g/m^3$.

In testimony on behalf of the AFL-CIO, Dr. Frank Mirer explained that using currently available and routinely used personal sampling pumps with a higher flow rate would easily collect sufficient amount of material to measure exposures at both the 50 $\mu g/m^3$ PEL and 25 $\mu g/m^3$ action level with acceptable precision. A pump collecting at 4.4 L/min would improve sensitivity by a factor of 2.5 compared to the current routine method (which is already sufficiently sensitive). NIOSH also endorsed this position in written comments stating:

> …either 4.4 L/min or 4.2 L/min can be used to meet the ISO [respirable] convention within acceptable limits. Other studies have investigated the role of sampling pulse pulsation on cyclone performance and established criteria for acceptability. Results from these and other recent studies support the proposed rule's description of the accuracy and precision of existing methods for respirable crystalline silica sampling and analysis at the proposed action level (Ex. 2177).

The AIHA-LAP, in response to questioning by Scott Schneider, LIUNA, also agreed that with the use of higher flow pumps, the 25 $\mu g/m^3$ level could be measured with sufficient precision (Tr. 3286-87):

MR. SCHNEIDER:	Okay. Because NIOSH in their testimony talked about the use of 4.2 L pumps. So if we were to use 4.2 L pumps, then presumably the ability to measure at the action level would be increased. Is that correct?
MR. WALSH:	That's correct. The air volumes and the denominators, so the greater the air volume the lower the measured amount. As long as the cyclones pulling at the four micron cut point, it's irrelevant as far as the analysis is concerned.
MR. SCHNEIDER:	Okay. So you feel like if we were to use the higher flow pumps that you'd feel confident that you could measure the action level with sufficient precision?
MR. WALSH:	Yes, I do.

The proposed standard requires that silica samples be collected and analyzed utilizing one of 6 specified methods and analyzed by an accredited laboratory that meets certain standards. Industry groups have argued that since current accreditation and proficiency testing programs have not certified or validated laboratories' silica sampling and analysis performance at the proposed 25 $\mu g/m^3$ action level, that the

proposed standard is not feasible (Exs. 2259, 2288). But as Mary Ann Latko from the AIHA-PAT program testified, and others testified at the hearings, this is largely due to the fact that there has been no demand from laboratories to do so given the current OSHA PEL of 100 µg/m^3 (Tr. 3304, 3798). But as witnesses testified, it is certainly possible to validate sampling and analytical methods and certify laboratories, at or below 25 µg/m^3 level, since it is clearly feasible to measure at these levels. As the AIHA-LAP testimony stated:

> AIHA-LAP is willing and expects to work with NIOSH and OSHA officials to review and validate new analytical methods as they are being developed. This is a role that AIHA-LAP has historically played, and we expect to play this role moving forward (Tr. 3514).

Moreover, as Chuck Gordon testified, the standard will provide the impetus for the development of new and improved methods to measure silica exposures, just as was the case with the promulgation OSHA's arsenic standard (Tr.3797-8).

V. Economic Feasibility: The Proposed Silica Standard is Economically Feasible

In setting standards OSHA is required to demonstrate that a standard is economically feasible. To establish economic feasibility, "OSHA must construct a reasonable estimate of compliance costs and demonstrate a reasonable likelihood that these costs will not threaten the existence of competitive structure of an industry, even if it does portend disaster for some marginal firms." *Steelworkers v. Marshall*, 647 F.2d 1189, 1272 (D.C.Cir. 1980).

In order to demonstrate economic feasibility of a standard, OSHA must provide a reasonable assessment of likely range of costs of its standard and the likely effects of those costs on industry. *Color Pigments Mfrs. Ass'n v OSHA,* 16 F3d 1157 (1994). A standard may be economically feasible even though from standpoint of employers, they are financially burdensome and affect profit margins adversely. *Industrial Union Dep't v Hodgson*, 499 F2d 467, 1974 (criticized in United States v Ward.). A standard is not economically infeasible because it is burdensome or even threatens survival of some companies within the industry so long as it does not threaten massive dislocation or imperil existence of industry. *Asarco, Inc. v Occupational Safety & Health Admin (*1984, CA9) 746 F2d 483, (1984).

The record demonstrates that the proposed standard is economically feasible. OSHA has prepared a Preliminary Economic Analysis on the costs of the standard in general industry, maritime and construction, based on a detailed and extensive assessment of exposures, required control measures and associated costs.

The economic analysis has estimated the total annual cost of the standard at $637 million, with a cost of $143 million in general industry and maritime and $495

million in the construction industry (Ex. 1720). The per establishment cost is $2,571 in general industry and maritime and $1,022 in construction, a relatively modest cost for the benefits that will be achieved. OSHA has determined that these costs do not threaten the profitability or viability of the affected industries, and that most firms will be able to absorb these costs.

While a cost-benefit analysis is not required, and indeed is not permitted in setting an OSHA standard, OSHA's analysis of benefits conducted as part of the regulatory analysis required under Executive Order 12866, shows significant benefits to workers as a result of the proposed rule. Specifically, OSHA has estimated that the proposed rule will prevent 688 silica related deaths each year and prevent 1,585 cases of silicosis (Table S1-1, 78 Fed. Reg. 56277, Sept. 12, 2013). But these estimates do not include the non-fatal cases of respiratory diseases and renal disease that will also be prevented. OSHA has estimated the value of these lives saved and diseases prevented at $5.25 million dollars a year.

A. OSHA's Cost Estimates are based upon Exposure Estimates That Fail to Take Into Account Cross- Contamination and Overstate the Cost of Control Measures That Are Needed to Reduce Exposures

OSHA's cost estimates in general industry and maritime have been generated based the control measures that are needed to reduce exposures to the PEL in individual jobs on a per worker basis. Assumptions have been made about the number of workers each control will protect, and total costs were developed based upon the number of workers in particular jobs in an industry that are in need of controls because they exceed the proposed 50 µg/m^3 PEL. Exposure estimates and distributions have been constructed by OSHA based upon exposure information from a wide variety of sources.

As we have pointed out in our comments on technological feasibility, many exposures to silica are a result of cross contamination and bystander exposure. That is, workers are being exposed to silica generated from other jobs. This is true of workers who work in jobs were there is no silica generated, as well as workers who work in silica generating jobs, who may also be exposed to silica generated in adjacent operations. The exposure estimates that OSHA has constructed include many jobs where there is exposure from cross contamination. But OSHA has not taken this source of exposure into account in its PEA when evaluating the controls that are needed to reduce exposure.

For example, in the iron foundry industry OSHA has estimated that 63 percent of workers in cleaning/finishing operator jobs are exposed above the proposed 50 µg/m^3 PEL (78 Fed. Reg. 56348, Sept. 12, 2013, Table VIII-4). The cost of controls for this operation/this job have been developed based upon these exposure estimates which assume that all the exposure from these workers is generated from that individual job. But as Dr. Frank Mirer explained, some of the exposure in this job actually comes from adjacent operations. Thus the actual silica exposures generated from cleaning and fishing operators that need to be controlled are less than that estimated by OSHA (Tr.

948). By failing to account for these other sources of exposure in determining required controls, OSHA has overestimated the number of controls that are needed, the number of workers that need these control measures and the associated costs. Thus the agency's cost estimates in general industry and maritime are overstated. Economic analyses by Stuart Sessions and Jack Waggener, on behalf of the American Chemistry Council, go further in that direction: they do not account for bystander exposure, but also assign engineering controls to individual workers even though the whole purpose of engineering controls is to capture dust at the source, thereby covering groups of workers, sometimes a whole facility (Exs. 2308 Sessions, 2308 Waggener, 3464).

B. OSHA Has Used Overly Conservative Assumptions in Its Preliminary Economic Analysis that Result in Cost Estimates That Are Overstated

While OSHA's Preliminary Economic Analysis is extensive and detailed and based on a substantial body of evidence, the analysis has used many conservative assumptions that result in cost estimates that are too high.

Dr. Ruth Ruttenberg, an economist with decades of experience working on economic analysis related to OSHA regulations, submitted detailed comments and testimony on behalf of the AFL-CIO concerning conservative assumptions used by OSHA's PEA that resulted in overestimated cost. These include the failure to take into account overlaps with other standards, assumption about the low level of current controls, the assumption that the standard will have a negative impact on productivity and others (Tr. 953-965; Ex. 2257 Ruttenberg).

Perhaps most importantly, OSHA based its cost estimates on current technology that fails to take into account innovations in technology that are likely to occur as a result of the new rule, a fact that OSHA itself has admitted in the PEA (Ex. 1720, Pp. V-211-12).

Decades of experience with OSHA standards has demonstrated that regulations often spur technological developments. As Dr. Ruttenberg and former DOL solicitor Chuck Gordon pointed out, this was the case with OSHA standards on vinyl chloride, coke ovens, lead, asbestos, lock-out/tagout, cotton dust, formaldehyde, ethylene oxide and other hazards (Exs. 2257 Ruttenberg, Ex. 2163). As a result, the actually cost of implementation of these standards was much lower than originally estimated by OSHA.

As Dr. Ruttenberg explained in her testimony:

> Technological improvements, both engineering and scientific are constantly occurring, especially when there is a pressure of pending or existing regulation. They provide a strong incentive to find a way to comply at lower cost. The genius of American industry basically is that once engineers and scientists are given the challenge of figuring out how to solve a

problem, they bring that to bear, and these technological improvements follow through (Tr. 954-5).

The experience that OSHA and industry groups have routinely overestimate impacts and costs of OSHA standards has been well documented. To date, OSHA has completed eight retrospective reviews of its standards under Section 610 of the Regulatory Flexibility Act (Ex. 2163). Other retrospective reviews have been conducted by the Office of Technology Assessment.[23]

These Section 610 reviews, along with retrospective reviews conducted by the Office of Technology Assessment, have been submitted to the Docket by the AFL-CIO or OSHA (Exs. 4072 Attachments 60-67; Ex. 3770).These reviews have routinely found that OSHA overestimated the predicted compliance cost of standards, and that industry estimates overstated costs to an even greater degree.

During questioning of OSHA at the hearing by Caryn Halifax of the Bricklayers, Robert Burt, OSHA Acting Deputy Director, Directorate of Standards and Guidance, confirmed that OSHA's cost-estimates for past standards had largely overestimated costs, and that the proposed silica standard had utilized a similar methodology as used in costing out these previous standards (Tr. 116-117):

MS. HALIFAX: …did OSHA use the economic and technical feasibility approaches and methodologies that it has used in previous rulemakings?

MR. BURT: Yes. This is basic -- the methodology is fundamentally similar to that that OSHA has used on previous health standards and in previous rulemakings.

MS. HALIFAX: Thank you. And in the past, what has happened following promulgation of final rules during look-backs, and are the costs similar to those estimated by OSHA or various industry groups during the rulemaking process?

MR. BURT: There are a number of studies that compare OSHA's final costs estimates with what actually -- and economic feasibility estimates with what actually happened later. There's OSHA's own look-back studies. There is a

[23] Section 610 "look back reviews have been conducted on standards on Cotton Dust, Ethylene Oxide, Excavation Standard, Grain Handling Facilities, Lead in Construction, Lockout/Tag-out Standard, Methylene Chloride, Presence Sensing Device Initiation (PSDI) Provisions of Mechanical Power Presses Standard.

study by the Office of Technology Assessment. I believe both of those are referenced in the Preliminary Economic Analysis. There's a study by some economists at Resources for the Future.

All of these show that the tendency is for OSHA to overestimate rather than underestimate costs in its final rule, and there is no evidence of industries that have been eliminated by or substantially altered by an OSHA final rule in any of those studies.

Just as past OSHA economic analyses have over-estimated the cost of OSHA standards, it is likely that the use of a similar methodology and utilization of conservative assumptions has resulted in cost estimates for the proposed silica standard that are too high.

In response to OSHA's request during the hearings, Dr. Ruth Ruttenberg has provided post-hearing comments that outline recommendations for improvements that OSHA could make in its final economic analysis on silica in order to present more realistic cost estimates (Ex. 4072, Attachment 56). These include considering the timing of compliance in estimating costs, using depreciation schedules and adding a technological improvement factor to estimate the expected regulatory costs. The AFL-CIO urges OSHA to incorporate these recommendations in preparing their final economic analysis on the silica standard.

VI. AFL-CIO POSITION ON KEY PROVISIONS OF THE RESPIRABLE CRYSTALLINE SILICA STANDARD

The AFL-CIO strongly supports OSHA's proposed standard to reduce worker exposure to respirable crystalline silica. There is extensive evidence that demonstrates that exposure to silica poses a significant risk to workers and that reducing permissible exposures to 50 $\mu g/m^3$ or less is feasible. It is our view that the proposed standard will significantly reduce the risk of workers exposed to silica. But as OSHA has acknowledged, the proposed standard still leaves workers at significant risk of death and disease. Indeed, the level of residual risk at the proposed PEL is greater than under many previous health standards promulgated by OSHA (78 Fed. Reg. 56335, Sept. 12, 2013, Tr. 71). But, at the same time, many of the ancillary provisions of the proposed standards are weaker than similar provisions in previous standards. It is well established that under the OSH Act, in setting standards, OSHA has an obligation to reduce significant risk to the extent that is feasible to do so. If the PEL fails to adequately reduce risk, OSHA must look to other provisions of the standard to do so. To further protect workers and reduce the risk of silica related death and disease, there are key provisions that must be strengthened in the final rule.

In our written comments submitted to the record and testimony presented at the hearings, the AFL-CIO outlined our initial position on the specific provisions in the proposed silica standard. This post-hearing submission presents our final position, based upon the full record of evidence and testimony presented during the proceedings. Like our earlier submission, these comments focus primarily on the standard as it applies to general industry. The Building and Construction Trades Department, AFL-CIO (BCTD) has presented comprehensive comments and testimony on the provisions of the construction standard and will be submitting its final recommendations on that standard. The AFL-CIO supports the BCTD's position on the silica construction standard. Due to differences in the nature of work and employment in construction and general industry, there may be differences in recommendations for final provisions in the construction and general industry standards. These recommendations are based upon what the unions believe are the best feasible approaches for protecting workers from significant risk of harm from exposure to silica in these different sectors.

A. The Proposed Permissible Exposure Limit (PEL)

The AFL-CIO supports OSHA's proposal to reduce the PEL for crystalline silica to 50 µg/m^3 for the current permissible limits of approximately 100 µg/m^3 in general industry and 250 µg/m^3 in construction and maritime. As discussed above, there is extensive evidence demonstrating that workers exposed to the current permissible levels of silica are at extremely high risk of death and disease. Reducing exposures to 50 µg/m^3 will significantly reduce the risk of death and disease from lung cancer, silicosis, other non-malignant respiratory diseases and renal disease. But as OSHA has acknowledged, the 50 µg/m^3 PEL is based on feasibility considerations, and still leaves workers at significant risk of death and disease.

The 50 µg/m^3 PEL is certainly not novel, groundbreaking or far reaching. The 50 µg/m^3 PEL was first proposed by NIOSH in its 1974 *Criteria for a Recommended Standard: Occupational Exposure to Crystalline Silica* (Ex. 0388). It is consistent with the exposure limits in a number of Canadian provinces, including Saskatchewan and Ontario (Ex. 4072, Attachment 43; Ex. 4073, Attachment 15b). Other authorities have adopted even more stringent limits to protect workers from silica. In 2006, the American Conference of Governmental Industrial Hygienists (ACGIH) lowered its recommended TLV to 25 µg/m^3 from 50 µg/m^3 which had been adopted in 2000 (Ex. 2257). The Canadian Labour Code has adopted a 25 µg/m^3 exposure limit as have the provinces of Alberta, British Columbia, Manitoba, Newfoundland, Nova Scotia, and Prince Edward Island and Mexico (Ex. 2257, Ex. 4072; Attachments 39, 40, 41, 42, 43 and 46).

The reduction of the PEL to 50 µg/m^3 has broad support from the medical and scientific community. NIOSH, the American Thoracic Society, American College of Occupational and Environmental Medicine and the American Public Health Association all support this proposed exposure limit (Exs. 2177, 2175, 2080, 2178).

OSHA's preliminary economic analysis clearly documents that a 50 µg/m^3 PEL is feasible and can be achieved in most industries, in most operations, most of the time.

Indeed OSHA estimates that of the nearly 2.2 million workers exposed to silica, 1.0 million – nearly half - are currently exposed at levels below 50 µg/m^3, and another 770,000 are exposed to levels between 50 and 100 µg/m^3 (Ex. 1720). The record evidence shows that exposures to silica can be significantly reduced through the implementation of simple, well-known control measures including wet methods, ventilation and isolation. In fact, these control measures have been described for decades and were recommended by NIOSH in their 1974 criteria document (Ex. 0388).

B. The 25 µg/m^3 Action Level

OSHA has proposed an action level of 25 µg/m^3 – half of the permissible exposure limit – to trigger exposure monitoring or exposure assessment. Under the proposed rule, the action level does not trigger the requirement for medical surveillance.

