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Public Interest Comment[1] on

The Occupational Safety and Health Administration's
Proposed Standards for Occupational Exposure to Respirable Crystalline Silica

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The George Washington University Regulatory Studies Center works to improve regulatory policy through research, education, and outreach. As part of the Center's mission, Center scholars conduct careful and independent analyses to assess rulemaking proposals from the perspective of the public interest. This comment on the Occupational Safety and Health Administration's (OSHA) proposed standards for occupational exposure to respirable crystalline silica does not represent the views of any particular affected party or special interest, but is designed to evaluate the effect of OSHA's proposal on overall social welfare. It builds on an article by the authors, "Defining What to Regulate: Silica & the Problem of Regulatory Categorization,"[3] which we attach to this comment and respectfully submit for the record in this rulemaking.

[1] This comment reflects the views of the authors, and does not represent an official position of the GW Regulatory Studies Center or the George Washington University. The Center's policy on research integrity is available at http://research.columbian.gwu.edu/regulatorystudies/research/integrity.

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[3] Andrew P. Morriss & Susan E. Dudley, "Defining What to Regulate: Silica & the Problem of Regulatory Categorization," *Administrative Law Review,* Vol. 58, No.2 (Spring 2006).

Introduction

OSHA is proposing to amend its existing standards for occupational exposure to respirable crystalline silica by establishing a new permissible exposure limit (PEL) as well as a series of ancillary provisions for controlling exposure, providing for respiratory protection and medical surveillance, communicating hazard, and recordkeeping.

Crystalline silica refers to a group of minerals composed of silicon and oxygen atoms that are arranged in a three-dimensional repeating pattern. Because oxygen and silicon are the two most common elements in the Earth's crust, silica is abundant in nature. Crystalline silica comes in several forms, the most common of which are quartz, cristobalite, and tridymite. According to the Bureau of Mines:

> this group of minerals has shaped human history since the beginning of civilization. From the sand used for making glass to the piezoelectric quartz crystals used in advanced communication systems, crystalline silica has been a part of our technological development.[4]

Because crystalline silica is ubiquitous in nature and valuable for a wide variety of materials and uses, workers may be exposed to it in a large variety of industries and occupations.[5] Scientists have long recognized that prolonged exposure to free crystalline silica is associated with silicosis, a progressive, incurable disease that involves scarring of the lungs and impaired respiratory function.[6] The U.S. National Toxicology Program (NTP) has also found associations

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[4] U.S. Department of Interior, Bureau of Mines, *Crystalline Silica Primer*, 1992. Available at: *http*://www.co.goodhue.mn.us/countygovernment/committees/MiningCommittee/Studies/Crystalline%20Silica%20Primer%20-%20US%20Bureau%20of%20Mines.pdf

[5] IARC *Monographs on the Evaluation of Carcinogenic Risks to Humans*, "Silica Dust, Crystalline, in the Form of Quartz or Cristobalite" Vol. 100C. p. 377. Available at: http://monographs.iarc.fr/ENG/Monographs/vol100C/mono100C-14.pdf

[6] *See* William G.B. Graham, "Quartz and Silicosis," in *Occupational Lung Disease: An International Perspective* 191, 191 (Daniel E. Banks & John E. Parker eds., 1998) ("Silicosis is the term used to designate the occupational lung disease caused by inhaling crystalline silica (alpha-quartz or SiO[2]) or its polymorphs, tridymite or cristobalite."); *see also* William Jones et al., "Dust Particles: Occupational Considerations," in *Handbook of Hazardous Materials* 213, 213 (Morton Corn ed., 1993) ("Pneumoconiosis is the reaction of the lungs to inspired dust."). The authors added that "silicosis is a fibrotic disease produced by inhalation of silica-containing dusts. High exposures to crystalline silica can result in acute silicosis. Acute silicosis develops rapidly (1-3 yr) and is characterized by labored breathing (dyspnea), fatigue, cough, and weight loss." *Id.* at 215; *see also* Paul Stark et al., "Standard Imaging in Silicosis and Coal Worker's Pneumoconiosis," in 30 The Radiological Clinics of North America: Occupational Lung Disease 1147, 1147-48 (Theresa C. McCloud, MD ed., 1992) (describing acute, chronic, and accelerated forms of silica dust exposure).

between exposure to certain forms of crystalline silica and lung cancer, and concluded that "respirable crystalline silica (RCS), primarily quartz dust occurring in industrial and occupational settings, is known to be a human carcinogen, based on sufficient evidence of carcinogenicity from studies in humans indicating a causal relationship between exposure to respirable crystalline silica and increased lung cancer rates in workers exposed to crystalline silica dust."[7]

As discussed in the attached article, OSHA faces a number of challenges in developing regulations to reduce the risk associated with exposure to respirable crystalline silica. First, a successful risk reduction strategy must consider the complex biological, mineralogical, chemical, physical, and other characteristics of silica, as well as avenues of exposure, and a range of individual factors including personal characteristics unrelated to the exposure, such as whether the individual smokes. Second, given the limitations on our understanding of what forms of silica are most hazardous and what factors mediate those hazards, as well as what practices will best reduce risks, OSHA faces the problem of trying to bring about desirable behavior without having a clear idea of what that behavior should look like. In essence, the risks associated with exposure to respirable crystalline silica are not the result of lack of motivation on the part of employers or employees to achieve a safer workplace, but lack of information on how best to do that.

This comment begins with a brief review of OSHA's proposed regulatory approach, and the statutory authority on which its proposal is based. It then focuses on OSHA's preliminary determination of significant risk, and its analysis of the risk reduction achievable by its proposed controls. It then evaluates alternatives to OSHA's proposal that would be more consistent with President Obama's regulatory guidance and also would be more likely to generate information to improve employee outcomes. The comment concludes with recommendations. We are also attaching for the record an article we authored on the challenges of regulating crystalline silica, which appeared in the *Administrative Law Review* in 2006.

Summary of Statutory Authority & OSHA Proposal

Section 6(b)(5) of the Occupational Safety and Health Act (OSH Act), requires OSHA to promulgate a standard that reduces significant risk to the extent that it is technologically and economically feasible to do so. OSHA proposes to find that 1) occupational exposure to respirable crystalline silica at current PELs constitutes a "significant risk" and 2) the proposed standard will substantially reduce that risk.

[7] National Institute of Health, Toxicology Program, *Report on Carcinogens*, Twelfth Edition (2011) http://ntp.niehs.nih.gov/ntp/roc/twelfth/profiles/Silica.pdf

> The available evidence indicates that employees exposed to respirable crystalline silica well below the current PELs are at increased risk of lung cancer mortality and silicosis mortality and morbidity. Occupational exposures to respirable crystalline silica also may result in the development of kidney and autoimmune diseases and in death from other nonmalignant respiratory diseases, including chronic obstructive pulmonary disease (COPD). [Preamble, p. 9]

To reduce this risk, OSHA is proposing a new PEL of 50 micrograms per cubic meter of air ($\mu g/m^3$) for respirable crystalline silica (defined as quartz, cristobalite, and tridymite). This represents a significant reduction from the current PELs, which OSHA adopted in 1971 and which are expressed as formulas. The current PEL for quartz in general industry is approximately equivalent to 100 $\mu g/m^3$ as an 8-hour time-weighted average. The PEL for quartz in construction and shipyards is a formula based on a 1962 consensus standard relying on a now-obsolete particle count sampling method that OSHA reports is approximately equivalent to 250 $\mu g/m^3$. The current PELs for cristobalite and tridymite are one-half of the values for quartz in general industry.

In addition to the PEL, OSHA proposes to impose requirements for exposure assessment, preferred methods for controlling exposure, respiratory protection, medical surveillance, hazard communication, and recordkeeping.

Analysis

OSHA's decision involves 3 elements. It must examine 1) whether workers face a "significant risk," 2) what actions it can require that would substantially reduce those risks, and 3) whether those actions are "feasible." OSHA has preliminarily determined that 1) current PELs impose a significant risk and a PEL of 50 $\mu g/m^3$ would both 2) substantially reduce that risk and 3) be feasible. While OSHA has made a "preliminarily finding that there is significant risk remaining at the proposed PEL of 50 $\mu g/m^3$," it does not believe a PEL of 25 $\mu g/m^3$ would be feasible ("engineering and work practices would not be sufficient to reduce and maintain silica exposures to a PEL of 25 $\mu g/m^3$ or below in most operations most of the time in the affected industries"). [Preamble, p. 420]

In this section, we examine the questions of whether current exposure levels constitute a significant risk, and whether OSHA's proposed requirements will substantially reduce that risk. We do not address the issue of whether the standards are "feasible" according to the definitions in the OSH Act and subsequent interpretations.

Do Current Levels Pose a Significant Risk?

OSHA states in the preamble:

> To promulgate a standard that regulates workplace exposure to toxic materials or harmful physical agents, OSHA must first determine that the standard reduces a "significant risk" of "material impairment." The first part of this requirement, "significant risk," refers to the likelihood of harm, whereas the second part, "material impairment," refers to the severity of the consequences of exposure.

The preamble goes on to say,

> In this case, OSHA has reviewed extensive toxicological, epidemiological, and experimental research pertaining to adverse health effects of occupational exposure to respirable crystalline silica, including silicosis, other non-malignant respiratory disease, lung cancer, and autoimmune and renal diseases. As a result of this review, the Agency has developed preliminary quantitative estimates of the excess risk of mortality and morbidity that is attributable to currently allowable respirable crystalline silica exposure concentrations. The Agency is proposing a new PEL of 0.05 mg/m^3 because exposures at and above this level present a significant risk to workers' health. [Preamble, p. 173]

The level of risk in the absence of regulation represents the baseline from which OSHA estimates risk reduction benefits of its proposed rule. To generate that counterfactual, it is important to look at trends in worker exposure to respirable crystalline silica and observed health outcomes over time.

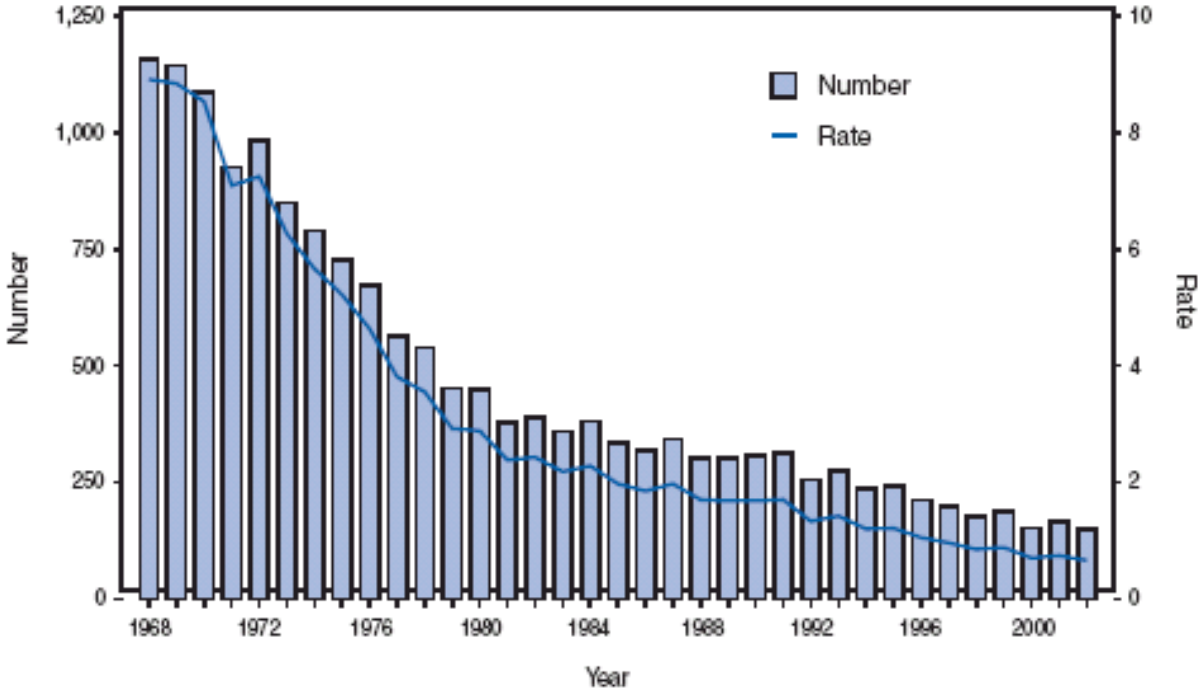
The International Agency for Research on Cancer (IARC) reports on an analysis of 7,209 personal sample measurements collected during 2,512 OSHA inspections during 1988–2003, which

> suggest that geometric mean crystalline silica exposure levels declined in some high-risk construction industries during the period under study, and revealed a significant decline when compared with silica exposure levels found in a previous study by Stewart & Rice (1990). Geometric mean airborne silica exposure levels among workers in various construction industries were significantly lower in 1988–2003 than in 1979–1987.[8]

[8] IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, "SILICA DUST, CRYSTALLINE, IN THE FORM OF QUARTZ OR CRISTOBALITE" Vol. 100C. Available at: http://monographs.iarc.fr/ENG/Monographs/vol100C/mono100C-14.pdf

The Center for Disease Control's (CDC's) analysis of data from the National Institute of Occupational Safety and Health (NIOSH) National Occupational Respiratory Mortality System (NORMS) between 1968 to 2002 also reveals a declining trend in silicosis mortality, as shown in Figure 1, reproduced here.[9]

FIGURE 1. Number of silicosis deaths and age-adjusted mortality rate*, by year — National Occupational Respiratory Mortality System, United States, 1968–2002



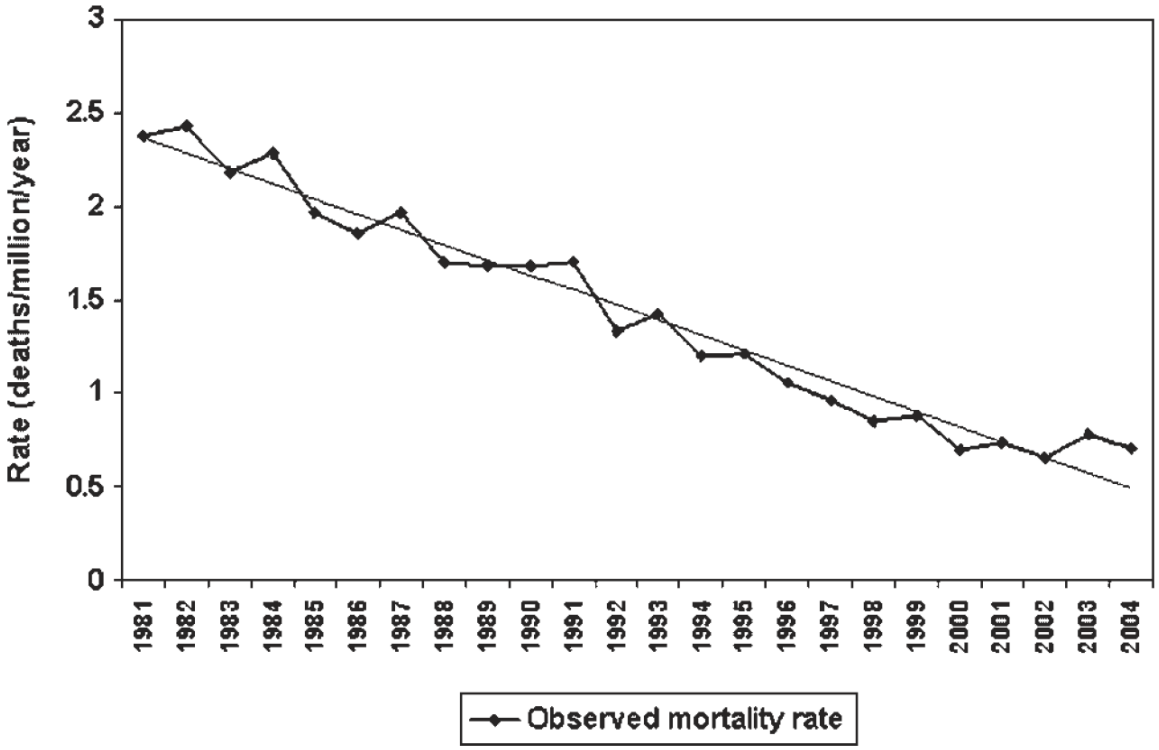
* Per million persons aged ≥15 years.

A study by NIOSH researchers (Bang et al.)[10] focused on more recent data from 1981 to 2004, and found a 70.5 percent decline in annual age-adjusted silicosis mortality rates (per million population). (Figure 2) Interestingly, the rate of decline in silicosis mortality appears to have been greater before 1980 than after. Particularly given the long latency between exposure to respirable crystalline silica and the onset of disease, this suggests that actions prior to the 1971 PEL contributed significantly to the reduction in risk observed between 1968 and 1980.

[9] CDC Silicosis Mortality, Prevention, and Control – United States, 1968-2002, MMWR Weekly April 29, 2005 / 54(16);401-405. Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5416a2.htm.

[10] Ki Moon Bang, PhD, MPH, Michael D. Attfield, PhD, John M. Wood, MS, and Girija Syamlal, MBBS, MPH, "National Trends in Silicosis Mortality in the United States, 1981–2004," AMERICAN JOURNAL OF INDUSTRIAL MEDICINE 51:633–639 (2008)

Figure 2. Silicosis Mortality Rate, 1981 – 2004



Despite these trends, OSHA's determination of the significance of the risk and its estimates of the risk reduction potential of its proposed regulation, implicitly assume that, absent regulation, risks will stop declining. Further, OSHA relies for its exposure assessment on a consultant report completed in 2008, which reviewed data through 2002.[11] Thus, the baseline OSHA uses in its analysis assumes that, contrary to the trends of the last 45 years, exposure and health effects would remain as they were over a decade ago in the absence of OSHA's proposed regulation. [PEA, Section VII] OSHA provides no evidence to support this conclusion, which is contradicted by the dramatic decline over the past decades. OSHA thus overstates the risk reduction benefits we can expect from the proposed standard.

[11] According to OSHA's Preliminary Economic Analysis (PEA), "OSHA has primarily relied on reports developed by OSHA's contractor Eastern Research Group, Inc. (ERG) [which] initially acquired silica exposure data and related information between 1999 and 2002 using literature search and retrieval processes; records provided by OSHA; and communications with representatives of the National Institute for Occupational Safety and Health (NIOSH), state agencies, identified industries, and other groups." [PEA, p. IV-2] "ERG contractor reports primarily relied on information sources published from 1990 through 2001, updated with some information through 2007. In a few cases, where sources more recent than 1990 were limited and earlier information existed, information from the 1980s was used." [PEA, p. IV-3]

Bang et al. fit a simple linear regression to their data, the slope of which (-0.08 deaths per million per year) is statistically significant ($P<0.0001$). If OSHA included that observed trend in establishing its baseline (and assumed that the trend in silicosis mortality would continue at that rate, rather than assuming that the trend would abruptly stop), mortality would drop to zero in about 10 years, even without further action. Even if the decline merely slowed rather than suddenly stopping, the benefits would be lower than OSHA's estimate.

Since OSHA does not present any evidence that the declines reported in the literature have stopped or even slowed, at a minimum, it should explicitly state that its estimates reflect an upper bound on the benefits of the proposed PEL and ancillary actions, and that a realistic range of benefits also includes zero. A more realistic baseline might lead to a different conclusion than OSHA has preliminarily reached about whether, given the declining trend in exposure, workers face a "significant risk."

OSHA's unrealistic assumptions regarding expected risks in the absence of regulatory actions are particularly unsatisfying because it bases its determination of significant risk on data that are at least a decade old. To meet its statutory mandate, and to develop an effective regulation, OSHA should rely on more current information on levels of workplace risk associated with respirable crystalline silica. At the least, OSHA should considered explicitly whether its assumption of a sudden stop in the trend of more than 40 years toward reduced mortality is realistic before basing its conclusion that a "significant risk" exists on that assumption.

Will the proposal achieve a substantial reduction in risk?

Understanding the reasons for the observed reductions in silicosis mortality is essential for devising strategies to continue to reduce the incidence of silicosis and other health effects of respirable crystalline silica exposure. Bang et al. suggest that OSHA standards and NIOSH guidance contributed to the declining trend in silicosis mortality, but that does not explain the more rapid rate of decline before 1981 (visible in Figure 1). The NIOSH researchers recognize:

> In some instances, dust control preceded Occupational Safety and Health Administration (OSHA) controls. For example, exposure levels in the granite sheds decreased from 20 to 50 million particles per cubic foot (mppcf) to 3–5 mppcf in the 1950s and 1960s, after the Vermont granite industry started to control exposures in the 1940s [Corn, 1980]. Along with the imposition of dust limits and associated measures, a greater awareness of the risks of inhaling silica dust may have contributed to the reduction in mortality. The efforts of NIOSH and other organizations, including improved surveillance, identification of hazards, and dissemination of education materials, may have contributed to this.[12]

[12] Bang et al., September 2008.

They also point to the decline in workers employed in heavy industry and suggest that perhaps fewer workers are being exposed to silica dust over time.

Unfortunately, OSHA does not explore these essential questions. Understanding what contributed to the successful declines in silicosis historically, including a 70 percent decline between 1981 and 2004, could help design successful strategies going forward.

As discussed in the attached article, OSHA also has limited information on the forms of crystalline silica that pose health risks. It defines respirable crystalline silica broadly, though it recognizes possible factors associated with the potency of silica:

> Although the Agency believes that the results of its risk assessment are broadly relevant to all occupational exposure situations involving crystalline silica, OSHA acknowledges that differences exist in the relative toxicity of crystalline silica particles present in different work settings due to factors such as the presence of mineral or metal impurities on quartz particle surfaces, whether the particles have been freshly fractured or are aged, and size distribution of particles. At this time, however, OSHA preliminarily concludes that it is not yet possible to use available information on factors that mediate the potency of silica to refine available quantitative estimates of the lung cancer and silicosis mortality risks, and that the estimates from the studies and analyses relied upon are fairly representative of a wide range of workplaces reflecting differences in silica polymorphism, surface properties, and impurities. [Preamble, p. 165-166]

Without fully accounting for the variation in silica potency, and without acknowledging the declining trend in silicosis, OSHA estimates that its proposed rule will "prevent 688 fatalities and 1,585 silica-related illnesses annually once it is fully effective," at an estimated cost of $637 million annually. In discounted present value terms, OSHA estimates "the proposed rule [will] generate net benefits of $4.6 billion annually." [Preamble, p. 12]

The evidence for that assertion is weak however, and hinges on questionable assumptions not only regarding what risks would be present in the absence of the regulations (the baseline problem noted above), but the potency of different forms of silica, and how effective the regulation will be at reducing exposure and risks.

Provisions other than the PEL itself represent approximately $223 million (or about 34 percent) of the rule's estimated total annualized costs of $658 million (using a 7 percent discount rate). [Preamble, p. 23] The two most expensive ancillary provisions are the requirements for medical surveillance and exposure monitoring, with annualized costs of $79 million and $74 million, respectively. [Preamble, p. 23] Yet, OSHA is unable to link the incremental changes in risk it

projects to any of the specific proposed requirements for controlling and assessing exposure. Instead, OSHA justifies the requirements with vague assertions of experience and tradition:

> OSHA is proposing to require primary reliance on engineering controls and work practices because reliance on these methods is consistent with long-established good industrial hygiene practice, with the Agency's experience in ensuring that workers have a healthy workplace, and with the Agency's traditional adherence to a hierarchy of preferred controls. [Preamble, p. 16]

As Lord Kelvin famously said, however, "to measure is to know."

