United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

Argued September 26, 2017 Decided December 22, 2017

No. 16-1105

NORTH AMERICA'S BUILDING TRADES UNIONS,
PETITIONER
v.

OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION
AND UNITED STATES DEPARTMENT OF LABOR,
RESPONDENTS

CHAMBER OF COMMERCE OF THE UNITED STATES OF AMERICA, ET AL.,
INTERVENORS

Consolidated with 16-1113, 16-1125, 16-1126, 16-1131, 16-1137, 16-1138, 16-1146

On Petitions for Review of a Final Rule of the Occupational Safety & Health Administration

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William L. Wehrum and *Bradford T. Hammock* argued the cause for the Industry Petitioners. *Susan F. Wiltsie*, *David Craig Landin*, *Tressi L. Cordaro*, *Michael B. Schon* and *Linda E. Kelly* were with them on brief. *Elizabeth C. Chandler Clements* entered an appearance.

J. Michael Connolly argued the cause for the Petitioners-Intervenors Chamber of Commerce of the United States, et al. *William S. Consovoy*, *Steven P. Lehotsky* and *Sheldon B. Gilbert* were with him on brief.

Jeremiah A. Collins and *Victoria L. Bor* argued the cause for the Union Petitioners. *Randy S. Rabinowitz*, *Lynn K. Rhinehart*, *Richard J. Brean* and *Ava Barbour* were with them on brief. *Stephen A. Yokich* entered an appearance.

Kristen M. Lindberg and *Lauren S. Goodman*, Senior Attorneys, and *Louise McGauley Betts*, Attorney, United States Department of Labor, argued the cause for the Respondents. On brief were *Nicholas C. Geale*, Acting Solicitor of Labor, *Heather R. Phillips*, Counsel for Appellate Litigation, *Nathaniel I. Spiller*, Counsel for Health Standards, and *Anne R. Godoy* and *Allison G. Kramer*, Senior Attorneys.

Victoria L. Bor argued the cause for the Respondents-Intervenors. *Jeremiah A. Collins*, *Randy S. Rabinowitz*, *Lynn K. Rhinehart*, *Richard J. Brean* and *Ava Barbour* were with her on brief.

William L. Wehrum, *Susan F. Wiltsie*, *David Craig Landin*, *Bradford T. Hammock*, *Tressi L. Cordaro* and *Linda E. Kelly* were on brief for the Industry Respondent-Intervenors.

Lisa W. Jordan was on brief for the *amici curiae* The American Thoracic Society, et al. in support of the respondent. *Adam Babich* entered an appearance.

Before: GARLAND, *Chief Judge*, and HENDERSON and TATEL, *Circuit Judges*.

PER CURIAM: Respirable crystalline forms of silica,[1] a compound made of silicon and oxygen, are commonly found in workplaces with rock, sand, gravel, concrete, and brick. Exposure to silica is one of the oldest known occupational hazards. And the health effects of exposure to silica—most commonly silicosis, a progressive and irreversible lung disease caused by the inflammatory effects of silica—are not a thing of the past. "Currently, silicosis is the most prevalent chronic occupational disease in the world." ROBBINS & COTRAN, PATHOLOGIC BASIS OF DISEASE 690 (9th ed. 2015).

In the United States, more than two million workers are currently exposed to some level of silica. In 2016, the Occupational Safety and Health Administration (OSHA), an agency within the United States Department of Labor, published a final rule regulating workplace exposure to silica. Occupational Exposure to Respirable Crystalline Silica, 81 Fed. Reg. 16,285 (Mar. 25, 2016) (codified at 29 C.F.R. Pts. 1910, 1915, and 1926) (Silica Rule or Rule). Petitions to review the Rule came from both sides; a collection of industry petitioners (Industry) believes OSHA impermissibly made the Rule too stringent and several union petitioners (Unions) believe OSHA improperly failed to make the Rule stringent enough.

Industry petitioned for review of five issues: (1) whether substantial evidence supports OSHA's finding that limiting workers' silica exposure to the level set by the Rule reduces a significant risk of material health impairment; (2) whether substantial evidence supports OSHA's finding that the Rule is technologically feasible for the foundry, hydraulic fracturing,

[1] The OSHA rule at issue regulates only respirable crystalline forms of silica. *See* 29 C.F.R. § 1910.1053(a)(1). For ease of reference, we use "silica" as a shorthand for respirable crystalline silica.

and construction industries; (3) whether substantial evidence supports OSHA's finding that the Rule is economically feasible for the foundry, hydraulic fracturing, and construction industries; (4) whether OSHA violated the Administrative Procedure Act (APA) in promulgating the Rule; and (5) whether substantial evidence supports two ancillary provisions of the Rule—one that allows workers who undergo medical examinations to keep the results confidential from their employers and one that prohibits employers from using dry cleaning methods unless doing so is infeasible. We reject all of Industry's challenges.

The Unions petitioned for review of two parts of the Rule: (1) the requirement that medical surveillance for construction workers be provided only if the employee has to wear a respirator for 30 days for one employer in a one-year period; and (2) the absence of medical removal protections. We reject the Unions' challenge to the construction standard's 30-day trigger for medical surveillance. We conclude that OSHA failed to adequately explain its decision to omit medical removal protections from the Rule and remand for further consideration of the issue.

I. BACKGROUND

The Occupational Safety and Health Act (OSH Act) authorizes the Secretary of Labor (Secretary) to "promulgate, modify, or revoke any occupational safety or health standard," 29 U.S.C. § 655(b), by requiring conditions or the adoption of practices, means, or methods "reasonably necessary or appropriate to provide safe or healthful employment and places of employment," *id.* § 652(8). If the standard applies to toxic materials or harmful physical agents, the Secretary "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" regulated by the standard "for the period of his working life." *Id.* § 655(b)(5). The Secretary has delegated his authority to OSHA. *See* 72 Fed. Reg. 31,160 (June 5, 2007).

In 1971, OSHA adopted a standard regulating exposure to a variety of substances, including silica. Occupational Safety and Health Standards; National Consensus Standards and Established Federal Standards, 36 Fed. Reg. 10,466 (May 29, 1971). The 1971 rule established a permissible exposure limit (PEL)—a time-weighted average of a worker's exposure during a workday—of 100 micrograms per cubic meter ($\mu g/m^3$) in general industry[2] and 250 $\mu g/m^3$ in the construction industry. *See* 81 Fed. Reg. at 16,294. In the 1990s, OSHA studied the efficacy of the 1971 rule regarding silica-related health effects in the workplace and concluded a new rule was needed. *See id.* at 16,295.

In 2016, OSHA promulgated its final Silica Rule. 81 Fed. Reg. 16,285. The Rule lowers the PEL to 50 $\mu g/m^3$ for all covered industries, including as particularly relevant here, the foundry, hydraulic fracturing, brick, and construction industries. *See* 29 C.F.R. §§ 1910.1053(c), 1926.1153(d)(1). Employers must assess silica exposure levels in the workplace (or, for certain construction industry tasks, adopt specific "safe-harbor" practices) and, if necessary, must implement

[2] OSHA uses the phrase "general industry" to refer to the standard set in 29 C.F.R. § 1910.1053, which "applies to all occupational exposures to respirable crystalline silica, except" construction work, agricultural operations, and sorptive-clay processing. *Id.* § 1910.1053(a)(1)(i)–(iii). As relevant to the petitions, general industry includes the foundry, hydraulic fracturing, and brick industries.

engineering and work practice controls to keep exposures below the PEL. *Id.* §§ 1910.1053(f)(1), 1926.1153(c)(1), 1926.1153(d)(3)(i). If engineering and work practice controls cannot reduce exposures to the PEL, the employer must use controls to the extent feasible and provide supplementary respirator protections. *Id.*

The Silica Rule also establishes various ancillary provisions including, again, as relevant here, housekeeping requirements and medical surveillance requirements. Under the challenged housekeeping provision, employers are prohibited from using dry sweeping methods to clean worksites if doing so could contribute to employee exposure to silica unless wet cleaning methods are infeasible. *Id.* §§ 1910.1053(h)(1), 1926.1153(f)(1). Under the challenged medical surveillance provisions, employers must provide medical screening to silica-exposed workers if certain conditions are met. Most of the information from the medical examinations, including medical professionals' recommendations limiting the employee's exposure to silica, are confidential and cannot be released to the employer unless the employee authorizes disclosure. *Id.* §§ 1910.1053(i)(6), 1926.1153(h)(6). Finally, the Rule provides no medical removal protections to workers whose doctors recommend either permanent or temporary removal from silica exposure on the job.

Different compliance dates were established for each industry: June 23, 2017 for the construction industry, *id.* § 1926.1153(k); June 23, 2018 for the foundry industry, *id.* § 1910.1053(*l*); and June 23, 2021 for the hydraulic fracturing industry, *id.*

II. ANALYSIS

We first decide Industry's challenges. In order, we address OSHA's significant risk findings, its technological feasibility findings, its economic feasibility findings, the procedural regularity of the Rule, and the challenged ancillary provisions. The substantive issues are governed by the "substantial evidence" standard, 29 U.S.C. § 655(f), under which we require OSHA to "identify relevant factual evidence, to explain the logic and the policies underlying any legislative choice, to state candidly any assumptions on which it relies, and to present its reasons for rejecting significant contrary evidence and argument," *United Steelworkers of America v. Marshall (Lead I)*, 647 F.2d 1189, 1207 (D.C. Cir. 1980). The APA governs the procedural challenge to ensure the Rule is not promulgated "without observance of procedure required by law." 5 U.S.C. § 706(2)(D).

We then turn to the Unions' challenges and address the 30-day medical surveillance trigger in the construction standard and the lack of medical removal protections in the general industry standard. Where the Unions have failed to identify evidence that their proposals would be feasible and generate more than a *de minimis* benefit to worker health, we reject them. *See Building & Construction Trades Department, AFL-CIO v. Brock (Asbestos)*, 838 F.2d 1258, 1271 (D.C. Cir. 1988). Where the Unions have met this initial burden, we ask whether OSHA has supported its decision with substantial evidence and otherwise engaged in reasoned decisionmaking.

A. SIGNIFICANT RISK

Before OSHA promulgates any permanent health or safety standard, it must make a "threshold finding" that "it is at least more likely than not that long-term exposure" to the regulated substance at current exposure levels "presents a significant risk

of material impairment" that "can be eliminated or lessened by a change in practices." *Industrial Union Department, AFL-CIO v. American Petroleum Institute (Benzene)*, 448 U.S. 607, 642, 653 (1980) (plurality).[3] The Supreme Court has provided the guidepost that OSHA follows: a one-in-a-thousand risk that exposure to the regulated substance will be fatal can reasonably be considered significant but a one-in-a-billion risk is likely not significant. *Id.* at 655–56.

OSHA must support its significant risk finding with substantial evidence. *Id.* at 653. Although it must rely on a "body of reputable scientific thought" when assessing risk, *id.* at 656, OSHA does not have to "calculate the exact probability of harm" or support its finding "with anything approaching scientific certainty," *id.* at 655–56. OSHA is entitled to "some leeway" when its "findings must be made on the frontiers of scientific knowledge." *Id.* at 656. We "do not reweigh the evidence and come to our own conclusion[s]; rather, we assess the reasonableness of OSHA's conclusion." *Public Citizen Health Research Group v. Tyson (Ethylene Oxide)*, 796 F.2d 1479, 1495 (D.C. Cir. 1986).