The AFL-CIO supports the inclusion of a 25 µg/m^3 action level in the standard. As we will discuss below, we believe that the action level should also serve as the trigger for medical surveillance in general industry.

The incorporation of an action level in health standards to trigger other provisions of rules has been a long-standing practice by OSHA. The concept has been incorporated into OSHA standards at least going back to the 1974 vinyl chloride standard, which included an action level of 0.5 ppm – one-half the permissible exposure limit of 1 ppm – that triggered requirements for exposure monitoring and medical surveillance (39 Fed. Reg. 35890). When the action level was first incorporated, the stated rationale was to "minimize the impact of the standard on employers who have attained exposure levels well below the permissible exposure limit (39 Fed. Reg. 35893, Oct. 4, 1974). Subsequently, the rationale for action levels evolved, and action levels were incorporated into standards in recognition that workplace exposures are variable; and to ensure that an employer is in compliance with the PEL, exposure monitoring should be conducted at levels below the PEL (78 Fed. Reg. 56447-8, Sept. 12, 2013; also see proposed asbestos standard, 49 Fed.Reg.14124, April 10, 1984).

During the hearings, in response to questioning, William Perry, OSHA's Acting Director of Standards and Guidance explained the purpose of an action level as follows:

> MR. PERRY: Well, the purpose of the action level is when there starts to be exposures in the workplace that are up at the action level or higher, we're getting pretty close to seeing exposures in excess of the PEL. So typically in OSHA standards, we will trigger various other protective measures to that action level, such as in this case, we trigger a requirement for periodic exposure monitoring from the action level (TR. 71).

As the AFL-CIO outlined in our earlier comments, most OSHA standards that include an action level set the level at one-half the permissible exposure limit, as was acknowledged by OSHA during the hearings (Tr. 72).

The only standards that have deviated from this approach are the 1994 asbestos standard and the 1992 formaldehyde standard. In the case of asbestos the action level was set at the same level as the PEL (0.1 fiber/cc) when OSHA determined that it was not feasible to accurately measure exposures below this level (59 Fed. Reg. 40974-5, Aug. 10, 1990). It should be noted that the 1994 revised standard was a result of a court challenge to the 1986 asbestos standard, which set a PEL of 0.2 fiber/cc and included an action level of 0.1 fiber/cc. In response to the court decision and remand, OSHA reduced the PEL to 0.1 f/cc, but did not reduce the action level due to constraints in the measurement technique. In the case of formaldehyde, the standard sets a PEL of 0.75 ppm and an action level of 0.5 ppm. That standard also represents the result of a court challenge and remand. The formaldehyde standard as originally issued in 1987 set a PEL of 1 ppm and an action level of 0.5 ppm (52 Fed. Reg. 46291, Dec.4, 1987).

The inclusion of an action level of one half the PEL in the silica rule has broad support. NIOSH, ASSE, APHA, ATS, AOEC, ACOEM the AFL-CIO and all of the unions that testified supported the need for an action level as a means to reduce exposures and better protect workers (Exs. 2177, 2339, 2178, 2175, 2080, 2257). In written comments, the National Industrial Sand Association (NISA) pointed out that the inclusion of an action level provides a strong incentive to employers to reduce exposures and urged OSHA to include an action level in the final standard:

> *Value of an Action Level*
> NISA strongly supports the inclusion of an action level in the crystalline silica rulemaking. In the absence of an action level, employers have to comply with all requirements of a standard no matter what level of exposure they achieve. On the other hand, if staying below the action level frees an employer from having to comply with the rule at all, the employer has a powerful economic incentive to do so. After 17 years of intensive OSHA focus on crystalline silica, it would be a tragic missed opportunity if the rule were to fail to incorporate an action level coupled with appropriate ancillary provisions (Ex. 2195).

As we have discussed above, OSHA has established that it is feasible to reliably and accurately measure exposures of 25 µg/m^3, and substantial evidence and testimony support this finding. The 25 µg/m^3 action level should be included in the final standard.

C. Exposure Assessment and Monitoring

The AFL-CIO supports OSHA's proposed requirements for exposure assessment and monitoring in general industry. The proposal requires that all employers who have workers potentially exposed to silica make an initial assessment of worker exposures. Employers are allowed to rely upon existing data from exposure monitoring conducted

within a 12 month prior time period when conditions closely resembled those that currently prevail, or rely on objective data.

Section 6(b)(7) of the Occupational Safety and Health Act mandates that standards provide for monitoring of exposures as is necessary for the protection of employees. Similar monitoring provisions have been included in all other health standards that include a permissible exposure limit (Ex. 2257)

The importance of exposure assessment and monitoring to protect workers from silica exposures was underscored and outlined in the American Foundry Society's publication, *Control of Silica Exposures in Foundries* (Ex. 3733):

> Collecting representative air samples for silica is an essential part of protecting employee health. While dusty operations may obviously need to be controlled, most managers need to see data (usually air monitoring data) to decide if a new or improved control measure is necessary.
> Air monitoring is important for the following reasons:
> - to determine which employees need to be protected and how much protection is necessary
> - to assess whether controls are effective or are remaining effective
> - to evaluate whether work practices need to be changed to reduce exposures
> - to comply with OSHA regulations.

If exposures are over OSHA PELs, there is an expectation on OSHA's part that employees will be protected with personal protective equipment until feasible engineering controls or work practice changes can reduce exposures below the PEL

The inclusion of exposure assessment and monitoring requirements in the standard was broadly supported by commenters and hearing participants including NIOSH, ASSE, APHA, AFL-CIO and the unions (Exs. 2177, 2339, 2178, 2257). The National Industrial Sand Association (NISA) testified that the absence of any exposure monitoring requirement in the current standard was likely a substantial cause of non-compliance with the current PEL since many employers have no idea of workplace exposure levels. As NISA stated, "personal dust sampling is thus key to ensuring compliance with any PEL (Ex. 2195).

The AFL-CIO supports the proposed periodic exposure assessments when workers' exposures are above the action level, with more frequent assessments required if exposures exceed the PEL. These regular follow-up exposure assessments will help employers identify if control measures are working and if further controls are needed. Similar requirements for periodic exposure assessments are included in all

other health standards that include exposure monitoring and should be included in the final silica standard.

1. Objective data

The proposed standard allows employers to rely on "objective data that demonstrate that respirable silica is not capable of being released at or above the action level under any expected conditions of processing, use or handling (78 Fed. Reg. 56487, Sept. 12, 2013). Similar types of provisions have been included in other OSHA health standards, and the AFL-CIO does not object to including such a provision in the final rule. As we stated in our initial comments, the final standard needs to provide greater clarification and guidance on the kind of data that may or may not be relied upon. We support the recommendations made by NIOSH for changes and improvements in the definition of objective data:

> Objective data means existing information that can be used to reasonably infer employee exposures about a current or future task. The tasks being compared must have similar exposure factors such as work operation, materials used, tools, work practices, production conditions, control methods, and environmental conditions (such as presence of other dust sources and open or enclosed nature of work area). Existing information can include air monitoring data from previous employer or industry surveys, or calculations based on the composition or chemical and physical properties of a substance. Information with partial or missing exposure factor information cannot be used. (Ex. 2177).

We believe these changes will help ensure that the data relied upon adequately reflect workers' actual exposures in the workplace or on the jobsite.

2. Use of real-time monitoring and direct reading Instruments

In written comments and in testimony, a number of parties supported the use of real time monitoring and direct reading instruments to assess and control silica exposures. Dr. Frank Mirer, testifying on behalf of the AFL-CIO, explained how real time exposure monitoring was used to identify high exposures, often caused by break down in control measures.

> And, finally, real-time aerosol monitor combined with area samples for silica would enable source identification, real-time results, knowing the overexposure within minutes of when it happened rather than waiting for the lab results to come back. I believe CPWR has done studies using this kind of equipment, and the final standard should permit this as an alternative to the full shift -- you should be able to assess exposure using this methodology.

> And we have put this into the hands of -- this technology, at the UAW, we put it in the hands of the UAW GM air sampling technicians who are hourly workers to map and assess metal working fluid exposures, in particular. And that instrument costs about the same as a noise meter, so it's like a -- it's a bargain compared to the typical industrial hygiene (Tr. 941-2).

This method of exposure assessment, conducted through a combination of direct reading instruments to measure total respirable dust and information about the percentage of quartz present in the dust permitted real time assessment of exposures and immediate intervention.

The American Foundry Society also testified about the utility of this kind of exposure assessment, and advocated that OSHA permit such assessments in any final silica standard:

> One is exposure monitoring. We really believe we need source information, that eight-hour time-weighted average does not tell us what the source is. And if all you do is repetitive eight-hour time-weighted average, you're not going to learn anything.
>
> So we believe that there is room for other kinds of measurement, real time monitoring, other alternative measures that can not only characterize exposure, but we can learn something about sources (Tom Slavin, AFS, Tr. 2668-9).
>
> And we used real-time methods there to identify the sources of the exposure. This is chipping and grinding with portable tools. And we were trying to assess the sources. We were also trying to establish ventilation parameters for a back draft hood and supply air combination that the foundry was considering, trying to get the proper -- and we used it there.
>
> And, basically, there isn't any monitor for respirable silica, you know, that reads it directly, but there is a respirable dust monitor, and the standard is respirable dust. But you need to know the silica content to calculate the target.
>
> I would say -- we've been using these methods now in the foundry industry for the last 20 years. But I would say, in the last 10 years, they're being more used. There's a number of OSHA offices that have seen reports that have been done after a citation as part of a compliance program, where OSHA requires that the foundry do an engineering study.

> A number of foundries have turned in those studies, which have used real-time instruments to define root causes (Robert Scholtz, AFS, Tr. 2738-9).

The AFL-CIO supports the use of real time monitoring to assess silica exposures. Recently, the Mine Safety and Health Administration has incorporated mandatory requirements for the use of direct reading dust monitors in its final standard on coal dust (30 CFR Part 71). We believe that the use of such technology and exposure assessment can greatly benefit exposure assessment and control for occupational silica exposures as well.

The AFL-CIO recognizes that at this time there is no standardized sampling method or technology for direct exposure assessment for silica. However, we believe that with the promulgation of a new final silica standard, such methods and technologies are likely to be developed quickly.

Therefore, we urge OSHA to provide for the development of such technologies and methods in the final standard. Specifically, we recommend that OSHA include provisions in the final standard, similar to those included in the final standard on cotton dust (29 CFR 1910.1043(d)) that allow for the use of alternative sampling and measurement methods if the employer demonstrates equivalency with the methods specified in the standard, and the alternative method is approved by OSHA.

D. Regulated Areas

In areas where exposures exceed the PEL, the proposed standard requires that employers establish a regulated area or implement a written access control plan to limit the number of workers exposed to high levels of silica. Provisions for regulated areas have been included in OSHA health standards for decades and is a well-established practice. But this is the first time that the agency has provided an option of establishing an actual area that is demarcated or a procedure that will limit access. It appears that the difference between the two approaches is that one requires a physical demarcation, and the other relies upon an individual or gatekeeper to limit the number of workers exposed. In neither case are there specific requirements for posting warning signs to alert workers to the presence of high levels of silica, provide specific health hazard warnings and control measures as have been included in all other OSHA health standards.

The record is replete with evidence that many of the worker exposures to silica are “bystander exposures” or exposures resulting from the generation of dust from nearby jobs or operations (Ex. 1720- PEA Table, Ex. 3429, Ex. 2253).[24] Limiting the generation of dust at the source must be the primary means of protection, but it is also important to limit the numbers of workers in the high exposure areas. It is the AFL-CIO’s view that the written access control option will not adequately protect workers and limit access to high exposure areas. It also will be very difficult to enforce.

[24] Also see Hierarchy of Controls – Bystander and Secondary Exposures, (V)(E)(1) of this brief.

OSHA has provided no justification for the departure from requiring regulated areas that are demarcated with warning signs, as has been included in all other health standards that regulate carcinogens. It is the AFL-CIO's view that the option for a written access control plan should be eliminated in the general industry standard and that the standard require the establishment of demarcated regulated areas where exposures will exceed the PEL, posted with warning signs. Proposed language for warning signs is outlined in the section of our comments on training and information below.

In order to avoid exposure from contamination of clothing, the proposed standard requires that employees in a regulated area (or access control area) be provided with appropriate protective clothing or another means to remove excessive silica dust from contaminated clothing. But this requirement is limited to "where there is the potential for employees' work clothing to become grossly contaminated with finely divided material containing crystalline silica (1910.1053 (e)(2)(v)). This language is vague and undefined. It will be difficult to interpret, comply with and enforce. Other standards which contain requirements for protective clothing and decontamination simply require that it be provided if there is exposure above the PEL.

As NIOSH and other witnesses testified, contaminated clothing can be a major source of worker exposure, and minimizing this exposure is important to reduce workers' overall exposure (Ex. 2177, Ex. 2310).

Don Beaver, testifying on behalf of HalenHardy outlined the problems with the language on "grossly contaminated" as follows:

> Given the critical importance of dealing correctly with contaminated clothing, I'd like to wind up with three key points. First, the words "grossly" or "excessive" should be eliminated as qualifiers of the level of contamination. And here's why: The words "grossly" and "excessive" should be eliminated because, given up to a tenfold increase in exposure from contaminated clothing, it must be addressed under any circumstances.
>
> The second reason why the words "grossly" or "excessive" should be eliminated is that they appear under the regulated area and access control section. Inherent in the definition of the regulated area or access control is the fact that the employee's exposure to RCS exceeds or can reasonably be expected to exceed the PEL. So by the very definition, you're working in an area where there's stuff floating around and getting on your clothes. Levels of silica dust in excess of PEL are already deemed dangerous to worker health. Thus, workers should be required to clean their clothing upon exiting these areas.

> And the third reason why "grossly" and "excessive" should be eliminated is they are ambiguous. There's no definition of "grossly" or "excessive" contained anywhere in the proposal and the use of these words creates a loophole in the proposal. Employers can avoid requiring workers to clean their clothing by taking the position that contaminated levels were not gross or excessive, thereby shifting the burden for OSHA to prove otherwise (Tr. 3906-7).

The AFL-CIO agrees with NIOSH, HalenHardy and other witnesses that the language in the proposed rule on "grossly contaminated" be removed from the final standard (Ex. 2177, Tr. 3906). We recommend the following language on protective clothing in regulated areas for the final general industry standard:

(v) *Protective work clothing in regulated areas.*
(A) The employer shall provide either of the following:
  (1) Appropriate protective clothing such as coveralls or similar full-bodied clothing; or
  (2) Any other means to remove silica dust from contaminated clothing that minimizes exposure to crystalline silica.
(B) The employer shall ensure that such clothing is removed or cleaned upon existing the regulated area and before respiratory protection is removed.

1. <u>Competent person</u>

The requirements for a competent person in the proposed standard are extremely limited. A competent person is only required if the employer chooses to establish a written access control plan instead of a regulated area in order to limit the number of workers in high silica exposure areas. Under the proposal, the competent person's stated responsibilities are limited to identifying the presence and location of any areas where respirable crystalline silica exposures are, or can be reasonably expected to be, in excess of the PEL ((e)(3)(A)). The proposal defines competent person as "one who is capable of identifying existing and predictable respirable crystalline silica hazards in the surrounding or working conditions and who has authorization to take prompt corrective measures to eliminate them (Section (b) *Definitions*).

The competent person provisions of the proposed silica standard are much less extensive than the competent person provisions in many other OSHA standards, particularly in the construction industry. And as OSHA has acknowledged in the preamble, the provisions on competent person are much more limited than those included in the draft silica standards for general industry and construction that were submitted to SBREFA for review in 2003 (the SBREFA drafts):

> OSHA included more extensive competent person requirements in both the draft general industry/maritime and

> construction standards presented for review to the Small Business Regulatory Enforcement Fairness Act (SBREFA) review panel. The SBREFA draft standards included requirements for a competent person at each worksite to ensure compliance with the provisions of the standard. Specifically, the SBREFA draft standards required that the competent person: Evaluate workplace exposures and the effectiveness of controls, and implement corrective measures to ensure that employees are not exposed in excess of the PEL; establish regulated areas wherever the airborne concentration of respirable crystalline silica exceeds or can reasonably be expected to exceed the PEL, taking into consideration factors that could affect exposures such as wind direction, changes in work processes, and proximity to other workplace operations; and check the regulated area daily to ensure the boundary is maintained. The SBREFA draft standards also required the employer to ensure that the competent person inspect abrasive blasting activities as necessary to ensure that controls are being properly used and remain effective; participate in the evaluation of alternative blast media; and communicate with other employers to inform them of the boundaries of regulated areas established around abrasive blasting operations (78 Fed. Reg. 56443, Sept. 12, 2013).