> In physical science the first essential step in the direction of learning any subject is to find principles of numerical reckoning and practicable methods for measuring some quality connected with it. I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the state of *Science*, whatever the matter may be.[13]

In this case, OSHA cannot measure the risk reduction it expects to achieve from these ancillary measures; it cannot express it in numbers, and thus, in Lord Kelvin's words, its knowledge is "of a meager and unsatisfactory kind."

> OSHA's preliminary conclusion is that the requirements triggered by the action level will result in a very real and necessary, but non-quantifiable, further reduction in risk beyond that provided by the PEL alone. OSHA's choice of proposing an action level for exposure monitoring of one-half of the PEL is based on the Agency's successful experience with other standards… [Preamble, p. 25]

OSHA could likely contribute far more to worker safety by focusing on understanding what has been working to reduce silicosis mortality over the last several decades, and sharing information on effective programs and practices that actually have been linked to risk reductions, instead of requiring engineering controls and work practices for which it has little evidence of effectiveness.

[13] Lecture on "Electrical Units of Measurement" (3 May 1883), published in *Popular Lectures* Vol. I, p. 73; quoted in *Encyclopaedia of Occupational Health and Safety* (1998) by Jeanne Mager Stellman, p. 1992.

Alternatives OSHA Considered

Executive Orders 12866 and 13563 require OSHA to identify the compelling public need its rule would address, and consider "alternatives to direct regulation" that would both "encourage the desired behavior" and provide incentives for knowledge creation, particularly with respect to the forms of silica that pose the greatest hazards, and the practices that can most effectively reduce them.

Compelling public need

According to OSHA's Preliminary Economic Analysis (PEA):

> The private market—augmented by information dissemination programs, workers' compensation systems, and tort liability options—has not been effective in reducing this level of risk for all workers due to a lack of information about health risks, the presence of externalities, imperfect competition, and other factors discussed above. The Agency has concluded that the private market will not provide the level of protection afforded by a silica health standard that adheres to the statutory requirements of the OSH Act. [PEA, p. 27]

OSHA does not take into account the impressive decline in silicosis mortality reported in the literature, nor does it base this conclusion on data more recent than 2004. Indeed, OSHA's PEA assumes these observed trends abruptly stopped almost a decade ago and will not continue without the rule. Interestingly, the benefits OSHA estimates from the rule are less than what would be observed by a continuation of trends.

OSHA argues that workers not only do not have adequate information on occupational risks, but that "most workers underestimate their own risk of work-related injury, disease, or fatality and, therefore, fail to demand adequate compensation for bearing those risks." [PEA, p. 18] This conclusion ignores an extensive and robust literature that indicates workers do receive wage premiums for undertaking riskier jobs.[14] Competition in the labor market encourages cost-effective approaches to reduce workplace risks, and may explain much of the observed decline in silicosis mortality.

Alternatives

While OSHA proposes to establish a set of engineering and procedural requirements, it also lays out several alternatives to the proposed PEL and ancillary provisions.

[14] See, for example, W. Kip Viscusi and Joseph E. Aldy, "The Value of a Statistical Life: A Critical Review of Market Estimates throughout the World," *Journal of Risk and Uncertainty*, Vol. 27, No. 1 (August 2003), pp. 5-76.

> OSHA believes that this presentation of regulatory alternatives serves two important functions. The first is to explore the possibility of less costly ways (than the proposed rule) to provide an adequate level of worker protection from exposure to respirable crystalline silica. The second is tied to the Agency's statutory requirement, which underlies the proposed rule, to reduce significant risk to the extent feasible. If, based on evidence presented during notice and comment, OSHA is unable to justify its preliminary findings of significant risk and feasibility as presented in this preamble to the proposed rule, the Agency must then consider regulatory alternatives that do satisfy its statutory obligations. [Preamble, pp. 413-414]

President Obama's Executive Order 13563 particularly directs agencies to "identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as … providing information upon which choices can be made by the public."[15]

OMB's guidance amplifies this key point:

> Consistent with Executive Order 13563, section 4, an agency might consider flexible approaches that maintain freedom of choice. If, for example, an agency is considering banning the sale of a potentially unsafe product, it might consider instead requiring disclosure of health risks to the public.[16]

Two of the alternatives OSHA presents in the preamble appear more consistent with the emphasis on flexible approaches that provide information and incentives to encourage desired behavior, and also encourage experimentation and opportunities for expanding knowledge as to how best to reduce the risks of respirable crystalline silica.

Regulatory Alternative #7 "would eliminate all of the ancillary provisions of the proposed rule, including exposure assessment, medical surveillance, training, and regulated areas or access control." The PEL would serve as a performance standard, but would allow employers to determine the most effective way to meet that standard. OSHA carefully notes that "in order to meet the PEL, employers would still commonly need to do monitoring, train workers on the use of controls, and set up some kind of regulated areas to indicate where respirator use would be required," and expects that "employers would increasingly follow the many recommendations to provide medical surveillance for employees." The advantage of such an approach, perhaps accompanied by guidance as to what OSHA believes are the best practices to meet the performance standard established by the PEL, is that it would provide incentives for

[15] President Barrack H. Obama, Executive Order 13563 Section 1(b)(5), January 18, 2011
[16] Office of Management and Budget, "Regulatory Impact Analysis, A Primer," August 15, 2011

experimentation and learning regarding effective practices. The attached article discusses the historical challenges to addressing concerns about silica exposure, and incentives to improve knowledge regarding both the sources of risk and remedies for reducing it.

Under **Regulatory Alternative #9**, OSHA would delay the effective date of a rule with the PEL and action levels as proposed (a PEL of 50 $\mu g/m^3$ and an action level of 25 $\mu g/m^3$), and at the same time issue an interim PEL of 100 $\mu g/m^3$ and an action level of 50 $\mu g/m^3$ to be in effect until the final rule takes effect. OSHA states that it could take this approach if it concluded that the proposed PELs were not technologically and economically feasible right away. An advantage of this approach is, as OSHA notes:

> consistent with the public participation and "look back" provisions of Executive Order 13563, the Agency could monitor compliance with the interim standard, review progress toward meeting the feasibility requirements of the final rule, and evaluate whether any adjustments to the timing of the final rule would be needed. [Preamble, p. 34]

Given the declining trends in silica exposure and health effects in the absence of regulation, the risk associated with these two alternatives (or perhaps a combination of the two – an interim PEL with a commitment to evaluating progress pursuant to the look back provisions of E.O. 13563) would appear to be small while the potential gains in knowledge generation could be great.

Discussion & Recommendations

OSHA has struggled for over 40 years to develop regulations to address risks from exposure to crystalline silica,[17] and, as discussed in the attached article, it has found navigating the problem of under-regulation and over-regulation to be challenging. Exposure to forms of respirable crystalline silica is associated with silicosis mortality and lung cancer, as well as other non-fatal effects. Bang et al. note that, despite a declining trend between 1981 and 2004, "about 30 silicosis deaths yearly have been recorded [between 1995 and 2004] among those of working age (15–64)." Current standards are based on obsolete sampling methods, and OSHA has been working on the proposed draft regulation since at least 1998 (when it first appeared on its semi-annual agenda of upcoming regulatory actions).

[17] See, Susan E. Dudley, "Toxic Sand? OSHA's Challenge in Regulating Crystalline Silica," Regulatory Policy Commentary, The George Washington University Regulatory Studies Center, September 2013, available at http://research.columbian.gwu.edu/regulatorystudies/sites/default/files/u41/20130903_Silica.pdf . OSHA first established a maximum permissible exposure level for crystalline silica in 1970 by adopting a consensus industry standard.

OSHA faces multiple challenges in devising a regulatory approach that will meet its statutory goal of reducing significant risk. However, the greatest challenge to reducing risks associated with silica exposure is not lack of will (on the part of employers or employees) but rather lack of information. Unfortunately, OSHA's proposed rule contributes little in the way of new information, particularly since it is largely based on information that is at least a decade old, which is significant given the rapidly changing conditions observed between 1981 and 2004.

As discussed in the attached article, before OSHA can properly dispatch its statutory authority to identify and reduce significant risks, it must first understand what forms of silica lead to these risks. Further, as discussed above, to devise solutions to address remaining risks, OSHA's analysis should at least recognize the observed declines in silicosis mortality over the last several decades, and work to understand the reasons behind these encouraging trends.

OSHA's proposal does not recognize or attempt to explain the decline in silicosis mortality reported in the literature. Instead, without justification, it assumes these observed trends will abruptly stop unless OSHA issues the proposed regulation. Not only is this analytical approach certain to overstate the risk-reduction benefits attributable to the rule, but it misses opportunities to identify and encourage successful risk-reducing practices. Despite using an unrealistic baseline assumption of no reduction in risk absent the rule, OSHA's estimated benefits are less than what would be projected if past trends were simply to continue.

To address the information problem that is at the root of continued risks from silica exposure, OSHA should follow the guidance of President Obama's Executive Order 13563 and devise approaches that provide information, maintain flexibility for experimentation, and encourage the generation of knowledge.

> Where relevant, feasible, and consistent with regulatory objectives, and to the extent permitted by law, each agency shall identify and consider regulatory approaches that reduce burdens and maintain flexibility and freedom of choice for the public. These approaches include warnings, appropriate default rules, and disclosure requirements as well as provision of information to the public in a form that is clear and intelligible.[18]

OSHA's PEL and engineering controls give a false impression of precision, and OSHA's analysis assumes that the controls it has specified will result in compliance with the new PEL. These are merely assumptions, however, as OSHA is unable to connect risk reductions to specific requirements. Perhaps more important, such standards provide no incentive for increasing knowledge about silica hazards in the workplace; indeed, they may even discourage it

[18] President Barrack H. Obama, Executive Order 13563 Section 4, January 18, 2011

by focusing attention on compliance with the standard rather than on harm reduction. Given the costs and time involved in changing OSHA regulations, the design-based standards are unlikely to encourage investigations by private parties into developing information as to the relative hazard of different forms of silica, or practices likely to reduce risks.[19]

The proposed engineering controls and ancillary requirements are based on OSHA's long-standing hierarchy of controls. It rejects approaches, such as employee rotation to reduce exposure, which could be very effective at reducing risk. It considers the use of personal protection equipment a last resort, after engineering controls have been applied without achieving the PEL.

At base, OSHA presumes that workers make inappropriate tradeoffs of immediate comfort and long-term health (by removing uncomfortable respirators) and/or do not properly understand the risks posed by the substances from which the respirators are intended to protect them. However, as long as OSHA regulations forbid reliance on respirators, the incentive to develop more effective, lower cost, and more comfortable equipment is eliminated. We observe a quite different rate of technical progress in other, similar areas of equipment. Scuba gear, for example, has progressed from heavy, relatively failure-prone, surplus military gear to light-weight, ergonomic, comfortable, fail-safe, consumer-friendly gear. As a result, scuba gear is in widespread use in environments where the potential for immediate injury and death from equipment failure is more severe than that found in most workplaces.[20] By closing off potentially more effective practices for reducing risk, OSHA's hierarchy of controls itself may distort the development of new knowledge that could provide superior protection for employees.

OSHA's Regulatory Alternative #7 is more consistent with the direction in Executive Orders to "specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt."[21] As OMB's guidance to agencies states:

> Performance standards express requirements in terms of outcomes rather than specifying the means to those ends. They are generally superior to engineering or design standards because performance standards give the regulated parties the flexibility to achieve regulatory objectives in the most cost-effective way. In general, you should take into account both the cost savings to the regulated parties of the greater flexibility and the costs of assuring compliance through monitoring or some other means.[22]

[19] Morris & Dudley 332

[20] Morris & Dudley 333-335

[21] E.O. 13563 Section 1(b), and E.O. 12866 Section 1(b)8.

[22] OMB Circular A-4, "Regulatory Analysis" (September 17, 2003), available at http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a004/a-4.pdf

OMB guidance also encourages agencies to consider the timing of compliance, noting:

> The timing of a regulation can have an important effect on its net benefits. Agencies should consider various possible compliance dates, because (for example) a later date might, in some circumstances, promote predictability and significantly reduce compliance costs without greatly reducing benefits.[23]

In this case, OSHA's Regulatory Alternative #9, which would phase in a more stringent standard over time (starting with 100 $\mu g/m^3$ and reducing the PEL as more information becomes available), could have benefits not only in reduced compliance costs, but in knowledge generation and sharing.

Regardless of the approach OSHA takes in the final rule, it should lay out a clear plan for conducting retrospective review, as required by Executive Orders 13563 and 13610,[24] including how it will measure exposure and risk, and how it will evaluate the effectiveness of the different components of the final rule.

[23] OMB Circular A-4 Primer

[24] President Barrack H. Obama, Executive Order 13610, "Identifying and Reducing Regulatory Burdens," May 10, 2012.

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DEFINING WHAT TO REGULATE: SILICA AND THE PROBLEM OF REGULATORY CATEGORIZATION

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ARTICLES

DEFINING WHAT TO REGULATE: SILICA AND THE PROBLEM OF REGULATORY CATEGORIZATION

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INTRODUCTION

Firms and doctors involved in silicosis suits are facing grand jury investigations in New York, and a federal judge in Texas has suggested fraud may be involved in some of the tens of thousands of silicosis claims pending in her court, charging that one firm had attempted "to inflate the number of Plaintiffs and claims in order to overwhelm the Defendants and the judicial system."[1] Doctors involved in diagnosing silicosis claimants are pleading the Fifth Amendment right against self-incrimination rather than electing to testify before Congress about their roles in the lawsuits.[2] At the same time, silica dust regulation is on the agenda of regulatory agencies around the world. The United States Occupational Safety and Health Administration (OSHA) and regulators in other countries[3] are considering issuing new standards for silica dust, spurred on by the International Labor Organization and the World Health Organization's Global Campaign for the Elimination of Silicosis and the International Agency for Research on Cancer's (IARC) 1997 classification of silica as a

1. Editorial, *The Silicosis Sheriff*, WALL ST. J., July 14, 2005, at A10; In re *Silica Products Liability Litigation*, 398 F. Supp. 2d 563, 676 (S.D. Tex. 2005); *see also* Editorial, *Case of the Vanishing X-Rays*, WALL ST. J., Aug. 31, 2005, at A8; Lester Brickman, *What Did Those Asbestos X-Rays Really Show?*, WALL ST. J., Nov. 5, 2005, at A9.

2. *See* Press Release, Energy and Commerce Committee, U.S. House of Representatives, Doctors Refuse to Testify at Silicosis Hearing; Others Recount Diagnoses 'Manufactured for Money' (Mar. 9, 2005), *available at* http://energycommerce.house.gov/108/News/03092006_1810.htm (announcing the refusal of three physicians to testify at length about the circumstances behind their silicosis diagnoses despite a subpoena ordering them to do so).

3. *See* Tee Lamont Guidotti, *A Small Committee with a Big Agenda: The ILO/WHO Global Campaign for the Elimination of Silicosis and the ICOH Scientific Committee on Respiratory Disorders*, ICOH Q. NEWSL. (Aug. 1999), http://envepi.med.uoeh-u.ac.jp/icoh/ICOH%20QuarterlyNesletter.htm (describing the elimination campaign and attempts to involve the worldwide community).

human carcinogen.[4] In addition to cancer, the regulators continue to have their traditional concerns with respiratory problems from dust inhalation, silicosis in the case of silica dusts.[5] Some action by OSHA on silica in the near future is virtually certain because the current standard, derived from a 1962 consensus standard originally created by the American Conference of Governmental Industrial Hygienists (ACGIH), "is based on particle counting technology, which is considered obsolete"[6] and because the IARC conclusion has made clear that the existing standard, which did not consider the cancer risk, is no longer adequate. As a result, silica regulation is a "high priority" initiative at OSHA, one of only four such listed in OSHA's December 2004 unified agenda.[7]

Occupational health and environmental regulators face challenges in developing regulations that adequately address the complexity of biological, mineralogical, chemical, physical, and other characteristics of substances like silica. Too much detail induces paralysis; too little produces regulations that fail to focus on the actual harmful substances and so imposes costs without corresponding benefits. As the *In re Silica Products Liability Litigation* opinion demonstrates,[8] crucial questions also arise as to the role of the tort system in regulating hazardous products.

In this Article we examine the current and future regulation of silica and the issues involved in developing new standards. In Section I, we describe the problem of categorizing the subject of regulation. In Section II, we use the experience with silica and public choice theory to focus on both the pressures agencies face and the roles interest groups play in shaping

4. International Agency for Research on Cancer, *Silica*, 68 IARC MONOGRAPH 41 (1997), *available at* http://monographs.iarc.fr/htdocs/monographs/vol68/silica.htm [hereinafter IARC, *Silica*] (concluding that there is sufficient evidence that silica is carcinogenic to humans when inhaled).

5. *See* William G.B. Graham, *Quartz and Silicosis*, *in* OCCUPATIONAL LUNG DISEASE: AN INTERNATIONAL PERSPECTIVE 191, 191 (Daniel E. Banks & John E. Parker eds., 1998) ("Silicosis is the term used to designate the occupational lung disease caused by inhaling crystalline silica (alpha-quartz or SiO_2) or its polymorphs, tridymite or cristobalite."); *see also* William Jones et al., *Dust Particles: Occupational Considerations*, *in* HANDBOOK OF HAZARDOUS MATERIALS 213, 213 (Morton Corn ed., 1993) ("Pneumoconiosis is the reaction of the lungs to inspired dust."). The authors added that "[s]ilicosis is a fibrotic disease produced by inhalation of silica-containing dusts. High exposures to crystalline silica can result in acute silicosis. Acute silicosis develops rapidly (1-3 yr) and is characterized by labored breathing (dyspnea), fatigue, cough, and weight loss." *Id.* at 215; *see also* Paul Stark et al., *Standard Imaging in Silicosis and Coal Worker's Pneumoconiosis*, *in* 30 THE RADIOLOGICAL CLINICS OF NORTH AMERICA: OCCUPATIONAL LUNG DISEASE 1147, 1147-48 (Theresa C. McCloud, MD ed., 1992) (describing acute, chronic, and accelerated forms of silica dust exposure).

6. OCCUPATIONAL SAFETY & HEALTH ADMIN. (OSHA), U.S. DEP'T OF LABOR, UNIFIED AGENDA OF FEDERAL REGULATORY AND DEREGULATORY ACTIONS (2005), *available at* http://ciir.cs.umass.edu/ua/Spring2005/agenda/DEPARTMENT_OF_LABOR_(DOL).html.

7. *See* Department of Labor 2004 Regulatory Plan, 69 Fed. Reg. 72,781 (Dec. 13, 2004) (listing and describing worker exposure to crystalline silica among the four high-priority initiatives).

8. *See infra* notes 469-81 and accompanying text.

occupational safety and health regulations. This regulatory history makes silica regulation an ideal case study for examining the general problem of categorizing regulated substances. In Section III, the history of asbestos litigation illustrates the undesirable consequences of relying on the tort system to drive regulation. In Section IV, we recap the problems associated with the regulation of silica and other compounds that are difficult to characterize, and we discuss possible options for developing sound policy.

I. THE PROBLEM OF CATEGORIZATION

Silica is the common name for minerals containing a combination of silicon and oxygen such as silicon dioxide (SiO_2). As silica is one of the most common substances in the Earth,[9] it might appear that defining silica for regulatory purposes would be trivial. And, of course, regulators could define silica for regulatory purposes as the mineral SiO_2. Yet such a definition would be grossly over-inclusive, potentially subjecting virtually every human activity to regulation.[10] Thus, a more sophisticated definition of silica is necessary for effective regulatory action.

Silica comes in multiple forms that have varying mineralogical characteristics. First, silica may be "free" (only SiO_2 is present), or it may be mixed chemically with another atom or molecule.[11] This is important because only free silica is currently considered to have human health effects.[12] Further, free silica can be distinguished into amorphous and

9. *See* BRANCH OF INDUS. MINERALS, U.S. DEP'T OF THE INTERIOR, CRYSTALLINE SILICA PRIMER 5 (1992) [hereinafter PRIMER] ("All soils contain at least trace amounts of crystalline silica in the form of quartz."). The Primer adds that "the average quartz content of igneous rocks is 12%" and that "[b]ecause of its abundance in the earth, silica, in both its crystalline and noncrystalline states, is present in nearly all mining operations." *Id.* at 5, 6. In addition, "quartz is . . . the major component of sand and of dust in the air." *Id.* at 5.

10. *See* Graham, *supra* note 5, at 191. Graham notes that people who experience "dusty non-occupational exposures, as in villages in the high Himalayas or in desert communities," also show abnormal chest radiographs and other indications of silica exposure and that even workers in very low exposure jobs also show abnormalities in cells and proteins:

> Whether these findings represent the presence of a disease process (alveolitis) is almost a subject for philosophical discussion, akin to asking whether tanning of the skin is a pathologic process or a normal response to an imposed stimulus. This analogy is not too far-fetched, since exposure to both quartz and sunlight have been constant companions in the evolution of biologic systems.

Id.; *see also* Mei-lin Wang & Daniel E. Banks, *Airways Obstruction and Occupational Inorganic Dust Exposure*, *in* OCCUPATIONAL LUNG DISEASE, *supra* note 5, at 69, 69 (noting that "Chronic obstructive pulmonary disease (COPD)" is a "physiologic parameter rather than an etiologically defined disease" and so "the cause explaining these abnormal pulmonary parameters in any single individual cannot be made without a clinical evaluation").

11. INDUS. ACCIDENT PREVENTION ASS'N, SILICA IN THE WORKPLACE 2 (2003) [hereinafter IAPA, WORKPLACE], *available at* http://www.iapa.ca/pdf/Silica-in-the-workplace-FEB03.pdf.

12. *See id.* (explaining that only dusts with more than 1% free silica by weight pose an exposure hazard).

crystalline silica.[13] The former is "essentially benign," while at least some forms of the latter are potentially toxic when inhaled or otherwise ingested.[14] As we will discuss in greater detail below, however, this simple binary characterization is still too crude to capture the distinctions necessary to differentiate the risks presented by different forms of silica.[15]

The difficulties in adequately characterizing even what appears to be a comparatively straightforward, common substance like silica, which has a long history of medical study, are magnified when the issue is a substance about which little scientific research has been undertaken.[16] Unless regulators are willing to employ a version of the precautionary principle that allows them to prevent all innovation until a substance is proven safe,[17]

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13. There are two states of silica: amorphous and crystalline, which are "quite different physically." PRIMER, *supra* note 9, at 3. Of the two states, "[o]nly the crystalline structures are highly toxic and fibrogenic." Marlene Absher, *Silica and Lung Inflammation*, *in* HANDBOOK OF HAZARDOUS MATERIALS, *supra* note 5, at 661, 662. Although there are seven forms, or polymorphs, of crystalline silica, four are considered "extremely rare." PRIMER, *supra* note 9, at 5. The three major forms are quartz, cristobalite, and tridymite. *Id.*

14. *See* Graham, *supra* note 5, at 191 ("Amorphous silica, which lacks a crystalline structure, is essentially benign. Crystalline silica in any form is potentially toxic when absorbed or inhaled in sufficient quantities.").

15. *See* PRIMER, *supra* note 9, at 16. There are several difficulties inherent in determining the content of a sample:

> The crystallinity of silica from different deposits, even from slightly different locations within the same deposits is not necessarily the same. This raises two problems. First, a single standard (that is, the reference material to which the silica in the sample is compared) may not be appropriate. Using a standard that matches the particle size and crystallinity of the silica in the sample is essential for an accurate analysis. Second, obtaining a representative sample, when the sample size is so small and the deposit is so large, is nearly impossible.