In promulgating the Silica Rule, OSHA conducted a Quantitative Risk Assessment in which it reviewed toxicological, epidemiological, and experimental studies about the adverse health effects of silica exposure. 81 Fed. Reg. at 16,380. OSHA quantified the excess risk[4] of silica-related

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[3] Although *Benzene* commanded only a plurality of the Court, a majority of the Court endorsed the significant risk requirement in a later case. *See National Maritime Safety Association v. OSHA*, 649 F.3d 743, 750 n.8 (D.C. Cir. 2011) (citing *American Textile Manufacturers Institute, Inc. v. Donovan*, 452 U.S. 490, 506 (1981)).

[4] Excess risk identifies the risk "solely attributable" to silica exposure, 81 Fed. Reg. at 16,372, by "factoring in the probability of surviving to a particular age assuming no exposure to [silica] and

health effects assuming exposure over a working life (45 years) to various levels of silica, including the original general industry PEL of 100 µg/m^3, the original construction PEL of 250 µg/m^3, and the new PEL of 50 µg/m^3. *Id.* at 16,300. OSHA concluded that silica exposure significantly "increases the risk of" four adverse health effects: silicosis and other non-malignant respiratory disease (NMRD) mortality, lung cancer mortality, silicosis morbidity, and renal disease mortality. *Id.* at 16,300, 16,386–87. OSHA also concluded that the risks at 50 µg/m^3—the new PEL—are lower than the risks at the original PELs of 100 µg/m^3 and 250 µg/m^3. *Id.* at 16,300. In total, OSHA estimated that the Silica Rule will prevent 642 deaths and 918 cases of silica-related disease each year. *Id.* at 16,399.[5]

Industry challenges OSHA's significant risk findings in three ways. First, Industry attacks two parts of OSHA's risk-assessment methodology. Second, it challenges OSHA's findings on each of the four individual health risks. Finally, Industry challenges OSHA's decision to include the brick industry within the scope of the Rule. We reject each challenge.

1. OSHA's Methodology

Industry challenges two components of OSHA's risk-assessment methodology: its no-threshold assumption and its failure to account for a dose-rate effect. We uphold OSHA's decisions on both.

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given the background probability of dying from any cause at or before that age," *id.* at 16,385.

[5] The number of deaths and cases of silica-related disease resulting from each of the individual adverse health effects is discussed *infra*.

First, Industry challenges OSHA's use of no-threshold exposure-response models in its risk assessments for silicosis and lung cancer. 81 Fed. Reg. at 16,351. The no-threshold concept means there is no exposure level below which workers would not be expected to develop adverse health effects. *Id.* OSHA did not definitively find that no threshold exists. Instead, it found that if a threshold exists it does so below the PEL, which justified its use of a no-threshold model. OSHA supported its selection of the PEL with studies showing that risks of lung cancer exist at 36 $\mu g/m^3$ and 10 $\mu g/m^3$, levels lower than the PEL. *Id.* at 16,351, 16,356. To OSHA, the studies showing risks below the PEL support its conclusion that any threshold, if it exists, does so below the PEL. *See id.* at 16,351 ("As 36 $\mu g/m^3$ is well below the previous industry PEL of 100 $\mu g/m^3$ and below the final PEL of 50 $\mu g/m^3$, the . . . study showed no evidence of an exposure-response threshold high enough to impact OSHA's choice of PEL."). Industry, in contrast, points to studies it claims not only show a threshold exists but also show a threshold exists above the PEL. OSHA rejected Industry's argument because the contrary studies used non-reactive and poorly soluble particles—which silica is not—and therefore the "findings regarding" the particles "[cannot] be extrapolated to crystalline silica." *Id.* at 16,349. OSHA acknowledged "there is considerable uncertainty" about whether a threshold exists but found that "the weight of evidence supports the view that, if there is a threshold," it is "likely lower than the" PEL. *Id.* at 16,351.

OSHA's no-threshold assumption is supported by substantial evidence. Although Industry claims OSHA's position is inconsistent with common sense and "mounting judicial skepticism" of no-threshold models, citing to several district court and state court cases disapproving a no-threshold approach, Industry Br. at 28–29, OSHA's position is in line with our precedent. In *Ethylene Oxide*, we upheld a no-

threshold model based on OSHA's having found evidence of adverse health effects at levels of exposure to ethylene oxide below the established PEL, then extrapolating that evidence to assume no threshold of ethylene oxide exposure existed below which risks did not exist and rejecting two contrary comments that purportedly showed a threshold did exist. 796 F.2d at 1500. As in *Ethylene Oxide*, Industry presents, and urges us to adopt, "one side of the debate." *Id.* But OSHA has explained why it rejected Industry's side of the debate, presented the other side of the debate, and supported it with evidence from which a reasonable conclusion could be made, as OSHA did here, that no threshold of safe exposure to silica exists. We cannot "choose a particular side as the 'right' one" in a scientific dispute. *Id.* Accordingly, OSHA's no-threshold assumption satisfies our substantial evidence test.

Second, Industry challenges OSHA's decision not to include a dose-rate effect in the model, which means OSHA assessed health risks based on the cumulative amount of silica exposure without accounting for the intensity of exposures. 81 Fed. Reg. at 16,375. OSHA took its position "because each of the key . . . studies" OSHA relied on used cumulative exposure as the only metric. *Id.* at 16,374–75. Multiple commenters supported the notion that "cumulative exposure is a reasonable and practical choice" and that cumulative exposure "is often the best predictor of chronic disease." *Id.* at 16,375. Competing commenters argued that OSHA's risk assessment should account for the intensity of exposures. *Id.* Industry relied on studies showing that not accounting for a dose-rate effect "could overestimate risk at lower concentrations." *Id.* The studies supporting Industry's position, however, largely observed an intensity-based effect at 500 $\mu g/m^3$ and 2,000 $\mu g/m^3$, exposure levels so "far above the previous PEL," *id.* at 16,395, that OSHA determined the

studies were of little use to the "exposure range of interest"—25 to 500 µg/m^3, *id.* at 16,376.

In *Ethylene Oxide*, we upheld OSHA's decision not to include a dose-rate effect in its model when faced with "competing technical opinions" about whether the amount or the intensity of ethylene oxide exposure mattered more. *Ethylene Oxide*, 796 F.2d at 1504. OSHA did the same in its Silica Rule: it took competing evidence, favored one side, and explained the reasons for its decision. We "cannot expect OSHA to [locate and use] absolutely conclusive studies on these difficult medical issues" and we must uphold OSHA's choice, even in the face of "controverted" evidence, if it falls within a "zone of reasonableness." *Lead I*, 647 F.2d at 1253 (quoting *Hercules, Inc. v. EPA*, 598 F.2d 91, 107 (D.C. Cir. 1978)). We believe OSHA's conclusions on handling the purported dose-rate effect are reasonable. "[C]ourts cannot interfere with reasonable interpretations of equivocal evidence," *Ethylene Oxide*, 796 F.2d at 1505, and therefore we do not interfere here.

2. Adverse Health Effects

As noted earlier, OSHA concluded that long-term silica exposure above the PEL presents a significant risk of four discrete adverse health effects: (1) silicosis and NMRD mortality; (2) lung cancer mortality; (3) silicosis morbidity; and (4) renal disease mortality. 81 Fed. Reg. at 16,300, 16,386–87. Industry challenges OSHA's findings as to all four. Industry acknowledged at oral argument that, to prevail, it would have to show none of the discrete findings is supported by substantial evidence. We address each in turn. We conclude OSHA's significant risk findings as to the first three adverse health effects are supported by substantial evidence, which supports OSHA's overall finding of a significant risk.

We do not reach OSHA's finding with respect to renal disease mortality.

i. Silicosis or Non-Malignant Respiratory Disease Mortality

Silicosis is a progressive, irreversible lung disease caused by the inflammatory effects of silica in the lungs. OSHA found that silica exposure at the original PEL of 100 µg/m^3 created an excess risk of silicosis mortality for 11 in 1,000 workers that would be reduced to 7 in 1,000 workers at the Rule's PEL of 50 µg/m^3. 81 Fed. Reg. at 16,303, 16,312. Other NMRD caused by silica exposure include emphysema, chronic obstructive pulmonary disease, and chronic bronchitis. *Id.* at 16,304. OSHA found that silica exposure at the 100 µg/m^3 PEL created an excess risk of NMRD mortality (including silicosis mortality) for 85 in 1,000 workers that would be reduced to 44 in 1,000 workers at the Rule's PEL of 50 µg/m^3. *Id.* at 16,303. Both Industry and the Chambers Intervenors [6] challenge OSHA's findings on silicosis and NMRD mortality.

To support its findings on silicosis and NMRD mortality, OSHA relied on two studies: the Mannetje study, which showed a statistically significant association between silicosis mortality and cumulative exposure to silica, and the Park study, which quantified the relationship between silica exposure and NMRD mortality. *Id.* at 16,317. Industry's objections to OSHA's conclusions primarily attack the reliability of the Park study. Industry claims the Park study (1) focused on workers with cumulative exposure levels far above what workers

[6] The Chamber of Commerce of the United States, the State Chamber of Oklahoma, and the Greater North Dakota Chamber of Commerce (collectively, Chambers) intervened on behalf of Industry.

typically faced under the original PEL and (2) produced results that were likely skewed by smoking because the study had smoking data for only one-half of the studied workers.

In its rulemaking, OSHA addressed both criticisms. On the first point, OSHA acknowledged "some uncertainty in using models heavily influenced by exposures above the previous PEL" but noted that the average cumulative exposure of the studied workers was "lower than what the final rule would permit over 45 years of exposure." *Id.* at 16,318. Accordingly, OSHA "[dis]agree[d] that the Park study should be discounted" and instead concluded that the study was both relevant and appropriate to rely on. *Id.* On the second point, OSHA acknowledged that "comprehensive smoking data would be ideal" but assessed the Park study's mechanics in detail and concluded that the risk estimates were "not likely to be exaggerated due to [studied workers'] smoking habits." *Id.*

Under our substantial evidence standard, OSHA has a duty to "present its reasons for rejecting significant contrary evidence and argument." *Lead I*, 647 F.2d at 1207. OSHA acknowledged and adequately responded to Industry's criticisms of the Park study. Even if the Park study was "flawed in some way," OSHA is not precluded from relying on imperfect evidence so long as it "recognize[s] and account[s] for the methodological weaknesses" of the evidence. *Ethylene Oxide*, 796 F.2d at 1487; *see id.* at 1495 ("While some of OSHA's evidence suffers from shortcomings, such incomplete proof is inevitable when the Agency regulates on the frontiers of scientific knowledge."). OSHA did recognize and account for the weaknesses of the two studies it relied on here.[7]

[7] Industry did not specifically challenge the Mannetje study in its brief so we do not analyze OSHA's reliance on it.

The Chambers, meanwhile, present a record of death certificates and their listed cause of death that shows silicosis-attributed deaths dropped from 1,065 in 1968 (three years before the 1971 PEL was implemented) to 123 in 2007. The decline, according to the Chambers, shows that the current risks are due not to exposure levels at the 1971 PEL but instead are due to pre-1971 exposures or exposures occurring in violation of the 1971 PEL. Thus, the Chambers argue, the 1971 rule is working and there is no need for a new one.