According to OSHA, the competent person provisions of the standard were changed in response to concerns raised by small business representatives during the SBREFA review, who believed that the provisions were too complicated and too costly (78 Fed. Reg. 56444, Sept. 12, 2013). So instead, the agency "proposed limited competent person requirements because the agency has concluded that the provisions of the proposed standard will generally be effective without the involvement of an individual specifically designated as a competent person (78 Fed. Reg. 56444, Sept. 12, 2013).

The AFL-CIO strongly disagrees. The evidence in the record clearly and overwhelmingly demonstrates that controlling silica exposures requires careful and continuous attention. High exposures can easily occur if controls are not properly utilized and properly maintained. Thus one of the most important ways to ensure that workers are protected is to have an individual onsite that can readily identify situations where exposures may be high and take action to see that corrective action is taken. Without such an individual, the provisions of the rule, including control measures will be much less effective.

The importance of having a competent person on site with specific responsibilities was highlighted by NIOSH and the American Industrial Hygiene Association, both of which strongly urged OSHA to include a provision for a competent

person in the final standards – for construction and general industry (Ex. 2177, Ex. 2169). The Building and Construction Trades Department and other unions provided extensive comments and testimony on why a competent person was critical to ensuring effective control of silica exposures (Ex. 2371, 2253, 2262, 2329).

While requirements for a competent person have been incorporated primarily in construction standards, such requirements also are applicable and useful to controlling exposures in general industry as well. Both the UAW and USW panels who presented testimony at the hearings outlined the ways bargaining unit members with training were involved in hazard identification and control (Tr.1866-7). For example, Richard Boecker, UAW Safety and Health Representative from Local 211 at the GM Defiance Plant explained how the union representatives conducted pressure checks to ensure that ventilation equipment was functioning properly (Tr.1867). Both the UAW and USW urged OSHA to adopt a competent person requirement in the general industry standard, and the need for a competent person in general industry was advocated by Dr. Frank Mirer as well (Tr. 985).

The AFL-CIO urges OSHA to include comprehensive provisions for a competent person in both the general industry and construction standards. For general industry we recommend that OSHA incorporate the requirements that were included in the 2003 draft standard.[25] In order to ensure that the competent person has appropriate training, the final standard should set forth the criteria for qualifications and training for the competent person. Recommendations for the required training for a competent person are set forth below in our comments on the standard's training provisions.

2. Exposure control plan

The proposed standards do not include a requirement for an exposure control plan. As OSHA notes in the preamble, the ASTM standards for general industry (ASTM E 1132-06) and construction (ASTM E 2625-09) both include a requirement for an exposure control plan that sets forth the engineering and work practice controls and other measures that will be used to bring exposures into compliance. OSHA has requested whether the silica standards should include a similar requirement.

The AFL-CIO believes that a written exposure control plan is a critical component for both the OSHA general industry and construction comprehensive silica standards. Worker exposure to silica is a result of specific operations or tasks that generate dust. Identifying these sources of exposure and implementing appropriate control measures is critical to protect workers from unnecessary exposure. These sources of exposure must be systematically identified, appropriate controls implemented and monitored to ensure that controls are effective and being maintained. The most effective means to do this is through a written exposure control plan.

[25] The Building and Construction Trades Department will be submitting final recommendations on the competent person provisions of the construction standard in its post-hearing brief. The AFL-CIO endorses these recommendations

In written comments and in hearing testimony, many witnesses, including NIOSH (Ex. 2177), ASSE (Ex. 2339), AFL-CIO (Ex. 2257), BCTD (Ex. 2371), UAW (Ex. 2282), USW (2336), IUOE (2262), LIUNA (Ex. 2253) and Public Citizen (Ex.2249) outlined the importance of a written exposure control plan and supported the inclusion of this requirement in the final standard.

Eileen Betit, testifying for the Building and Construction Trades Department, provided extensive testimony on the need for written exposure control plans:

> Written exposure control plans are important for identifying operations that will result in exposures, the specific control measures, and how they will be implemented and the procedures for determining if controls are being properly used and maintained.
>
> Such plans also facilitate the communication of this information to other employers on multi-employer worksites so that they, in turn, can take steps to protect their employees. Without such plans, there's no assurance that employers and employees will take a systematic and comprehensive approach to identifying, controlling, and sharing information about silica exposures on job sites (Tr. 1569-70).

While this testimony addressed exposure control plans in the construction industry, the need for such plans applies equally to general industry.

As NIOSH commented, "[a] written plan would greatly improve the reliability of the protection provided. The plan does not need to be complicated or burdensome (Ex. 3403, p. 5).

Indeed, there are numerous tools and guidance documents that have been developed to assist employers in developing exposure control plans for silica. The Center for Construction Research and Training (CPWR) has a web-based tool that allows an employer to select specific control measures for silica generating tasks and operations and to develop a silica control plan for those exposures (Ex.4073, Attachments 5a, 5b). The Canadian province of British Columbia has developed a model written exposure control plan and specific plans for concrete drilling and cutting, grinding and polishing stone (Ex. 4072, Attachments 14, 19, and 20).

Requirements for written dust control plans are included in the silica standard in Newfoundland and at the urging of the British Columbia Construction Association, Council of Construction Associations and other groups, in 2013 British Columbia proposed a comprehensive standard on "Respirable Silica and Rock Dust" that includes requirements for a written exposure control plan, among other measures (Ex. 4072, Attachments 41 and 38).

Most other OSHA health standards include a requirement for a written compliance plan or exposure control plan. Indeed, all OSHA health standards that set a permissible exposure limit include a requirement for a written compliance plan that, at a minimum, must set the control measures that will be used to meet the PEL.

The inclusion of a requirement for a written exposure control plan will enhance the effectiveness of silica control efforts. Indeed, the absence of such a requirement will make it more difficult to ensure control of exposures and protection of workers and subject workers to greater health risks.

As it has with most other health standards, OSHA should include a requirement for a written compliance and exposure control plan in the final silica standard. The requirement should be applicable to employers who are covered by the standard, not just to employers where exposures exceed the PEL. For employers that have exposures above the PEL, the plan should include the specific control measures that are being implemented to reduce exposures.

The elements of the silica exposure control compliance plan should be similar to those in other standards:

1) A description of operations, tasks or jobs where silica is generated and emitted, and the jobs where there is potential for exposure (either directly or as a result of bystander exposures);
2) A description or listing of the engineering and work practice control measures that will be/are being used to achieve compliance;
3) A description of the exposure assessment program, results of air monitoring documenting exposures, or objective data that the employer has relied on;
4) A description of the respiratory protection program, including jobs where respiratory protection is required, and a certification that workers have received the required fit testing and medical evaluation under 1910.134;
5) A description of the medical surveillance program, and certification that workers have received or been provided the opportunity to receive required medical surveillance; and
6) A description of the training program and how the employer has achieved compliance or certified that workers have received required training.

It is clear from the record that many of the worksites and workplaces where workers are exposed to silica are multi-employer workplaces, both in construction and in general industry. Workers of different employers may work side by side, exposed to silica dust.

Protecting workers' safety and health at multi-employer worksites has always been challenging. But it is becoming more so since in many industries, certain jobs increasingly are being contracted out either to sub-contractors or temporary staffing agencies. The record shows that often workers are sent to jobs with no protection or

training about hazards (Tr. 2450, 2456, 2478, 2489). But all of these workers should have a right to be protected from silica exposure.

In order to better ensure that all workers covered by the silica standard are afforded the required protective measures, the AFL-CIO recommends that OSHA include provisions addressing compliance at multi-employer worksites as part of the compliance and exposure control plan.

Specifically for multi-employer worksites we recommend that the compliance and exposure control plan include:

- The procedures the employer will use to inform other employers of the presence and location of areas where crystalline silica exposures may exceed the PEL, and any precautionary measures that are needed to protect employees;
- For an employer who generates exposure at a multi-employer worksite, the measures the employer will implement to limit exposure of employees of other employers at the site (e.g. establishment of regulated areas, communication of silica hazards);
- For an employer whose employees are assigned to work at a worksite or workplace where there is a potential for exposure to silica dust generated by operations controlled by another employer, how the employer will ensure that employees are afforded the protections provided by the standard, including required training, respiratory protection, medical surveillance and exposure assessment.

Such provisions addressing silica exposures at multi-employer worksites would not change employers' legal obligations under the standard, but would ensure that responsibility for compliance with the standard is clearly set forth.

The AFL-CIO also endorses the recommendation made by BCTD in its comments that the standard include an obligation for employers at multi-employer worksites to share their silica exposure control plans. Specifically, any employer whose employees are working at a site where there is potential for silica exposure such that the employer is subject to requirements under the standard, that employer shall provide a copy of their silica compliance and exposure control plan to the employer who controls the worksite. The controlling employer should provide to other employers whose employees are potentially exposed to silica at the site as a result of the work operations of another employer, a copy of the silica exposure control compliance plan of that silica generating controlling employer.

In order to ensure that workers are knowledgeable about the employers' silica compliance and exposure control plan, the training requirements should include a review of the compliance plan, and workers and their representatives should have the right to access and receive a copy of the plan.

E. Methods of Compliance

1. Hierarchy of Controls

The proposed silica rule maintains OSHA's longstanding hierarchy of controls and requires that exposures be reduced to or below the PEL through the use of engineering and work practice controls unless the employer can demonstrate that such controls are not feasible. Where engineering and work practices controls are not sufficient to reduce exposures to or below the PEL, the employer is still required to implement feasible controls, supplemented by respiratory protection, to comply with the PEL.

The AFL-CIO strongly supports OSHA's maintenance of the hierarchy of controls in establishing methods of compliance in the proposed silica rule. It is widely accepted that the control of workplace hazards should be based on the hierarchy, beginning with substitution with a safer chemical, product or process; followed by engineering controls such as isolation or installation of local exhaust ventilation; administrative and work practice controls such as limiting time during which a particular task is performed; and only as the final line of defense, personal protective equipment (PPE), including respiratory protection.

The hierarchy of controls is a long-established industrial hygiene practice based on evidence and experience that substitution of hazardous substances and implementing engineering controls to reduce exposures at their source are far more effective means of protecting workers than personal protective equipment. The hierarchy of controls has been adopted by industrial hygiene professionals, businesses and regulatory agencies throughout the U.S. and the world. OSHA has incorporated the hierarchy of controls into every health standard it has issued, starting with the asbestos standard in 1972. The courts have upheld the requirement for the hierarchy of controls in OSHA standards numerous times.

A number of industry commenters urged OSHA to change its longstanding policy of practice of requiring the application of the hierarchy of controls in its standards. Specifically, they recommended that the final silica standard allow respiratory protection such as the use of powered air purifying respirators, instead of engineering controls, arguing that advances in respiratory protection have made respirators an equally effective form of control technology (Exs. 2364, 3578).

The AFL-CIO strongly opposes this suggested change in methods of compliance. Extensive evidence and testimony in the silica rulemaking demonstrate that engineering and work practices controls provide superior protection to workers and that major deficiencies in respiratory protection remain that make them less effective for protecting workers. Numerous industry groups and employers continue to recommend and implement substitution, engineering controls and work practices as the preferred approaches to limiting worker exposure to silica. In addition, there is broad and near universal support in the record for maintaining the hierarchy of controls in the final silica

standard by safety and health organizations, medical professionals, unions, worker organizations and workers themselves.

a. There is broad support for maintaining the hierarchy of controls to limit silica exposures

Maintaining the hierarchy of controls and the requirement to use engineering and work practice controls as the primary means to reduce silica exposures is widely supported.

NIOSH, the lead research agency for occupational safety and health, has "clearly and consistently" and fully supported the hierarchy of controls as "the fundamental approach that most effectively protects workers from exposure to workplace hazards." And NIOSH supports OSHA's reliance on the hierarchy of controls as the exposure control measure in the proposed silica rule (TR. 3579) Integrating the hierarchy of controls into the silica rule also receives strong support from the American Public Health Association (Ex. 2178), and other well respected medical, public health, and scientific organizations, such as the American Industrial Hygiene Association and the American Society of Safety Engineers (Tr. 1044).

All of the unions and other worker organizations appearing at the hearings also endorsed the hierarchy of controls for controlling exposure to silica. As Peter Dooley from the National Advisory Committee on Occupational Safety and Health (NACOSH) explained:

> "…hierarchy of controls is the absolutely most fundamental premise in which we make advances in workplace health and safety. To rely on other methods such as personal protective equipment or various ways of not engineering and controlling the substance at the source, would be a really huge problem for us because the principle of really trying to reduce the controls with the most effective methods is extremely important." (Tr. 3162)

ANSI and other standard setting organizations continue to maintain the hierarchy of controls as the best way to control exposure. Current industry consensus standards on occupational exposure to respirable crystalline silica, ASTM E 1132-06 (for general industry) and ASTM E 2625-09 (for construction), includes the hierarchy of controls. Federal and national consensus standards adopted by OSHA not long after the Agency was created in 1971 during the Nixon administration included the hierarchy of controls.

The hierarchy is embedded in OSHA's Respiratory Protection Standard, 29 CFR 1910.34, which applies to airborne toxins; and the current silica standard, which is subject to the provisions of the Air Contaminants Standard, 29 CFR 1910.1000, follows the hierarchy of controls and requires that all feasible engineering and work practices controls be implemented to reduce exposure to the current PEL. Respiratory protection

is allowed only when the application of these control measures is insufficient to meet the PEL (Tr. 81):

MR. KOJOLA:	Does OSHA's existing standard… require that exposures be controlled through engineering and work practice controls?
MR. O'CONNOR:	Yes, it does.
MR. KOJOLA:	Okay. And can you tell us when that standard was adopted?
MR. O'CONNOR:	Shortly after the Agency was created in 1971.

The hierarchy of controls has been followed and adopted by safety and health regulatory agencies around the world. Testimony from Celeste Monforton, DrPH, MPH illustrated the incorporation of the hierarchy into mandatory risk reduction practices on an international level:

> Safe Work Australia, the country's tripartite health and safety body, emphasizes the hierarchy of controls is the best way to protect workers from hazards. And I quote, "The ways of controlling risk are ranked from the highest level of protection and reliability to the lowest. The model work Health and Safety Act regulations require duty holders to work through this hierarchy when managing risk," end quote. (Tr. 847)
>
> The Canadian Province of Ontario's Health and Safety Agency offers a variety of reasons why PPE is not appropriate when engineering and work practice controls are available. These include reduced performance due to increased difficulty breathing, possible hyperventilation syndrome, and possible susceptibility to heat stress. They note that the use of PPE, quote, "should be considered only the last line of defense, rather than the first," end quote. (Tr. 847)

Engineering and work practice controls are also recommended for use by industry groups to control exposures to silica. The National Industrial Sand Association (NISA) has built the hierarchy into its *Practical Guide to an Occupational Health Program for Respirable Crystalline Silica*, a joint effort of NISA and the Mine Safety and Health Administration (MSHA) (Ex. 1965). Their program specifically outlines engineering controls that take precedent when controlling silica exposure and recognizes the high costs associated with positive pressure respiratory protection.

In 2007, the American Foundry Society (AFS) worked with OSHA's Alliance Program to release its best practices manual, *Control of Silica Exposure in Foundries*, to guide its members with technical assistance in effective measures to reduce silica exposure among their employees (Ex. 3733). This manual outlines and fully describes the hierarchy of controls, stating that "Engineering controls are the primary method for controlling exposures to respirable silica dust" (Section 3). AFS also prioritizes work practice improvements as secondary to engineering controls, and above other control methods.

When defining best practices for their members to control silica in the workplace, Mr. Robert Scholz from AFS does not offer respirators as a form of protection. Instead, his recommendations focus on engineering controls, work practice controls and administrative controls (Ex. 3733, Section 3) Other companies also stress the importance of the hierarchy to employees throughout their work practices, such as the International Association of Geophysical Contractors (IAGC, a contractor for oil and gas companies) (Ex. 4072, #12). In Europe, industry groups have signed agreements for reporting silica exposures and have collaborated to produce good practice guides that prioritize engineering controls as the best way to control silica exposure (Ex.4072, #10 and #31).

Mr. Trauger, testifying on behalf of the National Association of Manufacturers, acknowledged the usefulness of implementing feasible and effective engineering controls to control against silica exposure, in alignment with OSHA's methods of compliance in the proposed rule on silica (Tr. Page 1753).

> MR. KOJOLA: …if the engineering controls were feasible and effective, would you be opposed to using those to control worker exposure to silica?
>
> MR. TRAUGER: I don't think so. No.

Other industries have taken proactive approaches to work towards developing better engineering controls. Engineering controls have been the foundation of the joint NIOSH-industry partnership to develop effective silica control technologies for road milling operations:

> Since 2003, NIOSH has been involved in the Silica Milling Machines Partnership, a collaborative effort by labor, industry, and government to reduce respirable crystalline silica exposure during asphalt pavement milling in highway construction. The Partnership is coordinated by the National Asphalt Pavement Association (NAPA) and includes all U.S. and foreign heavy construction-equipment manufacturers that currently sell pavement-milling machines to the U.S. market. The goal of the partnership is to develop and implement

engineering controls on all new half-lane and larger drivable milling machines to reduce silica exposures (Ex. 2177).

b. Substitution and engineering controls are effective means to reduce silica exposure

The reason why the hierarchy of controls is widely supported and adopted is because substitution and engineering controls are the most effective means to reduce exposures to toxic substances and protect worker health.