Id.; *see also* John E. Craighead, *Inorganic Mineral Particulates in the Lung*, *in* HANDBOOK OF HAZARDOUS MATERIALS, *supra* note 5, at 399, 405 ("[T]he SiO_2 cristobalite is far more toxic and pathogenic than the mineralogically similar alpha quartz. . . . Since different dusts cause disease by differing pathogenetic mechanisms, the issues are exceptionally complex."); Absher, *supra* note 13, at 663 ("Factors which determine whether an exposed individual develops pulmonary pathology include the dose and duration of exposure, the nature of the dust (quartz, cristobalite, or a variety of silicates and silica-bearing minerals) and the content of crystalline silica in the exposure material.").

16. *See* Elena Fagotto & Archon Fung, *Improving Workplace Hazard Communication*, 19 ISSUES IN SCI. & TECH. 63, 64 (Winter 2002-2003), *available at* http://www.issues.org/issues/19.2/fagotto.htm (noting OSHA estimates that employees are exposed to 650,000 hazardous products in the workplace and describing problems with getting sufficient information to evaluate those exposures); GEN. ACCOUNTING OFFICE (GAO), DELAYS IN SETTING WORKPLACE STANDARDS FOR CANCER-CAUSING AND OTHER DANGEROUS SUBSTANCES 9 (1977) ("Several sources say that about 2 million chemical compounds exist today; information on toxicity may be available for 100,000; about 13,000 known toxic chemicals are commonly used; and about 500 new substances are introduced each year.").

17. The literature on the precautionary principle is vast but generally does not assess the potential perils of the principle. For notable exceptions to this, see generally INDUR M. GOKLANY, THE PRECAUTIONARY PRINCIPLE: A CRITICAL APPRAISAL OF ENVIRONMENTAL RISK ASSESSMENT (2001), which argues that the precautionary principle has too great a reach. *See also* Jonathan H. Adler, *The Cartagena Protocol and Biological Diversity: Biosafe or Biosorry?*, 12 GEO. INT'L ENVTL. L. REV. 761, 777 (2000) (arguing that technological advances are important to biodiversity protection); Frank B. Cross, *Paradoxical Perils of the Precautionary Principle*, 53 WASH. & LEE L. REV. 851, 924-25

thereby cutting off huge areas of economic activity, regulators will have to operate with a great deal of uncertainty.[18] Regulators thus need a principled approach to determining how much of a distinction to draw in characterizing the subject of a regulation.

A. Characterization

The ability to regulate rests on the regulator's ability to define what is being regulated. Not only must the regulator offer a legal definition of the regulated substance, but regulators must also create a means of characterizing the regulated substance such that it can be identified using test equipment.[19] This implies the ability to define the regulated substance scientifically. Similar problems also exist with respect to non-physical definitions: A regulator of a financial product must define the characteristics of the product (for example, distinguishing a stock from a bond).[20] Although we concentrate on scientific characterization for the purposes of workplace health and environmental regulation, our analysis applies to other forms of regulation as well.

(1996) (suggesting that in many instances countervailing risks from well-intended regulatory programs produce harms as great or greater than those the regulations are intended to prevent).

18. Uncertainty is discussed most extensively in connection with environmental issues, rather than issues connected to workplace health and safety, but the concerns are similar. For concise summaries of issues caused by scientific uncertainty, see Daniel A. Farber, *Probabilities Behaving Badly: Complexity Theory and Environmental Uncertainty*, 37 U.C. DAVIS L. REV. 145 (2003), which addresses the problems of uncertainty in environmental regulations and explores statistical power laws to alleviate the problems. *See also* J.B. Ruhl, *Thinking of Environmental Law as a Complex Adaptive System: How to Clean Up the Environment By Making a Mess of Environmental Law*, 34 HOUS. L. REV. 933 (1997) (discussing the inherently uncertain nature of the environment and different approaches to dealing with the environmental issues).

19. *Cf.* Jones et al., *supra* note 5, at 218 (explaining that, for silica dust, "'respirable' samplers are used"). According to Jones,

> These are samplers that preferentially sample that fraction of the dust that enters the alveolar region of the lung. In this country the most common means for making this measurement is to use a small battery-operated pump to first draw air through a miniature cyclone to remove the nonrespirable particles and then through a filter to capture the respirable portion.

Id.

20. *See* Olufunmilayo Arewa, *Breaking Through the Intangibles Haze: Business Paradigms and Changing Business Discourse* 8-9 (Working Paper No. 4-14, 2004), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=589205 ("With the rise of intangibles has thus come a certain level of confusion as to how existing categories, rules and regulations initially drawn up in the context of a tangible paradigm should apply under an intangibles paradigm."). The general nature of the problem can be seen by examining the attempts to define the term "hedge fund," about which one author recently commented, "[t]o oversimplify slightly, a hedge fund is like a mutual fund that has been designed to avoid four federal laws that generally require investment funds and their advisers to identify fund officers and holdings and to submit to Securities and Exchange Commission oversight." David Skeel, *Behind the Hedge*, LEGAL AFF., Nov.-Dec. 2005, at 28, 30, *available at* http://www.legalaffairs.org/issues/November-December-2005/feature_skeel_novdec05.msp.

A hypothetical example illustrates the problem. Suppose a substance, kryptonite, is suspected of having deleterious health effects on humans exposed to it. Further investigation reveals that kryptonite comes in two forms: α-kryptonite and β-kryptonite. Based on this initial investigation, it appears that only α-kryptonite causes health effects; there is no evidence that β-kryptonite is harmful. But, there is also no evidence that β-kryptonite is *not* harmful. In short, we have reason to believe that α-kryptonite is harmful, although we do not know why it is harmful; we know only that β-kryptonite is different from α-kryptonite and that the data supporting the knowledge that α-kryptonite is harmful come from studies of α-kryptonite.

A regulation of "kryptonite" which does not distinguish between α-kryptonite and β-kryptonite will either over-regulate or under-regulate the uses of kryptonite.[21] If we regulate both forms of kryptonite at the level appropriate for α-kryptonite and β-kryptonite is not harmful (or not as harmful as α-kryptonite), then we will over-regulate. That is, a regulation that does not distinguish the two forms will impose unnecessary costs on users of β-kryptonite.[22] As a result, users of β-kryptonite will reduce output (since their costs have gone up), consumers of β-kryptonite products will face higher prices, and employment will decline in β-kryptonite-using industries and in industries using products made with β-kryptonite.

If, on the other hand, the kryptonite regulation regulates both forms at a level appropriate for β-kryptonite, it will under-regulate the users of α-kryptonite. That is, the regulation will fail to impose costs, the imposition of which would yield benefits that exceed those costs. As a result, users of α-kryptonite will use too much, causing harm to employees and/or consumers of products produced with the α-kryptonite.

Finally, a uniform standard based on an average of the two forms of kryptonite will under-regulate users of α-kryptonite and over-regulate users of β-kryptonite. The challenge for regulators, therefore, is to properly define what they are regulating so that they avoid the twin dangers of over-regulation and under-regulation.

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21. If α-kryptonite is uniformly distributed in kryptonite, a regulation that does not distinguish the two forms may not over-regulate since the amount of α-kryptonite is simply a fixed percentage of the amount of the total kryptonite. So long as the regulation takes into account that the exposures should be based on the impact of the proportion that is α-kryptonite, a regulation that does not distinguish between the two forms will not over-regulate.

22. Remember, we specified that we do not know if β-kryptonite is harmful. We nonetheless call regulation of β-kryptonite over-regulation because the justification of regulation rests on the studies linking the harm to α-kryptonite.

In the hypothetical we assume that both the regulators and the rest of the community know that kryptonite comes in both α and β forms, that the α-kryptonite form is hazardous, and that there is no evidence concerning the β form. It is also possible that the distinction between the α and β forms is unknown and that discovering the distinction will require substantial investment in research. Without knowledge of *how* a substance causes harm, it is difficult to determine which types of distinctions matter. We thus may face questions not only about α-kryptonite and β-kryptonite but also about α-kryptonite and α'-kryptonite. Resolving whether there is an α'-kryptonite and whether it is the distinction between α and α' forms, α and β forms, both, or neither that matters—and doing so on the basis of ambiguous epidemiological evidence[23] and animal studies[24]—requires a substantial investment of both time and money in research.[25]

Now suppose the regulator has available only a study that shows a health impact from an unspecified form of kryptonite. The regulator proposes a kryptonite standard based on the available evidence and resolving the uncertainties caused by the necessarily incomplete evidence before it. During the comment period, an entity potentially subject to the new standard provides evidence that kryptonite exists in both α and β forms and that the studies on which the regulator relied measured only the impact of α-kryptonite. Because the regulator does not know the precise mechanism through which kryptonite causes harm, he cannot know with certainty whether the α / β distinction is relevant. Because the α / β distinction was previously unknown, the regulator also cannot draw on a scientific consensus about its relevance.

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23. *See, e.g.*, SHEILA JASANOFF, SCIENCE AT THE BAR: LAW, SCIENCE, AND TECHNOLOGY IN AMERICA 120-21 (1995) (noting the potential for methodological defects in epidemiological studies); PETER S. BARTH, WORKERS' COMPENSATION AND WORK-RELATED ILLNESSES AND DISEASES 28-29 (1980) (citing further inadequacies in epidemiological studies).

24. *See* Bernard D. Goldstein & Mary Sue Henifin, *Reference Guide on Toxicology*, *in* REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 401, 406-09 (Fed. Judicial Ctr. ed., 2d ed. 2000), *available at* http://www.fjc.gov/library/fjc_catalog.nsf (search by title for "Reference Manual on Scientific Evidence," select "Reference Manual on Scientific Evidence, Second Edition," follow "Link or download" hyperlink, then select appropriate author hyperlink) (describing the assumptions in extrapolating data from animal studies to assess human health risks); Michael D. Green et al., *Reference Guide on Epidemiology*, *in* REFERENCE MANUAL ON SCIENTIFIC EVIDENCE, *supra*, at 333, 346 (discussing the disadvantages of animal toxicity studies for assessing human health risks). For a somewhat dated evaluation of similar issues, see generally Bert P. Krages II, *Rats in the Courtroom: The Admissibility of Animal Studies in Toxic Tort Cases*, 2 J. ENVTL. L. & LITIG. 229 (1987), which provides a thorough analysis of potential reliability problems with animal studies used in toxic tort litigation.

25. The costs of animal studies, for example, are measured in the hundreds of thousands of dollars. *See* Krages II, *supra* note 24, at 234 n.25 (providing several examples of costly animal studies).

How should the regulator respond to the new knowledge that the α / β distinction exists? Should he proceed to regulate only α-kryptonite? Or does some precautionary principle shift the burden to the regulated parties to show that the α / β distinction is relevant to the harm caused by kryptonite? If so, how can he do so without understanding the harm mechanism? Should the regulation be delayed entirely? With respect to the β-kryptonite only? How should a court treat evidence in a tort suit seeking to impose liability based on kryptonite exposure when such a distinction is demonstrated?

At some level, the burden must rest on the regulator—a showing of harm from exposure to benzene, for example, does not justify imposing regulations on cotton dust because benzene and cotton dust are easily distinguishable. But just as obviously, a showing of harm from one substance may justify regulatory action with respect to a close analogue in the absence of evidence that the distinctions between the two are relevant.[26]

We do not require individual regulations for each firm to be based on the precise chemical, physical, mineralogical, or other form of composition of its raw materials. We do require different regulations for substances that are different at a fairly crude level, even closer than the distinction between benzene and cotton dust. The questions, therefore, are where regulators are to draw the line initially and what sort of evidence from the regulated justifies shifting the line during the rulemaking process.

B. Silica Categorization and Health Effects

While silica is defined broadly, silica-related diseases are currently associated only with free crystalline silica.[27] Distinguishing between crystalline and noncrystalline silica is merely the beginning of our knowledge of potential distinctions, however. For example, the Mineralogical Society of America classifies crystalline silica into 17 forms.[28] Research on health effects focus on only four principal forms,[29] but the wider set of Mineralogical Society classifications suggests that these categories may not capture the impact of all of the potentially relevant distinctions among the types. Changes in scientific knowledge

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26. This principle can also be observed in the regulation of drugs. *See* Natalie M. Derzko, *The Impact of Recent Reforms of the Hatch-Waxman Scheme on Orange Book Strategic Behavior and Pharmaceutical Innovation*, 45 IDEA 165, 216-17 (2005) (discussing the issue of sameness in FDA regulations).

27. *See* IAPA, WORKPLACE, *supra* note 11, at 2 (describing the problem as existing only with free silica).

28. *See* Gilbert Hart, *The Nomenclature of Silica*, 12 AM. MINERALOGIST 383, 383-95 (1927), *available at* http://www.minsocam.org/MSA/collectors_corner/arc/silicanom.htm (illustrating the various classifications of silica).

29. *See* IARC, *Silica*, *supra* note 4, at 41 (identifying the dangerous, crystalline forms of silica as Cristobalite, Quartz, Tripoli, and Tridymite).

have already led to new theories about how silica causes health effects.[30] Future changes may lead to further development of knowledge. In its 2002 review, the National Institute of Occupational Safety and Health (NIOSH) recommended further research to reduce uncertainty regarding "mechanisms and the influence of particle characteristics on development of disease."[31]

Moreover, whether an individual exposed to silica dust develops silicosis depends on a range of individual factors including personal characteristics unrelated to the exposure, such as whether the individual smokes.[32] The American Thoracic Society, for example, found evidence suggesting that exposure to crystalline silica "'produces increased risk for bronchogenic carcinoma,'" but "'noted that less information was available for lung cancer risks among silicotics who had never smoked and for silica-exposed workers who did not have silicosis.'"[33] And not all dust containing free crystalline silica, currently thought to be the most dangerous, is harmful. Filtration by the nose, throat, and upper airways remove larger particles before they reach the innermost depths of the respiratory tract (alveoli or air sacs) where silicosis damage occurs.[34] The size of dust particles is thus important to determining hazard levels as well. This short summary is intended to make the point that our understanding of how silica affects human health is incomplete. Clearly we face a danger of over-regulation because we do not know whether particular forms of silica are harmful, even if we are certain that some particular form is harmful.

Most recently, studies have suggested that there may be a crucial difference between freshly fractured crystalline silica and silica with older fractures. Fractured silica that has aged for weeks to months poses fewer

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30. *See, e.g.*, R. K. Iler, *The Surface Chemistry of Amorphous Synthetic Silica—Interaction with Organic Molecules in an Aqueous Medium*, *in* HEALTH EFFECTS OF SYNTHETIC SILICA PARTICULATES 3, 3 (D.D. Dunnom ed., 1981). According to Iler,

> For many years it was supposed that the [health] effects were due to soluble silica dissolved from the fine particles by body fluids, but now it is generally conceded that they are due to the surface of crystalline quartz particles that adsorbs and interacts with certain molecular compounds of the living cells.

Id.

31. NAT'L INST. OF OCCUPATIONAL SAFETY & HEALTH (NIOSH), U.S. DEP'T OF HEALTH & HUMAN SERVS., HEALTH EFFECTS OF OCCUPATIONAL EXPOSURE TO RESPIRABLE CRYSTALLINE SILICA, at vii (2002) [hereinafter NIOSH HAZARD REVIEW].

32. *See* IAPA, WORKPLACE, *supra* note 11, at 6 (listing the relevant individual factors, including "amount and kind of dust inhaled, content of crystalline free silica in the dust, form of the silica, relative size of the inhaled particles, length of exposure, individual resistance, smoking habits, disease status, [and] age of worker").

33. NIOSH HAZARD REVIEW, *supra* note 31, at v-vi (quoting American Thoracic Society findings).

34. *See* IAPA, WORKPLACE, *supra* note 11, at 4 (emphasizing the efficiency of the human body's filtration system).

health risks than freshly fractured silica.[35] The Sorptive Minerals Institute (SMI), which represents the absorptive clay industry, is studying the differences in health risk between exposure to freshly fractured, aged silica and the "geologically ancient" clays (fractured over eons through natural geological processes) used in that industry.[36] The initial results of its experiments suggest that the characteristics of artificially fractured quartz (pulverized, ground, blasted, or otherwise fractured by man) make it a greater health threat than respirable quartz generated through natural geological processes.

We also face the danger of under-regulation. Prolonged exposure to free crystalline silica is associated with scarring of the lungs (silicosis). Silicosis is a progressive, incurable disease that impairs respiratory function.[37] It takes years to develop, seldom exhibiting symptoms in under five years.[38] Not controlling exposure to harmful forms of silica thus risks irreparable damage to exposed individuals' lungs. As described below, the regulatory history of silica includes frequent, incorrect assertions that the problems of silica exposure had been solved by regulatory measures that subsequent knowledge revealed to be less effective than promised. In the early 1990s, 200 to 300 silicosis deaths per year were reported.[39] Further, research has recently associated chronic exposure to high levels of certain forms of free crystalline silica with lung cancer. Delay in addressing silica exposure thus also has its costs, and there is now reason to believe that those costs are larger than previously thought.

The problem of categorization is central to regulatory action concerning silica. The IARC analysis of silica dust, for example, noted that "carcinogenicity in humans was not detected in all industrial circumstances studied. Carcinogenicity may be dependent on inherent characteristics of

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35. *See* Email from Vincent Castranova, Ph.D., NIOSH, to Andrew Morriss, Professor of Business Law & Regulation, Case School of Law (Aug. 3, 2005) (on file with authors) ("Freshly fractured silica has a greater ability to generate radicals, activate reactive species production from alveolar macrophages, cause in vitro toxicity, and is more inflammatory in vivo."). Dr. Castranova cited the following studies to support his conclusion: Vincent Castranova et al., *Enhanced Pulmonary Response to the Inhalation of Freshly Fractured Silica as Compared to Aged Dust Exposure*, 11 APPLIED OCCUPATIONAL & ENVTL. HYGIENE 937 (1996); Vincent Castranova et al., *Role of Surface Free in the Pathogenicity of Silicosis*, *in* SILICA AND SILICA-INDUCED LUNG DISEASES 91 (Vincent Castranova, Val Vallyathan & William E. Wallace eds., 1996); Val Vallyathan et al., *Freshly Fractured Quartz Inhalation Leads to Enhanced Lung Injury and Inflammation*, 152 AM. J. CRITICAL CARE MED. 1003 (1995); Vincent Castranova, *Generation of Oxygen Radicals and Mechanisms of Injury Prevention*, 102 ENVTL. HEALTH PERSPECTIVES 65 (Supp. 10 1994); Val Vallyathan et al., *Generation of Free Radicals From Freshly Fractured Silica Dust: Potential Role in Acute Silica-induced Lung Injury*, 138 AM. REV. RESPIRATORY DISEASE 1213 (1988).

36. This statement is based on discussions between the authors and members of the Sorptive Minerals Institute (SMI) at the May 2005 SMI Spring Forum.

37. *See supra* note 5 and accompanying text.

38. IAPA, WORKPLACE, *supra* note 11, at 6.

39. NIOSH HAZARD REVIEW, *supra* note 31, at 1.

the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs."[40] Determining which forms of silica pose a human health threat, and so are candidates for regulatory action, is thus key.

In sum, we know that silica can be classified in multiple ways. These classifications may or may not have a relationship to the health effects observed in epidemiological studies of silica exposure and other research on silica's health effects. We do not know, for example, exactly what form of silica medical researchers included in some early studies because distinctions now recognized were unknown or thought to be unimportant at the time the studies were conducted. Yet these distinctions are potentially as important as the distinction between silica dust and dust that does not contain silica. OSHA regulates (and is considering tightening regulations on) silica based on a recognition that silica dust is different from other dusts. If it turns out that only freshly fractured crystalline silica dust is hazardous, failing to draw that distinction will have unnecessarily imposed substantial costs on industries using other forms of silica. We are thus in the position of the regulator considering α-kryptonite, α'-kryptonite, and β-kryptonite: We have multiple distinctions, but we do not know if they are relevant. As our ability to draw distinctions based on chemical, mineralogical, and other bases grows, it increasingly exceeds our ability to understand the relevance of the distinctions we can draw.

We have thus established the fairly obvious fact that regulators must draw lines. What may be less obvious is that the ability to draw these distinctions is endogenous. That is, the characterization of the regulated substance (and other distinctions) depends on the investment by the regulator, the regulated, and other interest groups in creating and using knowledge about the subject of the regulation. Different participants have different incentives to invest in building and using such knowledge. We discuss these incentives in the next Section.

C. Incentives for Developing Knowledge

If we had complete knowledge about a workplace hazard, its risks, and its remedies, we might be able to design a comprehensive regulation that perfectly aligned protective measures and hazards, striking just the right balance between the cost and benefit of mitigation. Of course, we do not have such information about workplace hazards any more than we have it about anything else.[41] Examining attempts to implement regulatory

40. IARC, *Silica*, *supra* note 4, at 41.

41. There is generally considerable uncertainty about occupational disease. *See, e.g.*, BARTH, *supra* note 23, at 15-27 (recounting problems obtaining reliable data on occupational health and deaths).

solutions in economic policy, Nobel Prize-winning economist Friedrich A. von Hayek coined the term "the knowledge problem" to explain why centralized regulatory solutions are inferior to decentralized market processes.[42] Hayek's central point was that decentralized markets focus dispersed information—information that no one individual (not even a regulator) can obtain—and convey it efficiently to market participants.

1. Market Incentives and Market Failures

To understand Hayek's point, consider the financial incentives an unregulated workplace provides for protecting health and safety. First, employees have obvious incentives to protect their own health—faced with two otherwise equal jobs with different risks, employees will prefer the less risky job. Thus, informed employees will demand safeguards for health and safety.

Second, even wholly self-interested employers have incentives to provide safe and healthy work environments to ensure a productive workforce.[43] Employers often have significant investments in their employees' firm-specific human capital.[44] Safeguarding that investment requires reducing turnover.[45] Moreover, employees in more risky jobs can command higher wages than employees with equivalent skills in less risky environments, which provides financial incentives for employers to protect the health and safety of employees, even in the absence of government requirements.[46] Indeed, even critics of market forces concede that market responses sometimes occur before regulatory action.[47] For example,

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42. *See generally* Friedrich A. von Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519 (1945) (discussing problems with economic theory and the refinements needed to resolve those problems); Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1337 (1984-85) ("Such [regulatory] determinations impose massive information-gathering burdens on administrators . . . .").

43. Of course, employers may also have moral reasons to wish to provide a safe work environment. Curiously, those who readily attribute benevolence to governments and recoil from public choice theory's assumption that self-interest guides politicians and bureaucrats rarely concede even an enlightened version of self-interest to those involved in private enterprise.

44. *See generally* GARY S. BECKER, HUMAN CAPITAL: A THEORETICAL AND EMPIRICAL ANALYSIS WITH SPECIAL REFERENCE TO EDUCATION 15-44 (2d ed. 1975) (providing an overview of investment in human capital's potential effects on employer earnings).

45. Professor Christopher Sellers, no apologist for corporate America, noted that corporate interest in industrial medicine soared during labor shortages after World War I as a means of reducing turnover. CHRISTOPHER C. SELLERS, HAZARDS OF THE JOB: FROM INDUSTRIAL DISEASE TO ENVIRONMENTAL HEALTH SCIENCE 145 (1997).