But here again, OSHA adequately explained why it rejected this evidence. First, OSHA concluded that the death certificate data underreported risks after one commenter found that silicosis was listed as the cause of death for only 14 percent of people with confirmed silicosis. 81 Fed. Reg. at 16,328. Second, the death certificate data "d[id] not include information about exposure[]" levels for those who died as a result of silicosis, which made the data "inadequate and inappropriate for" setting a standard regulating silica at particular exposure levels. *Id.* at 16,326. Indeed, the agency that compiled and analyzed the death certificate data testified that relying on the death certificates to show no significant risk exists would be a "misuse" of the data. *Id.*

Moreover, OSHA responded directly to the Chambers' arguments that the death certificate data showed the risks of silica exposure are no longer significant. OSHA acknowledged that silicosis-related deaths have dropped since 1968 but pointed to evidence showing that the decline leveled off at approximately 90 to 180 deaths per year since 2000. *Id.* at 16,324. This evidence "suggest[s] that the number of silicosis deaths . . . may be stabilizing," *id.*, which also suggests that the significant risk of silicosis mortality would not disappear if OSHA simply let the 1971 PEL run its course, as Industry argued, *id.* at 16,325. OSHA also pointed to

evidence showing that the decline in silicosis-related deaths tracks the decline in high-exposure jobs as much as it tracks improved working conditions, further suggesting that OSHA "still h[as] work to do" to make silica exposure safe. *Id.* at 16,325–26. Thus, although OSHA agreed that the death certificate data was "useful for providing context and an illustration of a significant general trend in the reduction of deaths associated with silicosis over the past four to five decades," the "limited and incomplete" data made reliance on the death certificates "inappropriate." *Id.* at 16,330. OSHA "described in some detail [its] reasons for choosing between competing alternatives." *Asbestos*, 838 F.2d at 1266. Accordingly, OSHA has met its burden to identify the evidence it relied on and explain why it rejected contrary evidence.

ii. Lung Cancer Mortality

OSHA found that silica exposure at the 100 $\mu g/m^3$ PEL created an excess risk of lung cancer mortality equal to 11 to 54 deaths per 1,000 workers that would be reduced to an excess risk of 5 to 23 deaths per 1,000 workers at the 50 $\mu g/m^3$ PEL. 81 Fed. Reg. at 16,338. Industry argues the conclusion hinges on OSHA's unsupported assumption that silica exposure directly increases the risk of lung cancer in the absence of silicosis. That is, if the risk of lung cancer depends on pre-existing silicosis, then silica exposure alone does not create an independent risk of lung cancer.

Industry points to evidence that asserts the association between silicosis and lung cancer is "more compelling" than the association between silica exposure and lung cancer. Joint Appendix (J.A.) 3027. But the mere suggestion in some evidence that silicosis is a necessary precursor of lung cancer does not bind the agency. *See Ethylene Oxide*, 796 F.2d at 1504 (noting that suggestive statements "do not amount to a

scientific certainty binding on the agency"). Meanwhile, OSHA also cites to numerous studies that show silica exposure can lead directly to lung cancer. 81 Fed. Reg. at 16,309 (recapping and summarizing findings). As one commenter put it, the literature OSHA relied on shows "silica has been established as a cause of lung cancer." J.A. 7815. We lack the technical expertise to second-guess OSHA's judgment when it "review[ed] all sides of the issue and reasonably resolve[d] the matter." *Ethylene Oxide*, 796 F.2d at 1500. We do not second-guess OSHA's conclusions here.

Industry specifically challenges OSHA's decision to give weight to a 2004 Attfield and Costello study, which showed there is an association between silica exposure and lung cancer, instead of a 2011 Vacek study showing there is no such association. 81 Fed. Reg. at 16,338. Industry provides a laundry list of reasons why it believes the Vacek study is better: it is more recent, covered more workers, covered more years, and used more detailed information. But OSHA explained its reasons for rejecting the Vacek study. Among them: the Vacek study found an unexplained significant excess risk of lung cancer that called into question all of its results and had a low risk estimate for a particular type of worker (channel bar operators) that OSHA concluded had major consequences for the entire exposure analysis. *Id.* at 16,335–37. Moreover, OSHA provided affirmative reasons for choosing the Attfield and Costello study. Most importantly, OSHA reasoned, that study accounted for a healthy worker survivor effect—the tendency of healthy workers to remain in the workforce longer than ill workers and therefore face more exposure than ill workers, which "may" make the "risk of disease at higher exposures" improperly "appear to be constant or decrease"—but the Vacek study did not assess the healthy worker survivor effect. *Id.* at 16,336. "We have then, at worst, the ordinary situation of controverted evidence, in which we must defer to

the reasonable and conscientious interpretations of the agency." *Lead I*, 647 F.2d at 1258.

iii. Silicosis Morbidity

To support its finding of a significant risk of silicosis morbidity, OSHA relied on five studies that showed an excess risk between 60 and 773 cases of silicosis morbidity per 1,000 workers at a level of 100 µg/m^3 that would be reduced to an excess risk between 20 and 170 cases of silicosis morbidity per 1,000 workers at a level of 50 µg/m^3. 81 Fed. Reg. at 16,317. The variance among studies, according to Industry, "suggests that none of [the studies] is a reliable guide to a correct quantification" of exposures and therefore none of the studies can support a finding of a significant risk of silicosis morbidity. J.A. 3368. OSHA concluded the results of the five studies did not "differ remarkably," 81 Fed. Reg. at 16,321, which Industry asserts is "arbitrary and capricious reasoning," Industry Br. at 39.

In the rulemaking OSHA responded to critiques against the individual studies upon which OSHA relied. *See* 81 Fed. Reg. at 16,320–22. OSHA also responded to critiques of the variance among the studies, albeit in less detailed fashion, and concluded that the risk estimates among the studies "are in reasonable agreement." *Id.* at 16,322. OSHA's reconciliation of the data's variance is not airtight. A more important question, however, is whether the studies constitute substantial evidence supporting OSHA's finding of a significant risk of silicosis morbidity at the initial PEL that is reduced at the Rule's PEL. They do.

The variance in results may show uncertainty as to the precise amount of the risk of silicosis morbidity. Maybe it falls closer to 60 cases per 1,000 workers at 100 µg/m^3; maybe it falls closer to 773 per 1,000. Maybe it falls closer to 20

cases per 1,000 workers at 50 µg/m^3; maybe it falls closer to 170. "While each study individually may not be a model of textbook scientific inquiry," we assess, again, the "cumulative evidence" OSHA relied on. *Ethylene Oxide*, 796 F.2d at 1489. Even assuming the actual amount of risk is closer to the low end, a "reasonable person could draw from this evidence the conclusion that exposure to" silica presents a significant risk of silicosis morbidity. *Id.* "Even if a reasonable person could also draw the opposite conclusion, we must uphold the agency's findings." *Id.* We conclude, then, that OSHA's conclusion that exposure to silica presents a significant risk of silicosis morbidity is supported by substantial evidence.

iv. Renal Disease Mortality

OSHA concluded that the excess risk of renal disease mortality would drop from 39 deaths per 1,000 workers at the 100 µg/m^3 PEL to 32 deaths per 1,000 workers at the 50 µg/m^3 PEL. 81 Fed. Reg. at 16,342. OSHA relied on a single pooled study that provided "considerably less data" compared to the studies of the other disease endpoints. *Id.* at 16,345. OSHA rejected numerous other studies that showed no risk of renal disease. *Id.* at 16,344–45. Industry argues that OSHA lacked substantial evidence to support a finding of a significant risk of renal disease mortality and failed to explain its resolution of conflicting evidence.

OSHA acknowledged in the rulemaking that the evidence supporting its finding regarding renal disease mortality was "less robust" than the evidence supporting its findings for other silica-related health effects. *Id.* at 16,345. OSHA defended its position with a single footnote in its brief. We note OSHA's concession that the evidence is weak; if OSHA had relied solely on the risk of renal disease mortality to support the

Silica Rule, its decision may well have been unsupported by substantial evidence.

But we need not and do not decide whether OSHA supported its renal disease findings with substantial evidence because OSHA's findings with respect to silicosis and NMRD mortality, lung cancer mortality, and silicosis morbidity are sufficient to uphold the requisite threshold finding of a significant risk of material health impairment at the 100 $\mu g/m^3$ PEL that will be reduced at the new PEL. *See National Maritime Safety Association v. OSHA*, 649 F.3d 743, 752 n.11 (D.C. Cir. 2011) (upholding OSHA's significant risk finding where OSHA relied on four contributors to the risk but one was flawed; if OSHA "relied on [the flawed] factor alone, its significant risk determination might well have been arbitrary and capricious" but the presence of the other substantiated factors sufficiently supported OSHA's significant risk finding). And Industry does not show that any weakness with respect to OSHA's renal disease findings infected OSHA's findings regarding the other adverse health effects such that the entire significant risk conclusion is undermined. Accordingly, we do not decide the renal disease issue because OSHA, through its supported findings on the other three adverse health effects, has met its burden to show that the Silica Rule regulates a significant risk of material harm.

3. Brick Industry

Industry argues OSHA should have excluded the brick industry from the scope of the Silica Rule because OSHA did not have substantial evidence to find a significant risk of material harm in the brick industry. OSHA pins its findings on one study (the Love study) that surveyed brick plant workers. 81 Fed. Reg. at 16,378. The Love study reported that 1.4 percent—a rate below OSHA's risk estimates in other

industries but exceeding *Benzene*'s general 0.1 percent benchmark—of brick workers had small abnormalities in x-rays, which the authors said were "most likely" silicosis. *Id.* Industry makes three arguments to contest the findings based on the Love study.

First, Industry argues that OSHA used the Love study when it wanted to and did not use the Love study when it did not want to. Specifically, OSHA found the Love study showed a significant risk of silicosis but declined to include the Love study in the group of studies that formed the basis of OSHA's silicosis morbidity quantitative risk assessment. *See id.* at 16,377–78. If OSHA exhibits "apparently inconsistent handling of the evidence available to it," OSHA cannot be said to have relied on the best available evidence. *See American Iron & Steel Institute v. OSHA (Lead II)*, 939 F.2d 975, 1009 (D.C. Cir. 1991) (per curiam) (rejecting OSHA's conclusions when it criticized one industry study yet relied on another study with the same flaws).

But OSHA explained its rationale. The Love study excluded retired workers and had little follow-up data on the workers it included. 81 Fed. Reg. at 16,378. These two data pieces are "extremely important" to fully quantify risks of silicosis morbidity because "silicosis typically develops slowly and becomes detectable [decades after] a worker's first exposure." *Id.* at 16,377–78. Without the two data pieces, the Love study did not meet OSHA's "rigorous standards used in the studies on which OSHA's [silicosis morbidity] risk assessment relies" and therefore could not be included. *Id.* at 16,377. But the lack of the two data points did not render the Love study meaningless—if anything, OSHA reasoned, the failure to study workers at later stages of their career, when the latent effects of silica exposure are more likely to manifest, meant the Love study "underestimated" the risk of silicosis to

brick industry workers. *Id.* at 16,378. Moreover, the Love study was the only study specific to the brick industry that used exposure-response information, making it the "highest-quality" study for ascertaining risks. *Id.* As one commenter testified, the Love study was the "only sensible study to be used for setting an exposure limit . . . in brick manufacturing." *Id.* OSHA, then, explained its reasoning and supported it with substantial evidence.

Second, Industry argues that even if the Love study is a credible source, OSHA's risk estimates in other industries and for other disease endpoints (between 2 and 17 percent) at the PEL are greater than the risk estimates for the brick industry (1.4 percent), and therefore OSHA should have let the brick industry's risks remain unaltered. But Industry misunderstands the legal standard. The mere fact that the brick industry faces a lower risk than other industries does not mean the brick industry's risks are not significant. And the 1.4 percent risk quantified by the Love study surpasses the Supreme Court's 0.1 percent benchmark. *Benzene*, 448 U.S. at 655–56.