Eliminating silica or substituting it with less harmful substances is the most effective means of reducing silica exposures. Companies are already substituting silica with other less harmful substances for certain tasks. Michael Wright, Director of Health, Safety and Environment for the United Steelworkers, testified on substitution practices used by their members' employers during sandblasting operations:

> In some cases, we can control silica exposure by removing the silica. That's been done to a large extent in sandblasting, for example. There still is some sandblasting that goes on in our workplaces, but mostly it's been replaced by blasting with other media that don't involve silica exposure.

Where substitution is not feasible, engineering controls are the most effective measure to control silica exposure. There is extensive evidence in the record showing that many engineering controls can significantly reduce dust exposures. For example, a laboratory study on the generation rate and engineering control of dust from cutting fiber-cement siding found that connecting a dust-collecting circular saw to a dust collector can remove 80%-90% of the dust from cutting fiber-cement siding (Ex. 2177, p.18-19). Workers, employers and researchers provided many more examples of simple and effective engineering controls to the record.

Engineering controls capture dust at the source and one engineering control protects many workers, increasing their efficiency at controlling exposures. Max Kiefer and Frank Hearl from NIOSH agreed with Mr. Kojola's statement that "…for operations that generate large quantities of dust with high exposures to respirable silica, an engineering control like a local exhaust ventilation system would capture silica at the source of its generation and limit exposures to all workers engaged in that operation" (Tr. Page 184).

Further, engineering controls protect workers who are nearby but who are not engaged in the silica-generating operation. As discussed in our comments above on feasibility, there was extensive testimony by Dr. Frank Mirer and other witnesses that cross contamination and bystander exposure was a significant source of silica exposure for many workers. Substitution and engineering controls, not respirators are the most effective means to limit these exposures.

c. Respirators have significant limitations and deficiencies, and are less effective than engineering and work practice controls

Respirators suffer from significant problems and limitations that make them a much less effective means of controlling worker exposure to silica and other hazards. The American Public Health Association outlined a number of these problems and limitations it its written comments:

> "[Workers] report that (1) it is difficult to breathe, especially when engaged in heavy physical labor, while wearing a respirator; (2) wearing a respirator, instead of controlling the dust at its source, means co-workers in close proximity are still exposed to silica dust; (3) respirators are uncomfortable to wear, especially when working in a hot environment; and (4) it is difficult to communicate with co-workers when wearing a respirator, which can compromise safety (Ex. 2178).

Other witnesses and commenters also spoke to the limitations of these devices:

> "All respirators have some inherent qualities that make them less preferable than engineering controls. It depends on the particular type of respirator. Each… type can be a little bit different, but none of them are going to be as effective as engineering controls (David O'Connor, OSHA, Tr. 82).

> "…certainly respirators are considered a last resort as it puts the burden of protection on the worker. Engineering controls, substitution, and all those other things that you mentioned are more desirable because they rely on other systems to control the exposure to the worker. In addition to the issues that were raised previously by David O'Connor, fatigue, communication, improper fit, all of those things tend to make respirators not desirable as a control primarily (Max Kiefer, NIOSH, Tr. 184).

> "And although this respirator meets all of the standards, the required standards, it still lets too many particles in, even when it's being utilized in the correct way (Norlan Trejo, New Labor, Tr. Page 2455).

Many witnesses testified that wearing respirators was exhausting and made it difficult to do their jobs:

> If I'm running a grinder, especially if I'm grinding a ceiling overhead, holding a grinder up and I've got dust and sand

> and everything else blasting me for six or seven hours, at the end of the day, you're physically exhausted. You've been assaulted by this material that you're generating. There's productivity gains to be had by having this material collected at the source of generation where you're not exposed to it. You feel much better. You're not as tired (Mr. Johnson, BCTD).
>
> …productivity gains is the amount of man-hours that it would take to get the job completed. As the person who's using a HEPA vac or any other engineering controls, one, I don't have to change my respirator cartridges a whole lot, but I don't have to go back and back again to make sure that the levels are lowered and that everything's cleaned up (Sarah Coyne, BCTD).
>
> I know that being the head safety guy for the union, I tried to use my safety equipment as much as I could, wherever I could. I feel that I wore it much more often than the rest of the maintenance crew. It was just cumbersome and it was sweaty and it was hard to breathe… (Alan Schultz, page 3253-3254).

Silica work is often performed in hot temperatures and environmental conditions that are not suitable to wearing respirators.

> …I couldn't wear it all the time. Sometimes there were some machines I had to crawl into either on my back or my stomach and there wasn't room for one of those space helmets… I just didn't have room. I couldn't even wear my safety helmet inside some of the machines I had to get into. It was so constricted I couldn't wear my safety equipment at all times (Alan Schultz, Tr. page 3253).

Those who work with silica on a daily basis echo these concerns:

> …these are quite warm areas. So you're constantly sweating… in fact, against what most people think, it's actually much warmer in there in the wintertime because you definitely have all the windows and everything closed up tight… So putting the respirator on within five minutes, sometimes less, it will be sweat laden just like your clothes would be, and it makes it very difficult to breathe. You can definitely tell a difference in how hard it was to breathe when you first put the respirator on until a few minutes later where it was starting to pick up all this dust on it and starting to get

> damp and difficult to breathe through. It felt very restrictive (Jim Schultz, Tr. page 3252).

Placing even the most technologically advanced respirator on a worker is not a replacement for controlling the hazard at the source. Dr. Laura Welch, an occupational health physician explained:

> …When you look at the protection factor on respirators, respiratory protection obviously would not reduce the exposure significantly from some of these very dusty tasks, and that's well described in the OSHA proposal… From a clinical perspective, we examine people over years. …what really works is engineering controls. That's where… the data is. That's where the health studies are. Respirators are -- to a great degree… pretend. Seems simple, but because it's hard to implement, people don't wear them correctly, sometimes don't have them… and then they're not sufficiently protective for some tasks. So there's a lot of reasons that respirators -- we don't really expect respirators to work, and in my experience, they often don't (Tr. Page 1649).

Unlike engineering controls, respirators are required for every worker, and the process for selecting, supplying and maintaining their effectiveness if done properly can be resource intensive. In their best practices document specifically aimed at controlling silica in foundries, AFS instructs its members on the many factors to consider when relying on respirators in the workplace (Ex. 3733). These factors include:

- offering a variety of sizes and styles of tight fitting respirators due to the variations in people's faces;
- ensuring an adequate supply of clean air for loose fitting respirators; ensuring workers understand how respirators work and what they will protect against;
- ensuring workers know how to use, store, clean and maintain respirators; ensuring workers are medically qualified to wear the chosen respirator and that they are fit-tested by a medical professional;
- keeping abreast of the most current Assigned Protection Factors (APFs) and that the degree of protection is met by the chosen respirator and appropriate for the task;
- ensuring the appropriate filtering efficiency for respirable dust is provided by the chosen respirator;
- considering filter degradation and filter clogging by oil particles and other contaminants; and
- requiring an alarm or other indicator to assure that deadly carbon monoxide is not delivered to the worker (for supplied-air respirator systems).

Implementing respiratory protection programs is no easy task. In addition to receiving appropriate and timely fit testing and medical exams before wearing respirators, workers must also receive training on using and handling respirators, and employers should conduct an overall assessment of the environment a respirator will be used in. Without these procedures in place, respirators are not as effective and employers could be placing workers at risk for other life-threatening issues.

> It is illogical to suggest that diligently meeting all the laborious requirements necessary for an effective respiratory protection program for a whole crew of employees is easier than ensuring that a handful of silica-generating pieces of equipment are maintained (Celeste Monforton, Tr. page 847).

d. Bystander and secondary exposures

As discussed above, limiting exposure to silica at its source through engineering and work practice controls not only protects workers involved in dust-generating operations; these controls also limit exposure to other workers and the public at-large.

Relying on respirators as a primary control measure does not account for the movement of dust throughout a worksite and puts other workers in the area at risk of exposure. A line of questioning during NIOSH's testimony illustrates the dangers of only controlling one person's exposure (i.e., using a respirator) when many employees are working nearby (Tr. Page 184).

MR. KOJOLA:	Okay. By having a local exhaust ventilation system capturing the silica at the source of its generation, that would also limit exposures to other workers who might be exposed bystanders to that operation. Isn't that also correct?
MR. HEARL:	That's correct.
MR. KOJOLA:	Okay. Now isn't it also true that if only PPE, such as respirators, were used in an operation which generated high exposures of respirable silica, it would only provide protection to those workers who are wearing the respirator. Isn't that correct?
MR. HEARL:	That's correct.

MR. KOJOLA: Okay. So exposed bystanders who were not wearing respirators, for example, would not be protected from exposure to respirable silica, would they?

MR. HEARL: That's right.

Similarly, the panel from the Building and Construction Trades Department (BCTD) testified to the problematic approach of relying on respirators as a primary control measure and its effects on all workers. Mr. Smith, the Director of Training for the Bay Area Roofers and Waterproofers Training Center, stated:

> …going to respirators first completely ignores the other trades and the other people working in the same environment (Tr. Page 1650).

And Chris Trahan from the BCTD, underscored:

> Regarding the abandonment of the hierarchy of controls… It does nothing to reduce bystander exposure and really get people out of respirators is what we want to do. We want to control these hazards at the source for all workers (Tr. Page 1669).

During the hearings, we also heard from other workers with personal experience of the adverse effects of bystander exposure when only respirators are used. Norlan Trejo, Safety Liaison from New Labor, described in several instances his preference for engineering controls because of bystander exposure:

> … the wet system is a good system because it doesn't only protect you, it also protects your other co-workers as well (Tr. 2455).
>
> And aside from the fact that the protection for myself is limited, [the respirator] also does not offer any protection for my co-workers… so that's why I continue to prefer the wet cutting system as the best method for controlling silica dust (Tr. 2455-56).

Since respirators allow dust to freely float and transfer throughout the workplace and onto workers' clothing, other workers were deeply concerned about the transfer of silica into their homes and to their children:

> A respirator is a luxury that assists us in protecting ourselves from additional exposure, but it doesn't take way the dust that I'm going to have on my clothes or the dust that

> I'm going to find in my sink or what I bring home to my kids, whether it's in my car or in my laundry (*Sarah Coyne, BCTD, Tr. 1649).*
>
> Something that people don't realize, even in a foundry… but you get your clothes so dirty with this silica dust… and then you take the stuff home and you clean it, and then it gets in the washing machine, and the filters in the washing machine don't get rid of all this stuff. It goes throughout the family wash, and then your children and your families also get exposed to this stuff (*Alan Schultz, WisCOSH, Tr. 3181)*
>
> And that really, to me, is the scariest thing… when we're dealing with young children before puberty, and their cell division is four times faster, you know, the latency period is four times shorter. They're four times more susceptible, and this is something that is unimaginable to me too. You know, personally, I could die before I could ever look at my children getting sick or dying because of something I brought into the house (*Dan Smith, BCTD, Tr. 1708-9)*

e. OSHA's proposed silica rule does not prohibit all respirator use

Some industry groups have claimed that the proposed rule must abandon the hierarchy of controls because it does not allow for intermittent use of only respirators when maintaining engineering controls (*e.g.,* Ex. 2380). However, the proposed rule clearly states:

> Specifically, in areas where exposures exceed the PEL, respirators are required during the installation and implementation of engineering and work practice controls; during work operations where engineering and work practice controls are not feasible; when all feasible engineering and work practice controls have been implemented but are not sufficient to reduce exposure to or below the PEL; and during periods when any employee is in a regulated area or an area for which an access control plan indicates that use of respirators is necessary (78 Fed. Reg. 56466, Sept. 12, 2013)

As OSHA points out in its proposal, these allowances are consistent with other OSHA health standards, such as methylene chloride and chromium. Such respirator use is also consistent with the preamble of OSHA's Respiratory Protection Standard, 29 CFR 1910.34:

> Respiratory protection is a backup method which is used to protect employees from toxic materials in the workplace in those situations where feasible engineering controls and work practices are not available, have not yet been implemented, are not in themselves sufficient to protect employee health, or in emergencies.

Reliance on the hierarchy of controls does not exclude all respirator use. It is a widely accepted approach for controlling exposures in the workplace:

> …personal protective equipment is part of the hierarchy. It's the least desirable method to be incorporated in controlling the hazards. So it's not that it doesn't exist. But you're always thinking in every situation, what's the best method per the hierarchy to control this method, this hazard? So that's the principle that has to be in play, whether it's a short-term issue or a long-term issue. But it's not that it's excluded but it's the least desirable and least effective method (Peter Dooley, NACOSH, Tr. 3236).

f. Conclusions about the hierarchy of controls

Relying on respirators as the first line of defense is an attempt to shift the responsibility of protection on the worker. Employers introduce hazards into the workplace by choosing to use a chemical, and therefore it is the employer's responsibility to protect workers from exposure to that chemical. The statutory obligation to protect workers from hazards – including chemical exposures – is the employers.

> I just want to reiterate too that all too often, it's left up to the worker. [Respirators are] used as a first line of defense. The contractor says here's a dust mask. Go grind that wall, taking no responsibility whatsoever for the job site safety. Oftentimes, the individual has to provide his own respirator …it should be the last line of defense, and it is in the hierarchy of safety controls… (Deven Johnson, BCTD, Tr. 1650)

Workers can only protect themselves as much as the employer allows. Relying solely on respirators is an ill form of protection where a better one exists, and is not justified by the record.

> The idea of just controlling exposure with respirators… if we can engineer out the hazard, we don't have to worry about bystander exposure. We don't have to worry about regulated areas. We don't have to worry about exceeding

> the PEL. We don't have to worry about medical surveillance. We don't have to worry about air monitoring if we do it right. I mean we can just knock out these exposures and comply with the standard, but get that eradicated for everyone (Chris Trahan, BCTD, Tr. 3581).

We urge OSHA to reject any efforts to weaken the requirements for the implementation of engineering and work practice controls to limit occupational exposure to respirable silica.

2. Abrasive blasting

It has been long-recognized that the use of silica in abrasive blasting poses a significant health risk to workers. Because of this significant health risk and the difficulty of controlling exposures in this operation, a number of countries have banned the use of crystalline silica as an abrasive blasting agent including Great Britain, which banned the practice in 1950, Germany, Sweden, and Belgium (Ex. 2175). Dozens of states and authorities in the United States, including the U.S. Navy, Air Force and Coast Guard have done so as well (Ex. 2175). NIOSH recommended that silica sand be prohibited as an abrasive blasting material in its first recommendation in 1974, *Criteria for a Recommended Standard: Occupational Exposure to Crystalline Silica* (Ex. 0388), and reiterated this recommendation in a 1992 special alert, *Preventing Silicosis and Deaths from Sandblasting (*Ex. 0389).

Despite the widespread practice of banning the use of silica in abrasive blasting, OSHA has failed to include such a prohibition in the proposed rule. Instead, OSHA proposes to control exposure through the application of feasible engineering and work practice controls supplemented by respiratory protection. But OSHA itself has determined that it is not possible to reach the proposed PEL in abrasive blasting operations through the use of engineering and work practice controls (78 Fed. Reg. 56356, Sept. 12, 2013).

The most effective way to protect workers in abrasive blasting from the hazards of silica is to prohibit the use of silica as a blasting agent. The inclusion of a ban on abrasive blasting in the OSHA silica standard was strongly supported by many commenters and hearing participants including NIOSH (Ex. 2177), The American Thoracic Society (Ex. 2175), APHA (Ex. 2178), The International Safety Equipment Association (Ex. 2212), AFL-CIO (Ex. 2257), BCTD (Ex. 2371), UAW (Ex. 2282), and many other groups (Exs. 2173, 2341, 2373). As quoted previously in this brief, some employers of USW members have substituted silica with less harmful substances during sandblasting operations. OSHA should follow the lead of other countries and authorities and include such a prohibition in the final silica rule.

3. Cleaning methods

The proposed standard requires that dust accumulations be cleaned by HEPA-filtering vacuuming or wet methods where such accumulation, if disturbed, could result in exposures that exceed the PEL. The proposal also prohibits the use of compressed air, dry sweeping and dry brushing where the activities could result in exposures that exceed the PEL.

The prohibition of such practices is sound industrial hygiene and is critical to ensuring that dust is controlled. Evidence submitted by the Industrial Minerals Association- North America shows that dry sweeping can generate significant levels of dust (Ex. 3472).