46. *See* ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 117-18 (R.H. Campbell & A.S. Skinner eds., Oxford Univ. Press 1976) (1776) (offering a wage comparison of occupations with various levels of risk). *See generally* Joni Hersch & W. Kip Viscusi, *Cigarette Smoking, Seatbelt Use, and Differences in Wage-Risk Trade-offs*, 25 J. HUM. RES. 202 (1990) (using Smith's doctrine to study wage-risk assessments made by smokers and non-smokers as well as seatbelt users and non-users).

47. *See, e.g.*, Christopher C. Sellers, *"A Prejudice Which May Cloud the Mentality:" An Overview of the Birth of the Modern Science of Occupational Disease*, *in* TOXIC

systematic medical exams of employees, an important tool in uncovering workplace diseases, were part of "paternalistic programs to care for the workers' broader needs, often to wean them away from trade unions."[48]

The market failure analysis of workplace health and safety stresses obstacles to these incentives' operation. For example, some argue that because employees are ignorant of the true nature of the risks they face, they fail to demand sufficient safety.[49] Similarly, others contend that employers are able to impose one-sided bargains on employees and are able to force them to accept dangerous jobs when employees would prefer safer working conditions.[50] As a result of these market failures, critics argue, an unregulated work environment would be hazardous to employees' health and safety. Because employers could impose contracts including dangerous working conditions without fully compensating employees for the additional risk, employers would choose not to invest in safety, thereby shifting the cost to employees.

2. Incentives for Categorization and Knowledge

With respect to the problem of categorization, we can use our kryptonite example to illustrate how the incentives operate. Suppose we begin with the problem of kryptonite exposure generally, without regard to the various forms of kryptonite. Employers will have an incentive to invest in discovering whether there are relevant distinctions among forms of kryptonite (α, α', and β) because the discovery of a relevant distinction can reduce the risk premium they must pay to employees. Note that this benefit

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CIRCLES: ENVIRONMENTAL HAZARDS FROM THE WORKPLACE INTO THE COMMUNITY 233, 235 (Helen E. Sheehan & Richard P. Wedeen eds., 1993) ("[M]ining and railroad companies recognized particular health hazards associated with their industries many years before the turn of the [twentieth] century and began hiring their own physicians to treat employees.") (citation omitted).

48. *Id.* at 237-38. Unions often resisted physical exams. SELLERS, *supra* note 45, at 119. Protests over exams were "pronounced" by 1915, and then-President of the American Federation of Labor, Samuel Gompers, denounced them as a "menace for the freedom of workers." *Id.*

49. *See, e.g.*, BARTH, *supra* note 23, at 53 (quoting workers in Anaconda, Montana who, when informed of the risk of arsenic poisoning from copper smelter work, continued to work there because of the philosophy that "what bothers me is not what happens twenty years from now, but how I feed my kids tomorrow"); JOHN FABIAN WITT, THE ACCIDENTAL REPUBLIC: CRIPPLED WORKINGMEN, DESTITUTE WIDOWS, AND THE REMAKING OF AMERICAN LAW 32 (2004) (asserting that "an important obstacle to workplace safety [in the early twentieth century] was the persistent and usually irrational optimism that workingmen seemed to bring to estimations of the risks they faced").

50. *See, e.g.*, THOMAS O. MCGARITY & SIDNEY A. SHAPIRO, WORKERS AT RISK: THE FAILED PROMISE OF THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION 17 (1993) (describing how in light of employees' attempts to improve their working conditions "the history of occupational safety and health regulation is as much a story about workers seeking government help in adjusting the balance of power in the employer-employee relationship as it is a chronology of scientific discoveries concerning the cause and prevention of workplace injuries and diseases").

of increased knowledge to employers is dependent upon convincing employees that the distinction is relevant. Employers must persuade the employees to accept a lower risk premium for working with the less harmful form of kryptonite. Employers will have to make investment decisions under considerable uncertainty (since they do not even know if there are multiple forms of kryptonite, let alone whether the harm caused by the different forms, that may or may not exist, is different). The key is that the incentive exists to produce knowledge, even if the incentive is not to produce perfect knowledge.

However, market failures affect incentives to invest in categorization. If employees misperceive the risks of kryptonite generally, and so fail to demand an appropriate risk premium, or are unable to bargain for risk premiums at all, employers will have no incentive to invest in knowledge about kryptonite's potential forms. Moreover, if employees misperceive risks because they are incapable of understanding scientific evidence,[51] they will be unlikely to accurately assess the evidence produced by employers. Employers may then invest in inaccurate evidence to mislead employees about the risks of kryptonite. If the market failures dominate the unregulated market, the incentives for investing in knowledge will be diluted or destroyed, and a perverse incentive to create junk science may exist.

The choice in addressing health and safety issues is not, of course, between OSHA and the completely unregulated marketplace. We must therefore also consider the impact of intermediate regulatory measures on workplace health and safety. Since the early twentieth century, workers' compensation and other forms of insurance financed through premiums paid by employers have provided incentives for workplace health and safety.[52] Insurance gives employers incentives to promote safety because employers with poor safety records face higher workers' compensation insurance premiums.[53] These incentives appear to have had an impact on the workplace: The doubling of workers' compensation premiums between

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51. *See, e.g.*, Mine Safety and Health Administration, Final Hazard Communication (HazCom) Rule, 67 Fed. Reg. 42,314 (June 21, 2002) (premising hazard communication standards on a concern that, in the absence of regulation, "many operators and miners are not as aware of the presence and nature of hazardous chemicals as they should be").

52. *See* W. KIP VISCUSI ET AL., ECONOMICS OF REGULATION AND ANTITRUST 794 (3d ed. 2001) (recounting briefly a recent history of those incentives); *see also* SELLERS, *supra* note 45, at 114 ("The compensation systems not only helped spur the new round of corporate medical hiring, they also attuned many more managers and owners to what some of their number had already realized: that corporate doctors, if properly employed, could have a measurable effect on the bottom line.").

53. *See* VISCUSI ET AL., *supra* note 52, at 794 (discussing the powerful effect of the incentives on industry safety); BARTH, *supra* note 23, at 61 (noting that there is widespread agreement that a key aim of workers' compensation is to encourage "the maintenance of a safe and healthful workplace").

1984 ($15 billion per year) and 1991 ($31 billion), for example, led to significant improvements in worker safety. By the late 1990s, workers' compensation premiums had fallen to $26 billion.[54] Research suggests that, if not for workers' compensation, occupational fatalities would be one third higher than they are.[55] Workers' compensation insurance thus has had a demonstrable impact on workplace health and safety.

With respect to the incentives to understand health impacts of potentially hazardous substances in the workplace, workers' compensation insurance creates incentives for research by adding a repeat player concerned with lowering costs. Insurance companies profit from the difference between the claims they pay and the premiums they collect.[56] Workers' compensation insurers compete among themselves for employer business by offering lower premiums.[57] If an insurer can discover a basis for distinguishing among high- and low-risk employers (for example, the α / β kryptonite distinction), it can offer low-risk employers lower premiums and win market share. Moreover, employers who can demonstrate that their workplaces are less hazardous than the workplaces of other firms by showing a distinction in exposures will be able to negotiate lower premiums. Thus, both insurers and employers have incentives to seek to increase knowledge about the appropriate categorization of workplace hazards. A complete picture of the incentives to build knowledge of workplace hazards must include the incentives of repeat players such as insurance companies.

3. Government Failures and the Role of Interest Groups

Market failure theory proponents sometimes view documenting, or perhaps even simply asserting, the existence of one or both of the effects described above (employees' inadequate understanding of potential risks and inadequate bargaining strength compared to employers) as sufficient justification for state intervention. A crucial insight of public choice theory, however, is that we must consider the possibility that state interventions will make things worse. In other words, there may be a "government failure" as well as a market failure, and the means of properly

54. VISCUSI ET AL., *supra* note 52, at 794.

55. *Id.* The evidence on the impact of workers' compensation on injuries is weaker and influenced by "moral hazard" because insurance provides incentives to report, or even misrepresent, accidents in order to collect insurance benefits. *Id.*

56. *See* Kenneth S. Abraham, *Products Liability Law and Insurance Profitability*, 19 J. LEG. STUD. 837, 838 (1990) (discussing the significance of loss ratios to insurance profits).

57. This competition exists in all states except North Dakota, Ohio, Washington, West Virginia, and Wyoming, where the state operates a monopoly insurer. ALLISON DEMERITT, WASHINGTON POLICY CENTER, REFORMING WASHINGTON'S WORKERS' COMPENSATION SYSTEM (2004), *available at* http://www.washingtonpolicy.org/laborpolicy/PBDemerittLaborReformingWorkersCompensation2004.htm.

judging the relative worth of alternative institutions is to compare the strengths and weaknesses of both rather than the strengths of state action with the weaknesses of market processes.[58] Understanding the complete set of institutional strengths and weaknesses requires that we consider the incentives created by both.

Moreover, we must consider the form of the intervention required to compensate for any market failures. If the problem is a lack of information among employees about the magnitude of risks, for example, providing them with the information is one means of correcting the market failure; directly specifying the risk reduction measures employers must take is another. These two solutions have different incentive effects, and the costs and benefits of each should be considered in contemplating the form of intervention.

Given the other incentives employers and employees have to protect worker health and safety, what role should federal regulation have? Traditional welfare economics argues that the existence of market failures requires government intervention.[59] It suggests that politicians seeking to serve the public interest will regulate to correct those "market failures," in which case we would see regulations enacted to serve the public interest by addressing perceived or real market failures.[60] This does not appear to be uniformly the case, however, suggesting that a richer theory of regulation is needed.[61] Many regulations do not correspond to market failures. Economic regulations, the predominate type of regulation through the 1960s, were not well correlated with identifiable market failures, and indeed, they often seemed to serve private, not public, interests.[62] In the case of OSHA regulation, empirical analysis has not found strong evidence that OSHA regulations have had a substantial impact on worker health and safety,[63] suggesting that alternative explanations are necessary.

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58. *See generally* NEIL K. KOMESAR, IMPERFECT ALTERNATIVES: CHOOSING INSTITUTIONS IN LAW, ECONOMICS AND PUBLIC POLICY 21 (1997) (positing that the "question is not whether market performance improves or deteriorates with larger number of parties, but rather whether the market works better or worse than the courts").

59. *See generally* ARTHUR C. PIGOU, THE ECONOMICS OF WELFARE (4th ed. 1932).

60. VISCUSI ET AL., *supra* note 52, at 314-17 (suggesting the theory that government interference to correct market failures may be in the public's best interest).

61. Richard A. Posner, *Theories of Economic Regulation*, 5 BELL J. ECON. & MGMT. SCI. 335 (1974).

62. *See* VISCUSI ET AL., *supra* note 52, at 313-17 (explaining that industry often profits rather than general social welfare). *See generally* William A. Jordan, *Producer Protection, Prior Market Structure and the Effects of Government Regulation*, 15 J.L. & ECON. 151 (1972) (analyzing empirical studies showing that economic regulation was more likely to increase costs to the consumer than to protect the consumer).

63. *See* VISCUSI ET AL., *supra* note 52, at 789-90 (discussing empirical evidence that the declining trend in job-related accidents did not accelerate after the creation of OSHA and noting the implication that the "injury decline may have occurred in the absence of the agency"). There is evidence of at least a difference in emphasis in enforcing regulations. Professor Alison Morantz found that federal enforcement actions on construction safety

The understanding of regulation improved with the insights of George Stigler and James Buchanan, two Nobel Prize-winning economists. The works of Stigler and Buchanan developed insights for predicting when policymakers would promulgate regulations and the form they would be likely to take. In particular, Stigler's 1971 article, *The Theory of Economic Regulation*, helped raise awareness of the incentives created by regulations and wealth-redistribution consequences of economic regulation. Stigler started with the premises that (1) the basic resource of the government is the power to coerce, (2) an interest group that can convince the government to use its coercive power to its benefit can improve its well-being at the expense of others, and (3) agents (firms, individuals, government officials, interest groups) are rational and try to maximize their own utility (well-being).[64]

With this foundation, Stigler set forth the hypothesis that regulation is supplied in response to the demands of interest groups acting to maximize their own well-being (income).[65] He observed that the behavior of legislators is driven by their desire to stay in office (maximize political support). Regulation is one way to redistribute wealth, and interest groups compete for that wealth redistribution by offering political support in exchange for favorable legislation.

The implication of Stigler's theory is that regulation is likely to be biased toward benefiting interest groups that are better organized and have more to gain from the wealth redistribution. Regulation is thus likely to benefit smaller, better-organized interest groups with strongly felt preferences at the expense of larger interest groups with weakly felt preferences.

Buchanan's work (together with Gordon Tullock) contributed to this richer understanding of regulation through the creation of public choice theory.[66] Public choice economics begins with the recognition that (1) individuals in government (politicians, regulators, voters, etc.), just as individuals in other circumstances, are driven by self interest and (2) these individuals are not omniscient.[67] Public choice theory argues that government officials cannot simply systematically maximize the public

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regulations were significantly more aggressive than state enforcement actions in the level of fines imposed and in impact on firms' behavior. Alison D. Morantz, *Has Regulatory Devolution Injured American Workers? A Comparison of State and Federal Enforcement of Construction Safety Regulations* (Stanford Law and Economics, Working Paper No. 308, 2005), *available at* http://ssrn.com/abstract=755026.

64. *See* George Stigler, *The Theory of Economic Regulation*, 2 BELL J. ECON. & MGMT. SCI. 3, 4-7 (1971) (considering the various benefits that a state can provide an industry).

65. *See id.* (emphasizing the interest groups' intent to use the regulation to restrict entry into their market).

66. *See generally* JAMES M. BUCHANAN & GORDON TULLOCK, THE CALCULUS OF CONSENT (1962) (setting out the basics of the theory).

67. GORDON TULLOCK ET AL., GOVERNMENT FAILURE: A PRIMER IN PUBLIC CHOICE 16 (2002).

interest. For example, to produce favorable outcomes, even a benevolent politician must be in office. To gain and retain office, the politician must obtain campaign funds and votes; getting both requires cooperating with interest groups seeking to maximize their own welfare. Thus, public choice economics reach conclusions similar to those drawn from Stigler's economic theory of regulation. Public choice also recognizes that, because policymakers are not omniscient regarding the consequences of different policy choices, their interventions, even when designed to correct market failures, may produce "government failures."[68]

The insights of public choice theory and the economic theory of regulation shed new light on when we are likely to observe regulation and the forms it will take. Crucially, they tell us that we need not rely on bad actors in government to explain sub-optimal outcomes. Good people, with pure motives, will also produce special interest regulations due to the structure of the political system. Thus, small, organized interest groups can exercise the political will to gain specialized benefits while spreading costs to large unorganized citizens. To study regulation, therefore, we must understand the interest groups that have a stake in regulatory actions and the political players involved.[69]

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68. Nicholas Bagley and NYU Law School Dean Richard Revesz take issue with both Stigler's capture theory and public choice theory in a recent paper, arguing instead that the regulatory process is biased *against* regulatory action by interest group pressures. *See* Nicholas Bagley & Richard L. Revesz, *OMB and the Centralized Review of Regulation* (NYU Law and Economics Research, Working Paper No. 05-16, 2005), *available at* http://ssrn.com/abstract=786486. Bagley and Revesz contend that the impact of OMB review is to make agencies choose to regulate in ways to avoid conflict with OMB. *Id.* While we disagree with their analysis of the regulatory incentive structure, their arguments are compatible with ours in some respects. Most importantly, even under Bagley and Revesz's analysis, it will be important to define the subject of regulation, and agency decisions on that point will be subject to political pressures.

69. *See generally* MCGARITY & SHAPIRO, *supra* note 50 (providing an example of this lack of consideration of interest groups in a thorough account of OSHA's development through 1990). Although Professors McGarity and Shapiro are keenly attuned to the interests of businesses seeking particular actions from OSHA, they generally do not consider any motivation beyond disinterested concern for the best interests of the public for nonprofit actors. Thus, for example, in their account of OSHA's regulation of ethylene oxide, they accept at face value the participation of the Nader organization, Public Citizen Health Research Group. *See id.* at 83-87 (mentioning briefly the organization's petition but moving quickly to the promulgation of the ethylene oxide rule). Yet the Public Citizen Health Research Group had interests beyond seeking to implement its vision of the public good. For example, the group needed to be able to raise money to support its activities. Similarly, McGarity and Shapiro accept the claims of OSHA employees who resigned during the Reagan Administration that they resigned because political interference from the Administration was keeping the agency from sound science. *Id.* at 92-93. An alternative hypothesis is that these OSHA employees disagreed with the changes in policy instituted by the Reagan Administration and sought to use their departures to embarrass the Administration. For a thorough discussion of the roles of "public interest" groups in various environmental regulations, see Jonathan H. Adler, *Rent Seeking Behind the Green Curtain*, 19 REGULATION 26 (1996), *available at* http://www.cato.org/pubs/regulation/reg19n4b.html. *See generally* Jonathan H. Adler, *Clean Politics, Dirty Profits*, *in* POLITICAL ENVIRONMENTALISM: GOING BEHIND THE GREEN CURTAIN 1 (Terry L. Anderson ed., 2000).

II. AN INTEREST GROUP-BASED ACCOUNT OF SILICA REGULATION

In Section I, we argued that significant problems must be resolved for the design of effective regulatory measures. In this Section, we turn to the regulatory history of silica dust because understanding regulatory outcomes depends on the examination of the roles interest groups and incentives play in shaping regulatory policy.

A. The Early Awareness of the Health Risks of Silica

Silica is everywhere—it is the second most common mineral in the earth's crust.[70] Silica dust is a highly visible air contaminant, unlike many other workplace hazards like gases that are potentially carcinogenic at low concentrations and difficult to identify in the workplace. Dust, after all, is generally visible to the naked eye even if the specific particles that are most hazardous are not. Discussions of silica and silicosis often begin with a quote from *De Re Metallica,* a sixteenth-century treatise on mining, by the German scholar, doctor, and founder of modern geology Georg Bauer (also known as Georgius Agricola), or another source of similar historic vintage to make the point that the hazards are well-known.[71] Such accounts are at least partially correct. By as early as the end of the nineteenth century, occupational health writers had clearly established a relationship between

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70. PRIMER, *supra* note 9, at 4. The most common form of silica (SiO_2) in nature is quartz. *Id.* at 2-3.

71. For a brief account of Bauer's life, see Georgius Agricola (1494-1555), http://www.ucmp.berkeley.edu/history/agricola.html (last visited Mar. 29, 2006). Bauer noted, "The critics say further that mining is a perilous occupation to pursue, because the miners are sometimes killed by the pestilential air which they breathe; sometimes their lungs rot away." Daniel E. Banks, *The World-Wide Problem of Occupational Lung Disease, in* OCCUPATIONAL LUNG DISEASE, *supra* note 5, at 3 (quoting Bauer); *see also* Marvin R. Balaan & Daniel E. Banks, *Silicosis, in* ENVIRONMENTAL & OCCUPATIONAL MEDICINE 435, 435 (William N. Rom ed., 3d ed. 1998) ("[Silicosis is a] man-made disease, it is probably as old as human history and was known to the ancient Egyptians and Greeks . . . . Although the prevalence of silicosis apparently peaked in the late 19th and early 20th century when mechanized industry was just beginning . . . ."); Frederick L. Hoffman, *The Mortality from Consumption in Dusty Trades, in* FROM CONSUMPTION TO TUBERCULOSIS: A DOCUMENTARY HISTORY 524, 524 (Barbara Gutmann Rosenkrantz ed., 1994) ("The importance of dust as a factor in occupation mortality has attracted the attention of every authority on occupation diseases from Ramazzini to Thomas Oliver."); Balaan & Banks, *supra*, at 435 (noting that Hippocrates reported on miners suffering from silicosis); GEORGE ROSEN, THE HISTORY OF MINERS' DISEASES: A MEDICAL AND SOCIAL INTERPRETATION 3 (1943) ("The earliest evidences of occupational diseases in miners reach far back into prehistoric times."); Absher, *supra* note 13, at 661 ("Silicosis is a disease of ancient origin."); Stark, *supra* note 5, at 1147 ("Silicosis is a chronic fibrosing disease of the lungs produced by prolonged extensive exposure to free crystalline silica. It was first described in the sixteenth century."); MARTIN CHERNIACK, THE HAWK'S NEST INCIDENT: AMERICA'S WORST INDUSTRIAL DISASTER 37 (1986) ("The patriarchs of occupational medicine, Agricola in the sixteenth century and Ramazzini in the eighteenth, associated the disease [silicosis] with the dusts created in tool manufacture, as well as in mines and quarries.").

dusts, including silica dusts, and health.[72] Thus, the hazards of silicosis are not a new discovery, even though the complexities of its cause and effect are still being explored today.[73]

A conclusion one might draw from these venerable sources is that the market has clearly failed with respect to dust exposures. How, after all, could hundreds of years of exposure to dangerous dusts occur unless there was a market failure? The answer lies with the evolving nature of scientific knowledge and the nature of dust-induced health problems. Despite widespread general knowledge that dust exposure posed risks, in fact little specific knowledge existed as to the types of risks with which we are concerned today. Nineteenth-century and earlier observers could see dust in the air in mines and other workplaces and observe that some of the employees working in those locations became sick. They had little accurate knowledge about why the employees became ill, why some did and some did not, and how the dust they observed was connected to the illness. Conditions in these workplaces were generally quite different from those that prevail today. Exposures in pre-industrial economies, for example, tended to be limited to a few high-risk occupations (for example, mining). Even in those occupations, the technology used in pre-Industrial Revolution mining differed from modern methods, and it produced different types and volumes of dust. We remember the successful identification of the association between dust and silicosis, forgetting the many similar theories that have since been proven wrong (for example, the connection between "miasmas" and disease).[74] We cannot conclude from Agricola's writings that the public widely understood that the conditions he observed caused disease. Nor can we conclude that the absence of action to control the dust hazard until the twentieth century represents indifference to the health and welfare of the employees by either the employees themselves or their employers.

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72. *See* Stark, *supra* note 5, at 1147 (noting that "[t]he specific name silicosis was introduced in 1870 by Visconti" and thus demonstrating that knowledge of the problem of silica dusts has existed for over 125 years). General knowledge of dusts as a source of occupational disease was also prevalent. For example, a 1902 address on "the Dust Problem" to a Sanitary Congress in Manchester, England by Sir James Crichton-Browne included the statement that "'[t]he mortality of the principal dust-producing occupations, compared with that of agriculturalists, who live and work in what is practically dustless atmosphere, is excessive to a startling degree.'" Hoffman, *supra* note 71, at 525 (quoting Sir Crichton-Browne's address). Similarly, an 1879 article in "Buck's Hygiene and Public Health" by Dr. Roger S. Tracy considered dust issues at length, including noting problems of chronic and progressive disease. *See id.* at 527-28 (quoting the article and noting its detailed discussion of the symptoms of the disease).

73. *See* Graham, *supra* note 5, at 191 (implying that silicosis was a well-documented problem in the 1700s, although the term "silicosis" only dates to 1870).

74. *See* Elizabeth B. Cooper, *Social Risk and the Transformation of Public Health Law: Lessons from the Plague Years*, 86 IOWA L. REV. 869, 881-83 (2001) (discussing changes in theories as to the cause of disease).

B. From the Industrial Revolution to the New Deal

Although miners and some other occupations had experienced dust exposures for centuries, the development of power tools and other new technologies as a result of the industrial revolution dramatically changed the scope and type of dust exposure for employees in a wide range of industries.