Industry finally argues that OSHA's different treatment of the brick industry and the sorptive minerals industry is arbitrary and capricious. According to Industry, the substances in both industries have chemical properties that reduce the toxicity of silica (which would reduce the health risks of exposure to silica) yet the Rule includes the brick industry but not the sorptive minerals industry. OSHA explained its decision in the preamble to the rule. The evidence for the sorptive minerals industry was unclear and thus insufficient to conclude a significant risk exists. 81 Fed. Reg. at 16,379–80. In contrast, the evidence in the brick industry—the Love study, primarily—showed there is a significant risk. *Id.* at 16,377–78. Even if brick clay and sorptive minerals have similar

chemical properties that reduce the toxicity of silica within those compounds, OSHA found the evidence as it existed in the record was not similar enough to treat them similarly. *Id.* OSHA's position is supported by substantial evidence and a reasonable explanation, and therefore we uphold the inclusion of the brick industry in the Silica Rule.

B. TECHNOLOGICAL FEASIBILITY

This court has interpreted the OSH Act's requirement that OSHA health standards protect workers "to the extent feasible," 29 U.S.C. § 655(b)(5), to include "two types of feasibility," namely, "technological and economic." *Lead I*, 647 F.2d at 1264. Our standard of review narrowly cabins our consideration of OSHA's finding of technological feasibility. Specifically, we must ensure only that OSHA found its standard feasible and supported that finding with substantial evidence.

"To 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*.'" *Lead II*, 939 F.2d at 980 (quoting *Lead I*, 647 F.2d at 1272). OSHA need not show with certainty that all firms will be able to meet the new standard in all operations. If "'only the most technologically advanced plants in an industry have been able to achieve [the standard]—even if only in some of their operations some of the time,' then the standard is considered feasible for the entire industry." *Id.* (alteration in original) (quoting *Lead I*, 647 F.2d at 1264).

As with its finding of significant risk, OSHA must support its finding of technological feasibility with substantial evidence. Substantial evidence does not require absolute

"certainty." *Id.* Where OSHA regulates on the frontiers of scientific knowledge, it is bound to confront inconsistency and uncertainty. But the mere "possibility of drawing two inconsistent conclusions from the evidence does not prevent [the] agency's finding from being supported by substantial evidence." *American Textile Manufacturers Institute, Inc. v. Donovan (Cotton Dust)*, 452 U.S. 490, 523 (1981) (quoting *Consolo v. FMC*, 383 U.S. 607, 620 (1966)). So long as "OSHA makes reasonable predictions based on 'credible sources of information' (*e.g.*, data from existing plants and expert testimony), then the court should defer to OSHA's feasibility determinations." *Lead II*, 939 F.2d at 980.

Where OSHA has demonstrated technological feasibility for the typical firm in most operations and has supported that finding with substantial evidence, it has satisfied its burden and we must defer to its conclusions. To mount a successful attack on OSHA's feasibility finding, then, challengers must do more than suggest that compliance will be infeasible for some firms or in "a few isolated operations." *Id*.

In the robust process leading up to the promulgation of the silica rule, OSHA found that the rule would be technologically feasible based on a thorough consideration of available sources of information. For general industry and construction, OSHA identified job categories that involve silica exposure and developed profiles showing current exposure levels. OSHA then identified the individual jobs for which additional controls are required to comply with the new PEL, and identified available controls that would reduce exposure below the new PEL. 81 Fed. Reg. at 16,433–34.

OSHA concluded that achieving the new PEL is technologically feasible for 87 out of 90 job categories considered in general industry—including 36 categories in the

foundry industry, all of which were deemed feasible—and 19 of 23 tasks considered in construction. *Id.* at 16,454–55, 16,459. On this basis, OSHA found that there was a reasonable possibility that the new standard could be achieved by the typical employer in most operations and was thus technologically feasible.

In performing its analysis, OSHA relied on data from a variety of sources, including reports from OSHA inspections, National Institute for Occupational Safety and Health (NIOSH) reports, site visits conducted by a contractor, data from external stakeholders, and a variety of studies looking at the effectiveness of various controls. OSHA also considered and responded to testimony and comments submitted to the rulemaking record.

With our highly deferential standard of review and OSHA's process in mind, we now turn to Industry's objections. Industry challenges OSHA's feasibility findings in only three industries: foundries, hydraulic fracturing, and construction. While Industry identifies sundry examples of infeasibility for certain firms or in certain operations, their objections do not collectively undermine OSHA's overall finding of feasibility for the typical firm in most operations nor do they meaningfully call into question the evidence on which OSHA relied.

1. Foundries

Industry disputes OSHA's finding of technological feasibility on two grounds: that variability in exposure levels makes compliance infeasible; and that OSHA did not rely on the best available evidence.

On the issue of exposure variability, Industry contends that because of the dynamic and unpredictable nature of silica exposure, firms must strive to attain an exposure level well

below the new PEL to ensure compliance with certainty. This argument runs headlong into our standard of review: "Feasibility of compliance turns on whether exposure levels . . . can be met in most operations most of the time; therefore, it is the *routine* exposure levels that determine feasibility, and atypical outliers cannot invalidate a feasibility finding." *Lead II*, 939 F.2d at 990.

Industry's focus on whether all foundries can always meet the new standard with certainty is thus beside the point. The relevant question is whether OSHA has shown that the typical firm can meet the standard in most operations. OSHA has done just that. It pointed to data—including over 1,000 samples from nearly 100 foundries—supporting its feasibility finding. Indeed, a study by the American Foundry Society, which Industry itself relies on, shows that the new PEL is already being met in most foundry job categories. OSHA further recognized that variability can be smoothed through consistent use of engineering controls. And OSHA expressly contemplates flexible enforcement to accommodate unexpected swings in exposure levels, an approach this court has approved in prior feasibility determinations. 81 Fed. Reg. at 16,459; *see Lead II*, 939 F.2d at 991.

Industry may well be right that exposure levels vary uncontrollably and unpredictably across the foundry industry and within individual firms. That, however, is exactly why our standard of review does not require compliance from all firms in all operations all of the time; it is designed to permit OSHA to regulate in the face of variability and uncertainty. And Industry has failed to show that variability in the foundry industry undermines OSHA's finding of feasibility for the typical firm in most operations most of the time.

Industry also challenges the foundry-industry evidence on which OSHA relied. The data OSHA considered came from a variety of sources including its own visits to worksites, enforcement data, and other inspection reports, as well as NIOSH reports, state program reports, industrial hygiene literature, and survey data from the American Foundry Society, all of which supported OSHA's feasibility finding. Industry, insisting that "no two foundries are alike," contends that OSHA ignored the best available evidence, namely, the experiences of foundries attempting and failing to comply with the prior standard. In particular, Industry singles out sand system operators and finishers as two job categories in which compliance is infeasible. Industry Br. at 63–65. But Industry's evidence suggests, at most, that compliance will be infeasible for some foundries or in some operations. And OSHA identifies controls that might be able to achieve compliance in the specific foundries and operations that Industry identifies. Even assuming that Industry is correct that compliance is unachievable in the foundries and operations it identifies, such isolated examples of infeasibility are, under our standard of review, insufficient to defeat OSHA's finding of feasibility for "the typical" foundry in "most . . . operations." *Lead I*, 647 F.2d at 1272.

2. Hydraulic Fracturing

Because OSHA only recently recognized the risk of silica exposure in the hydraulic fracturing industry, available data is limited and what data is available shows, unsurprisingly, that the vast majority of firms are not yet in compliance with the new standard. According to Industry, this evidence shows that the new standard is unattainable as there is no evidence of any controls reducing exposure below the new PEL.

But even if sufficient controls do not yet exist, Industry's challenge to OSHA's feasibility finding nonetheless fails. In considering which controls can feasibly be implemented, OSHA "is not bound to the technological status quo." *Lead I*, 647 F.2d at 1264. "Because the OSH Act is a 'technology-forcing' statute, OSHA can also 'force industry to develop and diffuse new technology'" to meet its standard. *Lead II*, 939 F.2d at 980 (quoting *Lead I*, 647 F.2d at 1264). So long as OSHA "gives industry a reasonable time to develop new technology" and "presents substantial evidence that companies acting vigorously and in good faith can develop the technology," it can "require industry to meet PELs never attained anywhere." *Lead I*, 647 F.2d at 1264–65.

Given the nascent state of silica-control technology in the hydraulic fracturing industry, OSHA gave firms five years to comply with the new standard. Acknowledging that controls have yet to be widely implemented in the industry, OSHA identified controls, some currently available and others under development, that promise to sufficiently reduce exposure, citing to comments from several vendors. 81 Fed. Reg. at 16,455. In support of the five-year grace period, OSHA relied on an industry expert who described significant progress made over the prior five years and an inventor of one silica-control technology who explained that the technology took only three years to develop. *Id.* at 16,457. Though Industry disagrees with OSHA's forecast of future silica-control developments in hydraulic fracturing, the agency's evidence is more than sufficient "to show that modern technology has at least conceived some industrial strategies or devices which are likely to be capable of meeting the PEL and which the industries are generally capable of adopting" in the extended time horizon OSHA provided. *Lead II*, 939 F.2d at 1006 (quoting *Lead I*, 647 F.2d at 1266).

3. Construction

In assessing the technological feasibility of its rule in the construction industry, OSHA relied on the Table 1 safe harbor. Under the new rule, if a construction employer implements the controls listed on Table 1—applicable to nineteen of twenty-three construction tasks—it is freed from its obligation to achieve the new PEL. OSHA determined not only that most employers would follow Table 1 for most tasks, but also that it would be technologically feasible for them to do so given the ready availability of Table 1 controls. OSHA also found the rule to be technologically feasible for tasks not appearing on Table 1. 81 Fed. Reg. at 16,458.

Industry's primary challenge to OSHA's feasibility finding is that the Table 1 controls cannot always be implemented and sometimes require respiratory protection. But even were we to accept Industry's arguments, these isolated exceptions hardly undermine OSHA's finding of feasibility for the *typical* firm in *most* operations.

As to situations where Table 1 controls cannot be implemented, Industry focuses on six tasks for which wet methods are prescribed, arguing that it is sometimes infeasible to introduce water to the work environment, such as for some indoor work or in cold-weather environments. Industry Br. at 98–99. But OSHA adduced evidence showing that employers can overcome many of the barriers identified by Industry, for example, by using heated water in cold-weather environments. 81 Fed. Reg. at 16,460. Moreover, even where wet methods cannot be implemented, Table 1 functions as just one of two paths to compliance: where an employer cannot or elects not to follow Table 1, it is free to take the traditional path to compliance by implementing controls of its choice to reduce exposures below the new PEL. OSHA acknowledged in the

rulemaking record that such situations may arise and contemplated alternative controls that might be implemented. *Id.* at 16,460–61. Even accepting Industry's arguments that compliance for some tasks is infeasible under certain work conditions does not overcome OSHA's finding of feasibility for the typical employer in most operations. Because Industry argues neither that the typical employer cannot implement wet methods nor that such methods are required in most operations, it has failed to carry its burden of showing that the use of wet methods renders the rule infeasible.

On the issue of respiratory protection, OSHA assesses technological feasibility based on whether firms can "develop and install engineering and work practice controls" to meet the standard "without relying on respirators." *Lead I*, 647 F.2d at 1272. The fact that "respirators will be necessary in a few . . . operations, will not undermine th[e] general presumption in favor of feasibility." *Id.* Thus the question for our review remains whether the need for respirators is so widespread as to undermine OSHA's finding of feasibility for the typical firm in most operations.