Other OSHA health standards that regulate exposure to dusts include similar provisions to prohibit dry sweeping and the use of compressed air (e.g. asbestos 29 CFR 1910.1001, lead 29 CFR 1910.1025 and cadmium 29 CFR 1910.1027). However, all of these standards require that accumulations of dust be kept as low as practicable and do not trigger prohibitions by exposure above the PEL. OSHA has determined that exposure to silica at the PEL still poses a significant risk to workers. All feasible efforts should be made to reduce exposures to reduce those risks.The American Society of Safety Engineers (Ex. 2339), NIOSH (Ex. 2177), and HalenHardy (Ex. 2310) all advocated that dry sweeping and the use of compressed air be prohibited at all exposure levels, as did the AFL-CIO (Ex. 2257), BCTD (Ex. 2371), UAW (Ex. 2282) and USW (Ex. 2336).

OSHA should follow the well-established approach in its other health standard and prohibit practices of dry sweeping, compressed and require HEPA-filtering vacuuming or wet methods whenever silica dust is present, not just at exposures above the PEL.

A number of commenters, including NIOSH, IMA-NA and HalenHardy presented evidence documenting the effectiveness of clothes cleaning systems that utilize a clothes cleaning booth and ventilation to remove dust from contaminated clothing (Exs. 2177, 2310, 3472). NIOSH, HalenHardy and the ASSE all advocated that the final standard permit, but not require, the utilization of such equipment as a means to remove dust from clothing (Exs. 2177, 2310, 2339). The AFL-CIO supports the inclusion of such a provision in the final rule.

F. Respiratory Protection

The proposed silica standard for general industry requires that employers follow the requirements of 29 CFR 1910.134 when respiratory protection is required under the rule. For construction, in addition to this basic requirement, Table 1 of the construction standard specifies the type of respiratory protection for certain high silica exposure operations.

But there is no provision in 1910.134 or in the proposed silica rules for an employee to request or choose a respirator that provides a higher level of protection than that required by the selection table in 1910.134, as is provided by a number of other OSHA health standards. For example, the asbestos standards for both general industry (1910.1001) and construction (1926.1101) and the cadmium standard (1910.1027, 1926.1127) require the employer to provide an employee a powered air purifying respirator instead of a negative pressure respirator upon request. Other standards, including formaldehyde (1910.1048), butadiene (1910.1051) and MDA (1910.150) require that where employees have difficulty breathing or cannot not wear a negative pressure respirator that a positive pressure respirator be provided.

In our earlier comments, the AFL-CIO urged OSHA to include a provision in the final silica standards for both general industry and construction that provides workers the ability to choose a power air purifying respirator in place of a negative pressure respirator (Ex. 2257). The inclusion of such a provision was supported by NIOSH (Ex. 2177), the National Council for Occupational Safety and Health (Ex. 2173), BCTD (Ex. 2371), USW (Ex. 2336) LIUNA (Ex. 2253) and others. This will allow workers who may encounter breathing resistance or other difficulty in wearing a negative pressure respirator, the ability to continue working in a job where silica exposures cannot feasibly be controlled below the PEL. OSHA itself has recognized that there may be situations where workers are unable to wear a negative pressure respirator. Indeed the standard, anticipates that such a finding may be made during the medical surveillance conducted under the rule. The final standard should follow the model of the asbestos and cadmium standards and allow workers to request and obtain a PAPR without revealing their health status or health condition to their employer.

The need for a provision allowing workers to request a more protective respirator was described by James Schultz, a former foundry worker, who testified on behalf of WisCOSH:

> As a worker in this facility, I often was required to wear a respirator. While I was working as a furnace operator, I was able to get them to give me a PAPR type respirator but in other areas, they refused to provide that for me, and I think that myself and a number of other workers there had facial hair and some of them were willing to shave. Some of us had religious reasons why we would not, and we would ask for alternative respirator protection than what they were providing us (Tr. 3201).

Jim Frederick, Assistant Director, USW Health, Safety and the Environment, testified that workers who have the right to request a more protective respirator do in fact exercise that right:

> [Y]es, in varying workplaces with exposures requiring respiratory protection, either from an OSHA requirement or

because of something negotiated by the union and agreed to by the employer, we have opportunities where workers can request additional, higher level of respiratory protection, such as a PAPR, and yes, they do take advantage of that in some instances, and in others, some workers choose not to (Tr. 2614).

The AFL-CIO urges OSHA to include a provision in the final rule that allows workers to request a respirator that provides a higher level of protection.

G. Medical Surveillance

The proposed standard includes requirements for employers to provide medical surveillance for workers exposed to silica. Such surveillance is important to detect adverse health effects that may occur as a result of silica exposure, provide appropriate medical follow-up and allow the medical provider to recommend appropriate interventions to reduce exposures and the risk to employees. Similar requirements for medical surveillance have been included in all OSHA standards for toxic substances.

The AFL-CIO strongly supports the inclusion of the medical surveillance requirements but has concerns that the requirements as proposed are inadequate. We also have deep concerns about that the standard does not protect the confidentiality of employees' medical information.

1. Trigger for medical surveillance

The proposed standard requires that medical surveillance be available to all employees exposed to silica above the permissible exposure limit for more than 30 days a year. In our original comments, the AFL-CIO noted that this is a departure from all other health standards that require that medical surveillance be provided to workers exposed above the action level (Ex. 2257). During the hearings, OSHA acknowledged that this was indeed the case (Tr. 71-72):

MS. SEMINARIO:	And most OSHA comprehensive health standards have included an action level, and hasn't that traditionally been set or usually set at one-half the permissible exposure limit for most other regulated substances?
MR. PERRY:	Usually, yes.
MS. SEMINARIO:	And in the silica rule, as you said, the action level trigger is exposure monitoring, but medical surveillance is triggered by the PEL. Is that correct?
MR. PERRY:	That's what we've proposed, yes.

MS. SEMINARIO: But for all other standards that OSHA has set n health hazards, the action level has been the trigger for both the exposure monitoring and medical surveillance. Isn't that correct? So it's been the same level that has triggered both exposure monitoring and medical surveillance.

MR. PERRY: I believe that's correct. That's been our typical practice in the past, at least where we've had action levels in the standard.

A review of the draft of the proposed rule that was submitted to OMB for review – under Executive Order 12866 in 2011 – shows that the rule as sent to OMB required that medical surveillance be provided to all workers exposed above the action level (Ex.2257). However, during the review that provision was changed to initiate medical surveillance at the permissible exposure limit, instead of the action level.

The change in this requirement is quite troubling given OSHA's findings that exposures at the proposed PEL pose a significant risk to workers with an overall excess risk of mortality of 93-101 deaths/1,000 workers per year due to lifetime exposure (Table VII-2, 78 Fed. Reg. 56333, Sept, 12, 2013). This risk does not reflect the risk of diseases that do not result in death, which is far greater. Moreover, according to OSHA's preliminary economic analysis, there are a large number of workers exposed between the PEL and the action level – 53,329 workers in general industry and 202,883 workers in construction (Table VIII-5, 78 Fed. Reg. 56349-52, Sept. 12, 2013).

In our initial comments, the AFL-CIO urged OSHA to follow its long standing policy and practice and trigger medical surveillance at the action level in the final rule. ATS, The Association of Occupational and Environmental Clinics, American College of Occupational and Environmental Medicine, APHA, and the Collegium Ramazzini all supported the use of the action level to trigger medical surveillance (Exs.2175, 2080, 2178, 2148). Additionally, the National Industrial Sand Association (NISA) and Industrial Minerals Association – North America (IMA-NA) recommended that medical surveillance be triggered at the action level (although both groups recommended a higher PEL and action level than proposed by OSHA) (Exs. 2195, 2200)

The AFL-CIO and unions recognize that due to differences in the proposed exposure monitoring requirements in general industry and construction, there may not be exposure data available for many operations in construction, since employers who follow the control measures set forth in Table I are relieved of that obligation. Therefore in construction, it may not be possible to determine which employees are exposed

above the action level.[26] But in general industry, there will be exposure information available for workers exposed at the action level or above since an exposure assessment or monitoring is required for these workers. Medical surveillance should be provided to these workers to help further reduce the risk of serious disease from silica exposure. The final standard for general industry should trigger medical surveillance for workers at exposure to the action level and above.

The AFL-CIO agrees with the Building and Construction Trades that in construction, the requirement for 30 days of annual exposure to trigger exposure is not workable and makes no sense. Given the changing and short-term nature of much construction work and mobility of employment, it is simply not possible to predict if a worker will be exposed for more than 30 days a year. We endorse the BCTD's position that this 30 day exposure requirement should be removed in the construction standard.

We point out that in a number of other OSHA health standards, including hexavalent chromium, benzene, formaldehyde and methylenedianiline, medical surveillance can also be triggered by reports of signs and symptoms associated with exposure, even if the employee is not exposed above the trigger exposure level. Such a provision is particularly appropriate in the silica standard given the high level of risk that remains at exposures to the PEL and action level. We urge OSHA to include a provision that provides for medical examinations in response to employee reports of signs or symptoms of adverse health effects related to silica exposure in the final standard for both general industry and construction.

2. Frequency of medical surveillance

The proposed standard requires that follow-up medical surveillance be provided to employees once every three years or more frequently if recommended by the health care provider. This is a change from the draft standard submitted to OMB for review in 2011, which required annual examinations, with a three year frequency for chest x-rays and pulmonary function tests, unless recommended more frequently by the health care provider. It is also a departure from the frequency for medical examinations in other OSHA health standards.

The AFL-CIO evaluated the comments from medical experts and NIOSH on the proposed frequency in medical surveillance. We support the recommendation made by the APHA that medical examinations be provided at a 3 year interval, but with a requirement that the second exam be provided within 18 months of the first exam (Ex. 2178,). As Dr. Rosemary Sokas testifying on behalf of APHA explained, this will allow an appropriate baseline to be established and to identify if there are any changes or conditions that need further evaluation or attention (Tr. 791-2). We also recommend that OSHA include a provision for follow-up exams to also be triggered by employee reports

[26] It will be possible to determine which workers are presumable exposed above the PEL, since those workers will be required to wear respiratory protection.

of signs or symptoms of silica exposure as is provided for in the OSHA standard on hexavalent chromium and other health standards.

3. Content of examinations

The proposed standard requires that medical examinations include a chest x-ray, pulmonary function test in addition to TB testing, a physical examination and medical and exposure history, and other tests recommended by the health care provider. These examinations are appropriate for detecting conditions related to silica exposure.

One of the significant risks posed by exposure to silica is lung cancer. Indeed in its risk assessment OSHA has found that the risk of mortality from lung cancer caused by silica is greater than the risk of mortality from silicosis.[27] As a number of witnesses testified, recently there have been significant advances in early detection for lung cancer through screening with Low Dose CT (LDCT) scans (Exs. 2163, 2257, 2282, 2336, 4196). In December 2013, the U.S. Preventive Services Task Force (USPSTF) recommended annual LDCT scans for individuals who were at high risk of developing lung cancer (Exs. 2257, 4196).

During the hearings, there was considerable discussion as to whether there was sufficient information to support a mandatory requirement for LDCT scans in the final silica standard. While there was agreement that LDCT was indeed an effective screening test for detecting lung cancer early and reducing lung cancer mortality, there was not agreement whether clear criteria could presently be established for defining worker populations at high risk based upon silica exposure.

Based on the medical testimony presented, the AFL-CIO believes that OSHA should specifically provide for LDCT scans to be provided if recommended by the PLHCP, pulmonary specialist or occupational medicine specialist. We recommend that OSHA include information on the utility of LDCT scans for lung cancer screening in Appendix A – Medical Surveillance Guidelines. In addition, we urge the agency to include a medical surveillance provision in the standard that would allow such tests to be provided with regularly frequency if an authoritative medical group recommends such testing for silica exposed workers.

4. PLHCP's written opinion and medical confidentiality

The proposed standard requires the PLHCP to provide the employer with a written medical opinion that includes a description of the employee's health condition as it relates to exposure to silica, including the PLHCP's opinion as to whether the PLHCP has detected any medical conditions that would place the employee at increased risk from exposure to silica; and any recommended limitations on the employee's exposure to silica or upon the use of PPE such as respirators. The PLHCP is not allowed to

[27]OSHA estimates that the excess risk of lung cancer mortality at the existing general industry PEL of 0.1 mg/m3 general industry PEL is 22-29 1/1,000 workers and the excess risk of mortality from silicosis is 11/1,000 workers- Table VII-2, 78 FR 56333.

reveal to the employer specific findings or diagnoses unrelated to silica. Under the proposal, the employer, not the PLHCP is required to provide the written opinion to the employee.

The provisions on written medical opinions and confidentiality in the proposed silica standard are similar to the provisions that have been included in other OSHA standards for decades. However, as the AFL-CIO and many other witnesses pointed out in comments and testimony, OSHA's approach to medical confidentiality is outdated and fails to reflect changes that have occurred in medical privacy and confidentiality (Exs. 2257, 2371, 2148).

In particular, as Dr. Laura Welch, Medical Director, CPWR, testifying on behalf of the Building and Construction Trades explained, the Health Insurance Portability and Accountability Act (HIPAA) adopted in 1996 and the American with Disabilities Act (ADA) include strict provisions which restrict access to confidential medical information:

> But what I mostly wanted to talk today about was confidentiality of medical information. The OSHA standard, as proposed, requires the employer to have an exam conducted and requires the examining medical provider to provide that information, the results of the exam, to the employer. And we think that does not reflect, really, the changes in the management of medical information that have occurred in the society around us.
>
> Particularly when you think about the Americans with Disabilities Act and HIPAA, the Health Insurance Portability and Privacy Act, both of which don't directly apply, but I think to reflect the way, outside of this occupational setting, people would expect their medical records and private medical information to be handled.
>
> So, you know, under the Americans with Disabilities Act, if an employer conducts a medical examination, it has to be closely tied to the individual's job and their ability to do the job. It's not focused on some future risk.
>
> Now, medical surveillance has a different role, but the ADA, if it were applying to the provisions in the law, they would not be permitted under the ADA. Employer can't just do exams because they feel like it and store them away. That's private medical information under the ADA (Tr.1578-9).

In response to these changes in law and policy, in 2012, the American College of Occupational and Environmental Medicine (ACOEM) adopted new Guidelines on Confidentiality of Medical Information in the Workplace greatly restricting the information that should be provided to an employer without the worker's written consent (Ex. 3622).

During the hearings there was extensive testimony from workers, unions, physicians and others that some employers would misuse the results of medical exams to “blackball” workers from future employment, or retaliate in order to reduce obligations under the standard or worker’s compensation or disability costs.

Representatives from the Building and Construction Trades Department union panel outlined these concerns (Tr. 1654 - 56):

MS. HALIFAX:	Yes. I have one other question, but it's a two-parter. What is the Building Trades' experience with worker concerns or fears about being blackballed for being diagnosed with a health condition that may be work-related?
MS. TRAHAN:	Sarah?
MS. COYNE:	What's the level of fear?
MS. HALIFAX:	Well, really, what's the experience with workers' concerns or fears?
MS. COYNE:	Extreme. I have multiple friends who are diagnosed with silica, back injuries, you name it. And the concern is, because we've seen it, is that if you come forward with that, well, now I'm a high risk. Just today, not having those here present testifying on their own behalf, I think, says it all.
MR. BYRD:	With respect to drivers on construction sites, commercial drivers have to have a medical certificate. They have to pass a comprehensive physical exam. If they were to report that they had a debilitating condition such as silicosis, they would more than likely not pass the respiratory criteria, and they'd be disqualified from working anywhere. So, you know -- and so it'd be really disadvantageous for them -- for a driver to report to an employer that they have a medical condition.
MS. TRAHAN:	Deven?

MR. JOHNSON: In the construction industry, there's a term called the bloody hand in the pocket syndrome, and that is, if you're injured, don't tell anybody about it because you don't want to be blacklisted. You don't want to be reported as having been injured.

I've seen guys go around the corner on a job. They're pouring concrete and will twist their knee or hurt their shoulder or strain a back and will quickly put themselves out of view of everyone else while they recover because they don't want the foreman or superintendent or somebody see that they tweaked their back or they did something.

The same is true with occupational illnesses,that the last thing that a worker wants is to have any information that he's somehow compromised because, even though we want to think the best of the employer, that somebody wouldn't take action against that individual, we know for a fact that it happens. It's happened to our membership.

Fears about employer retaliation for silica related health problems discovered in medical exams were a major concern for immigrant workers who testified on behalf of worker centers, such as Mr. Norlan Trejo from New Labor:

> My concerns, well, firstly, I don't think that the boss has any reason to know what's going on with your health. If you're sick, he knows that this illness is something that could get worse and so you are likely to be fired. And the boss also knows that if this happens that you could sue him. And so then he is going to try and protect himself against being sued. And so at the end of the day, it's the worker who ends up being negatively impacted by this (Tr. 2471).