1. Industrialization's Impacts

Industrialization in the United States brought a sharp increase in accidental deaths and injuries.[75] Throughout the late nineteenth and early twentieth centuries, Americans grappled with a number of responses to the problem. Not surprisingly, given the toll from accidents, the problem of workplace disease was not the first priority.[76] The initial response to the increased accident rate was an "outpouring" of new tort litigation despite the restrictive tort doctrines that made suits difficult for plaintiffs to win—between 1870 and 1910, tort cases in New York City had grown from 4.2% to 40.9% of the trial court caseload.[77] Complaints concerning the plaintiffs' bar used alarmist terms: "'barratrous speculations,'" "'communistic tendencies,'" and "'enormous verdicts'" all contributed to the denigration of "'manly and professional dignity'" at the bar.[78]

Dust may not have been at the top of the social agenda, but it too was affected by industrialization. As a result of technological change, the scope of the dust problem grew dramatically with the Industrial Revolution.[79] Exposure to silica dust increased sharply in the early years of the twentieth century after the invention of the pneumatic hammer drill in 1897 and sand blasting in 1904.[80] The new technologies meant that more dust was made up of smaller particles.[81] Although no systematic measurements existed,

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75. WITT, *supra* note 49, at 22 ("By virtually all accounts—contemporary accounts as well as those of historians writing a century later—the United States witnessed an industrial-accident crisis of world-historical importance.").

76. *Id.* at 37 ("[A]round the turn of the twentieth century, the industrial accident emerged in the United States as among the most visible of social ills.").

77. *Id.* at 59.

78. *See id.* at 62 (quoting *Slap at Roosevelt in Barnes Reply*, N.Y. TIMES, Oct. 6, 1913, at 5).

79. DAVID ROSNER & GERALD MARKOWITZ, DEADLY DUST: SILICOSIS AND THE POLITICS OF OCCUPATIONAL DISEASE IN TWENTIETH-CENTURY AMERICA 38 (1991) ("In the first two decades of the twentieth century, steam-driven equipment replaced hand drills and sledgehammers in granite quarries throughout the nation."); *see also id.* at 41 (describing the higher risk from power tools because of the greater amounts of dust they create).

80. PRIMER, *supra* note 9, at 12; *see also* ALAN DERICKSON, WORKERS' HEALTH, WORKERS' DEMOCRACY: THE WESTERN MINERS' STRUGGLE, 1891-1925, at 40 (1988) (describing the spread of power tools in mining and the resulting increase in silicosis).

81. *See* DERICKSON, *supra* note 80, at 41 (explaining that enhanced drilling techniques resulted in greater amounts of dust particles that were smaller in size and therefore better capable of penetrating the alveoli of the lungs).

federal studies conducted by the Bureau of Mines found that mines in Joplin, Missouri and Butte, Montana contained dust levels at more than 100 times the levels later allowed under the OSHA standards imposed in the 1970s.[82] Even in states with laws requiring ventilation of dusty workplaces, insufficient knowledge resulted in laws that lacked specificity in defining meaningful exposure or ventilation levels.[83]

Further, the limits of pre-twentieth-century medical knowledge significantly hampered medical diagnosis of dust-related injuries. The absence of X-ray technology severely limited the ability to examine the lungs of living patients,[84] and the lack of the germ theory left doctors without a correct causal understanding of much of what we take for granted in medicine today.[85] For example, scientists had trouble distinguishing

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82. *Id.* at 42.

83. *See* SELLERS, *supra* note 45, at 38 (observing that the laws lacked the specificity necessary to ensure adequate protection for the workers).

84. *See* ROSNER & MARKOWITZ, *supra* note 79, at 32 (providing anecdotal evidence of the development of the X-ray machine and its impact on the analysis of particles within the lungs).

85. *Cf.* SELLERS, *supra* note 45, at 114-15 (describing the impact of new medical advances). Elizabeth Fee attributes some of the growth of medical knowledge to the increased crowding in urban areas that accompanied industrialization:

> The [prior] belief that epidemic diseases posed only occasional threats to an otherwise healthy social order was shaken by the industrial transformation of the late nineteenth century. The burgeoning social problems of the industrial cities could not be ignored: the overwhelming influx of immigrants crowded into narrow alleys and tenement housing, the terrifying death and disease rates of working-class slums, the total inadequacy of water supplies and sewage systems for the rapidly growing population, the spread of endemic and epidemic diseases from the slums to the homes of the wealthy, the escalating squalor and violence of the streets.

ELIZABETH FEE, DISEASE AND DISCOVERY: A HISTORY OF THE JOHNS HOPKINS SCHOOL OF HYGIENE AND PUBLIC HEALTH 1916-39, at 12 (1987). Solving these social problems required understanding them, thus producing a demand for medical knowledge that spilled over into industrial contexts. This resulted in a transformation in public health agencies, shifting personnel from those hired due to "patronage or political considerations" to experts, part of the general Progressive Era trend toward expert agencies. *Id.* at 16. Public health and medicine had direct benefits for the military, among others, allowing the construction of the Panama Canal after the defeat of yellow fever and malaria. *See id.* at 16-17 (touting the triumph of improved public health over the high death toll that had previously hindered completion of the Canal). These lessons were brought home and applied in the public health and industrial contexts. *Id.* at 17-18. The resulting agencies and projects demanded trained personnel, helping to spark professional schools in the field. *See id.* at 18 (noting the newfound stress on the need for full-time health professionals). The emphasis remained on public health rather than industrial health, however. The 1915 *Manual for Health Officers*, the first handbook for public health officers, devoted only four pages to industrial concerns, compared to three hundred on contagious diseases. *Id.* at 21. Fee suggests that the profession took a wrong turn by focusing on individual disease-causing agents rather than larger social contexts. *See id.* at 21-22 (decrying the lack of majority commitment to study more than just the immediate physical impact of the various "disease-causing organisms"). However, we believe that the marginal net value from addressing individual diseases was so large that the profession's direction was more the result of picking "low hanging fruit" than simply bad intellectual choices.

tuberculosis from lung scarring caused by dust exposure.[86] Even today, radiographic techniques cannot distinguish silicosis from many other respiratory diseases.[87] Similarly, variation in individual susceptibility to various industrial hazards discouraged investment in general mitigation measures solely because some employees became ill.[88] Medical standards changed rapidly in the first quarter of the twentieth century, becoming more science-based and making much greater use of technology.[89] This included expansion of information technology such as punch cards, which enabled the tracking of patterns of disease.[90]

Pre-twentieth-century understanding of dust hazards was primitive by modern standards, and improving that understanding ultimately required technological change (the invention of radiography in 1895)[91] and scientific breakthroughs in medicine (the germ theory's impact on medicine in the 1870s and 1880s).[92] Although the discovery of X-ray technology prompted a massive reaction almost overnight—machines were for sale in the United States for $50 within a short time after the discovery of the technique in Germany, and more than 1,000 articles and 49 books on the topic appeared in the first year after its discovery[93]—it took time for the

86. *See generally* Am. Lung Ass'n, Interstitial Lung Disease, http://www.cheshire-med.com/programs/pulrehab/ipf.html (last visited Mar. 29, 2006) (discussing the various causes of the disease and noting the lack of understanding of all of the origins and treatment of the disease); BARTH, *supra* note 23, at 87 (noting that "there are no pulmonary function tests specific to silicosis").

87. *See* BARTH, *supra* note 23, at 87 (adding that, despite the inability of the tests to identify conclusively the cause of the disease, workers' compensation acts still base decisions on X-ray analysis).

88. *See* SELLERS, *supra* note 45, at 28 (describing the reaction of employers who assumed that workers who became ill despite the existing safety precautions were somehow more susceptible to the disease, leading to the conclusion that no greater safety efforts were necessary).

89. *See* JOEL D. HOWELL, TECHNOLOGY IN THE HOSPITAL: TRANSFORMING PATIENT CARE IN THE EARLY TWENTIETH CENTURY 3 (1995) ("[T]he entire hospital had become, by 1925, quite actively and self-consciously based on science."); *id.* at 5 (noting the increased use of machinery, including X-ray equipment).

90. *See id.* at 40-42 (tracking the early history of calculating technology). The use of such methods reflected more than technological change—they also reflected the growth of the same scientific management techniques for reorganizing factories. *See id.* at 42, 55 (illustrating the similarities between the recordkeeping of hospitals and general businesses, including the methods common in factory settings).

91. *See id.* at 103 (summarizing the findings of Wilhelm Conrad Rontgen, the German physics professor who invented the first X-ray machine); *see also* RUTH BRECHER & EDWARD BRECHER, THE RAYS: A HISTORY OF RADIOLOGY IN THE UNITED STATES AND CANADA 3-9 (1969) (describing the discovery of X-ray technology).

92. *See, e.g.*, Lawrence O. Gostin, *The Resurgent Tuberculosis Epidemic in the Era of AIDS: Reflections on Public Health, Law, and Society*, 54 MD. L. REV. 1, 4-7 (1995) (describing the impact of changes as a result of the discovery of the bacteriological basis for tuberculosis).

93. HOWELL, *supra* note 89, at 104. The first duplication of the result in the United States took place in January 1896. BRECHER & BRECHER, *supra* note 91, at 11-12. The *American X-Ray Journal*, a monthly publication devoted to "practical X-ray work and allied arts and sciences" began publication in May 1897. *Id.* at 301.

practical application of it to spread beyond major urban centers.[94] It also took time for the new technology to become accepted as a vital part of diagnosis even for obvious conditions such as broken bones.[95] Finally, although the technology was certainly available by 1900, major innovations in reducing the cost of its use were not realized until the demands of World War I prompted innovation.[96]

In addition, before the twentieth century, public health was "still largely the province of amateurs and gentlemen,"[97] and the gentlemen did not have the tools or the political base to demand resources. Only when private foundations and state governments began funding research in the first years of the twentieth century did a more systematic analysis of workplace safety and health begin.[98] The demand for more knowledge about dust-related health hazards also grew because of the changes that the Industrial Revolution introduced in factories.

Slowing the development of accurate knowledge of the causes of workplace diseases

> was the ambiguous way that occupational ailments often manifested themselves. Even widely recognized industrial diseases could be difficult to identify with any certainty in a given worker. Ailments without characteristic signs of their occupational origins, such as cardiovascular illnesses, many muscular strains and cramps, or even the infectious lung diseases that often complicated silicosis, were easily

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94. *See* HOWELL, *supra* note 89, at 108-09 (noting that it took "decades" for the technology to spread to geographic locations near "most Americans").

95. *See id.* at 108 (quoting a medical paper's assertion that "'no one will for a moment suppose that the vacuum-tube and induction-coil . . . will, or ever can, displace the sense of touch guided by a well-balanced and experienced mind'"). This sentiment can also be seen in the lengthy delays between hospital admission and radiographic examination for patients in the hospital records studied by Howell until at least the 1920s. *See id.* at 110-11, 119-20 (confirming the rather infrequent use of X rays throughout the technology's early existence). As Howell notes, "The mere existence of a diagnostic technology did not dictate how or where it would be used; both hospital and machine had to change before the x ray or any other machine could significantly influence hospital care." *Id.* at 132.

96. *See id.* at 118-19 (remarking that the war created a shift from glass plates to film, spurred the creation of portable units, and led to the development of faster film).

97. FEE, *supra* note 85, at 2. As Fee notes,

> Before the twentieth century, there were few formal requirements for public health positions, no established career structures, no job security for public health officials, and no formalized ways of producing new knowledge. Public health positions were usually part-time appointments at nominal salary; those who devoted much effort to public health typically did so on a voluntary basis.

Id. at 9. Since industrial medicine lagged behind public health, one may fairly attribute similar characteristics to those few interested in the relationship between work and illness.

98. For example, the Russell Sage Foundation conducted the first systematic investigations of accidents as a part of its Pittsburgh Survey. JACQUELINE KARNELL CORN, PROTECTING THE HEALTH OF WORKERS: THE AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS 1938-1988, at 2 (1989). The Illinois Occupational Disease Commission performed the first survey of industrial disease in the United States in 1910. *Id.* at 3.

> attributable to nonoccupational rather than workplace causes. Even for those diseases more specifically connected with certain occupations, like lead poisoning, recognition could be difficult.[99]

A close look at when knowledge developed supports this account. An article published in 1900 in the *Journal of the American Medical Association* became the first major U.S. medical publication to identify silica dust as the cause of fibrosis.[100] It discussed elevated death rates following the introduction of mechanical milling equipment in a Nevada gold milling firm.[101] British researchers also documented problems in South African mines in this same period.[102] Significantly, dust hazards were first documented in the context of high exposure occupations (mining and milling) in which new techniques increased the hazard at the same time as new medical technology and knowledge made diagnosis possible.

The public reacted to the new knowledge by demanding yet more knowledge. As early as 1911, for example, an insurance company statistician pushed for a federally funded study into the health of metal miners.[103] Insurance company interest in the subject is not surprising: Some estimates today are that "at least thirty thousand" metal miners "at any time" during this period had silicosis.[104] And insurance policies for factory workers had boomed in the preceding decades—estimates run as high as 3.5 million policies by 1900.[105] New knowledge was produced—"By the 1920s, silicosis was established as an important industrial disease."[106] The new knowledge was far from complete: "[S]ilicosis was perceived as a problem affecting rural, relatively isolated populations in widely scattered communities" rather than as a widespread problem.[107] Knowledge about silicosis grew together with more general knowledge

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99. SELLERS, *supra* note 45, at 21.

100. *See* ROSNER & MARKOWITZ, *supra* note 79, at 31 (explaining the impact of this article on the recognition in the United States that silicosis was a distinct condition).

101. William Winthrop Betts, *Chalicosis Pulmonum or Chronic Interstitial Pneumonia Induced by Stone Dust*, 34 J. AM. MED. ASS'N 70 (1900); *see also* CHERNIACK, *supra* note 71, at 38 ("An aggressive, often fatal form of silicosis, caused by milling of the quartz dust, was identified in Nevada in the 1890s.").

102. *See* ROSNER & MARKOWITZ, *supra* note 79, at 31-32 (discussing the success of the studies in bringing the devastating effects of industrial dusts to light).

103. *Id.* at 33; *see also* SELLERS, *supra* note 45, at 60-61 (relating the initiative taken by Frederick Hoffman to initiate the most comprehensive studies at the time); BARTH, *supra* note 23, at 6 (noting the end of sales of insurance to asbestos workers in 1918 as proof of the insurance industry's knowledge of the hazards).

104. DERICKSON, *supra* note 80, at 52.

105. SELLERS, *supra* note 45, at 25.

106. ROSNER & MARKOWITZ, *supra* note 79, at 48. A Department of Labor report addressed "The Problem of Dust Phthisis in the Granite-Stone Industry" in May 1922. CORN, *supra* note 98, at 7.

107. ROSNER & MARKOWITZ, *supra* note 79, at 48.

about work-related disease—Professor Sellers concludes, for example, that the field of industrial hygiene "coalesced between the 1910s and 1930s."[108]

Viewed in light of contemporary knowledge and technology, the market reacted to the unprecedented increases in silica dust exposure caused by the new technologies around the turn of the twentieth century by demanding knowledge. Insurance companies, among others, stood to profit from creating better understanding of the health effects of silica dust exposure, and as diagnostic technology advanced and medical knowledge improved, private interests reacted to the increased exposure and resulting increase in silicosis by investing in knowledge. These investments appear to us to have been made faster than would have been expected given the long latency periods for silicosis. Far from a market failure, this initial response appears to have been quite rapid in light of the uncertainties in medicine, primitive understanding of the disease, long latency period, and rapid technological change.

2. The Reaction of Interest Groups

The same industrial innovations that produced finer and more dangerous dust also led to major increases in labor productivity and, as a result, produced significant dislocations in a number of industries.[109] For example, in the nineteenth-century foundry industry, mould-making was a skilled occupation[110] supported by a great deal of semi-skilled and unskilled labor.[111] Starting in the twentieth century, much of the support work was mechanized and output soared: "By the early years of the [twentieth] century, one worker running a machine mixer for two hours could mix as much sand [for moulds] as two workers mixing by hand for an entire day."[112] Craft workers generally resisted employer control over their work,[113] which limited employer knowledge about hazards. For example, Sellers reported that:

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108. SELLERS, *supra* note 45, at 2.

109. *See* SELLERS, *supra* note 45, at 109 ("The early 1910s were a time of intense change and upheaval in the workplace. Restructuring attempts by scientific managers helped provoke an unprecedented strike wave as expert approaches to the threatened worker body continued to proliferate."). But not all technological change increases hazards. *See* BARTH, *supra* note 23, at 51-52 (listing technological changes that have reduced hazards); *id.* at 54 (discussing some improvements in occupational health from technological change).

110. ROSNER & MARKOWITZ, *supra* note 79, at 54 ("The nineteenth-century molders saw themselves as artists as well as artisans.").

111. *See id.* at 50-51.

112. *Id.* at 52.

113. *See* DAVID MONTGOMERY, WORKERS' CONTROL IN AMERICA: STUDIES IN THE HISTORY OF WORK, TECHNOLOGY, AND LABOR STRUGGLES 16-17 (1979) (discussing craft workers' resistance to attempts to limit their autonomy through "daily self-assertion on the job" rather than organized strikes); *id.* at 23 (describing the battle between stove companies and the molders' union); *id.* at 26 ("Most important of all, new methods of industrial management undermined the very foundation of craftsmen's functional autonomy.").

> [T]he Wheeling nail manufacturers rented out nail-making machines on their premises and paid nailers by the piece; otherwise, they left many of the nailers' working methods in the hands of the nailers themselves. Many Wheeling nailers chose not to wet down their cutting machines, which would have reduced the volume of dust to which they were exposed, because dry nail cutting went faster and paid better—at least over the short term.[114]

In the case of the mould-makers, pneumatic tools for cleaning cast items also raised efficiency, as did the addition of power tools to the finishing stages of polishing and grinding.[115] The biggest change was the introduction of moulding machines that replaced the skilled mould-makers.[116] These innovations also created greater silica exposure, since the power and pneumatic tools both created more dust and blew more dust into the air.[117] The increased production raised exposures, as did the expansion of the industry triggered by the falling prices of iron products due to higher labor productivity.

In this environment, it is not surprising that occupational disease issues became an important bargaining tool for unions.[118] The same changes that threatened union members' positions within firms threatened the health of their members. Employees also resisted safety measures at times, not accepting the new equipment and methods either because they did not believe them safer or because the changes reduced income as well as increasing safety.[119] Opposing technological change is difficult without a non-Luddite rationale, and health issues provided unions with the means to seek to control the impact of technology in the workplace. Similarly, as the number of small foundries grew in the late nineteenth and early twentieth

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114. SELLERS, *supra* note 45, at 26 (footnotes omitted).

115. *See* ROSNER & MARKOWITZ, *supra* note 79, at 52 (noting, however, the resulting increase in the amount of dangerous dust particles these new machines threw into the air).

116. *See id.* at 56 (explaining the link between the mechanization of the molding process and the declining autonomy of skilled molders).

117. *Id.* at 62.

118. *See id.* at 60 (outlining the union's argument that it should not have to bear the financial burden of poor worker health due to mechanization); *id.* at 63 (noting union arguments against allowing mechanized processes); *id.* at 73 ("Labor and management defined silicosis in terms increasingly removed from the discourse of public health and medicine."); DERICKSON, *supra* note 80, at 162 (describing the major role played by mining unions in silicosis issues). Interestingly, the unions used the health issue in part to eliminate competition from women, by arguing that female workers should be excluded from jobs with dust exposures to protect their health. For example, "[a]t its annual convention in 1912, the [mould-makers] union resolved 'to use every effort to bring about the elimination' of the employment of women in foundries because 'twentieth century civilization is not in favor of the dragging down of American womanhood so that the foundrymen can increase their profits.'" ROSNER & MARKOWITZ, *supra* note 79, at 61 (quoting NEW YORK STATE, 3 SECOND REP. OF THE FACTORY INVESTIGATIONS COMMISSION 813 (1913)).

119. *See* WITT, *supra* note 49, at 32 (explaining employee resistance to the implementation of safety measures).

centuries,[120] unions must also have seen the health issue as a means of limiting this competition to the larger, unionized shops since the smaller shops generally could not afford to follow the safety standards set by the larger firms.[121] The craft-basis of early twentieth-century American unionism limited its effectiveness by fragmenting workers in each shop.[122]

The early twentieth century also saw the passage of state laws protecting the health of employees and the creation of agencies that investigated factory conditions and occupational health issues, part of the Progressive Era tendency toward expert agencies. The organization of the American Association for Labor Legislation (AALL) in 1906 created a lobbying group seeking labor legislation and supporting its demands through conferences, investigations, and reports.[123] It held its first national conference on industrial disease in 1910.[124] The organization also sponsored publication of papers on the topic. As a result, after the publication of papers from the second AALL conference, American publications exceeded those of the former leaders—the British and the Germans.[125] The AALL made occupational diseases one of its top priorities.[126] The policy entrepreneurs of the AALL, who included Richard Ely and John Commons, sought to define a "scientific" path to legislation that would improve human welfare.[127] In doing so, they helped create a "more coherent field of study" dealing with occupational disease.[128] Undoubtedly motivated by concern for the general welfare, these experts also "aimed to secure a place for their professions" in public policy.[129]

Popular demand for action grew, in part, from media accounts of workplace hazards. Magazine and book publishers printed regular accounts of workplace disease and injury because such stories sold magazines.[130] State factory inspectors grew in number nationwide, from fewer than 300 in 1907 to 425 in 1911.[131] In the process, they helped

120. ROSNER & MARKOWITZ, *supra* note 79, at 64.
121. *Id.* at 64-65.
122. *See* ROBERT H. ZIEGER, AMERICAN WORKERS, AMERICAN UNIONS 32 (2d ed. 1994) (discussing the physical breakups of shops as workers were summoned to various unions).
123. CORN, *supra* note 98, at 5.
124. *Id.* at 5-6.
125. SELLERS, *supra* note 45, at 61.
126. *Id.* at 50.
127. *See id.* at 52 (describing Ely's assertion that the organization would use "scientific study" to convince lawmakers to better protect employees).
128. *Id.* at 53.
129. *Id.* at 60.
130. David Rosner & Gerald Markowitz, *The Early Movement for Occupational Safety and Health, 1900-1917*, *in* SICKNESS AND HEALTH IN AMERICA: READINGS IN THE HISTORY OF MEDICINE AND PUBLIC HEALTH 467, 469 (Judith Walzer Leavitt & Ronald L. Numbers eds., 3d ed. rev. 1997) ("The publishers of these magazines and books were not printing this material as a public service. Rather, they recognized that it could sell magazines . . . .").
131. SELLERS, *supra* note 45, at 72.

create a constituency for legislation.[132] Organizations representing a variety of interest groups sprang up in the 1910s.[133] By 1914, 33 states had created factory inspection bureaus,[134] 15 states had passed legislation requiring reporting of occupational diseases by all physicians,[135] and 25 had passed workers' compensation statutes.[136] World War I's demands on the economy and labor stimulated even greater interest in industrial hygiene.[137]

While these first agencies' capabilities were rudimentary,[138] reflecting the scientific standards of the time, their creation meant that a state bureaucracy now invested in documenting occupational diseases. Not surprisingly, these new agencies quickly expanded: New York went from one to four doctors between 1922 and 1924; Connecticut formed a "Division of Occupational Diseases" in 1928 and had "both a physician and an 'industrial hygienist' on its staff by 1930."[139] The federal government also funded studies aimed at occupational disease.[140] Workers' compensation statutes spurred companies to hire plant physicians—a Public Health Service study in 1919 found "118 out of the 170 plants questioned paid a physician for services, either part-time or full-time."[141] This interest by governments spurred further market responses: The first American textbooks on occupational medicine appeared in 1914,[142] and

132. Rosner & Markowitz, *supra* note 130, at 478 ("For almost a decade, exposés of inhumane working conditions and demands for reform were regular features in newspapers and magazines across the country.").