OSHA, however, contemplates only limited respirator use. Industry argues that "one-third of [Table 1 tasks] require some form of respiratory protection when the task is performed for just over four hours," which is "significant and . . . completely undercuts OSHA's claim of technological feasibility." Industry Br. at 95–96. Table 1, however, includes nineteen construction tasks, thirteen of which require no respiratory protection at all. OSHA Br. at 92 n.56 (explaining that though only eighteen tasks are listed, a nineteenth task, performed by ground crew assisting equipment operators, is covered by Table 1). Certain others, the one-third of tasks to which Industry refers, require respirators under only certain circumstances, such as when the task is performed indoors or

for over four hours. *See* 29 C.F.R. § 1926.1153(c)(3). And OSHA credibly found that most tasks would be performed for four hours or less and/or outdoors. 81 Fed. Reg. at 16,724. Again, the fact that respiratory protection will be required in some operations some of the time fails to satisfy Industry's burden to rebut OSHA's feasibility finding for the typical firm in most operations.

Industry points to OSHA's finding that it expects 13% of all workers to need some amount of respiratory protection as an indication that the rule is infeasible. Specifically, Industry argues that in litigation related to OSHA's Hexavalent Chromium rule, the agency rejected respirator use by 9.5% of employees as unacceptably high. Industry Reply Br. at 51–52. The very language Industry relies on, however, defeats its claim. In the Hexavalent Chromium litigation, OSHA stated: "While the agency estimated that a total of 9.5% of all employees in all application groups would need respirators . . . that overall figure did not factor into OSHA's technological feasibility findings . . . ." *Public Citizen Health Research Group v. OSHA*, Nos. 06-1818 and 06-2604, Final Brief for Respondents, at 45 (3d Cir. Dec. 14, 2007). There, OSHA noted that "respirator use was more than 'isolated' where almost one third or more of the exposed employees in the affected groups would have to use respirators." *Id.* Here, OSHA's conclusion that 13% of workers using respirators amounts to only "isolated" respirator use neither overwhelms its finding of technological feasibility nor conflicts with its position in the Hexavalent Chromium litigation. As we have explained, OSHA must show only that compliance is feasible for the typical firm in most operations—that some respirator use may sometimes be needed is not enough to defeat OSHA's finding.

Even combining the effects of these two issues—the sometimes need for respiratory protection and the occasional situations where wet methods are infeasible—Industry has failed to show that it is infeasible for the typical employer to meet the standard in most operations. Some employers may be unable to implement the Table 1 controls in all operations—though OSHA reasonably explains why there are fewer such situations than Industry suggests. And some may have to resort to respiratory protection for certain tasks, though, as OSHA points out, only for a minority of tasks and only under certain circumstances. But Industry's identification of atypical circumstances in a minority of operations where compliance with Table 1 is infeasible falls far short of rebutting OSHA's well-supported finding of feasibility for the typical firm in most operations.

Industry mounts a handful of additional challenges. None has merit.

First, Industry again raises the issue of exposure variability. But this argument fails in construction just as it failed for the foundry industry: OSHA provided evidence suggesting that variability is controllable and, in any event, our standard of review is designed to accommodate just such variability. Moreover, exposure variability—to the extent it presents a problem—is further mitigated in construction, where Table 1 provides a path to compliance without any need for exposure testing.

Next, Industry criticizes the evidence upon which OSHA relied in determining how the PEL could feasibly be met. Specifically, Industry takes issue with OSHA's reliance on short-duration exposure samples and its calculation of an eight-hour average assuming no additional exposure during the un-sampled portion of the eight-hour period. Industry Br. at 90–

94. Although few of OSHA's exposure samples were eight hours long, the vast majority (70%) were four hours or longer and nearly half (43%) were more than six hours long. 81 Fed. Reg. at 16,435. And OSHA considered Industry's objection and adequately justified the no-further-exposure assumption by adducing evidence of the intermittent and short-duration nature of silica exposure in construction tasks. *Id.* Moreover, OSHA's assumption aligns with its enforcement practice. When OSHA compliance officers collect partial-shift samples during an inspection, they calculate eight-hour time-weighted average exposures using the same assumption of no further exposure during the un-sampled period. The alignment between OSHA's evidence and its enforcement practice confirms that any harm to Industry from this assumption is more semantic than substantive.

Finally, Industry disputes OSHA's finding of feasibility for four particular tasks: hole drillers using handheld or stand-mounted drills, jackhammering and using other powered handheld chipping tools, masonry cutters using stationary saws, and mobile crushing machine operators and tenders. Industry Br. at 99–105. We have no need to address Industry's arguments as to these tasks, for even were we to accept them, Industry would still have failed to rebut OSHA's finding of feasibility in "most operations." *Lead II*, 939 F.2d at 990. In any event, OSHA cited evidence that employers could reduce exposure levels for each task using available controls. In response, Industry recites a number of by-now familiar arguments: that OSHA's data was inadequate, that the tasks are sometimes performed for longer than OSHA assumes, and that particular controls (again, wet methods) sometimes cannot be implemented. But OSHA considered and responded to each of these objections, making "reasonable predictions based on 'credible sources of information.'" *Lead II*, 939 F.2d at 980 (quoting *Lead I*, 647 F.2d at 1266). Once

again, Industry's insistence that compliance is infeasible for some firms in some operations some of the time cannot upend our deference to OSHA's well-supported finding that compliance is feasible for the typical firm in most operations.

C. ECONOMIC FEASIBILITY

The OSH Act's requirement that OSHA health standards protect workers "to the extent feasible," 29 U.S.C. § 655(b)(5), also requires OSHA to show that its rule is economically feasible, *Lead I*, 647 F.2d at 1264. As with technological feasibility, the scope of our review of OSHA's economic feasibility finding is narrowly circumscribed.

A rule is economically feasible in a particular industry so long as it does not "threaten massive dislocation to, or imperil the existence of, the industry." *Id.* at 1265. Thus, "[a] standard is not infeasible simply because it is financially burdensome or even because it threatens the survival of some companies within an industry." *Id.* (citation omitted). "OSHA is not required to prove economic feasibility with certainty, but is required to use the best available evidence and to support its conclusions with substantial evidence." *Lead II*, 939 F.2d at 980–81. OSHA must also provide "a reasonable estimate of compliance costs and demonstrate a reasonable likelihood that these costs will not threaten the existence or competitive structure of an industry, even if it does portend disaster for some marginal firms." *Lead I*, 647 F.2d at 1272. "Courts, [moreover], 'cannot expect hard and precise estimates of costs.'" *Lead II*, 939 F.2d at 1006 (quoting *Lead I*, 647 F.2d at 1266). As before, the mere "possibility of drawing two inconsistent conclusions from the evidence" or deriving two divergent cost models from the data "does not prevent [the] agency's finding from being supported by substantial

evidence." *Cotton Dust*, 452 U.S. at 523 (quoting *Consolo*, 383 U.S. at 620).

Industry does not challenge OSHA's overall methodology for assessing economic feasibility. Instead, it questions the evidence on which OSHA relied in the foundry, hydraulic fracturing, and construction industries. Industry also gestures towards a challenge to OSHA's findings on the brick industry, claiming only that OSHA "cannot adopt a standard that imposes very large costs on an industry without producing any quantifiable health benefit." Industry Br. at 130. But because OSHA found significant risk in the brick industry, as we explained above, and Industry does not otherwise claim economic infeasibility, this argument is foreclosed.

Industry's economic feasibility arguments, like its technological feasibility arguments, raise a host of claims about OSHA's sources that do not collectively undermine the evidence OSHA relied on and the conclusions it reached, especially in light of our standard of review and the narrow scope of Industry's challenge. In its economic feasibility analysis, OSHA developed estimates of the annualized cost of compliance for each affected industry—and for small and very small employers within each industry—and compared those costs against industry revenues and profits. *See* 81 Fed. Reg. at 16,462–582 (describing OSHA's economic feasibility methodology). OSHA explained that "while there is no hard and fast rule," it "generally considers a standard to be economically feasible" for an industry where annualized costs of compliance are less than one percent of revenue or ten percent of profit. *Id.* at 16,533. OSHA considers this benchmark to be "fairly modest," so costs exceeding the threshold do not imply per se infeasibility, but rather serve as a trigger for further analysis. *Id.*

For each of the industries at issue here—foundries, hydraulic fracturing, and construction—OSHA determined that costs as a percentage of revenues and profits were below the one percent and ten percent thresholds. *Id.* at 16,536, 16,538, 16,573. For foundries and construction, these costs were well below these benchmarks for all industry subgroups considered: even doubling OSHA's cost estimates in foundries and tripling them in construction would only barely trigger the thresholds for further inquiry. *Id.* at 16,538 (showing, among subgroups within the foundry industry, costs as a percentage of profits of 5.62% at the greatest); *id.* at 16,573 (showing, among subgroups in construction, costs as a percentage of profits of 3.66% at the greatest). For hydraulic fracturing, compliance costs were somewhat nearer OSHA's thresholds, though still below, with costs as a percentage of revenues of 0.56% and costs as a percentage of profits of 7.94%. *Id.* at 16,536 (assessing hydraulic fracturing as part of the "Support Activities for Oil and Gas Operations" industry). OSHA thus provided "a reasonable estimate of compliance costs and demonstrate[d] a reasonable likelihood that these costs will not threaten the existence or competitive structure of an industry." *Lead I*, 647 F.2d at 1272.

Industry points out that compliance costs exceed OSHA's threshold for small and very small employers in the hydraulic fracturing industry and for very small employers in the foundry industry, arguing that this alone renders the rule economically infeasible. Industry Br. at 71; *see* 81 Fed. Reg. at 16,553, 16,562, 16,564. As explained above, however, exceeding this threshold does not in and of itself demonstrate infeasibility; instead, it triggers further analysis by OSHA. 81 Fed. Reg. at 16,533–34. And the standard for economic feasibility contemplates that compliance may be infeasible for a subset of firms within an industry, like the small and very small firms at issue here. *See Lead I*, 647 F.2d at 1272 (allowing a finding

of economic feasibility even where a rule "portend[s] disaster for some marginal firms"). Indeed, consistent with its understanding of these thresholds as merely triggers for additional analysis, OSHA engaged in further inquiry into the impact on these firms and reasonably concluded that the Rule did not threaten "massive industry dislocation." *See Lead II*, 939 F.2d at 980.

1. Foundries

Industry makes a handful of arguments against OSHA's sources and assumptions, relying primarily on analysis by URS Corporation and Environomics showing compliance costs much higher than OSHA's estimates. Industry Br. at 72. But, as explained above, our standard of review does not permit us to compare competing analyses and decide which we prefer—it leaves that responsibility to OSHA. So long as OSHA supports its position with substantial evidence, we have no need to consider alternatives it might otherwise have adopted. We turn, then, to Industry's challenges to the evidence upon which OSHA did rely.

First, Industry disputes OSHA's assumption of an even apportionment of costs between those required for compliance with the *prior* PEL—which are not attributable to the new rule—and those required to further reduce exposure from the prior PEL to the new PEL—which are. Industry Br. at 76–77. But OSHA specifically addressed Industry's objection and supported its decision to rely on this assumption with substantial evidence. 81 Fed. Reg. at 16,473–74. OSHA cited data in the record showing that the average worker exposed above the prior PEL was exposed at levels significantly higher than the prior PEL. Such high exposures can be addressed only with certain substantial controls, like local exhaust ventilation systems, which in turn account for the

bulk of the costs associated with exposure reduction. *Id.* Accordingly, OSHA reasoned, since the bulk of the expense will come from reducing uncontrolled environments to the *prior* PEL, less cost will result from controls implemented to reach the new PEL. *Id.* Moreover, the reduction from the average uncontrolled level (300 µg/m^3) to the old PEL (100 µg/m^3) represents a larger reduction—both relatively and absolutely—than the reduction from the old PEL (100 µg/m^3) to the new PEL (50 µg/m^3), which mitigates Industry's claim that costs increase disproportionately as facilities reach lower exposure levels. OSHA's assumption here was just that, an assumption, which the agency adequately supported on the basis of the best available evidence. And given that OSHA's cost estimates were well below its threshold for concern, any error resulting from this assumption would be harmless. *National Cottonseed Products Association v. Brock*, 825 F.2d 482, 488 (D.C. Cir. 1987) (finding OSHA's failure to include certain costs in an economic feasibility analysis to be harmless error).