According to many witnesses, fearing retaliation, many workers would be reluctant to participate in medical surveillance. The Building Trades panel was “one hundred percent certain” that absent strict confidentiality provisions workers would “absolutely not” participate (Tr. 1656-7):

MS. HALIFAX: With all this in mind, without strict confidentiality provisions for medical information and anti-retaliation protections, do

you think that workers will participate in the medical surveillance scheme set up under this standard?

MR. JOHNSON: Could you repeat the question please?

MS. HALIFAX: Sure. With all of this in mind, without strict confidentiality protections for medical information and anti-retaliation protections, do you think workers will participate in medical surveillance?

MR. JOHNSON: One hundred percent, absolutely not.

MS. COYNE: Absolutely not. I wouldn't.

MS. TRAHAN: I think we're

MS. HALIFAX: All right.

MS. TRAHAN: in agreement on that.

Mr. Dale McNabb, a former masonry worker, suffering from silica-related disease, testifying as part of the Bricklayers and Allied Crafts panel was equally emphatic (Tr. 3053-4):

MS. TRAHAN: And, Mr. McNabb, the -- my -- this question is for you. Without strict confidentiality protections for medical information and anti-retaliation protections, do you think workers will participate in medical surveillance?

MR. McNABB: Absolutely not. You can get black-balled very easily by having that information given to employers, so I would not. I do believe that it's important that there's early detection of this, so three years I think is well within, you know, because I started feeling effects early. And I just didn't know what it was.

Jim Frederick from the USW, a union with significant experience with medical surveillance programs underscored that medical confidentiality was critical for encouraging worker participation in medical surveillance programs:

There's no doubt in our experience in other workplaces that workers will be more likely to participate in medical screening if they feel confident that their records will be private and confidential (Tr.2547)

Dr. David Weissman, from NIOSH, also testified about the importance of medical confidentiality as a critical factor for worker participation in the NIOSH Black Lung screening program and other workplace medical surveillance programs (Tr. 169):

DR. WEISSMAN: Exactly, and maintaining that confidentiality is critical to that program. One of the biggest reasons in focus groups that miners have given for not participating in surveillance is fear of their medical information being shared without their permission.

MS. SEMINARIO: All right. And would you have any reason to think that those fears would be different for exposure to silica in another work environment?

DR. WEISSMAN: I would expect that there would be a similar situation.

Dr. Christine Oliver, an occupational physician with extensive clinical experience, testifying on behalf of the Collegium Ramazzi, also testified that workers feared retaliation by employers based upon medical results (Tr. 3881):

MS. SEMINARIO: Thank you. I believe when you were introducing yourself you stated that you are still a practicing occupational physician with a specialty in pulmonary medicine. So you do see and examine workers on somewhat of a regular basis; is that correct?

DR. OLIVER: Yes, I do.

MS. SEMINARIO: For occupational disease and occupational exposure conditions?

DR. OLIVER: Yes.

MS. SEMINARIO: Is it your experience that workers who may be experiencing an occupational disease due to their job may be reluctant for any adverse health effects information to be shared with their employer?

DR. OLIVER: Yes, yes. I think that most definitely is the case because there's a very real concern about their job and whether they will be able to keep their job if certain information is shared.

Dr. Rosemary Sokas, testifying on behalf of the APHA, echoed these sentiments:

> But from APHA's perspective, our concern is that if the employee knows that the employer is going to get this information, they're going to have to get it from the employe[e]. And their job is not secure since in this country we don't have real job security without union contracts. Then there is every reason to believe that people will avoid the surveillance if they can possibly avoid it. And that's even more true for construction when people are continuously looking to new jobs and new work because then they would be worried that they have the scarlet letter, basically, I think (Tr. 820).

It is the AFL-CIO's strong view that it is time for OSHA to bring the medical confidentiality provisions of its standards up to date and to protect workers' confidentiality and privacy. To this end, the AFL-CIO recommends that OSHA adopt an approach to the provision of medical information to employers that follows the approach contained in the regulations governing medical information under the Black Lung Program (30 CFR 90.3). Dr. David Weissman, from NIOSH explained, the confidentiality provisions of this program as follows (Tr. 169):

MS. SEMINARIO: Now, NIOSH has experience as well with respect to dealing with occupational exposures and medical surveillance in the mining environment. Is that correct?

MR. WEISSMAN: That's right. We operate the Coal Workers' Health Surveillance Program.

MS. SEMINARIO: And when a miner receives a medical exam under that program, does the employer receive the results of that medical exam or any information from that medical exam?

MR. WEISSMAN: No, that information is provided only to the miner, and there are actually in the regulations prohibitions on the employer asking the miner for that information. It's only given out with the permission of the miner or, if the miner's unable or deceased, their next of kin.

MS. SEMINARIO: So it would require the written authorization of the miner --

MR. WEISSMAN: Exactly.

MS. SEMINARIO: -- to the healthcare provider to provide that information to the employer?

MR. WEISSMAN: Exactly, and maintaining that confidentiality is critical to that program.

It is the AFL-CIO's position that the final silica standard should require that the PLHCP's written opinion be provided directly to the employee by the PLCHP. The written opinion or other information from the medical examination should only be provided to the employer at the initiation by and with the written consent of the employee. The only information that should be provided directly to the employer by the PLHCP to the employer is a determination that the employee is unable to wear a respirator. This position is shared by all of the unions - the BCTD, BAC, IUOE, LIUNA, USW, UAW and AFSCME (Exs. 2371, 2329, 2262, 2253, 2336, 2282, 2142). It is also strongly supported by the APHA:

> A PLHCP's written opinion should only be provided to the employee, not the employer. The employee's health record must be considered confidential. The employee must have a right to determine when, or if, to share the PLHCP's written opinion with his or her employer. The only health information that a PLHCP should report to the employer concerns the employee's fitness to wear a respirator (Ex.2178).

Dr. Christine Oliver, testifying on behalf of the Collegium Ramazzini, testified that this was the practice she followed in conducting worker medical surveillance exams (Tr. 3882-3):

MS. SEMINARIO: So would there be - absent a written consent by the worker/patient, would any of the information from that visit or diagnosis be shared with the employer?

DR. OLIVER: No. In my clinical practice, no. I screen Boston public school custodians for asbestos-related disease. I've been doing that for quite some time. And in that screening I submit an "employer's written report," but all it says is that -- it doesn't give any details of that person's medical history.

MS. SEMINARIO: What would be included in that report?

DR. OLIVER: The only thing that would be included in that report would be whether this person is allowed to wear a respirator or not.

In addition, the AFL-CIO strongly urges OSHA to include provisions in the final standard that explicitly prohibit the employer from asking the employee or the PLHCP for a copy of the medical information, as is included in the black lung regulations.

And most importantly, the rule must include an explicit prohibition against an employer for retaliating or taking any adverse action against an employee based the employee's participation in the medical surveillance program or upon the results of any medical examination or tests conducted in the surveillance program. Violation of these requirements should be the basis for a citation under the rule, subject to penalty, in addition to any applicable action under the retaliation protections provided under section 11(c) of the Act.

Only with the inclusion of a clear prohibition in the rule and a strong enforcement mechanism can workers have any real confidence that they will be protected from retaliation for participating in medical surveillance for silica disease. The medical surveillance provisions of the silica standard will only be effective with the inclusion of these protections.

The AFL-CIO also recommends that the Medical Surveillance Guidelines in Appendix A of the standard include a new section outlining the medical confidentiality requirements of the rule and provide clear guidance on the medical information that may be and may not be provided to an employer, without the informed written consent of the employee.

5. Medical Removal Protection and Multiple Physician Review

Unlike many other OSHA health standards, OSHA has not included provisions on medical removal protection (MRP) or a multiple physician review mechanism (MPR) in the proposed silica standard. The stated reason is that the agency has made a preliminary determination that there are few instances where temporary worker removal and MRP will be useful (78 Fed. Reg. 56291, Sept. 12, 2013).

It is the AFL-CIO's strong view that OSHA's decision to omit MRP from the silica standard is wrong, and that the failure to include MRP will put workers at increased risk of harm from silica exposure.

As the AFL-CIO documented in our written comments, Medical Removal Protection has been an important element of many OSHA health standards starting with the lead standard issued in 1978 (29 CFR 1910.1025). Since that time MRP has been included in OSHA health standards on formaldehyde (29 CFR 1910.1048), benzene (29 CFR 1910.1028), methylenedianiline (MDA) (29 CFR 1910.1050), cadmium (29 CFR 1910.1027), and methylene chloride (29 CFR 1010.1052).

One of the agency's key reasons for including MRP in its health standards is to encourage workers to participate in medical surveillance programs provided under these standards. As the agency stated in the preamble of the lead standard:

> It is clear that the medical surveillance provisions of the inorganic lead standard should serve several critical functions. These functions will be served and the purposes of the Act furthered, however, only to the extent that workers freely and confidently participate inn offered medical surveillance. Participation in medical surveillance offered under the lead standard will sometimes prompt the temporary medical removal of workers at risk…..Without MRP, many workers exposed to inorganic lead would face a painful dilemma. A worker could fully participate in the medical surveillance offered by the standard and risk losing his or her livelihood, or resist participating in a meaningful fashion and thereby lose the many benefits that medical surveillance can provide. OSHA is convinced…., absent MRP, many workers will either refuse or resist meaningful participation in medical surveillance offered by the final standard. The economic disincentives to participation are severe and must be removed if the medical surveillance provisions of the lead standard are to substantial advance the goals of the Act (43 FR 54442).

In the preamble to the 1992 cadmium standard, OSHA explained the need for MRP as follows:

> With MRP, workers are assured of being removed to low exposure jobs when necessary to protect their health. And with MRPB, workers are assured that, if they fully participate in medical surveillance and if the results of medical surveillance require removal from their high-cadmium exposures jobs, their wages and job status will be protected for an extended period (57 Fed. Reg. 42367-8, Sept. 14, 1992).

OSHA went on to explain that MRP is a control method as a means to protect the health of the worker, and that such costs should be borne by the employer, not the worker:

> Viewed as a means to achieve the health goals of the standard, temporary medical removal is a method of control not so different in this respect from engineering controls, which control airborne cadmium emissions…..Consequently, the costs of MRP, like the costs of providing respirators and engineering controls, are placed on the employers rather than on the shoulders of individual workers unfortunate enough to be at risk of sustaining material impairment to health due to occupational exposure to cadmium (57 Fed. Reg. 42368, Sept. 14, 1992).

As was discussed above, many workers exposed to silica fear that they will be retaliated against if they suffer and report adverse health effects due to exposure. Absent protection against retaliation and the assurance that they will not suffer adverse economic consequences as a result of health conditions, workers will not participate in and gain the benefits from medical surveillance.

The need for MRP is just as critical in the silica standard as it is for the lead, cadmium and other OSHA health standards. Participation in the medical surveillance provided by the silica standard is critical as a protective measure to identify workers who may be experiencing adverse effects and need medical follow-up, treatment or other intervention to reduce exposures. Just as OSHA has included MRP in many previous OSHA health standards as a means to encourage participation in medical surveillance and to provide protection to workers by removing them from further exposure, it is appropriate and important for OSHA to include MRP in the final silica standard for general industry.[28]

Mr. Jim Frederick from the United Steelworkers, a union with extensive experience with the medical removal provisions under other OSHA health standards and collective bargaining agreements, outlined why medical removal protection was a necessary component of effective medical surveillance programs that should be included in the silica standard (Tr. 2541-44):

> I'll start with a few comments around medical removal protection. We strongly believe that medical removal protection and multiple physician review should be added to the final rule.
>
> Without medical removal protection and multiple physician review, workers may not participate in screening programs.

[28] The AFL-CIO defers to the Building and Construction Trades Department, AFL-CIO on the appropriateness of including MRP in the silica standard for construction.

> We'll talk a bit more about this, but again, we know the realities of what goes on in workplaces, and the number of reasons why employers put programs in place that keep workers from participating in things like a voluntary medical screening program.
>
> As we said then [in previous rulemakings], encouraging worker participation in medical screening -- medical surveillance, prior testimony has documented various reasons that workers might not participate in medical surveillance, for fear of job loss, other retaliation, and coercion.
>
> Medical removal protection provides workers with a backstop, and a vastly improved understanding that negative medical results will not result in immediate loss of job, benefits, salary, et cetera as a result of participation in medical screening.

There is no doubt that there will be workers exposed to silica for which the physician or other PLHCP recommends removal from a high exposure job in order to limit further exposure and risk to the worker. Indeed, Alan White, a member of the United Steelworkers who participated in the OSHA press conference announcing the proposed silica rule, is one such individual. After being diagnosed with silicosis, his physician recommended that he be transferred to another lower job, and under the union contract this was done. But most workers don't have the benefits of a union contract like Alan White. They need the protection afforded by the MRP provisions in an OSHA standard.

The AFL-CIO takes issue with OSHA's statement in the preamble that temporary removal and MRP will not be useful to protect workers exposed to silica. This seems to suggest that MRP is only useful to address temporary health conditions. The AFL-CIO strongly disagrees. Under virtually all previous standards that include MRP, this protection applies to a broad range of health impacts, some temporary and some permanent. For example, the cadmium standard requires medical removal protection where a determination is made that the worker is unable to wear a respirator. There is no requirement that the condition is temporary. Similarly, as noted above, all of the standards that include MRP – lead, benzene, formaldehyde, MDA, cadmium and methylene chloride – require removal protection when a physician determines it is necessary to remove a worker from exposure for health reasons related to exposure. This provision is not limited to conditions which are temporary. Indeed, in the decision on OSHA's 1987 final formaldehyde standard, the court rejected OSHA's argument that MRP should be limited to temporary reversible health conditions, finding that other standards required removal for permanent conditions (*International Union, UAW v. Pendergrass: 878 F.2d 389, 399-400 (1989)*. Upon remand, the formaldehyde standard was amended to provide MRP for removal involving permanent health conditions (57

Fed.Reg. 22290, May 27, 1992). Under the MRP provisions, it is the term of removal and benefits, not the medical conditions that are limited.

Even for permanent health conditions, removal protection can be of great importance in protecting workers' health. Removal protection will allow workers to be removed from further high silica exposure and will also provide time for employers to find other positions with lower exposures for at risk workers. MRP will give workers confidence that they can participate in medical surveillance without fear of adverse impacts due to adverse health effects from exposure.

There was widespread support for the inclusion of MRP in the final silica standard from the occupational medical professionals who participated in the hearings. Specifically, the American Thoracic Society (Ex. 2175), Association of Occupational and Environmental Clinics (Tr. 832), the Council of State and Territorial Epidemiologists (Ex. 2175), American College of Chest Physicians, (Ex. 2175) American Public Health Association (Ex. 2178), and Collegium Ramazzini (Ex. 2148) all strongly urged OSHA to include MRP in the final standard.

Dr. Christine Oliver, testifying on behalf of the Collegium Ramazzini, presented comprehensive testimony on the need for and appropriateness of including medical removal protection in the final silica standard for both temporary and permanent conditions (Tr.3869 – 71):

> The Collegium Ramazzini believes that MRP is necessary to workers' full participation in medical surveillance provided for in the proposed standard, and that such participation is necessary to the early detection of silica-related disease.
>
> Accordingly, the Collegium Ramazzini strongly urges the Agency to include provisions for MRP in the proposed rule. The bases for this position are as follows:
>
> (1) There is nothing about this standard that is different from previously promulgated standards with regard to worker reluctance to participate in medical examinations that may result in job loss. The risk of job loss should a silica-related medical condition be discovered is real and for many workers covered by the standard, not worth taking without job and benefit protection.
>
> (2) Among the components of the medical examination, the medical history is likely to be most affected by lack of MRP. Workers must feel free to discuss respiratory and other symptoms with the PLHCP.

As noted earlier in this commentary and by the Agency itself in the preamble, respiratory symptoms of cough, phlegm, shortness of breath and wheeze may be the initial manifestation of early lung disease associated with silica exposure. These may occur in the absence of demonstrable abnormalities on spirometry or chest radiograph.

(3) Temporary removal of workers with silica-related lung disease is advisable under certain circumstances. Although silicosis is a chronic disease, other silica-related nonmalignant respiratory disease, while chronic, has periods of exacerbation that may benefit from temporary removal from workplace exposure to silica. These conditions include bronchitis, airway hyporeactivity, and COPD. Such exacerbations are generally short term but may last for weeks and may require hospitalization.

Temporary removal is advisable in the case of an employee who is referred to a pulmonary specialist for further medical evaluation as a result of medical examination.

In response to questioning by OSHA, Dr. Robert Cohen testifying on behalf of the ATS, Dr. Rosemary Sokas on behalf of the APHA and Dr. Tee Guidotti on behalf of the AOEC, set forth their reasons why MRP was appropriate and necessary in the silica standard (Tr. 830 – 832):

MS. PENNIMAN: Okay, thank you. Speaking of the lead standard, my next question is about medical removal protection. And I think this is another item that we had general agreement on as a recommendation that OSHA should be looking at for the silica standard.
In the lead standard, when workers are removed, it's because we expect their lead level to go down. Silica is different. And silicosis, as we know, we've been talking about here is a progressive disease. How would you construct medical removal protection in this situation?