133. *See* CORN, *supra* note 98, at 6-7 (naming several such organizations, including the National Council for Industrial Safety (1913), the Industrial Hygiene Section of the American Public Health Association (1914), the Conference Board of Physicians in Industry (1915), and the American Association of Industrial Physicians and Surgeons (1916)). The physicians group's membership soared from 125 in 1916 to 600 by the end of World War I. SELLERS, *supra* note 45, at 145.

134. Sellers, *supra* note 47, at 236.

135. *Id.* at 237.

136. *Id.* at 238; *see also* CHERNIACK, *supra* note 71, at 38 ("In 1915 the first workmen's compensation laws provided implicit, though not explicit, coverage for silicosis.").

137. CORN, *supra* note 98, at 8; *see also* SELLERS, *supra* note 45, at 145-46 (discussing the interest in medicine spurred by labor shortages).

138. Sellers, *supra* note 47, at 236 (reviewing the enforcement powers of state agencies following the war).

139. *Id.* at 253.

140. *See id.* at 239 (discussing the Bureau of Labor's support of investigations into the phosphorus match and lead industries in the early twentieth century); CHERNIACK, *supra* note 71, at 38 ("By 1914 the Federal Bureau of Mines had begun to recommend yearly physical examinations for workers exposed to dusts containing silica.").

141. Sellers, *supra* note 47, at 246.

142. *Id.* at 240. No mention of occupational factors that might lead to fibroid phthisis, a silicosis predecessor, appeared in a widely used medical textbook in the 1880s, for example. *Cf.* SELLERS, *supra* note 45, at 31-33 (recounting the history of early medical textbooks on occupational diseases).

Harvard appointed the first full-time professor of industrial medicine in 1919.[143] The initial state response mimicked the private sector response: investing in creating knowledge.

3. Workers' Compensation

As a result of the increase in workplace hazards brought about by industrialization, a broad coalition developed in favor of legislation to address the problems it posed for employers, employees, and insurance companies.[144] Employees wanted compensation; employers and insurance companies wanted limited liability; social reformers wanted more state intervention in the workplace. Moreover, reformers often believed regulatory solutions to be inadequate, turning to the financial incentives offered by the insurance approach.[145] The primary result in the United States was the development of the workers' compensation system for industrial accidents (although initially not for workplace diseases), a compromise that limited employers' liability and increased employees' certainty of recovery.[146] Other new initiatives included the establishment and expansion of state labor agencies, the creation of the federal Department of Labor, and the passage of various acts regulating working conditions in specific industries.[147]

The first wave of workers' compensation statutes, however, did not address diseases. Why not? Several factors contributed to the initial focus on injuries rather than disease, a relatively crude version of the categorization problem. First, workers' compensation, so commonplace today, was a radical innovation at the time.[148] Second, mass industrial

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143. Sellers, *supra* note 47, at 247.

144. *See* Rosner & Markowitz, *supra* note 130, at 478 ("The movement to control workplace hazards was widespread, encompassing a variety of different groups.").

145. WITT, *supra* note 49, at 100-01 (emphasizing the failures of regulatory approaches and the increasing momentum for a focus on insurance as a way to ensure worker safety).

146. *See* BARTH, *supra* note 23, at 61 ("The essential quid pro quo of [workers' compensation] . . . involved the abrogation of the injured employees' right to pursue a common-law action against their employer. In return they received an assurance of a speedy and certain award in amounts specified by law."); CRYSTAL EASTMAN, WORK-ACCIDENTS AND THE LAW 216-20 (2d ed. 1916) (discussing explicitly the quid pro quo in a report for the Russell Sage Foundation and helping build public support for workers' compensation systems). Public interest regulation theorists suggest that workers' compensation legislation developed out of state legislatures' concern for employees, "many of whom were recent immigrants or former slaves and hardly in a position to strike hard bargains with the industrial tycoons of the day." MCGARITY & SHAPIRO, *supra* note 50, at 17. Left unspecified, however, is how these powerless employees convinced the members of legislatures to defy the industrial tycoons and pass legislation against the tycoons' interests. The public choice account is superior, in our view, because it explains the rise of the legislation without resort to episodic defiance by legislatures of powerful interests that are otherwise believed to control events.

147. Rosner & Markowitz, *supra* note 130, at 479.

148. *See generally* John M. Kleeberg, *From Strict Liability to Workers' Compensation: The Prussian Railroad Law, the German Liability Act, and the Introduction of Bismarck's*

disease, as opposed to isolated incidents, was still relatively unrecognized. The long latency periods (as much as twenty years for silicosis)[149] and relatively primitive understanding of medicine made diagnosis of non-acute conditions challenging.[150] The industrial changes that increased exposure combined with the latency period to make the real boom in disease recognizable only after state legislatures had passed the first wave of workers' compensation statutes.[151] One key result of the introduction of workers' compensation insurance, however, was that a lawyer named Crystal Eastman began to gather statistics on the causes of injuries.[152] A benefit of workers' compensation acts was that they "moved analysis of work accidents from the close specificity of individualized inquiries into particular accident cases to a higher plane of statistical generality."[153] Insurers sought to introduce preventative measures to lower risks.[154] It worked: "From 1907 to 1920, work-fatality rates per manhour in American industry dropped by two-thirds; nonfatal work-injury rates and lost workdays per manhour . . . appear to have declined by half."[155]

Interest in such issues remained at the state level in part because the federal government had not yet become large enough to make a difference. "State and local government expenditures were about five times larger than the federal budget in 1929"—federal expenditures represented a mere three percent of gross national product that year.[156]

The 1920s were a time of economic growth and advancement for employees. Industrialization brought new material wealth:

> Throughout the late 1920s surveys of consumer habits marveled at the wide range of purchases made by working-class people, many of them involving durable goods such as radios, washing machines, and even

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Accident Insurance in Germany, 1838-1884, 36. N.Y.U. J. INT'L L. & POL. 53 (2003) (describing innovations in creating workers' compensation).

149. *See* BARTH, *supra* note 23, at 67 (noting that the latency period for silicosis is between four and twenty years).

150. *See id.* at 63 (discussing problems that long latency periods pose for workers' compensation generally).

151. The new legislation, which began with New York's adoption of a workers' compensation statute in 1910 and reached fruition in 1963 with the adoption of a statute by every industrialized state, thus preceded widespread silicosis. *See* ARTHUR LARSON & LEX K. LARSON, LARSON'S WORKERS' COMPENSATION LAW § 2.07-.08 (2003) (describing the development of workers' compensation acts in the United States).

152. *See* WITT, *supra* note 49, at 126-27 (touting her efforts and her influence on the introduction of statistical science to workers' compensation statutes).

153. *Id.* at 142.

154. *See id.* at 145 (addressing the impact on the introduction of preventive measures by making employers responsible for injuries).

155. *Id.* at 187.

156. DAVID M. KENNEDY, FREEDOM FROM FEAR: THE AMERICAN PEOPLE IN DEPRESSION AND WAR, 1929-1945, at 55 (1999). At the end of the twentieth century, state and local expenditures were about the same size as federal expenditures, which now totaled more than 20% of the Gross National Product. *Id.*

> automobiles. . . . All experts agreed that by the end of the 1920s, the nation's working people had greater access to health care, recreational and cultural facilities, public services, and education than ever before.[157]

Prices for consumer goods were falling rapidly, putting them within the reach of an ever-widening proportion of the country's population.[158] Labor peace largely prevailed, with strike activity reaching historic lows.[159] "Welfare capitalism" meant that employers had taken the initiative in addressing a wide range of issues for employees, defusing employee interest in initiating workplace reforms.[160] Not everything was perfect; unemployment remained a concern for many, reaching eight percent in mid-1929.[161] Nonetheless, the success of so many during the 1920s resulted in little demand for tackling hard to understand problems like silicosis. Unions, the one interest group that might have spurred public interest, were preoccupied with declining membership—a sympathetic observer says the American Federation of Labor (AFL) "languished in torpor and apathy throughout the 1920s"[162]—and losing ground because it had not yet cracked the mass production industries.[163] Most importantly for explaining the lack of state interest in issues like silicosis, the AFL unions, under Samuel Gompers' philosophy of "voluntarism," largely shunned involvement with the government.[164] To the extent that the pre-1930s responses to silicosis (and industrial diseases generally) seems inadequate in retrospect, the inadequacy was a failure of both the market and the state, for neither anticipated the full impact of silicosis. From the vantage point of today, this may seem surprising, but the long latency period and lack of understanding of the disease explains why neither state nor market responded more quickly.

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157. ZIEGER, *supra* note 122, at 5-6; *see also* KENNEDY, *supra* note 156, at 22 ("[I]n the pulsing industrial cities, virtually all Americans dramatically improved their standards of living over the course of the post-World War I decade.").

158. KENNEDY, *supra* note 156, at 21 ("A car that cost the average worker the equivalent of nearly two years' wages before the First World War could be purchased for about three months' earnings by the late 1920s.").

159. *See* ZIEGER, *supra* note 122, at 6 (celebrating the rising prosperity that had brought an end to the cycle of unrest and violence).

160. *See* KENNEDY, *supra* note 156, at 27 (describing the death of the organized labor movement at the hands of increased efforts by employers to offer more attractive benefits); MONTGOMERY, *supra* note 113, at 33 (stressing the goals of personnel managers to "pacify" the concerns of the workers to ensure greater productivity).

161. ZIEGER, *supra* note 122, at 7.

162. *Id.* at 23.

163. *Id.*

164. KENNEDY, *supra* note 156, at 25; *see also* ALAN BRINKLEY, THE END OF REFORM: NEW DEAL LIBERALISM IN RECESSION AND WAR 202 (1995) (noting the American Federation of Labor (AFL) became disenchanted in part because of a "historic reluctance to rely on government assistance (a reluctance born of the conviction that once labor became dependent on the state it could be—and would be—oppressed by the state)").

4. The Silicosis Crisis of the 1930s

Because most of the first wave of workers' compensation legislation had either explicitly excluded or not explicitly included industrial disease,[165] workers who became ill as a result of dust exposure sought relief in the courts. Where some industrial disease coverage was provided, legislatures adopted it as "a conservative alternative to plans for state-sponsored health insurance."[166] Lawsuits over silicosis from workplace exposures began to proliferate in the 1930s.[167] Thousands of such suits created a liability crisis[168] and made silicosis "an issue of national import."[169] Insurers reported that they faced "'the most serious claim problem ever encountered'" as a result of silicosis suits.[170] More than a billion dollars of silicosis suits were pending in 1934,[171] the equivalent of over $14 billion today. One important reason these suits increased dramatically in the 1930s was that silica suits offered a means to survive the Depression, converting the tort system into a rudimentary social welfare system,[172] and "as workers won their suits, it emboldened more of the unemployed and their lawyers."[173]

A variety of factors might explain the explosion of silicosis litigation in the 1930s. One is undoubtedly that silicosis's long lead time meant that incidence of the disease lagged the introduction of dust-producing

165. *See* BARTH, *supra* note 23, at 92-93 (analyzing a brief history of workmen's compensation laws that did not include occupational disease).

166. SELLERS, *supra* note 45, at 146.

167. GEORGE G. DAVIS ET AL., THE PNEUMONOKONIOSES (SILICOSIS): BIBLIOGRAPHY AND LAWS 7 (1935) (noting the increase in litigation over silica in the 1930s). Manufacturers in New York in 1925 supported a bill to stop the "hundreds" of common law suits over silicosis because "hundreds of thousands of dollars" had already been spent by then in settlements. *Id.* at 50.

168. *See* ROSNER & MARKOWITZ, *supra* note 79, at 3 (stating that in 1933 "newspapers, magazines, and professional journals were filled with stories about the threat of a new scourge—silicosis—that was crippling workers in a wide variety of industries"). For example, in New York State in 1934, there were $50 million in damages claimed in silicosis suits, prompting efforts to bring the condition into the workers' compensation system. DAVIS, *supra* note 167, at 30; *see also* ROSNER & MARKOWITZ, *supra* note 79, at 91-96 (describing the crisis in New York). In Massachusetts, the costs of covering silicosis claims required $2 per $100 of payroll fee on top of the $2.70 per $100 occupational disease rate for foundries, almost doubling the cost of the insurance. DAVIS, *supra* note 167, at 51.

169. ROSNER & MARKOWITZ, *supra* note 79, at 4.

170. *Id.* at 79 (quoting from a 1930-era insurance company's twenty-fifth annual report to its policyholders about the seriousness of silicosis claims).

171. DAVIS, *supra* note 167, at 75.

172. *See* ROSNER & MARKOWITZ, *supra* note 79, at 78-79 (describing the negative impact of the suits on industry itself and even workers as a group); BARTH, *supra* note 23, at 4 (noting, among factors increasing silicosis claims, "an apparent effort to find some source of income by the unemployed, a number of whom had had the disease for some time but continued to work until economic conditions caused them to be laid off").

173. ROSNER & MARKOWITZ, *supra* note 79, at 81.

equipment in various industries.[174] Both researchers and the public understood silicosis less well than many other industrial diseases, as "researchers had great difficulty devising experiments or other kinds of investigations that persuasively established the chain of events between contact with silica dust and actual symptoms."[175] Another important factor, however, is that the Great Depression created economic conditions that led "workers to use the issue of industrial illness as a means of achieving social welfare objectives."[176] Lawsuits filed by "workers in the dusty trades"[177] "brought 'silicosis within the range of practical politics.'"[178] Faced with an "actuarial potential for disaster,"[179] employers and political leaders experienced enormous pressure to find a solution. Yet another reason is the federal funding that flowed from the new Social Security Act to state boards of health to establish industrial hygiene divisions,[180] agencies that then assembled information on the state of occupational diseases in various industries. Finally, the Gauley Bridge disaster (discussed in more detail below),[181] in which hundreds of men lost their lives to acute silicosis, spurred congressional hearings and litigation in 1935-1936.

Many of these suits, of course, involved genuinely injured individuals who had suffered real damages and who properly sought compensation through the tort system. Others, however, did not. Accurate diagnosis was difficult, yet some experts felt that too many doctors were willing to

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174. Rosner and Markowitz's study links the rise of silicosis to a combination of factors. First, they note that from the late 1800s until the early 1900s, medical understanding of dust-related diseases focused on tuberculosis. *See id.* at 15-21 (describing the early struggle of the scientific community to come to an understanding about the origins of the disease). Early in the twentieth century, evidence began to emerge, first in Britain and later in the United States, that cast doubt on the bacteriological model, but the medical consensus on the bacteriological model remained. *See id.* at 21-22 (explaining the slow move toward a broader understanding of the disease).

175. SELLERS, *supra* note 45, at 204.

176. ROSNER & MARKOWITZ, *supra* note 79, at 5; *see id.* at 76 (stating that, during the Depression, "[a]s workers were thrown out of work and families forced to support the disabled on meager or no income, the arguments about responsibility for industrial disease and disability took on a new urgency and meaning").

177. *Id.* at 77.

178. *Id.* at 78 (quoting James D. Hackett, *Silicosis*, 11 N.Y. DEP'T OF LAB. INDUS. BULL. 475 (Dec. 1932)).

179. *Id.* at 87.

180. CHARLES LEVENSTEIN & GREGORY F. DELAURIER, THE COTTON DUST PAPERS: SCIENCE, POLITICS, AND POWER IN THE "DISCOVERY" OF BYSSINOSIS IN THE U.S. 43 (2002). Interestingly, these state agencies sought expanded funding during the war years on the grounds that war production required more attention to employee health efforts. *Id.* at 45-46. This source of funding shifted the location of state industrial disease control from state labor departments to state health departments. ROSNER & MARKOWITZ, *supra* note 79, at 126; *see also* Interview with Leonard J. Goldwater, *in* CORN, *supra* note 98, at 147 (adding that state programs were made possible by Social Security money).

181. For a discussion of the Gauley Bridge disaster, see *infra* notes 198-202 and accompanying text.

support doubtful claims based on unskilled readings of radiographs.[182] Silicosis suits brought with them bitter disputes over alleged fraudulent claims such as those detailed in articles like *The Dust Hazard Racket*[183] and those evidenced by fights between insurance companies and their insured over coverage.[184] As one observer in the 1930s complained,

> Missouri is a paradise for this type of racketeering. Under its law 9 jurors out of 12 may decide a case. Though the laws against barratry and champerty are still in existence they are apparently forgotten. Plaintiffs' attorneys have employed runners, or solicitors to comb the state, paying particular attention to the unemployed. As much as $25 a case is paid to solicitors for every signed contract brought in. Cases are taken on a 50 per cent contingent basis and notices under the attorney's lien law are promptly served on the employer. At first the solicitors confined themselves to cases where some disability existed. More lately solicitation has been carried on among workers still engaged in active work, who have no more outward appearance of disability than the dust on their clothes and some outward appearance of age.[185]

This scenario presented a crisis when people without injuries took advantage of some states' looser standards to bring fraudulent claims.

Eventually the "crisis" abated with the shifting of silicosis suits to the workers' compensation system beginning in the mid-1930s.[186] What brought about the change? In some states, court rulings added silicosis or other industrial diseases to workers' compensation. In California, for example, a ruling by the state supreme court that the limitation period for occupational disease claims would be based on when the disease was discoverable, not when the exposure occurred,[187] led insurers to seek substantial rate increases (from $11 for every $100 of payroll to $22.25 for every $100 of payroll in the case of underground gold mines, for example)[188] and prompted legislative action. The wave of suits, partially

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182. *See* SELLERS, *supra* note 45, at 204 (addressing the dangers associated with the combination of the X ray's limited diagnostic usefulness with doctors' limited X-ray reading skills).

183. DAVIS, *supra* note 167, at 52.

184. *See, e.g.*, Frederick Snow Kellog, *Silicosis Claims—A New Problem in the Insurance Field*, N.J. L.J., 1935, at 1; ROSNER & MARKOWITZ, *supra* note 79, at 70 (explaining that the foundry industry was "under pressure from the insurance industry, which was threatening to withdraw its liability coverage").

185. DAVIS, *supra* note 167, at 33; *see also id.* at 73 (noting that "[a]n epidemic of suits aggregating $974,000 against one company alone, have been filed in Missouri" for work-related silicosis claims).

186. *See* LABOR LAW INFO. SERV., U.S. DEP'T OF LABOR, OCCUPATIONAL-DISEASE LEGISLATION IN THE UNITED STATES, 1936, at 1-3 (1938) (describing the initiation of occupational disease coverage for "dust diseases").

187. *See* Marsh v. Indus. Accident Comm'n of Cal., 18 P.2d 933, 938 (Cal. 1933) (basing the date of the injury on the date it becomes discoverable through "the exercise of reasonable care and diligence").

188. *See Silicosis*, TIME, Jan. 6, 1936, at 58 (discussing the *Marsh* case); *see also The*

spurred by the Depression, got employers' attention, and their liability insurance companies were presumably anxious to add the workers' compensation insurers to the defense team.[189] Life insurance companies were worried that they had covered people now likely to die far earlier than the companies had predicted. Covering industrial diseases fell within the interest of a wide range of groups, including both employees and employers.[190] The growing experience with accident coverage through workers' compensation insurance inspired confidence that the system could absorb disease claims. And, finally, the results of the increased exposures to dust and other workplace disease agents was now producing enough injured employees to attract attention. In particular, the Gauley Bridge disaster put a spotlight on silicosis.

5. The New Deal

The initial wave of New Deal labor legislation did not address occupational disease issues. Preoccupied with attempts to deal with the staggering economic crisis of the Great Depression, and without the guidance of a coherent theory on how to do so, the Roosevelt Administration embarked on a raft of economic reform measures. One of the most far reaching was the National Industrial Recovery Act and the agency it created, the National Recovery Administration (NRA), the essence of which was hostility to the idea of competition.[191] Led by Hugh Johnson, who envisioned the agency as "a giant organ through which he could play on the economy of the country,"[192] the NRA quickly "mushroomed into a bureaucratic colossus" with a staff of 4,500 overseeing "more than seven hundred [industry] codes, many of which overlapped, sometimes inconsistently."[193] These codes cartelized "huge sectors of American industry."[194] Trade associations and large producers dominated the NRA codes.[195] Despite the varied efforts and alphabet soup of agencies

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Silicosis Problem, N.Y. TIMES, Apr. 22, 1936, at 22 ("Few liability companies will assume a silicosis risk at any but a prohibitive premium.").

189. A representative of the Association of Casualty and Surety Executives, for example, reported that silicosis costs "threaten[] the ruin of many American industries." *The Silicosis Menace*, LITERARY DIG., Dec. 15, 1934, at 15.

190. *See* U.S. Dep't of Labor, *Committees for Prevention of Silicosis in Industry*, 42 MONTHLY LAB. REV. 1545, 1546 (1936) (quoting Labor Secretary Francis Perkins on the interests of all sectors in resolving liability crisis and explaining the great interest of many industrial and legal groups in how to handle the silicosis problem).

191. KENNEDY, *supra* note 156, at 179.

192. *Id.* at 177 (quoting Arthur Schlesinger). Kennedy notes that Johnson's comments were sometimes hard to interpret. For example, upon being appointed, he announced that, "It will be red fire at first and dead cats afterward." *Id.*

193. *Id.* at 185; *see* BRINKLEY, *supra* note 164, at 39 (summarizing complaints about National Recovery Administration (NRA) codes).

194. KENNEDY, *supra* note 156, at 184.

195. *Id.* at 184.

and statutes, the New Deal was sputtering by 1935. Unemployment remained at twenty percent, and opposition on both the right and the left began to grow.[196] 1935 saw the launch of the "Second New Deal," a new wave of proposed regulatory statutes including "the Emergency Relief Appropriation Act, the Banking Act, the Wagner National Labor Relations Act, the Public Utility Holding Companies Act, the Social Security Act, and the Wealth Tax Act," which were, in part, designed to head off the threats from populists Father Charles Coughlin and Senator Huey Long.[197]

One key event spurring the expansion of the workers' compensation system to cover industrial disease was a particularly horrific series of 500 deaths (out of 2,000 employees) from acute silicosis during the 1929 tunnel project in Gauley Bridge, West Virginia. Another 1,500 were eventually disabled from chronic silicosis.[198] The tunnel route, unfortunately, ran through a vein of almost pure quartz, producing extremely high exposures.[199] The story broke nationally in 1936.[200] As one account noted,

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196. *Id.* at 218-19.

197. *Id.* at 242.

198. Balaan & Banks, *supra* note 71, at 435. Civil suits by the workers were largely settled out of court. *See also Silicosis: Tunneling Through an Atmosphere of Deadly Dust*, NEWSWEEK, Jan. 25, 1936, at 33, 34 (discussing generally the case and resulting settlements).

199. *See* Balaan & Banks, *supra* note 71, at 435; PRIMER, *supra* note 9, at 25 (describing the composition of silicic rock as more than two-thirds quartz). Cherniack provides the most thorough account. He notes that estimates of the silica content showed it was at least 90%. CHERNIACK, *supra* note 71, at 41. Cherniack also suggests that the death toll may have been as high as 764. *Id.* at 104.