Industry next faults OSHA for engaging in a per-worker assessment of costs—calculating compliance cost based on the number of exposed workers—rather than looking at costs on a per-facility basis. Industry Br. at 73–76. OSHA, however, adequately defended its choice on a perfectly reasonable basis. *See* 81 Fed. Reg. at 16,469–70. OSHA rejected the URS study's facility-based approach because it failed to take into account situations where only some but not all workers are exposed and where there are existing controls in place; according to OSHA, record evidence showed that where one or both of these conditions exists, firms can reduce exposure by means other than a full set of controls. *Id.* Though OSHA's approach may understate costs in some situations where fixed investment is out of proportion to the number of workers impacted, the per-facility approach is vulnerable to the same

problem in the opposite direction. Between these imperfect options, OSHA supported its decision to rely on the per-worker approach with substantial evidence—all our standard of review requires.

Industry also criticizes OSHA's exclusion of the cost of certain controls mentioned in its technological feasibility analysis. Industry Br. at 77–80. But given that the new rule mandates no particular set of controls, OSHA considered the lowest-cost combination of controls that would allow the typical foundry to meet the new PEL. 81 Fed. Reg. at 16,482. This court, moreover, has endorsed this "typical employer" approach to economic feasibility. *Lead II*, 939 F.2d at 1005. OSHA directly addressed Industry's objection in the preamble to the rule: "Just because a control is mentioned in the technological feasibility analysis does not mean that OSHA has determined that its use is required—only that it represents a technologically feasible method for controlling exposures." 81 Fed. Reg. at 16,482. Notwithstanding its decision to exclude certain controls from its cost analysis, OSHA has discharged its duty to provide "a *reasonable* assessment of the *likely* range of costs of [the] standard." *Lead II*, 939 F.2d at 1006 (alteration in original) (emphasis added) (quoting *Lead I*, 647 F.2d at 1266).

Finally, Industry argues that OSHA's cost estimates do not reflect the best available evidence. They contend that the best available evidence is "the actual experience of employers that have installed the control" as provided by the American Foundry Society. Industry Br. at 81 (emphasis omitted). They point to two examples—ventilation and housekeeping vacuum systems—where the Society's cost estimates were significantly higher than OSHA's. *Id.* at 80–83. OSHA, however, adequately defended its cost estimates for both of these controls. For ventilation systems, OSHA based its cost

estimate on analysis by its contractor, Eastern Research Group, finding the estimates to be reasonable, while acknowledging "that there can be a wide range of both capital and operating costs associated with" ventilation. 81 Fed. Reg. at 16,480. For housekeeping, OSHA based its estimate on its calculation of average production floor space from NIOSH field studies and cost evidence from a firm specializing in the industrial cleaning of foundries. *Id.* at 16,481. OSHA considered and rejected Industry's higher estimates of housekeeping costs, which were based on a single quote and "communicat[ions] with industry representatives." *Id.* at 16,481–82. OSHA's well-supported estimates and considered rejection of alternative evidence are sufficient to justify its findings of economic feasibility.

2. Hydraulic Fracturing

Industry alleges that OSHA relied upon "industry revenues and profits, which . . . do not reflect the real world" because they fail to capture a "significant drop in revenue" resulting from declining oil prices. Industry Br. at 84. In its final analysis, OSHA incorporated the most recent data available and performed additional analysis to ensure that the new rule would not imperil the hydraulic fracturing industry. 81 Fed. Reg. at 16,549. OSHA expressly acknowledged that the "recent drop in oil prices has caused a series of bankruptcies and closures across the oil industry," but cited a forecast of increased oil prices in the coming years. *Id.* at 16,549–50. Recognizing the uncertainty inherent in such predictions, OSHA observed that the cost of complying with the rule is a "small fraction" of the cost to the industry of fluctuation in energy prices. *Id.* at 16,550. And OSHA's delayed implementation timeline in hydraulic fracturing gives the industry further opportunity to develop new, cost-efficient technologies. *See Lead I*, 647 F.2d at 1265 ("Granting

companies reasonable time to comply with new PELs might . . . enhance economic feasibility generally . . . .").

OSHA concluded that "even in a lower price environment, hydraulic fracturing entrepreneurs will be able to implement the controls required by th[e] final rule without imposing significant costs, causing massive economic dislocations to the . . . industry, or imperiling the industry's existence." 81 Fed. Reg. at 16,550. Given the inherent uncertainty in forecasting future economic conditions, OSHA's thorough consideration of Industry's concerns, and the delayed implementation timeline, OSHA's finding that the rule is economically feasible in hydraulic fracturing finds ample support in the record. Though Industry's arguments raise concerns about the fundamental health of the hydraulic fracturing industry, they never claim that OSHA's rule will seal the industry's fate.

As a final matter, Industry again argues that OSHA underestimated compliance costs by including the cost of only some of the controls discussed in the technological feasibility analysis. Industry Br. at 83–85. But this argument fails here just as it did for foundries: OSHA estimated only the *typical* cost of compliance and need not consider every single control discussed. *See Lead II*, 939 F.2d at 1005.

3. Construction

Industry first contends that OSHA's final cost estimates "make no sense in the real world of construction," pointing to several industry subgroups where OSHA's estimated annualized cost per affected establishment is under $1,000. Industry Br. at 106. But just because the amounts seem low does not imply that they are unsupported. And OSHA explained that many firms have only a handful of affected employees, 81 Fed. Reg. at 16,408, and that recommended controls are often inexpensive systems integrated into hand

tools, *id.* at 16,436. In light of OSHA's explanation of the reason for the apparently low costs in certain construction industry groups, Industry's bare argument that the costs are too low carries little weight.

Next, Industry critiques OSHA's assumption of a 150-day working year, which Industry argues is too short and thus understates costs. Industry Br. at 107–08. But OSHA points to sufficient record evidence supporting this assumption: equipment cannot be used with perfect efficiency, especially in light of weather conditions that interfere with construction. Although OSHA does not explain how it arrived at 150 days, any error would be harmless. 81 Fed. Reg. at 16,494. Moreover, OSHA explains that this assumption does not function the way Industry describes: the agency used the 150-day assumption only as a divisor when calculating the per-day cost of certain engineering controls. As a result, increasing the days-per-year assumption would actually *decrease* the cost per day. OSHA Br. at 141–42. Even were this assumption to function in the way Industry imagines, costs in construction would have had to triple before triggering OSHA's threshold for further inquiry, confirming that OSHA's ultimate conclusion was well supported. 81 Fed. Reg. at 16,573.

Finally, Industry objects to OSHA's calculation of compliance costs based on an assumption that employers will follow Table 1, arguing that this "ignores substantial evidence in the record that employers will not be able to follow Table 1 in all of the operations all of the time." Industry Br. at 108–10. As before, however, OSHA need not look at the cost of compliance for all employers in all operations all of the time; rather, it is required to consider only the typical compliance costs for the "typical" employer. *Lead II*, 939 F.2d at 1005. OSHA did just that; indeed, the agency did more, calculating alternative compliance costs for operations categorically

excluded from Table 1 (tunnel boring, for example), 81 Fed. Reg. at 16,486, and estimating sampling and monitoring costs for employers whose exposure levels are so low as to never trigger the rule's requirements and who would thus not follow Table 1, *id.* at 16,514.

Conclusion

OSHA's cost estimates in each of these industries are inevitably imperfect due to the limitations of available data and the uncertainties inherent in predicting future costs. But this is why "hard and precise estimates of costs" are not required. *Lead II*, 939 F.2d at 1006 (quoting *Lead I*, 647 F.2d at 1266). OSHA's only obligation is to confirm, on the basis of substantial evidence, that its rule does not "threaten massive dislocation to, or imperil the existence of, the industry." *Id.* at 980 (quoting *Lead I*, 647 F.2d at 1265). There can be little doubt that OSHA has done so here.

D. PROCEDURAL CHALLENGES

Both the OSH Act and the APA, which govern the process for promulgating occupational safety and health standards, require the Secretary to publish proposed rules and provide an opportunity for comment. 29 U.S.C. § 655(b)(2); 5 U.S.C. § 553. "[I]n order to allow for useful criticism, it is especially important for the agency to identify and make available *technical studies and data* that it has employed in reaching the decisions to propose particular rules." *American Radio Relay League, Inc. v. FCC*, 524 F.3d 227, 236 (D.C. Cir. 2008) (quoting *Connecticut Light & Power Co. v. Nuclear Regulatory Commission*, 673 F.2d 525, 530 (D.C. Cir. 1982)). "An agency commits serious procedural error when it fails to reveal portions of the technical basis for a proposed rule in time to allow for meaningful commentary." *Owner-Operator Independent Drivers Association v. Federal Motor Carrier*

Safety Administration, 494 F.3d 188, 199 (D.C. Cir. 2007) (quoting *Solite Corp. v. EPA*, 952 F.2d 473, 484 (D.C. Cir. 1991) (per curiam)).

Industry points to two alleged procedural defects in OSHA's process.

First, Industry faults OSHA for disclosing data from the OSHA Information System (OIS) on the last day of the data-submission period—June 3, 2014—thereby depriving Industry of an opportunity to respond. Industry Br. at 117–18. But OSHA's reliance on the OIS data was unproblematic given that it provided adequate opportunity for comment. After the data-submission period, OSHA offered an additional two months—until August 18—for parties to submit final briefs and arguments, a deadline that OSHA twice extended. 81 Fed. Reg. at 16,298. Though Industry argues that they had no opportunity to submit additional data in response to the OIS data, they never explain why the two-month response period was insufficient to allow them opportunity for "meaningful commentary." *Owner-Operator Independent Drivers Association*, 494 F.3d at 199. Nor does Industry make any effort to explain why they were prejudiced by OSHA's actions. Barring a total failure to engage in notice and comment, we "will not set aside a rule absent a showing by the petitioners 'that they suffered prejudice from the agency's failure to provide an opportunity for public comment.'" *American Radio Relay League*, 524 F.3d at 237 (quoting *Gerber v. Norton*, 294 F.3d 173, 182 (D.C. Cir. 2002)). OSHA's actions here were at worst harmless, and, more likely, not even in error.

Second, Industry criticizes OSHA's reliance on data and estimates from its contractor Eastern Research Group (ERG), arguing that OSHA failed to disclose the basis for ERG's assumptions. Industry Br. at 119–21. This court has

previously approved OSHA's reliance on information from external consultants in rulemaking, making clear that the key question is whether the challenger can "buttress its general allegation of excessive reliance with any specific proof that the [agency] failed to confront personally the essential evidence and arguments in setting the final standard." *See Lead I*, 647 F.2d at 1217. Here, OSHA placed all available ERG evidence in the record and made clear what information it relied upon in reaching its conclusions. Though Industry criticizes OSHA for relying on ERG's "estimates" and interviews with unidentified individuals, they fail to propose alternative data sources or explain why ERG's opinions are insufficient. Industry has given us no grounds for questioning OSHA's conclusion that ERG provided the best available evidence.