DR. COHEN: Well, we think that it is a progressive disease in that the dust is retained in the lungs. The inflammatory process continues. But with continued exposure, we expect worse progressing, you know, and more severe rates of progression, so we want to prevent that. So

that's similar to what's done with coal miners. We think that that is an important thing to mitigate that ongoing exposure. And while we cannot reverse what's there, we would prevent additional injury.

DR. SOKAS: And just to sort of pile onto that, so it's not that we're trying to emulate the lead standard here. It's that it's already in effect for coal miners. And so we would encourage OSHA to explore how that has work for coal worker pneumoconiosis and see if there is an equivalent approach that might be useful.

DR. COHEN: And the issue of susceptible workers is the other question so that if it, you know, if everything is in compliance, then this person is likely more sensitive to have developed disease in a compliant workplace so that that person likely needs removal because of their individual host characteristics perhaps.

DR. GUIDOTTI: AOEC, in its written testimony, also not only agrees with the logic of ATS, but also offers another reason, and that's that although an individual who has developed moderate or advanced silicosis may be at little risk for that particular outcome with further exposures, in terms of little risk of making it worse once it's at a certain level of severity, but additional exposure to respirable particulates can contribute risk for other outcomes, such as bronchitis and exacerbation of chronic obstructive airways disease. So the medical removal provision both decelerates the potential speed at which silicosis will develop and also subtracts out the aggravational factor of the dust exposure for an individual who already has a respiratory compromise.

The AFL-CIO recommends that OSHA include MRP provisions in the final general industry standard that are modeled after MSHA's Part 90 program (under 30 CFR Section 203(a)) of the Coal Mine Safety and Health Act as was advocated in the ATS, AOEC, CSTE and ACCP comments (Ex. 2175), APHA (Ex. 2178) and other witnesses (Ex. 3424). Under the MSHA regulations, the decision to seek removal/transfer is the coal miner's decision based upon a finding and recommendation

of the examining physician that is made directly to the employee. The recommendation for removal/transfer is not conveyed to the employer unless the worker initiates that action.

In order to maintain medical confidentiality and privacy, we recommend that OSHA take a similar approach with the MRP provisions in the final silica standard. That is, the standard should provide for MRP rights to be exercised at the discretion of the worker upon a medical determination that the worker should be removed from a job where exposures exceed the PEL. The findings and recommendations should be transmitted by the PLHCP to the employee. At the request and with the consent of the employee, the PLHCP can provide a written medical opinion to the employer that the employee should be removed from a high exposure job, triggering the MRP provisions of the rule.

With respect to what type of findings or conditions should trigger the medical removal provisions under the rule, the AFL-CIO supports the recommendations made by Dr. Christine Oliver on behalf of the Collegium Ramazzini that medical removal be triggered by both temporary and permanent conditions (Tr.3869 – 71). Specifically we recommend that medical removal/transfer rights be triggered by the PLHCP's determination that the worker should be removed from exposure based upon the results of medical examinations and tests; inability to wear a respirator; evidence of illness, other signs or symptoms of silica related dysfunction or disease or any other reason deemed medically sufficient by the PLHCP; or when the worker is referred to a pulmonary specialist or occupational physician for further evaluation.

As the AFL-CIO and Dr. Christine Oliver pointed out in comments and testimony, similar types of triggers for medical removal have been included in other OSHA health standards (Exs. 2257, 2148). Specifically, the asbestos (1910.1001), cotton dust (1910.1013) and cadmium (1910.1027) standards provide for removal due to a determination that a worker in unable to wear a respirator. Standards on lead (1910.1025), benzene (1910.1028), cadmium (1910.1027), formaldehyde (1910.1048), methylene dianiline (1910.1050) and methylene chloride (1910.1052) all provide for workers to be removed upon a PLHCP finding of signs, symptoms, or disease and/or other medical determination that the employee should be removed from exposure. And the benzene standard (1910.1028) provides for removal when a worker is referred to a specialist for further evaluation.

Upon such a determination by the PLCHP, and a decision by the worker to exercise their medical removal rights, the standard must require that the employer remove the worker from the job and transfer the worker to a job where exposure is as low as possible, but does not exceed the action level with no loss of pay, benefits or seniority. If there is no available position, the employer must still remove the worker from exposure.

The AFL-CIO recommends that the final standard provide for up to 6 months of medical removal benefits. We note other OSHA standards provide for medical removal

protection benefits for up to 6 months. The benefits should continue until it is determined that the worker can return to his or job, the worker is transferred to another position with no loss of pay, or for 6 months, whichever is shorter.

In addition to MRP, the final general industry standard should also provide for multiple physician review (MPR), similar to the MPR provisions in the OSHA health standards on lead, formaldehyde, MDA and cadmium. As OSHA pointed out in the preamble of the cadmium standard, the effectiveness of medical surveillance "depend[s] substantially on workers' trust and confidence in examining physicians and health care professionals (57 FR 42373). The need for trustworthy and independent medical opinions was underscored by the United Steelworkers and in their comments and testimony (Ex. 2336, Tr.2545, 2626).

The AFL-CIO recommends that OSHA include provisions on multiple physician review in the final general industry silica standard that are modeled after the cadmium standard and other OSHA health standards that contain these provisions. Specifically, the standard should provide for workers to seek a second medical opinion, if they disagree with the medical opinion provided by the physician or health care provider chosen by the employer. In the case where the two physicians disagree, there shall be a review and examination by a third health care provider chosen jointly by the employer and employee. The results of all of these examinations shall be provided directly to the employee following the same confidentiality restrictions that limit the provision of confidential medical information to the employer. It should be the employer's obligation to pay for these examinations and reviews.

H. Training and Information

The proposed silica standard builds off the Hazard Communication Standard (HCS) (29 CFR 1910.1200) to provide employees information and training about the hazards and control measure for occupational exposure to respirable silica. Employers are also required to ensure that each "affected employee" can demonstrate knowledge with respect the specific operations in the workplace that could result in exposure to silica; procedures the employer has implemented to protect the employee from exposure including appropriate work practices and the use of personal protective equipment; the requirements of the standard; and the purpose of the medical surveillance requirements of the rule.

While the information and training provisions embodied in the Hazard Communication standard may be appropriate for workers with potential exposure to silica, workers exposed to silica in the course of their work need additional training and information beyond what Hazard Communication and the proposed standard provide.

1. Training

Many commenters and hearing participants underscored the importance of training workers exposed to silica in order to protect workers and limit exposures, and

urged OSHA to include a tiered approach to training. In particular, the Building and Construction Trades Department recommended that all affected workers with potential exposure to silica should receive awareness training under the standard and that workers who performed silica dust-generating tasks have task specific training on engineering controls and work practices associated with the worker's tasks. In addition the BCTD recommended further training as needed for the competent person to carry out their specific duties (in conjunction with their recommendation for the designation of a competent person with specific duties as part of the control provisions of the standard) (Ex. 2371).

The AFL-CIO believes that a similar tiered approach for training is appropriate for the general industry standard as well.

For all affected workers with potential exposure to silica, we recommend that the final standard require awareness training as outlined in the proposed standard. For workers who are assigned to silica generating operations and tasks or for workers whose exposures exceed the action level, there should be job specific training on engineering and work practice control measures for workers. In addition the training should include a review of the employer's silica exposure control plan.

The standard should provide for refresher awareness training for workers with potential exposure to silica once every 3 years, and for workers assigned to silica generating operations and tasks, the full training required under the standard should be provided annually. For workers newly assigned to jobs with potential exposure to silica, awareness level training should be provided before placement in the position. Similarly, for workers who are assigned to a new silica generating task or operation, training on the job specific control measures for that position should be provided prior to assignment.

The final standard must also include a specific requirement that the training be provided in a language and manner that the employee can understand as is required by the bloodborne pathogens standard (29 CFR 1910.1030(g)(2)). This is particularly important in industries where there are large numbers of non-English speaking workers. The preamble indicates that this is OSHA's intent, but there is no requirement in the standard itself (78 Fed. Reg. 56474, Sept. 12, 2013).

The general industry standard must also provide for training for a competent person so that the person has adequate knowledge to carry out their responsibilities under the standard. . Specifically, in addition to the hazard awareness training provided to all workers exposed to silica, the competent person should receive training and education on:1) the sources of silica exposures and jobs and operations that are likely to generate exposure, including work performed by other employers at the site; how to identify overexposures to silica including how to interpret objective data and exposure monitoring data; the employer's exposure control plan including the required engineering and work practices to limit exposures and the proper operation and maintenance of those controls; the required respiratory protection and the employers'

respiratory protection program; and the employers' training and education program for silica.

2. Warning signs

As proposed, the silica standard fails to provide for warning signs to advise workers of the presence of silica in the workplace, its health hazards and appropriate control measures. While the hazard communication standard requires warning labels and data sheets for silica containing products, it does not require warning signs at the worksite. The absence of the requirement for warning signs was confirmed by David O'Connor from OSHA's Directorate of Standards and Guidance in response to questions by Jim Frederick, USW:

MR. FREDERICK: Turning to a couple of other issues in my remaining time, I don't find anywhere in the proposal that posting of signs or warning labels, of warnings in the workplace are going to be required. Is that correct?

MR. O'CONNOR:	The regulated area provisions do require demarcation of those regulated areas. They don't have specific requirements with regards to signs and labels that would be used, but simply a performance-oriented requirement for demarcation.
MR. FREDERICK:	So not like in other standards where there's a specific verbiage of a sign that should be posted?
MR. O'CONNOR:	That's correct.

But as OSHA acknowledged, such warning signs are required under most other OSHA heath standards for toxic substances.

Many witnesses and commenters urged OSHA to include a requirement for posting warning signs with specific language warning of the hazards for silica and the appropriate control measures. These include the AFL-CIO (Ex.2257), BCTD (Ex.), IUOE (Ex.), USW (Ex. 2336), UAW (Ex. 2282), Charles Gordon (Ex.), Greg Siwinski and Michael Lax (Ex. 2244), APHA (Ex. 2178), National Consumer League (Ex. 2373), and HalenHardy (Ex. 4030).

It is the AFL-CIO's view that warning signs are a critical measure to protect workers from silica exposures. There is extensive evidence in the record demonstrating that many of the exposures to workers occur from cross-contamination and bystander exposures with silica generated in particular jobs and operations exposing other workers in the vicinity. Thus warning signs are particularly important to warn workers who may be exposed about the presence of silica and its hazards. Moreover as Mr. Charles Gordon, a former solicitor at DOL with extensive experience in OSHA standards pointed out, under section 6(b)(7) of the OSH Act OSHA has a legal

obligation to include requirements for warning signs in the standards (Ex. 2163) Specifically, section 6(b)(7) states that:

> "(7) Any standard promulgated under this subsection shall prescribe the use of labels or other appropriate forms of warning as are necessary to insure that employees are apprised of all hazards to which they are exposed, relevant symptoms and appropriate emergency treatment, and proper conditions and precautions of safe use or exposure."

The AFL-CIO urges OSHA to include a requirement for the posting of warning signs in regulated areas where there is exposure to respirable silica. Such signs should warn of the presence of silica, respiratory hazard, the cancer hazard and the need for respiratory protection. Both the BCTD (Ex. 2371) and HalenHardy (Ex. 4030-D) have provided recommendations for the minimum language that should be included on warning signs that are good models for the language that should be required by the standard.

VII. PROCEDURAL ISSUES

A number of industry participants have argued that OSHA has failed to properly follow rulemaking procedures in developing and publishing the proposed respirable silica rule. (Exs. Chamber 2288, CISC 2319, ACC 2307). In particular, they have claimed that the agency failed to adequately consult with the Advisory Committee on Construction Safety and Health (ACCSH); provide for the necessary review by small business as required under the Small Business Regulatory Fairness and Enforcement Act (SBREFA) and provide sufficient time for comment on the proposed rule.

The AFL-CIO believes that OSHA has met all of its procedural obligations, and more. The agency had extensive consultations with the Advisory Committee on Construction Safety and Health, as OSHA has outlined in the preamble and as the Building and Construction Trades have outlined in their post-hearing brief.

To meet its obligation to consult with small businesses prior to the issuance of a proposed rule, in 2003 OSHA convened a SBREFA panel to obtain advice and recommendations from small business groups on both the draft silica standards for construction and general industry. We point out that, under this process, small businesses are given special and unique opportunity for input that is not provided to workers, their representatives or other members of the public. Based upon the SBREFA review and recommendations made, OSHA made a large number of changes in the proposed rule, many of which reduced obligations on employers; and a number of which in the view of the AFL-CIO improperly reduced protection afforded to workers.

Industry groups have argued that since nearly a decade passed between the SBREFA panel and the issuance of the proposed rule, that OSHA should have convened a second SBREFA panel prior to issuing the proposed rule. There is no

requirement for OSHA to conduct such a review. We are compelled to point out that the major reason that the proposed rule was delayed was due to objections by industry groups, who raised objections to the rule at every stage, claiming that the rule was not needed, and urging the agency to abandon the rulemaking. Due to industry objections, development of the silica rule was put on hold by the Bush administration in 2004. And in 2011, the rule was again delayed, this time for 33 months at the Office of Management and Budget, for "extended review" under EO 12866. Again, industry objections were the cause of the delay. If anyone has a legitimate grounds to complain about delays in the rule, it is the workers who have continued to be exposed to high levels of silica and suffered unnecessary disease and death due to inaction on this serious hazard.

Since the proposed silica standard was finally issued on September 12, 2013, industry groups have continued their efforts to delay the rulemaking, claiming that OSHA has provided inadequate time for review and comment on the proposed rule. There is no truth to these assertions. As the AFL-CIO outlined in our initial comments, the amount of time provided by OSHA for comment and public input at the hearings is equal to or greater than the amount of time the agency has provided for other rulemakings on other health standard (Ex. 2257). In addition, the agency has granted extensions, both in the pre-hearing and post-hearing comment periods. A total of six months were provided for pre-hearing written comments, two months after the close of the public hearings for post-hearing comments, and two and one half additional months for the filing of post-hearing briefs which have a deadline for submission of August 18, 2014, almost exactly a year since the proposed rule was publicly announced and unveiled last August 23, 2013.

The OSHA rulemaking process provides greater opportunity for public input than most other government agencies, including public hearings with the opportunity for participants to cross examine other witnesses. As part of the silica rulemaking, OSHA held three weeks of public hearings, from March 18 to April 4, 2014, providing all parties with as much time to present testimony as they requested. Some industry groups, including the Chamber of Commerce, American Chemistry Council Silica Panel and Construction Industry Safety Coalition were each provided more than a day to make their presentations. All of these participants were given the opportunity to cross-examine the agency and other witnesses.

All participants have had ample time to present their views and provide evidence to OSHA on the proposed silica standard. Additional time is not needed, and would only serve to further delay this rule causing further significant impairment to workers.

VIII. CONCLUSION

Millions of workers are exposed to silica dust. Workplace place exposures to this deadly dust put workers at serious risk of death and disease. The current OSHA regulations for silica are woefully outdated, based on science and feasibility information from the 1920's. Exposures allowed under the current general industry standard (100 µg/m3) and construction standard (250 µg/m3) pose a significant risk of death and

disease. Moreover, current regulations are difficult to enforce and fail to provide for exposure monitoring, medical surveillance, training and other measures that are needed to protect workers from this serious health risk.

The OSHA proposed respirable crystalline silica standards are long overdue and welcome. The proposed standards for general industry and construction incorporate well-established control and protective measures that will significantly reduce the risk of silica-related disease and death. These standards are based on extensive evidence that demonstrates that the standards are needed to protect workers, will reduce the risk of silica disease and are technologically and economically feasible.

But as OSHA has recognized, even under exposures permitted by the proposed standard, workers will still face a significant risk of harm. The 50 $\mu g/m^3$ PEL is based on OSHA's determination that 50 $\mu g/m^3$ is the lowest level that it is feasible to attain. But there are other provisions in the rule that can help reduce exposures and reduce risk including provisions on control methods, medical surveillance and training. Yet many of the provisions for these measures that OSHA has proposed for silica are much weaker than similar provisions in other standards, even for standards where the risk is much lower. The provisions on exposure control, medical surveillance and training must be strengthened in the final rule to help further reduce risk from silica exposure.

Workers have waited far, far too long for protection from deadly silica dust. The AFL-CIO urges OSHA to move expeditiously to complete this rulemaking and to issue final silica standards to protect workers from unnecessary disease and death.