200. The story of Gauley Bridge came to light when a "young New York playwright" was traveling through West Virginia and gave a miner a ride. *Village of Living Dead*, LITERARY DIG., Jan. 25, 1936, at 6. Learning of the "village of the living dead," where many still-living tunnel workers with silicosis resided, the playwright wrote "a grim short of a miner slowly suffocating" from silicosis for *New Masses*, a radical paper. *Id.* A labor paper, *People's Press*, then picked up the story and published a non-fiction account. *Id.* U.S. Representative Vito Marcantonio (R-N.Y.), a man "[d]ark-haired, outspoken, simple in dress, . . . [who] has already impressed his colleagues with his earnestness," then launched a congressional investigation. *Id.* Marcantonio, later termed "the most electorally successful radical politician in America," in his first term in Congress proposed "'reopening and operating shut-down factories by and for the benefit of the unemployed producing for use instead of profit.'" Vito Marcantonio: His Life and Milieu, http://users.rcn.com/redpost/life.html (last visited Mar. 29, 2006). The most comprehensive biography of Marcantonio described him as "frequently the sole spokesman in Congress for America's radical left" from 1936 to 1950. ALAN SCHAFFER, VITO MARCANTONIO, RADICAL IN CONGRESS 1 (1966). Marcantonio read the story in *People's Press*, which spurred the hearings. *Silicosis*, *supra* note 198, at 33. Marcantonio later called the Rinehart & Dennis Co., which constructed the tunnel, "worse than Dillinger and Al Capone." U.S. Dep't of Labor, *Silicosis Deaths Assailed in the House, Committees for Prevention of Silicosis in Industry*, 42 MONTHLY LAB. REV. 1545, 1546 (1936). In an interesting side note, one of the witnesses was a scientist from the NYU Medical School who was recruited to testify in response to a request from Marcantonio. The scientist's main motive in testifying was "a girlfriend in Washington" whom he thought would be impressed by his "being a big shot and testifying before a congressional committee." When he produced lung specimens to show the committee, "they emptied the room." Interview with Leonard J. Goldwater, *in* CORN, *supra* note 98, at 142.

"'Popular interest in silicosis, stimulating social and legislative activities and affecting judicial decisions, was notably accentuated by the newspaper notoriety of the Gauley Bridge episode.'"[201] Indeed, some federal officials felt that the Gauley Bridge disaster advanced occupational disease legislation "almost a decade."[202]

Congressional hearings were held in 1936,[203] and the federal Department of Labor convened national conferences on the topic to encourage legislation in the states, beginning just three weeks after the congressional hearings concluded.[204] By creating a national debate over the subject of silicosis, and bringing together both labor and industry representatives in a forum, the government attempted to make it possible for the parties to bargain their way to a mutually advantageous solution,[205] in keeping with the Administration's corporatist approach to labor issues.[206] The combination of the threat of silica suits against employers, ambiguity in many states' workers compensation laws on occupational disease coverage,[207] causation issues for plaintiffs,[208] and unions' interests in using the issue to expand their role in the workplace[209] made gains from

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201. CHERNIACK, *supra* note 71, at 109 (quoting WILLIAM G. COLE & LEWIS G. COLE, PNUEMOCONIOSIS (SILICOSIS): THE STORY OF DUSTY LUNGS 3 (1940)).

202. Carlton Skinner, *Silicosis Deaths to Hasten Legislation Controlling Occupational Diseases*, WALL ST. J., Feb. 29, 1936, at 4.

203. *Investigation Relating to Health Conditions of Workers Employed in the Construction and Maintenance of Public Utilities Before the H. Comm. on Labor*, 74th Cong. (1936).

204. *See* LABOR LAW INFO. SERV., *supra* note 186, at 5 (describing the national conferences); CHERNIACK, *supra* note 71, at 109 (noting that the conferences began less than three months after the congressional subcommittee issued its report); U.S. Dep't of Labor, *Committees for Prevention of Silicosis in Industry*, 42 MONTHLY LAB. REV. 1545, 1545-46 (June 1936) (describing the content of the debate within the conferences).

205. The Roosevelt Administration sought to encourage a compromise, as it had through its other attempts at using boards to negotiate between labor and management. ROSNER & MARKOWITZ, *supra* note 79, at 218. A federal solution could not be imposed, as the Roosevelt Administration had previously attempted on other issues, because the Supreme Court had recently struck down the National Industrial Recovery Act as unconstitutional. *Id.* at 102. As an example of the bargaining made possible, the silicosis conferences produced a call for uniform state legislation on the problem "[b]ecause of competition between the same or similar industries in various States." U.S. Dep't of Labor, *Program for Prevention and Compensation of Silicosis*, 44 MONTHLY LAB. REV. 909, 913 (1937).

206. *See* BRINKLEY, *supra* note 164, at 35 (discussing the corporatist ideology of many New Deal reformers); *id.* at 40 (discussing Roosevelt's attempts to sponsor cooperative business-labor partnerships in 1938).

207. *See* LABOR LAW INFO. SERV., *supra* note 186, at 4 (describing the debate over whether state statutes covering "injuries" rather than "accidents" included occupational disease coverage); *see also* ROSNER & MARKOWITZ, *supra* note 79, at 86 (noting the problems with the compensation system for silicosis-related diseases when experts disagreed on diagnoses, the course of the disease, and other key issues). The bargaining was particularly explicit in New York, where the first attempt at a legislative solution threatened to bankrupt the insurance industry. *See id.* at 94-95 (noting the inadequacies of later compromises).

208. *See id.* at 86 (noting that silicosis "was extremely difficult to diagnose").

209. *See id.* at 7 ("[S]ome of the new industrial unions added safety and health issues to more traditional demands for shorter hours and better wages."); Sellers, *supra* note 47, at

cooperation possible: Employers could eliminate the threat of civil suits, and unions could expand their influence over the workplace[210] through a new federal agency.[211] Indeed, "[i]n the midst of the Depression, silicosis was frequently framed as a labor and management problem, not solely as a health issue."[212] Unions in the mid-1930s were on the upswing; after dramatic declines to fewer than three million members over the 1920s and early 1930s, union membership reached nine million in 1939.[213] However, the disputes between the AFL and the Congress of Industrial Organizations (CIO) divided the unions and weakened their political clout.[214] Economic conditions were also turning against the unions. In 1937 the recovery collapsed, and the "Roosevelt Recession" began, ending the active phase of the New Deal.[215]

Employers, however, resisted the quasi-Faustian bargain; the main impact of the federally sponsored conferences was to spur the opposing sides to organize nationally to battle for control of the workplace.[216] Faced with the threat of moves to create another of the New Deal "alphabet" agencies (the leading congressional figure in the Gauley Bridge hearings

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237 (adding that unions in the first part of the twentieth century created their own medical clinics for workers); MONTGOMERY, *supra* note 113, at 163 (explaining that unions used health and safety issues as bases for "quickie" strikes during periods of relatively high labor demand in 1936 and 1937). The United Mine Workers, for example, fought long and hard for the inclusion of safety provisions in union contracts and finally gained their inclusion in the Appalachian Wage Agreement of 1941. Charles Anthony Morton, The United Mine Workers and the Establishment of Coal Mine Safety Regulations 82-83 (1954) (unpublished M.A. thesis, Ohio State Univ.) (on file with the Ohio State University Library).

210. The primary issue for unions in the 1930s was gaining control over the workplace. *See* ZIEGER, *supra* note 122, at 28 ("Workers in the 1930s resolved to limit managerial authority and to safeguard their standards and status with clear contractual safeguards.").

211. As Rosner and Markowitz note,

> It became clear that it was in the interest of a broad range of groups to try to defuse the social crisis surrounding silicosis. The insurance industry took the lead, but state government, labor unions, and the professional community all saw the social crisis of silicosis suits as a threat. It was necessary to remove the disease from the political arena and return it to the stewardship of the professionals.

ROSNER & MARKOWITZ, *supra* note 79, at 82.

212. *Id.* at 107. According to an interview with Warren A. Cook, unions at this time generally did not have industrial hygienists on staff. CORN, *supra* note 98, at 135.

213. ZIEGER, *supra* note 122, at 26; *see also* BRINKLEY, *supra* note 164, at 201 ("The rise of the American labor movement had been one of the most striking social developments of the 1930s.").

214. *See* ZIEGER, *supra* note 122, at 45, 55 (describing the conflict between the AFL and Congress of Industrial Organizations (CIO) as they competed over membership); KENNEDY, *supra* note 156, at 301-03. Brinkley notes that Roosevelt vacillated over appropriate policies at this point. *See* BRINKLEY, *supra* note 164, at 86-87 (illustrating some of the criticism of the President over his lack of concrete planning). Within the Administration, the period was referred to as the "struggle for a program." *Id.* at 97.

215. BRINKLEY, *supra* note 164, at 3, 23.

216. *See* ROSNER & MARKOWITZ, *supra* note 79, at 133 ("The National Silicosis Conference had not resolved the silicosis issue. Rather, it had spurred the contending groups to organize nationally.").

advocated federal solutions),[217] employers opted for the devil they knew—workers' compensation. The change was evident, in the sense that "[b]y the end of 1937, forty-six states had enacted laws covering workers afflicted with silicosis."[218] By way of comparison, only 15 states covered some or all occupational diseases at the start of 1936.[219]

Workers' compensation was not the only area in which state involvement in industrial disease expanded during the 1930s. The Roosevelt Administration offered states financial incentives to expand their involvement: 19 states established industrial hygiene departments by 1936 in response to a federal initiative that made Social Security funds available for such departments through the Public Health Service; only seven had had such programs before 1935, and those were "of a limited nature."[220] Federal spending on industrial hygiene rose quickly, from $100,000 in 1936 to almost $750,000 in 1938.[221] State budgets rose to $589,000 in 1938, with 161 employees across 26 states.[222] Importantly for future activity, the Temporary Conference of Official Industrial Hygienists organized in 1936 and would soon become the influential National Conference of Governmental Industrial Hygienists (NCGIH), and in 1946, the American Conference of Governmental Industrial Hygienists (ACGIH), which continues today.[223]

6. Explaining the 'Moderate' Outcome

One important reason industry was able to head off regulation was that employers organized quickly in response to the federal interest in Gauley Bridge.[224] Employers saw union efforts to control the workplace as a

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217. *See* Skinner, *supra* note 202, at 4 (addressing Rep. Marcantonio's call for federally imposed safety standards). The threat was probably seen as significant. Roosevelt's rhetoric had taken a hard turn left in 1935, and "he now brandished the mailed fist of open political warfare" at business. KENNEDY, *supra* note 156, at 278. Because the main threat to Roosevelt lay to the left in 1935, his shift leftward was aimed at Father Charles Coughlin and Gerald L.K. Smith, the successor to the assassinated Huey Long's political program. *Id.* at 283. Roosevelt may not have meant it, as Kennedy concludes, but his rhetoric was undoubtedly alarming at the time. *See id.* at 284-85 (noting that Roosevelt "substituted insult *for* injury").

218. CHERNIACK, *supra* note 71, at 110; *see also* ROSNER & MARKOWITZ, *supra* note 79, at 92 (noting that New York employers introduced a bill making silicosis coverable under the workers' compensation system).

219. Skinner, *supra* note 202, at 4.

220. *See* CORN, *supra* note 98, at 10-11 (covering the growth of state industrial hygiene units); U.S. Dep't of Labor, *Third National Conference on Labor Legislation, 1936*, 43 MONTHLY LAB. REV. 1438, 1442 (1936) (tracking the formulation of these units within the individual state health departments).

221. CORN, *supra* note 98, at 11.

222. *See id.* at 12-13 (providing state by state figures in table form).

223. *See id.* at 15 (recounting the history of this important organization). The permanent organization organized in 1938. LIORA SALTER, MANDATED SCIENCE: SCIENCE AND THE SCIENTISTS IN THE MAKING OF STANDARDS 37 (1988).

224. *See* ROSNER & MARKOWITZ, *supra* note 79, at 106 (describing the initial meeting of

serious threat to the productivity gains of the first part of the twentieth century.[225] The opening years of the New Deal had made clear the stakes and the Roosevelt Administration's likely approach to labor issues.[226] The Air Hygiene Foundation was quickly established to serve as a clearinghouse and establish voluntary standards.[227] It conducted "nearly all" silicosis research after its establishment.[228] And despite employers' fears of New Deal legislation, given Roosevelt's status as a "diffident champion of labor, and especially of organized labor unions,"[229] the Administration did not strongly resist employer efforts to head off stronger reform efforts.

To the extent that they sought to use the Gauley Bridge incident to create federal authority over occupational health, the unions overreached.[230] And organizing, not occupational health, was the top union priority in 1936 and 1937.[231] The unions were also resisting provisions of industrial disease legislation that might lead to afflicted employees losing their jobs.[232]

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the industry coalition the day before congressional hearings on Gauley Bridge began).

225. *See* ZIEGER, *supra* note 122, at 28 (describing industry's steadfast resistance to unionism).

226. For example, the Roosevelt Administration had convened a series of conferences of state labor department representatives and union leaders beginning in 1934 to push states to develop a model labor code. Louis Stark, *44 States Prepare Model Labor Code*, N.Y. TIMES, Feb. 16, 1934, at 20. These conferences pushed "for the leveling upwards" of labor legislation across states. *President Promises Continued Uplift of Labor Standards*, WALL ST. J., Nov. 10, 1936, at 8. The first conference's industrial health committee adopted a report advocating industrial disease coverage, periodic factory inspections, NRA-style industrial codes at the state level, ventilation standards, and a host of other measures. *See* U.S. Dep't of Labor, *Washington Conference on Labor Legislation, February 1934*, 38 MONTHLY LAB. REV. 779, 780-81 (1934) (listing the various implementations recommended by the committee). A second conference held in 1935 reached similar conclusions. *See* U.S. Dep't of Labor, *National Conference on Labor Legislation, Asheville, N.C., October 4-5, 1935*, 41 MONTHLY LAB. REV. 1247, 1250-53 (1935) (describing the additional recommendations of the second conference). The third conference initially adopted a call for a constitutional amendment authorizing federal legislation on minimum wages and "other social legislation," although the latter phrase was later deleted at the request of Secretary of Labor Perkins, who argued that it was too broad. *See Labor for Change in Constitution*, N.Y. TIMES, Nov. 12, 1936, at 2 (describing the amendment and Perkins' influence on its final language).

227. *See* ROSNER & MARKOWITZ, *supra* note 79, at 108 (noting the instant legitimacy enjoyed by the Air Hygiene Foundation).

228. *Id.* at 129.

229. *See* KENNEDY, *supra* note 156, at 297 (suggesting that Roosevelt "was more interested in giving workers purchasing power than in granting them political power").

230. *See* ROSNER & MARKOWITZ, *supra* note 79, at 129-30 (describing the call of the unions for federal regulation of the workplace rather than the adoption of voluntary standards).

231. KENNEDY, *supra* note 156, at 289.

232. *See, e.g.*, *The Silicosis Bill*, N.Y. TIMES, Apr. 3, 1936, at 22 (noting that, in crafting a New York state bill on silicosis, "[l]abor successfully opposed physical examination [of workers at risk] and this through fear of losing the right to earn a living. Apparently the risk of death was not heeded"); *Silicosis Problem in State at 'Crisis'*, N.Y. TIMES, Apr. 15, 1936, at 9 (quoting an AFL spokesman that the need for X-ray examination was unquestioned "[w]here silicosis exists" but that employees should not be discharged or assigned to lower paying jobs if they were discovered to have silicosis).

Although labor interests succeeded in getting legislation introduced in Congress to implement their approach in the late 1930s,[233] by that time a conservative coalition had emerged in Congress with the strength to block the legislation,[234] and the White House did not push the legislation through.[235] Moreover, the Supreme Court had not yet "switched" to allowing the Roosevelt reforms,[236] and Secretary of Labor Francis Perkins was worried over the Court's possible attitude toward labor legislation generally.[237]

Another reason why more radical solutions were not adopted was that many viewed the problem as largely solved. Perkins,[238] for example, told the second national conference on silicosis that "its present hazards [can be] reduced to a minimum and the disease itself finally eradicated,"[239] and employer representatives confidently asserted that ventilation equipment's development had reached the point that "'the existence of a dust hazard is already on its way out.'"[240] Moreover, experts thought that only two percent of the workforce was at risk and only half of that number was at serious risk.[241]

The problem of "dust rackets" grew out of the lagging medical technology for determining causation. Dust-related diseases, and occupational diseases generally, were hard to diagnose definitively.[242] Without the diagnostic tools to attribute illness to exposure, the tort system risked both under- and over-inclusiveness. Where rigorous causation standards applied, even plaintiffs genuinely injured by an occupational exposure were unlikely to prevail. When the plaintiffs' bar gained relaxed

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233. *See* ROSNER & MARKOWITZ, *supra* note 79, at 131 (listing the bill for "prevention of industrial conditions hazardous to the health of employees" introduced by Senator James E. Murray as evidence of this success).

234. KENNEDY, *supra* note 156, at 339.

235. *See* ROSNER & MARKOWITZ, *supra* note 79, at 133 (noting the Administration's preoccupation with the coming war). Attention also shifted to international efforts, with the International Labor Office convening a conference on the topic in 1938. *Silicosis Parley Opens*, N.Y. TIMES, Aug. 30, 1938, at 3.

236. KENNEDY, *supra* note 156, at 335 (describing the Supreme Court's reversal on the constitutionality of the New Deal legislation in 1937).

237. *Id.* at 265.

238. Perkins combined

> the commonsense practicality of her New England forebears, the sometimes patronizing compassion of the social worker milieu in which she had been steeped at Jane Addams's Hull House as a young woman, and a large fund of political know-how compiled in her career as a labor lobbyist and industrial commissioner in New York.

Id. at 259. She believed that government could do better for workers than either employers or the workers themselves. *Id.* at 260.

239. *Bars to Silicosis Cited by Experts*, N.Y. TIMES, Feb. 4, 1937, at 23.

240. *Silicosis Problem in State at 'Crisis'*, *supra* note 232.

241. U.S. Dep't of Labor, *Program for Prevention and Compensation of Silicosis*, 44 MONTHLY LAB. REV. 909, 909 (1937).

242. *See supra* note 99 and accompanying text.

proof and pleading standards, de facto, if not de jure, fraudulent claims could prevail as well as legitimate ones. Of particular relevance for our discussion is the institutional response to the silica litigation: Life insurance companies took an interest in the question because it affected their payments on policies.[243] The insurance companies also developed the data that unseated the bacteriological theory.[244] Significantly, only a few decades earlier an actuary who addressed the 1893 World's Fair "Auxiliary Congress" "wistfully concluded [that], most 'hazards of occupations' were 'unknown and almost incalculable.'"[245] In a short time, motivated by the desire to increase profits by accurately classifying risks, the insurance industry helped create a revolution in knowledge about industrial disease.

Attempts to resolve the failure of the tort system by including silicosis as a compensable occupational disease under state workers' compensation statutes brought financial stresses and demands for fiscal reforms to those systems.[246] Causation issues plagued both common law and workers' compensation solutions, as silicosis and tuberculosis often went hand in hand.[247] Moreover, susceptibility to silicosis is related in part to characteristics of the exposed individual, including both voluntary—for example smoking—and involuntary—for example genetic—characteristics,[248] creating additional problems for both tort and insurance solutions. Such transfers failed to resolve the fundamental problem of determining who had a covered disease and simply shifted the problem from the tort system to the insurance system.

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243. *See* ROSNER & MARKOWITZ, *supra* note 79, at 24 (describing how statisticians at Metropolitan Life and Prudential handled 80% of the $3 billion market for "industrial insurance" policies sold to workers); *id.* at 75 (quoting Anthony Lanza's 1939 account that "[o]ut of a clear sky and with dramatic suddenness, the insurance companies were faced with a situation that was in many respects terrifying").

244. *See id.* at 25-26 (explaining that the work of Frederick Hoffman, a Prudential analyst, "was critical to the unmasking of silicosis as a distinct condition in the United States").

245. SELLERS, *supra* note 45, at 20 (quoting actuary William Standen). The insurance companies did not develop accurate information immediately. *See id.* at 29 (discussing the development of insurance companies' customer screening practices).

246. *See* DAVIS, *supra* note 167, at 30 (describing the fiscal crisis in New York); *id.* at 52 (describing the fiscal crisis in Massachusetts).

247. Vermont granite workers, an occupational group whose high silicosis rates spurred much of the modern research on the disease, primarily died of tuberculosis after contracting silicosis. Graham, *supra* note 5, at 200; *see also* DERICKSON, *supra* note 80, at 52 ("[T]he most important source of misunderstanding [in the early twentieth century] was the pervasive failure to differentiate silicosis from tuberculosis.").

248. Absher, *supra* note 13, at 663 ("[C]onfounding factors include genetics, smoking habits, and underlying diseases such as tuberculosis and rheumatoid arthritis."); Craighead, *supra* note 15, at 401 ("Clearance of particulate matter from the lower respiratory tract is more complex and is influenced by numerous variables, only a few of which can be satisfactorily defined quantitatively. Not the least of these factors is the variability between individuals, the effects of aging, and cigarette smoke."); Wang & Banks, *supra* note 10, at 70 ("In the general population, cigarette smoking accounts for the overwhelming proportion of patients with severe airways obstruction.").

To summarize, by 1940 the legal treatment of silica dust had undergone several key changes. Although the medical community had long recognized that breathing dust was unhealthy, it was not until industrialization greatly increased dust exposures (and other hazards) that American jurisdictions adopted regulatory measures aimed at workplace hazards generally or silica dust in particular. The increased injury rates of the new mechanized factories, mines, and other workplaces helped produce a broad coalition that demanded legislation to spread the costs. In a compromise between labor and industrial interests, both sides accepted workers' compensation systems to spread the costs of accidents. Eventually, the increase in industrial diseases, especially silicosis, led to their inclusion in the system as well. This latter development did not occur until the financial pressure of silicosis lawsuits produced a new broad coalition in favor of action. In essence, industrial interests found workers' compensation coverage less of a threat than the numerous suits brought by alleged silicosis victims and the possibility of federal intervention.

The institutional response to silica dust during the first part of the twentieth century is thus understandable in the interest group framework. Mechanization led to a greater demand among those injured. Institutional entrepreneurs responded to this demand by innovating (the workers' compensation system coverage of accidents, the 1930s silicosis lawsuits, and the extension of workers' compensation to cover silicosis and other industrial diseases). Further, the interplay of interest groups produced compromises as well as new institutions.

The categorization problem arose in the context of these debates. Silicosis and other industrial diseases were covered by the new institutions; tuberculosis and other "social" diseases were not. This was not a foregone conclusion; labor and left-wing interests campaigned early for a comprehensive approach to public health rather than a workplace-specific approach.[249] The outcome of the debate, however, introduced a legal distinction between the two types of disease.

Implementing the distinction proved difficult. Diagnosis was—and remains—a challenge; early twentieth-century medicine was not up to the task of definitively determining whether a particular individual was sick because of occupational exposures or because of other factors. As a result, distinctions that later came to be seen as arbitrary were introduced, such as the requirement that radiographic evidence be used to diagnose lung conditions rather than loss of capacity.[250] By awarding benefits for a

249. *See* Rosner & Markowitz, *supra* note 130, at 475-77.