E. ANCILLARY CHALLENGES

Although reducing the PEL to 50 $\mu g/m^3$ represents the Rule's central innovation, OSHA determined that even the reduced PEL poses substantial employee health risks. *See* 81 Fed. Reg. at 16,287 ("[OSHA] considers the level of risk remaining at the new PEL to be significant."). The Rule therefore contains ancillary measures designed to "provid[e] additional layers and types of protection" to exposed employees. *Id.* at 16,294. Industry challenges two of these measures. Finding that substantial evidence supports OSHA's choices, we reject both challenges. *See International Union, United Automobile, Aerospace & Agricultural Implement Workers of America, UAW v. Pendergrass (Formaldehyde)*, 878 F.2d 389, 391–92 (D.C. Cir. 1989) (reviewing ancillary provisions under substantial evidence standard).

1. Medical Surveillance

Industry first targets the Rule's medical surveillance provisions. Under the Rule, employers must offer no-cost

medical surveillance to certain silica-exposed employees. *See* 29 C.F.R. §§ 1910.1053(i)(1)(i); 1926.1153(h)(1)(i). Participating employees receive periodic medical screening and written reports that include, among other things, the examining physician's recommendations regarding "limitations on the employee's exposure to respirable crystalline silica." *Id.* §§ 1910.1053(i)(5)(iii); 1926.1153(h)(5)(iii). But absent the employee's written authorization, the employer never receives the recommendations. *Id.* §§ 1910.1053(i)(6)(ii); 1926.1153(h)(6)(ii).

Industry challenges OSHA's decision to let employees decide whether to notify their employers of their doctors' recommendations. Past standards, Industry argues, entitled employers to such information regardless of employee consent. And, Industry further contends, the Rule's novel consent-based approach unreasonably risks withholding from employers information needed to ensure workplace safety.

Industry correctly observes that prior OSHA standards have unconditionally entitled employers to notice of their employees' medically indicated exposure limitations. *See, e.g.*, *id.* §§ 1910.1026(k)(5)(i)(B) (chromium); 1910.1028(i)(7)(i)(C) (benzene); 1926.62(j)(3)(v)(A)(2) (lead). Agencies, however, are "free to change their existing policies as long as they provide a reasoned explanation for the change." *Encino Motorcars, LLC v. Navarro*, 136 S. Ct. 2117, 2125 (2016). Agencies undertaking such a change "need not always provide a more detailed justification than what would suffice for a new policy created on a blank slate," so long as they "display awareness that [they are] changing position" and "show that there are good reasons for the new policy." *Id.* at 2125–26 (quoting *FCC v. Fox Television Stations, Inc.*, 556 U.S. 502, 515 (2009)); *see also Formaldehyde*, 878 F.2d at 400

(requiring "at the least some explanation" for an agency's "'swerve' from prior practice").

In the Rule's preamble, OSHA openly acknowledged that the Rule's consent-based approach to reporting employees' medical restrictions treads new ground. *See* 81 Fed. Reg. at 16,834 ("The requirements for the type of information provided to the employer [under the Rule's medical surveillance provisions] are different from requirements of other OSHA standards . . . ."). OSHA has also offered good reasons for its new approach, explaining that disregarding employees' "reluctance to let employers know about their health status" could compromise worker safety by deterring employees fearful of the employment consequences of an adverse diagnosis from participating in medical surveillance. *Id.* at 16,832. And, more generally, "evolving notions about where the balance between preventive health policy and patient privacy is properly struck," *id.* at 16,831, led OSHA to conclude that "employees have the most at stake in terms of their health and employability" and so should be entitled to decide for themselves whether to relay potentially compromising medical information, *id.* at 16,833.

Industry challenges OSHA's decision to allow employees to withhold medical information from their employers, arguing that knowing employees' health status helps employers adopt appropriate workplace health and safety measures. OSHA considered and reasonably rejected this argument during the rulemaking. Silica-related illnesses have long latency periods, and OSHA reasoned that an employee's present diagnosis with an illness likely contracted long ago "will not provide useful information about" the efficacy of an employer's "*current* controls or exposure conditions." *Id.* (emphasis added). And although knowing which silica-exposed employees are particularly vulnerable to adverse

health effects could prompt an employer to find safer placements for those employees, OSHA preferred to leave employees the freedom to decide for themselves whether to seek such a placement. Because OSHA has "explain[ed] its logic and the policies underlying its choices," we have no basis for second-guessing its reasonable judgments. *National Maritime Safety Association*, 649 F.3d at 752.

Industry also argues that the Rule's medical surveillance provisions exceed OSHA's statutory authority to regulate. Absent unconditional employer notification, Industry argues, medical surveillance lacks the workplace nexus that is prerequisite to OSH Act regulation. *See Cotton Dust*, 452 U.S. at 540 ("[T]he [OSH] Act in no way authorizes OSHA to repair general unfairness to employees that is unrelated to achievement of health and safety goals . . . ."). But the Rule's medical surveillance provisions obviously possess such a nexus. After all, an employer assumes medical surveillance obligations only by exposing its employees to workplace silica, thereby creating the need to assess the exposure's potential health effects. Although Industry fleetingly argues that the medical surveillance provisions violate the OSH Act's disclaimer of authority to "supersede or in any manner affect" state worker's compensation systems, 29 U.S.C. § 653(b)(4), it entirely fails to explain how.

2. Dry Sweeping, Dry Brushing, and Compressed Air

Industry's second challenge to the Rule's ancillary provisions targets measures that prohibit dry sweeping, dry brushing, or (barring suitable ventilation) the use of compressed air for certain purposes "where such activity could contribute to employee [silica] exposure" and if alternative methods are feasible. *See* 29 C.F.R. §§ 1910.1053(h); 1926.1153(f). The proposed rule would have limited these

housekeeping methods only where they could "contribute to employee exposure to respirable crystalline silica *that exceeds the PEL*." 78 Fed. Reg. at 56,274, 56,499 (Sept. 12, 2013) (emphasis added). The final rule, though, instead restricts these methods whenever they could contribute to silica exposure to *any* degree. Industry argues that this revision is unsupported by substantial evidence because it essentially imposes a wholesale prohibition on the covered methods.

Industry's challenge fails. OSHA found that silica exposure, even at levels below the PEL, poses significant risks to employee health, *see* 81 Fed. Reg. at 16,796, and that the Rule's restrictions on dry sweeping, dry brushing, and the use of compressed air reduce exposure, *see id.* at 16,794. Except insofar as Industry argues that OSHA lacked substantial evidence to find significant employee health risks even *at* the PEL—an argument that we have already rejected, *see supra* Part II.A—Industry presents no meaningful challenge to these findings. Industry briefly suggests that a study cited in the Rule's preamble as linking dry sweeping to increased silica exposure was "insufficient to support OSHA's prohibition on *all* dry sweeping, dry brushing, or use of compressed air that contributes to employee exposure to silica at *any* level." Industry Reply Br. at 63. The study, however, cited as an "example," was not the sole basis for OSHA's conclusions. *See* 81 Fed. Reg. at 16,794 (summarizing comments that discuss other studies).

Having failed to undermine OSHA's supportable finding that the Rule's housekeeping provisions promote worker safety, Industry next argues that OSHA inadequately addressed concerns that alternatives to the restricted housekeeping methods can be hazardous or impractical. But OSHA explained in the preamble that the Rule resolves precisely these concerns by allowing employers to use the restricted methods

where alternatives are infeasible. *See id.* at 16,796 ("[I]n situations where [alternatives] would not be effective, would cause damage, or would create a hazard in the workplace, the employer is not required to use these [alternative] cleaning methods."). Industry quibbles that "[t]he Rule does not define what is feasible in any particular situation" and that the employer bears the burden of showing an alternative's infeasibility, Industry Br. at 115–16, though it offers nothing beyond unsupported speculation to suggest that the infeasibility exception will inadequately serve the very purpose for which it was adopted.

F. UNION CHALLENGES

We turn finally to the Unions' challenges.

As it has with many long-latency occupational diseases, OSHA required employers to provide medical exams to help combat the risks posed by silicosis and other silica-related diseases. 29 C.F.R. §§ 1910.1053(i); 1926.1153(h). OSHA concluded that such exams "will allow for identification of respirable crystalline silica-related adverse health effects at an early stage so that appropriate intervention measures can be taken." 81 Fed. Reg. at 16,625. Employer-provided medical surveillance not only motivates employers to reduce exposures to avoid surveillance costs, but also provides information to employees so that they can "take action, such as changing jobs or wearing a respirator for additional protection." *Id.* at 16,626.

The Unions' challenges are to the temporal bookends to these medical exams. The construction unions challenge (in the construction standard only) the initial trigger for when an employer must offer an exam. The general industry unions challenge (in the general industry standard only) what happens after an exam is completed.

1. Medical Surveillance Trigger

In the general industry standard, employers must offer triennial exams to any employee "who will be occupationally exposed . . . at or above the action level for 30 or more days per year." 29 C.F.R. §§ 1910.1053(i)(1)(i); 1910.1053(i)(3). OSHA used the action level of 25 µg/m^3 for this trigger because it concluded that a significant risk persisted at the PEL of 50 µg/m^3, and that employees exposed at lower levels still faced a significant risk of developing silica-related diseases. In the construction standard, however, OSHA determined that it would be impractical for medical surveillance to be triggered by any particular exposure limit because OSHA anticipated that most construction employers would rely on Table 1 and would not make exposure assessments. 81 Fed. Reg. at 16,815; *see generally supra* Part II.B.3. OSHA therefore required construction employers to provide surveillance to employees "who will be required . . . to use a respirator for 30 or more days per year" with that employer. 29 C.F.R. § 1926.1153(h)(1)(i); *see* 81 Fed. Reg. at 16,817. Because respirator use in the construction industry (in Table 1) is generally tied to exposure at or above the PEL of 50 µg/m^3, construction employees may be exposed to greater silica concentrations before receiving medical surveillance than general industry employees, for whom surveillance is tied to exposure at the action level of 25 µg/m^3.

The Unions do not dispute that keying medical exams to respirator use is sensible because using Table 1 eliminates the need to measure actual exposure. Union Br. at 36; Union Reply Br. at 14. The Unions are concerned, however, that some employees might use a respirator for 30 days in a year—and therefore endure exposures at or above the PEL for 30 days—but fall through the cracks of OSHA's screening mechanism because they split that use across multiple

employers.[8] This problem is especially acute in the construction industry, the Unions argue, because "[e]mployment in the construction industry is transitory and intermittent." Union Br. at 36. The solution to the problem, they suggest, is for even a single day of respirator use to trigger medical screening.[9]

In *Asbestos*, a union challenged OSHA's decision to trigger some employer duties at the action level and others at the PEL. The union argued that it was "feasible to trigger many of the latter duties at the action level rather than at the PEL, and that the Secretary therefore erred in not so providing." 838 F.2d at 1274. OSHA had defended its decision as reasonable priority-setting that "permit[ted] employers to concentrate their resources on those employees and workplace conditions with the potential for high asbestos exposures." *Id.* (quoting Occupational Exposure to Asbestos, 51 Fed. Reg. 22,612, 22,707 (June 20, 1986)). This court, like the union, was "skeptical of the agency's asserted justification" because it did not explicitly relate to either feasibility or lack of benefit. *Id.*

Nonetheless, the court rejected the union's challenge. As we explained, "the force of the evidence and argument that OSHA must offer to defend its choice will vary with the force of the proponent's evidence and argument." *Id.* at 1271. And

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[8] The Unions also express concern that an employer might be unable to predict an employee's respirator use in the coming year. Union Br. at 38. As OSHA explained in the preamble, however, the trigger is met as soon as the employer knows respirator use will exceed 30 days in the year, even if the employer did not initially anticipate such use. 81 Fed. Reg. at 16,818.