Appendix 1: Technological Feasibility in the Foundry Sector

Analysis of the Evidence by Dr. Franklin Mirer, PhD, CIH, Professor Environmental and Occupational Health and Safety, CUNY School of Public Health

A. The Proposed 50 µg/m^3 PEL is Feasible

Our original submission and testimony, summarizing OSHA's PEA, noted that for foundries, "Overall, nearly 20% of sampled operations were less than 25 µg/m^3, 45% below 50 µg/m^3, while 30% exceeded the current PEL of 100 µg/m^3 (Ex. 2257, Mirer). The assessment of feasibility is a matter of judgment of levels to be achieved in all operations if the scofflaw operations were controlled."

Table IV-C16 is reproduced below in Figure 1. We emphasize that the sources emitting silica exposures of >100 µg/m^3 are a major source of the worker silica exposures between 50 µg/m^3 and 100 µg/m^3. Were the >100 µg/m^3 exposures controlled, most worker exposures currently in the 50-100 µg/m^3 range would be below 50 µg/m^3, and substantial numbers would be less than 25 µg/m^3.

The sources of exposure in main foundry operations are correctly listed in Table IV.c-15 on page IV-135 of the PEA. Table IV.c-15 is reproduced below in Figure 2. For molder, coremaker, furnace operator, knockout operator, abrasive blasting operator, material handling, and maintenance operator, "dust released from adjacent operations" is listed as a source of exposure, and is listed as the only source for pouring operator. Thus, for furnace operators (median 34 µg/m^3, mean 109 µg/m^3) and pouring operators (median 48 µg/m^3, mean 79 µg/m^3), their own activities at their work stations do not emit silica. Yet, these workers suffer substantial silica exposures. This demonstrates that a cloud of silica permeates these factories, and some fraction, perhaps 40 µg/m^3, of the median exposure would be reduced by control of other, silica-generating operations. Similar subtractions could be applied to all operations, which would reduce the grand median to close to 25 µg/m^3.

The heart of the foundry process is the pouring loop, which is fed by the melt process and the coremaking process, and which in turn feeds the finishing process. The pouring loop consists of muller-molding (core setting)-[pouring-cooling]-shakeout-knockout. Sand from shakeout is recycled to the muller. The primary emissions points are shakeout-knockout, and the return sand conveyor to the muller.[29]

There is no silica exposure generated by pouring iron into molds – there may be smoke and metal oxide fume, but no silica. Silica exposure to iron pourers comes from fugitive emissions from the adjacent processes.

Silica emissions from molding are modest, because molding sand is formulated to stick together to hold shape. There are usually several employees assigned to this

[29] See EPA diagram in Figure 3, and diagram in original testimony (Ex. 2257).

task, but little or no additional exhaust ventilation is needed. Sources of exposure are largely from adjacent operations, notably, return sand from shakeout.

Thus, multiple job classifications will be protected by ventilation and enclosure of shakeout-knockout and shakeout return sand.

Castings removed from shakeout-knockout are substantially coated with molding sand, but no energy is applied to these articles. At most, modest amounts silica may be emitted as the castings are conveyed and loaded into a shot blasting machine, which is an enclosed cabinet equipped with exhaust ventilation.

For the sand system, the sources of release (other than fugitive) are return sand from shakeout-knockout, usually on a conveyor feeding the muller (enclosed sand mixer), and fresh sand being added to the system. Typically the sand is stored in a hopper, and then moved by gravity from the hopper into a muller (sand mixer). Mullers are typically enclosed and provided with exhaust ventilation to prevent dust release from sampling ports. If this equipment is appropriately enclosed and if appropriate exhaust volume is applied, direct emissions should be very small. In addition, the muller is used to produce molding sand by adding coal, cereal, and water to make molding sand which sticks together around the pattern, creating the space within the mold into which iron is poured. The molding sand is wet and less likely to generate airborne respirable dust. Ventilation requirements in volume terms are determined by the area of openings; capture velocity through these opening of 150 fpm should reduce emissions to near zero.

B. The AFS Detailed Submission Further Reinforces the Impact of Carryover Emissions

The chart labeled “Figure 4 – Variability of Silica Exposures for Job Categories” is extracted from the AFS Testimony by Robert Scholz (Ex. 2279). The chart depicts the median and 84th percentile exposure for 12 particular operations in foundries selected by the AFS. The median exposures are indicated by the red squares.

For the “automatic mold machine operator,” which would be considered a silica generating operation, 50% of exposures were less than 18 µg/m^3. For the “shot blast loader”, 50% of exposures were less than 35 µg/m^3. For chipping and grinding, which is the most difficult operation to contain silica dust, 50% of exposures were less than 36 µg/m^3. For eight out of 12 operations, many of which are silica generating operations, showed median exposures below 50 µg/m^3.

By contrast and most notably, “mold pouring” displayed a median of 64 µg/m^3 and an 84th percentile exposure of 165 µg/m^3, essentially the highest exposures in the lot. As noted repeatedly, “mold pouring” generates no silica. The exposures at this station are coming from adjacent operations. Similarly the “pressure pour operator” endured a median of 45 µg/m^3 with large excursions.

The highest exposure mean and upper interval was observed for “ladle relining.” This is a specialized and limited duration task in the melt department, where silica refractory is added to the ladle. It would be considered a maintenance task for which respiratory protection would be acceptable. Even so, this task should be provided enclosure and exhaust to prevent spread of emissions, even if the operator might still need respiratory protection.

C. The Submission of Exposure Data by the American Foundry Society (AFS) Supports a Conclusion That a PEL of 50 µg/m^3 Is Feasible

The AFS exposure data are not submitted in as useful a format as the PEA data, but claim lower exposures than the PEA, thus supporting feasibility.

First, we compare the overall data set submitted by AFS to the PEA data.

Table 1.

	>50	>100	>50,<100	Mean (µg/m^3)	Median (µg/m^3)
AFS All	33%	13.2%	20%		
PEA All	56%	23%		138	62

The AFS data state that 67% of foundry operations, weighted for job distribution, are now below the 50 µg/m^3 proposed PEL. This would appear to be “most of the operations,” a criterion for feasibility.

AFS did not provide mean and median exposures. If the reductions in mean and average are assumed to be proportional to the reductions in excess proportion, it would appear the AFS mean and median would be in the region of 60 ug/m^3 and 32 ug/m^3.

Next, we compare data for non-silica generating operations (pouring and furnace) where exposure is “carryover.” For the AFS data set, it appears that the proportion of samples for pouring and furnace exceeding the 50 µg/m^3 and 100 µg/m^3 cut points are essentially the same as those for the data set as a whole. The proportion of samples exceeding 50 µg/m^3 are the same for both operations (~33%), while those violating the current PEL are somewhat higher in furnace and lower in pouring.

Table 2.

	>50	>100	Mean ($\mu g/m^3$)	Median ($\mu g/m^3$)
AFS				
Pouring	33%	7%		
Furnace	30%	17%		
PEA				
Pouring	50%	33%	79	45
Furnace	38%	38%	109	34

Once again, almost 70% of the AFS reported exposure results for these operations are below the proposed PEL. These data support a conclusion that the foundry atmosphere includes a cloud of dust from high silica generating activities which contributes to exposure and overexposure of all operations including the silica generating operations.

Finally, we present the AFS data for acknowledged silica generating operations:

Table 3.

	>50	>100	>50,<100
Sand System	54%	30%	24%
Knockout	48%	10%	38%
Shakeout	42%	23%	19%
Cleaning	38%	19%	21%
Molder	37%	9%	26%

Only for the sand system are the majority of the AFS estimates above the proposed PEL. Note that the sources of exposure for those operations >100 $\mu g/m^3$ are also contributing to the exposures for those less than 100 $\mu g/m^3$ but greater than 50 $\mu g/m^3$.

Figure 1.

Table IV.C-16
Respirable Crystalline Silica Exposure Range and Profile for Ferrous Sand Casting Foundries (NAICS 331511, 331513)

	Exposure Summary			Exposure Range		Exposure Profile				
Job Category	**Number of Samples**	**Mean (µg/m³)***	**Median (µg/m³)**	**Min (µg/m³)**	**Max (µg/m³)**	**<25 (µg/m³)**	**≥25 and ≤50 (µg/m³)**	**>50 and ≤100 (µg/m³)**	**>100 and ≤250 (µg/m³)**	**>250 (µg/m³)**
Ferrous Sand Casting										
Sand Systems Operator	58	228	78	11	2,430	10 17.2%	9 15.5%	15 25.9%	16 27.6%	8 13.8%
Molder	152	74	50	6	1,417	40 26.3%	37 24.3%	44 28.9%	29 19.1%	2 1.3%
Coremaker	106	76	39	9	1,780	27 25.5%	34 32.1%	31 29.2%	10 9.4%	4 3.8%
Furnace Operator	8	109	34	13	281	3 37.5%	2 25.0%	0 0.0%	1 12.5%	2 25.0%
Pouring Operator	24	79	48	10	280	6 25.0%	6 25.0%	4 16.7%	7 29.2%	1 4.2%
Shakeout Operator	97	101	66	10	500	14 14.4%	25 25.8%	29 29.9%	17 17.5%	12 12.4%
Knockout Operator	37	111	78	13	540	4 10.8%	13 35.1%	7 18.9%	9 24.3%	4 10.8%
Abrasive Blasting Operator	61	155	90	13	1,002	4 6.6%	15 24.6%	17 27.9%	17 27.9%	8 13.1%
Cleaning/Finishing Operator	213	196	77	12	1,868	33 15.5%	46 21.6%	41 19.2%	45 21.1%	48 22.5%
Material Handler	32	80	56	11	231	9 28.1%	6 18.8%	10 31.3%	7 21.9%	0 0.0%
Maintenance Operator	24	376	72	13	5,851	4 16.7%	6 25.0%	5 20.8%	4 16.7%	5 20.8%
Housekeeping Worker	14	146	75	16	646	2 14.3%	2 14.3%	6 42.9%	2 14.3%	2 14.3%
Total Ferrous Sand Casting Foundries	**826**	**138**	**62**	**6**	**5,851**	**156 18.9%**	**201 24.3%**	**209 25.3%**	**164 19.9%**	**96 11.6%**

*µg/m³ = micrograms per cubic meter

Figure 2.

Table IV.C-15
Job Categories, Major Activities, and Sources of Exposure of Workers in Ferrous Sand Casting Foundries

Job Category*	Major Activities and Sources of Exposure
Sand Systems Operator	Controlling processing and mixing of new sand, recycled sand, and mold or core additives in mixer (muller) or sand reclamation equipment. Sand is typically fed via hoppers. Might be batch or continuous. • Dust released during loading of hoppers. • Dust released during sand transport. • Dust raised by using compressed air for cleaning.
Molder	Monitoring molding machine operation. Might apply mold parting/coating compound. • Dust generated by handling dry cores and refractory mold coatings (washes). • Dust raised by using compressed air for cleaning mold surfaces. • Dust released by adjacent operations.
Coremaker	Overseeing transfer of mixed sand and additives to automated coremaking equipment. Cleaning and finishing cores. Applying core coatings. • Dust created by grinding, filing, and sanding cores. • Dust raised by using compressed air for cleaning. • Dust released by adjacent operations.
Furnace Operator	Controlling and monitoring furnaces used to produce molten metal. In small operations, might hand-load metal into furnaces. • Dust generated as furnace emissions. • Dust from molding sand adhered to scrap metal for remelt. • Dust from adding sand to molten metal (e.g., stainless steel). • Dust released by adjacent operations.
Pouring Operator	Transferring molten metal into ladle or holding furnace, then into molds, typically via a crane or monorail configuration. • Dust released by adjacent operations.
Shakeout Operator	Overseeing operation. Contact with equipment and castings depends on the degree of automation. • Dust generated by agitating, breaking, and separating molds from castings.
Knockout Operator	Removing sprues, gates, and risers from castings. • Dust generated by the use of hammers and saws to remove excess metal from the castings. • Dust released from adjacent operations.
Abrasive Blasting Operator	Cleaning residual mold or core material from castings typically operating an abrasive blasting cabinet. • Dust generated by performing shotblasting on open floor or blasting booth, if the casting is large. • Dust raised by using compressed air for cleaning surfaces. • Dust released from poorly maintained abrasive blasting cabinet. • Dust released form adjacent operations.
Cleaning/Finishing Operator	Removing remaining molding sand from castings. • Dust generated by using portable or bench tools such as chippers, grinders, and polishers. • Dust raised by using compressed air for cleaning surfaces.

Table IV.C-15
Job Categories, Major Activities, and Sources of Exposure of Workers in Ferrous Sand Casting Foundries

Job Category*	Major Activities and Sources of Exposure
Material Handler	Transporting sand, castings, or other materials using a front-end loader, forklift, or other material moving equipment. • Dust generated when adding or removing materials from the sand system. • Dust raised by manually sweeping or shoveling dry sand. • Dust raised by using compressed air for cleaning surfaces. • Dust released from adjacent operations.
Maintenance Operator	Repairing and maintaining foundry and sand-handling equipment. Might perform repair and maintenance of refractory furnace linings. • Dust released during repair and maintenance of equipment. • Dust generated during removal of old refractory linings using hammers, pneumatic chisels, and jackhammers. • Dust released from adjacent operations.
Housekeeping Worker	Removing spilled sand and debris from floors, conveyor discharges, abrasive machines, and dust collectors. • Dust raised during dry sweeping, vacuuming, shoveling, or front-end loader operations.

*Job categories are intended to represent job functions; actual job titles may differ and responsibilities may be allocated differently, depending on the facility.

Source: ERG-GI, 2008.

Figure 3. Generic Foundry in Three Dimensions

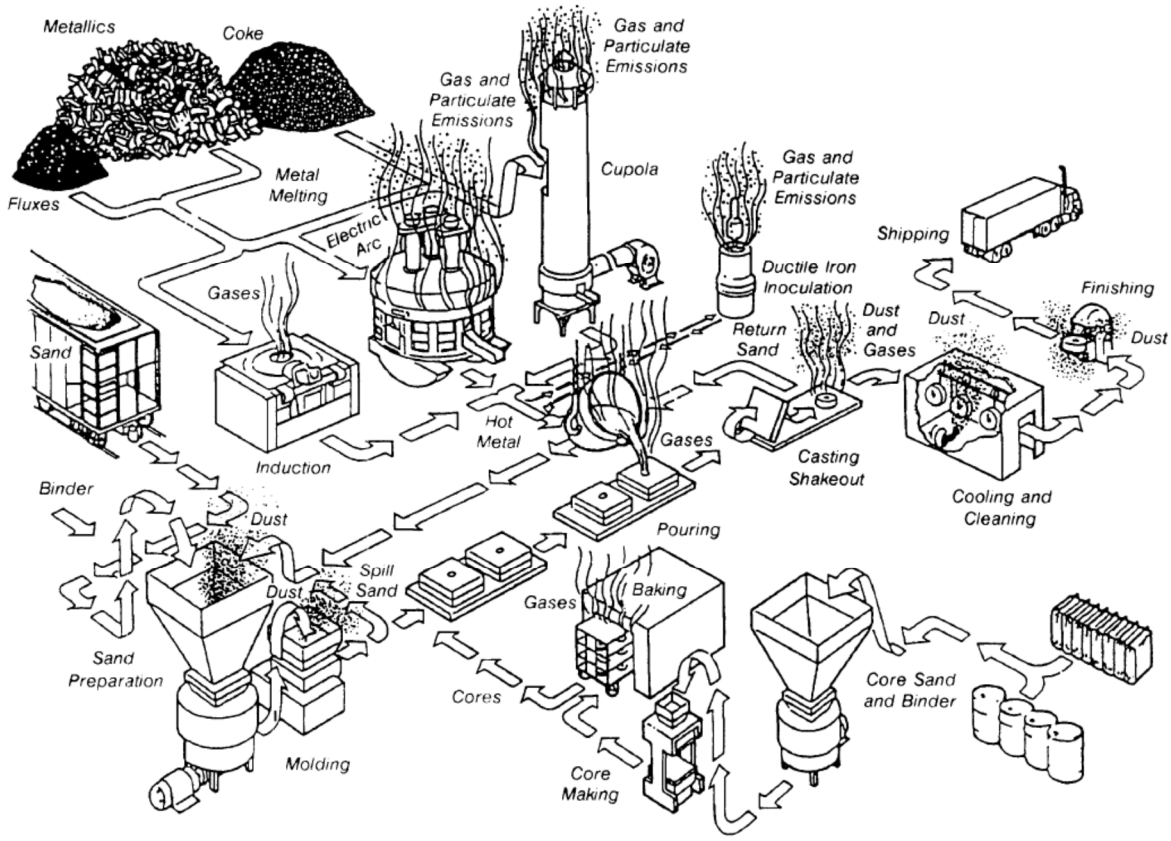

Figure 1. *Emission points in a typical iron foundry.*

EPA depiction of emissions sources in a generic foundry. Note that melting operations generate metal fume and gases but not silica; pouring operations generate metal fume, combustion products and gases but not silica. [Emission Factors for Iron Foundries, EPA 600-S290/044, 1991]

Figure 4: AFS Submission