[9] Counsel conceded at oral argument that the Unions did not advance before the agency the alternative approach of tracking employees' respirator use across employers. Oral Arg. at 1:57:25.

the burden is on the challenger to a rule to "demonstrat[e] that the variations it advocates will be feasible to implement and will provide more than a *de minimis* benefit for worker health." *Id.* Because in that case the union "failed to point to any evidence" that using the stricter trigger "would result in a greater than *de minimis* incremental benefit," we concluded that OSHA had not abused its discretion in rejecting the suggested provision. *Id.* at 1274.

Following this approach today, we reject the Unions' challenge to the medical surveillance trigger in the construction standard. OSHA's stated reason for adopting the 30-day trigger does leave something to be desired. OSHA noted that commenters had suggested a range of possible triggers, and it selected 30 days as "strik[ing] a reasonable balance between the administrative burden of offering medical surveillance to all employees, many of whom may not be further exposed or only occasionally exposed, and the need for medical surveillance for employees who are regularly exposed and more likely to experience adverse health effects." 81 Fed. Reg. at 16,816. The Unions suggest that this statement reflects the kind of balancing of "burdens and benefits" that is impermissible for rulemaking under 29 U.S.C. § 655(b)(5). Union Br. at 39; *see Cotton Dust*, 452 U.S. at 509; *National Cottonseed Products Association*, 825 F.2d at 485 n.1.

We do not, however, construe such a "casual" comment "as amounting to an arguably improper cost-benefit test, especially when OSHA has expressed its vigorous opposition to such a test." *Lead I*, 647 F.2d at 1309. OSHA did not explicitly frame its rejection of the Unions' proposal as infeasible or as failing to protect against a material impairment of health, the relevant considerations under § 655(b)(5). But "[a]s long as the agency's path may reasonably be discerned, we will uphold the decision even if it is of less than ideal

clarity." *Casino Airlines, Inc. v. National Transportation Safety Board*, 439 F.3d 715, 717 (D.C. Cir. 2006) (internal quotation marks omitted). OSHA's explanation that many employees would not be further exposed or only occasionally exposed indicates that the agency saw little benefit in providing medical surveillance to workers exposed at or above the PEL for fewer than 30 days a year. And as in *Asbestos*, the Unions have not pointed to any evidence that setting the trigger at one day instead of 30 days would produce more than a *de minimis* benefit to worker health. Indeed, they have not identified how many—if any—employees would use a respirator more than 30 days in a year, but would not do so with any single employer. Nor did OSHA act unreasonably in rejecting the Unions' speculation that construction employers might deliberately terminate employees nearing the 30-day trigger in an effort to avoid the costs of medical surveillance, given that the costs of hiring and training a new employee would likely exceed the "modest" cost of providing triennial medical examinations for an existing employee. 81 Fed. Reg. at 16,817. That being so, we conclude that OSHA did not abuse the "almost unlimited discretion the statute affords it to devise means to achieve the congressionally mandated goal." *Asbestos*, 838 F.2d at 1271 (internal quotation marks omitted).

2. Medical Removal Protection

Medical removal protection (MRP) provisions "typically require the employer to temporarily remove an employee from exposure when such an action is recommended in a written medical opinion" and to "maintain the employee's total normal earnings, as well as all other employee rights and benefits," during the removal. 81 Fed. Reg. at 16,838; *see Formaldehyde*, 878 F.2d at 399.[10] OSHA has included MRP

[10] In this opinion, we use MRP to refer to transfer and wage protections generally, and not to refer to any specific scheme.

provisions in some of its rules addressing worker health. Indeed, it recently did so in the beryllium standard, 82 Fed. Reg. 2,470, 2,720–21 (Jan. 9, 2017), which it promulgated after the Silica Rule that is now before us. This court approved such a provision in the lead standard, accepting OSHA's explanation that "removal was a preventive device" and that, "unless workers were guaranteed all their wage and seniority rights upon removal, they would resist cooperating with the medical surveillance program that determined the need for removal, since they reasonably might fear being fired or sent to lower-paying jobs if they revealed dangerously high blood-lead levels." *Lead I*, 647 F.2d at 1237.

OSHA has not always included MRP in its health standards, however. *See, e.g.*, Hexavalent Chromium Rule, 71 Fed. Reg. 10,100, 10,366 (Feb. 28, 2006); Ethylene Oxide Rule, 49 Fed. Reg. 25,734, 25,788 (June 22, 1984). And when it promulgated the Silica Rule, the agency had previously included MRP in only six standards. *See* 81 Fed. Reg. at 16,838. It did not include MRP in the Rule's general industry standard, a decision the Unions now challenge.

To start, we reject OSHA's suggestion that we should deny the Unions' petition because they did not present sufficient evidence of MRP's economic feasibility. We can uphold a rule only on grounds upon which the agency itself relied. *See NLRB v. CNN*, 865 F.3d 740, 751 (D.C. Cir. 2017). And the agency did not purport to reject MRP on that ground in the silica rulemaking. *See* 81 Fed. Reg. at 16,838–40.

According to the Unions, OSHA engaged in unreasoned decisionmaking in failing to provide MRP for those employees: (a) whose doctors recommend permanent removal; (b) whose doctors recommend temporary removal to alleviate exacerbated symptoms of chronic obstructive pulmonary

disease (COPD); (c) whose doctors recommend temporary removal pending a determination by a specialist; and (d) who are unable to wear a required respirator. The Unions contend that OSHA's stated reasons for rejecting MRP in each of these four circumstances are inadequate.

(a). We begin with OSHA's rationale for denying any period of MRP to employees whose doctors recommend permanent removal. OSHA acknowledged that "some employees might benefit from removal from respirable crystalline silica exposure to possibly prevent further progression of disease." 81 Fed. Reg. at 16,839; *see* Oral Arg. at 2:07:07–:15. But temporary removal would rarely "improve employee health," OSHA said, because silica-related illnesses are irreversible. 81 Fed. Reg. at 16,839. To produce a lasting health benefit, "removal[] would have to be permanent," and "[w]orkers' compensation is the appropriate remedy when permanent removal from exposure is required." *Id.*

In some previous rules, however, OSHA has provided MRP for employees whose doctors recommend permanent removal. *See*, *e.g.*, 29 C.F.R § 1910.1028(i)(8)(v) (benzene). And we have held that the agency cannot rely "on an across-the-board rule that appears inconsistent with past decisions." *Formaldehyde*, 878 F.2d at 401 (opinion on rehearing). One reason OSHA has provided MRP is to ensure that employees fully engage with medical surveillance by reporting their symptoms. Absent MRP, employees might conceal symptoms rather than risk "being fired or sent to lower-paying jobs if they revealed" those symptoms. *Lead I*, 647 F.2d at 1237; *see Formaldehyde*, 878 F.2d at 400. In the Silica Rule, however, OSHA dismissed this rationale. Even without MRP, it said, employees would readily cooperate with examining physicians because the Rule's enhanced medical privacy

protections would eliminate the risk of automatic wage loss. 81 Fed. Reg. at 16,389–40. Those protections withhold doctors' recommendations from employers absent employees' written authorizations. *See supra* Part II.E.1.

OSHA's explanation misses a logical step. According to OSHA, medical surveillance provides information so that employees can "take action, such as changing jobs or wearing a respirator for additional protection." 81 Fed. Reg. at 16,626. The medical privacy protections may well mitigate the concern that employees will underreport symptoms to their doctors. But without MRP, employees whose doctors recommend removal may hide those recommendations from their employers.

OSHA has acknowledged that continued exposure can worsen even an irreversible silica-related disease. *See id.* at 16,839; *see* Oral Arg. at 2:07:07–:15. And OSHA has not explained why MRP—critical in some standards to protect workers from having to decide between learning about their health and avoiding economic loss—is not equally critical to protect workers from having to choose between disclosing their health issues (and thus preserving their health) and avoiding economic loss. Because OSHA acknowledges the health benefit of removal and has not given an adequate reason for rejecting some period of MRP for employees whose doctors recommend permanent removal, we remand to the agency for reconsideration or further explanation.

(b). OSHA also concedes that, in some cases, "employees might benefit from temporary removal . . . to alleviate exacerbation of COPD." 81 Fed. Reg. at 16,839; *see* Oral Arg. at 2:09:41–:10:20. OSHA nonetheless rejected medically recommended temporary removal because symptoms likely would recur at some point after the removal

ended. But OSHA's statutory mandate directs it to "set the standard which most adequately assures . . . that no employee will suffer material impairment of health . . . ." 29 U.S.C. § 655(b)(5). And, as OSHA explained in the preamble to this rule, the agency considers "irritation of the skin, eyes, and respiratory system . . . to be material impairments of health." 81 Fed. Reg. at 16,290. OSHA may have valid reasons for rejecting MRP for temporary removal to alleviate exacerbated symptoms, but the fact that symptoms might recur when the removal ends is not by itself a sufficient reason. Thus, a remand to further address this circumstance is also warranted.

(c). OSHA also rejected the Unions' proposal that it require MRP for those employees whose doctors recommend temporary removal pending a determination by a specialist. Although OSHA's brief recognizes that the agency has required such temporary removal under other standards, it argues that removal would not benefit employees in this rulemaking because "the available evidence suggests that, given the slow progression of silica-related diseases, 'there is no urgent need for removal from . . . exposure while awaiting a specialist determination.'" OSHA Br. at 157 (quoting 81 Fed. Reg. at 16,840).

But that is not quite what OSHA said in the rulemaking. Rather, it said that "*in most cases*, there is no urgent need for removal from [silica] exposure while awaiting a specialist determination." 81 Fed. Reg. at 16,840 (emphasis added). And it acknowledged that, although rare, one type of silicosis—"acute silicosis"—is an exception to the generality that silica-related diseases progress slowly. *Id.* Indeed, OSHA said that "acute silicosis can occur within a few weeks to months after inhalation exposure to extremely high levels" of silica, leading to death "within months to a few years of disease onset." *Id.* at 16,381. In light of that, the agency has

not explained why temporary removal would not benefit those workers whose physicians have found enough initial signs of the disease to indicate referral to a specialist. We therefore remand for the agency to better explain its decision not to require MRP in this circumstance as well.

(d). Although OSHA's reasons for not requiring MRP in the three circumstances just discussed are inadequate to sustain those decisions, we reject the Unions' contention that OSHA failed to engage in reasoned decisionmaking by not including MRP for employees who are unable to wear a respirator. OSHA concluded that such a provision was unnecessary because OSHA already requires employers to provide a powered air-purifying respirator to employees who are unable to wear a negative pressure respirator. 81 Fed. Reg. at 16,840; *see* 29 C.F.R. § 1910.134(e)(6) (respiratory protection). The Unions speculate that some employees might be unable to wear either type of respirator, but they have not pointed to any evidence indicating how many such employees there are likely to be. We therefore reject this challenge because the Unions have not met their burden to show that MRP would provide more than a *de minimis* benefit in this circumstance. *See Asbestos*, 838 F.2d at 1271.

III. CONCLUSION

In sum, we reject all of the petitioners' challenges to the Silica Rule, with three exceptions. We hold that OSHA was arbitrary and capricious in declining to require MRP for some period when a medical professional recommends permanent removal, when a medical professional recommends temporary removal to alleviate COPD symptoms, and when a medical professional recommends temporary removal pending a specialist's determination. We remand to the agency to reconsider or further explain those aspects of the Rule.

So ordered.