250. *See* Daniel M. Fox & Judith F. Stone, *Black Lung: Miners' Militancy and Medical Uncertainty, 1968-1972*, *in* SICKNESS AND HEALTH IN AMERICA, *supra* note 130, at 32, 39 (describing the controversy in the 1960s over this requirement for diagnosing black lung).

subset of employees with reduced lung capacity, the institutions that grew out of the 1930s created incentives both for employees to be diagnosed with silicosis and other covered diseases rather than other conditions and for employers to seek different diagnoses for claimants in order to eliminate the need to pay compensation. This line of division became politically determined because the categorization issue could not be settled objectively.

C. World War II to OSHA

During the war, labor became, "in effect, a ward of the state."[251] The Roosevelt Administration protected unions from decertification but demanded and received a "no strike" pledge and wage restraint in return.[252] Labor demands after the end of the war centered on wages.[253] The passage of the Taft-Hartley Act in 1947 made union organizing more difficult.[254] After the war, "national labor leaders in both [the AFL and the CIO] came to see the labor movement's political goals as broadly conceived support for lower- and middle-class Americans."[255] Politically, the union movement "align[ed] itself squarely with the larger liberal agenda of countercyclical public spending and generous programs of social protection."[256] This more general focus to labor activism meant attention shifted away from workplace issues like industrial diseases. As in the 1920s, the expanding economy during the 1950s and early 1960s brought prosperity that dulled the union movement's appetite for institutional reform.[257] Moreover, the post-war industrial relations system centralized wage and benefit issues, but left "matters related to work rules, discipline, job assignment, and grievances" to local unions to resolve.[258]

The most important changes in workplace health thus came from the private sector. Industry turned to the industrial hygienists' trade organization for standards. The ACGIH, which had expanded its membership criteria to offset the decline in government activity after the war,[259] began to receive requests from firms for standards governing

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251. BRINKLEY, *supra* note 164, at 212.
252. *Id.* at 209-11.
253. *See* ZIEGER, *supra* note 122, at 104 ("[F]or most workers, the relatively straightforward question of wages remained the first priority.").
254. *See id.* at 110 (stating that the Taft-Hartley Act created allegedly "endless bureaucratization of labor relations").
255. *Id.* at 120.
256. BRINKLEY, *supra* note 164, at 223.
257. *See* ZIEGER, *supra* note 122, at 137 (suggesting that economic expansion and stability crippled the labor movement).
258. *Id.* at 154.
259. *See* CORN, *supra* note 98, at 29 (allowing full and equal membership to professional government employees).

workplace exposure.[260] The organization formed the Committee on Industrial Hygiene Codes, and it created a table of "maximum allowable concentrations" (MACs) as a first step toward a comprehensive industrial hygiene code in 1946.[261] A separate Technical Standards Committee also considered the issues and took over the project.[262] The organization also took advantage of increased interest in the subject during the war "to organize and develop industrial hygiene agencies where they had not previously existed. By the end of the war a network of units had been established in nearly every state and many large industrial cities."[263]

ACGIH then published its maximum allowable concentrations as "Threshold Limit Values" (TLVs).[264] The organization insisted that the TLVs were merely guides and not "fine lines between safe and dangerous concentrations."[265] Despite regular repetition of such warnings, however, many states used TLVs as legal limits in state-level workplace regulatory schemes,[266] and they continue in widespread use around the world.[267] The TLVs offered firms a focal point around which to structure their workplace safety campaigns, without requiring the firms to invest individually in the research necessary to set them. And firms could point to their compliance with "industry standards" if questions were raised about particular substances. The range of substances to which employees were exposed grew with the post-war explosion in the chemical industry, but there was no increase in dust exposures comparable to that introduced by the industrial revolution.

The one industry in which dust exposures increased dramatically was coal mining, which the United Mine Workers encouraged to move toward greater mechanization,[268] and the industry became virtually completely

260. *See id.* at 32-33 (noting debates over ACGIH's role in setting industry standards).

261. *See id.* at 33-34 (providing the committee's objectives). Three values for silica were established: five million particles per cubic foot of air (mppcf) for "Silica-High (above 50% free SiO_2)," 20 mppcf for "Silica-Medium (5-50% free SiO_2)," and 50 mppcf for "Silica-Low (below 5%)." *Id.* at 40.

262. *Id.* at 35.

263. *Id.* at 43.

264. ACGIH replaced the term Maximum Allowable Concentrations (MACs) with the term Threshold Limit Value (TLV) because of terminology concerns. *See* SALTER, *supra* note 223, at 57 (providing new terminology because of "inappropriate connotations"). "Threshold Limit Value" and "TLV" are both copyrighted terms. *See id.* at 36.

265. *See* CORN, *supra* note 98, at 60 (quoting the Committee on Threshold Limits).

266. *Id.* at 61-62.

267. *See* SALTER, *supra* note 223, at 43-44 (describing ACGIH's activities today); *see also* Health and Safety Homepages, Occupational Exposure Limits: Summary of Information from EU Member States and Other Sources, http://www.healthandsafety.co.uk/OELs_Summary_of_information.html#us (last visited Mar. 28, 2006) (noting nations that selected exposure standards values based on ACHIH's standards).

268. William N. Denman, The Black Lung Movement: A Study in Contemporary Agitation 8-9 (1974) (unpublished Ph.D. dissertation, Ohio University) (noting that the miners union supported mechanization and quoting a *Fortune* magazine article labeling John L. Lewis "the best salesman the machinery industry ever had").

mechanized after the war.[269] In this one industry, we do find persistent efforts to create regulatory measures. Congress introduced a series of bills during the 1950s proposing federal investigations of mine safety issues generally; some of these singled out silicosis for special mention, and others did not.[270] The International Union of Mine, Mill, and Smelter Workers, working with Montana Democratic Congressman Lee Metcalf, was a major force behind these bills.[271] In 1958, Congress appropriated $128,000 in funding for a Public Health Service study,[272] and in 1961, Congress authorized a federal study of health and safety hazards in mines (excluding coal mines) and quarries.[273]

As with silicosis, lung injuries from coal dust (referred to as black lung) were well-known but were not yet the focus of government action.[274] The problem of black lung came to the forefront at the same time as the Johnson Administration began a push for general occupational safety and health legislation.[275] Ralph Nader, for example, began a public campaign in 1968 to spur federal action on black lung with an article in *The New*

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269. *Id.* at 6 ("[T]he almost complete mechanization of coal mining in America, particularly since the end of the Second World War produced significantly greater amounts of coal dust in the mines.").

270. *See, e.g.*, H.R. 2622, 84th Cong. (1955) (providing for silicosis compensation); S. 2299, 84th Cong. (1955) (requiring study of silicosis); S. 3097, 84th Cong. (1955) (mandating investigation of health conditions in mines); S. 764, 85th Cong. (1957) (providing compensation for silicosis); H.R. 1240, 85th Cong. (1957) (authorizing federal mine and quarry inspections); H.R. 4111, 85th Cong. (1957) (requiring federal mine and quarry inspections); H.R. 9483, 85th Cong. (1957) (authorizing federal mine and quarry inspections); S. 828, 85th Cong. (1957) (authorizing federal mine and quarry inspections); H.R. 3394, 85th Cong. (1957) (mandating investigation of health conditions in mines and quarries); S. 403, 86th Cong. (1959) (providing for federal silicosis compensation); S. 811, 86th Cong. (1959) (providing federal mine and quarry inspections); H.R. 3741, 86th Cong. (1959) (authorizing federal mine and quarry inspections); H.R. 3760, 86th Cong. (1959) (authorizing federal mine and quarry inspections); H.R. 6295, 86th Cong. (1959) (authorizing federal mine and quarry inspections).

271. *See* ROSNER & MARKOWITZ, *supra* note 79, at 200-01 (detailing the steps in building a nationwide campaign regarding rock miners' health).

272. *See id.* at 206.

273. *See* Pub. L. No. 87-300, 75 Stat. 649 (1961) (granting investigative authority).

274. DENMAN, *supra* note 268, at 24.

275. *Id.* at 26-27. Testimony at the 1968 hearings on the Johnson Administration's OSHA proposal often included mention of silicosis and mine dust issues. *See, e.g., Occupational Safety and Health Act of 1968: Hearings on S. 2864 Before the S. Subcomm. on Labor of the Comm. on Labor and Public Welfare*, 90th Cong. 59-60 (1968) [hereinafter *1968 OSHA Hearings*] (statement of David S. Black, Undersecretary of the Interior) (noting that ACGIH will be adopting a mine dust standard and recounting the Department of Interior's activities on dust issues); *id.* at 64 (statement of W. Willard Wirtz, Secretary of Labor) (listing dust issues in mining as in need of address); *id.* at 229 (statement of Sen. Jennings Randolph) (calling for improvements to keep pace with problems); *id.* at 245 (statement of William Naumann, Associated General Contractors of America) (discussing silicosis exposure from rock work); *id.* at 272 (statement of Paul Hafer, National Association of Manufacturers) (characterizing coal miners' dust diseases as "the greatest single group of occupational diseases in the United States in terms of disability and compensation costs").

Republic and a public letter to Interior Secretary Stewart Udall.[276] Coupled with a heavily publicized West Virginia coal mine explosion later that year,[277] Nader's campaign pushed black lung to the forefront of public awareness. The mine disaster "badly tarnished" the industry and made it more willing to accept regulation.[278] The following year the new Nixon Administration introduced a federal mine safety bill, which at least some observers termed stricter than the Johnson Administration's efforts.[279] Many coal companies, which oil companies recently acquired, accepted regulation to help head off strikes.[280]

Despite the increased activity of the ACGIH, from World War II until the creation of OSHA in 1970, there was little federal or state action on silicosis or related diseases. Indeed, after the war, government funding for industrial hygiene fell,[281] and the profession declined despite the appearance of new technologies that posed new dangers in the workplace.[282]

Nevertheless, the ACGIH was active. Between 1961 and 1970, it issued 220 TLVs, bringing the total to 500.[283] ACGIH, and the TLV committees within ACGIH,[284] had considerable autonomy. The organization rejected the consensus approach of the American Standards Association because its members asserted that experts should set the health standards without interference from outsiders and that ACGIH members' governmental employment freed them from conflicts of interest.[285] But, public choice theory raises the question, what were ACGIH's and others' interests in the regulatory adoption of the TLVs?

First, the organization delivered professional status to its members, allowing them to both improve their status within firms and bureaucracies

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276. Denman, *supra* note 268, at 27-28.
277. *Id.* at 51.
278. *Id.* at 175.
279. *Id.* at 141.
280. *Id.* at 177. A last minute veto threat by the Nixon White House on fiscal grounds prompted a wildcat strike in Charleston, West Virginia and brought a quick signature from Nixon. *Id.* at 185.
281. *See* CORN, *supra* note 98, at 51 (noting that state industrial hygiene programs declined through the 1950s); *id.* at 195-96 (describing the impact of declining post-war federal funds on state programs in an interview with Charles D. Yaffee, who stated, "when the war ended, a depression set-in in industrial hygiene. A number of programs folded for lack of funds").
282. *See id.* at 29 (noting new industrial developments).
283. *See* SALTER, *supra* note 223, at 39 (citing 1931 through 1968 as ACGIH's most active period).
284. *See id.* at 44 (noting that TLV committee membership has been stable). Specifically, from 1961 to 1983, only 57 different people served on the committee. *Id.* TLV committee membership is controlled by the chair, and substances are selected generally based on industry requests. *Id.* at 47.
285. *See id.* at 38 (discussing ACGIH's belief that manufacturing and health standards should be set differently).

and to raise the profession as a whole.[286] The ACGIH's role in setting standards adopted by state governments, and eventually the federal government, enhanced that status. Second, the adoptions gave the organization influence: Firms followed its recommendations, and government agencies adopted its TLVs. Strong evidence that the organization derived some benefit from their use can be found in the fact that the organization and its members tolerated such uses over long periods, uses that directly contradicted the stated purposes of the TLVs.[287]

The ACGIH also played an important role for large firms, which, in turn, assumed key roles in creating and determining the TLVs. As one study noted, "It is easy to document the influence of industry, and of industry

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286. *See id.* at 60 (explaining that, in order to effectively control industry practices, ACGIH, not a professional association per se, needs the participation of those in the industry). There is little evidence of direct personal benefit to any members of the organization or the committees—committee members were paid only their travel expenses. *Id.* at 44, 47.

287. TLVs for about 400 substances were incorporated into OSHA consensus standards via their earlier use under the Walsh-Healey Act standards, although some were "based on inadequate documentation." *See* CORN, *supra* note 98, at 91 (describing OSHA's congressional authority to bypass rulemaking procedures and establish "start-up" standards). ACGIH did not attempt to stop OSHA's inappropriate use of the TLVs. *See id.* at 92 (clarifying that the TLVs were not meant to be standards). According to Corn, "ACGIH seemed to have mixed emotions about use of the TLVs. They wanted to contribute to the new federal effort to bring about a healthy and safe workplace, and they were proud of the TLVs. Very little discussion can be found about this issue." *Id.* In the one discussion recorded in the minutes, ACGIH seems to have been resigned to OSHA's inappropriate use of the TLVs. *See id.* (elaborating that, although the ACGIH was displeased with the Labor Department for misusing the TLVs, it felt that if the Labor Department was going to use TLVs for that purpose it might as well use ACGIH's TLVs). The board responded to a question from the floor by saying: "There is nothing in my opinion, that ACGIH can do to prevent or stop anyone, any state or federal agency, from using our ACGIH TLVs in standards." *Id.* at 92-93. One participant recalled that, despite the language in the TLV publications warning against treating them as standards, the group "was rather tickled with themselves that the TLVs were being used that way." Interview with Leonard J. Goldwater, *in id.* at 145. Goldwater also noted that the ACGIH "took no measures, whatsoever, to disassociate themselves from [OSHA's use of the TLVs] after it was made, after these things were adopted." *Id.* at 144. ACGIH standards were technically "not consensus standards, but the legislation establishing OSHA required that only consensus standards be adopted." SALTER, *supra* note 223, at 42. As one informant [to the study] suggested,

> Section 5(a) of the OSHAct mandates the Secretary of Labor to adopt, without dealing with title 5 of the Administrative Procedures Act [sic], as soon as practicable, any of the consensus standards already established in federal regulations . . . Some argue that the Secretary had discussions (before adopting the standards). Others argue that the adoption was automatic because the big employers were already using these standards.

Id. In addition, "There was some discussion in ACGIH about whether to adopt a consensus method, but ACGIH did not do so." *Id.* As one person described the situation,

> Stokinger saw the legislation (OSHAct) required consensus standards from that point on (for the purpose of their being adopted as OSHA regulations). So he looked around and appointed industry and union representatives on the TLV committee for the first time. I don't think this is appreciated. Stokinger was wrong, but he thought he could make the TLV committee (into) a consensus body if there were industry and union representatives.

Id.

consultants in ACGIH,"[288] especially since unions generally did not participate in the TLV process[289] and the ACGIH developed TLVs largely in response to industry requests.[290] Large firms thus obtained standardized TLVs around which state regulations, and eventually federal regulations, coalesced, helping prevent inconsistent standards. The process gave the firms influence over both the substances included and the levels set—influence they would find much harder to exercise over government regulatory bodies. ACGIH thus played a larger part than the Baptists (to large firms' "Bootleggers") in a "Bootleggers and Baptists" regulatory coalition.[291] It was a priestly caste in a theocracy.

Moreover, the eventual expansion of the federal role in occupational health and safety was foreseeable long before 1970.[292] The role of the ACGIH TLVs was also foreseeable. One ACGIH member and government agency employee described the use of TLVs by OSHA to a researcher as follows:

> I don't think it was accidental. There had been several attempts over the preceding years to promulgate an OSHAct . . . and it was just a question of time as to when there would be a national occupational health and safety program. The language of the OSHAct specifically provided for the Secretary of Labor to promulgate as interim or start-up standards, national consensus standards, that had already been promulgated under certain Acts including the Walsh-Healy Act. Now the people in the Bureau of Labor Standards who were responsible for promulgating those standards were the same people who were going to be responsible under OSHA for setting the interim standards. Many of these people were

288. SALTER, *supra* note 223, at 59. ACGIH and its members, however, deny that they are biased toward industry. *Id.* (explaining that many ACGIH members view the organization as an "industry watchdog").

289. *Id.* at 46 (referring to the labor industry as a "reluctant participant" in the ACGIH). Unions refused to participate in ACGIH, believing the organization was "industry dominated." MCGARITY & SHAPIRO, *supra* note 50, at 124.

290. *See* SALTER, *supra* note 223, at 47-48 (describing generally the informal process by which the ACGIH sets priorities and develops standards).

291. The Bootleggers and Baptists theory of regulation suggests that two different groups often work together to achieve political goals. *See* Bruce Yandle, *Bootleggers and Baptists: The Education of a Regulatory Economist*, AEI J. GOV'T & SOC'Y 13 (May/June 1983), *available at* http://www.mercatus.org/pdf/materials/560.pdf. Like the bootleggers in the early twentieth-century South, who benefited from laws that banned the sale of liquor on Sundays, special interests need to justify their efforts to obtain special favors with public interest stories. The Baptists, who supported the Sunday ban on moral grounds, provided that public interest support. While the Baptists vocally endorsed the ban on Sunday sales, the bootleggers worked behind the scenes and quietly rewarded the politicians with a portion of their Sunday liquor sale profits. *Id.*

292. *See* CORN, *supra* note 98, at 90 (explaining that ACGIH has unsurprisingly endorsed the OSH Act).

> ACGIH members but that doesn't make it an ACGIH decision. These people knew what was coming down the road and that they would have a job to do. If you had that responsibility, what would you use?[293]

Another factor in the expanding federal role may have been the Nixon Administration's distrust of bureaucrats relative to private enterprise. Nixon supported initiatives like environmental legislation, at least in part, for political advantage, but he also wanted to keep these initiatives carefully constrained to avoid incurring economic penalties or alienating his business supporters.[294] Adopting the consensus standards, already in use at many large businesses, both satisfied his political need to appear to be doing something and minimized the economic effects and potential decline in support from business. The expansion of ACGIH's TLVs during the 1960s, and their "inappropriate" use in state, and eventually federal, regulations, thus served the interests of the members, the organization, the large firms, and politicians.

Several factors explain the disappearance of silicosis and industrial hygiene generally from the legislative agenda until the late 1960s. First, the improvements in ventilation and other safety measures had greatly reduced dust exposures, especially outside mining. Follow-up studies on Vermont granite cutters in the 1950s and 1960s, for example, concluded that improved ventilation had solved the silicosis problem there.[295] The optimism expressed at the silicosis conference seemed to have been borne out.[296] Second, although some mining unions continued to push for federal studies and silicosis benefits, many unions lost interest in the issue because of their success at winning health benefits from employers.[297] The 1950s brought a "period when the issue of work and health became synonymous with health insurance packages and third-party coverage for the American work force. Unions bargained for financial support of welfare funds and Blue Cross or private health insurance coverage rather than for prevention of disease at the workplace."[298] Third, there were no Gauley Bridge-like

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293. SALTER, *supra* note 223, at 42.

294. *See* JOHN MORTON BLUM, YEARS OF DISCORD: AMERICAN POLITICS AND SOCIETY, 1961-1974, at 402 (1991) (detailing Nixon's environmental initiatives as a reaction to his main political opponent's position).

295. ROSNER & MARKOWITZ, *supra* note 79, at 210.

296. *See, e.g., 1968 OSHA Hearings*, *supra* note 275, at 59-60 (statement of David S. Black, Undersecretary of the Interior). Mr. Black testified that the department's programs had had "a marked effect over the last 30 years in steadily decreasing the number of cases of silicosis." *Id.* "Even silicosis, formerly a matter of major concern, has to a large extent been controlled" and that social security disability figures for silicosis claims reflect "exposures that occurred many years ago, particularly in coal mining, rather than current conditions." *Id.* at 461 (statement of Andrew Kalmykow, Counsel, Am. Ins. Ass'n).

297. *See* CORN, *supra* note 98, at 65 (noting that unions lagged behind management and government in industrial hygiene issues).

298. ROSNER & MARKOWITZ, *supra* note 79, at 212.

figures to focus public attention on the issue.[299] The anti-communism of the 1950s and the growth of the civil rights movement in the 1960s focused public attention elsewhere.[300] Due to a lack of scientific breakthrough, vigorous efforts by interest groups, or a salient public event, little changed in regulation. When action did come with the 1970 passage of the OSH Act, it came as part of the contest between the Nixon Administration and the Democratic Party for blue collar voters.[301] Nixon had an "acute political sensitivity" and followed virtually every policy discussion with "a presidential expatiation which be[gan]: 'Now let me talk about the politics of this thing; how it will turn out in October and November; how it will translate into votes.'"[302] Labor votes were central to Nixon's plan, even if he could not completely win over its leadership.[303] Charles Colson, a key

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299. BARTH, *supra* note 23, at 5-6 (discussing the importance of disasters that gain public notice in spurring change in workplace regulation).

300. *See* CORN, *supra* note 98, at 44 ("Americans in the 1950s were not very interested in occupational health. Other public health problems, for example, delivery of health care, and political issues dominated their thinking.").

301. MCGARITY & SHAPIRO, *supra* note 50, at 34 (denouncing the compromise that the final version of the OSH Act struck between Republicans and Democrats, namely that while OSHA would have the authority to set the standards, another agency, the Occupational Safety and Health Review Commission, would be the adjudicatory body to determine whether the Act had been violated). Nixon sought an electoral realignment. *See* ROBERT MASON, RICHARD NIXON AND THE QUEST FOR A NEW MAJORITY 3 (2004) (describing Nixon's immediate goal of securing a large majority for re-election in 1972). Nixon had beaten Hubert H. Humphrey in 1968 by only 500,000 votes out of 72 million votes cast, an election in which unions had worked vigorously for Humphrey. *See* ZIEGER, *supra* note 122, at 182-83 (marking the 1968 presidential election as "the end of the New Deal dispensation"). Nixon was aware after the 1968 election that he "had not yet won over any majority" and that "he owed his election to the votes of a minority rallied in opposition to the mistakes of the Democrats rather than in support of his promise." MASON, *supra* note 301, at 37. The closeness of the election undoubtedly had turned in part on active union support for Humphrey. The AFL-CIO "financed a strong operation to turn the labor vote from Wallace back to the Democrats." BLUM, *supra* note 294, at 314. Although Zieger terms Nixon "one of labor's chief nemeses, dating from his red-baiting campaigns for the U.S. Congress and Senate in 1946 and 1950," he also notes that Nixon had "cultivated some elements of the labor movement—hard core conservative construction unions, for example, and a huge Teamsters' union by now almost completely isolated from and disdainful of the AFL-CIO." ZIEGER, *supra* note 122, at 191. The 1968 election results demonstrated two key facts. First, "[t]he Johnson coalition of 1964 splintered in 1968," with George Wallace's third-party candidacy pulling significant blue collar support in North central states (Ohio, Michigan, Indiana, and Illinois). BLUM, *supra* note 294, at 316. Looking to 1972, Nixon could thus hope to improve his margins among these voters. Second, Nixon had to find new support to win reelection. *See* MASON, *supra* note 301, at 6 (detailing Nixon's efforts to find this new support through refusing to oppose the notion of governmental activism, which was popular at the time, and through leaving intact a majority of the programs created by Democrats between the 1930s and the 1960s). There was no guarantee that the crisis within the Democratic Party, which played to Nixon's advantage in 1968, would continue into the 1970s. *See id.* at 36 (referring to Nixon's reliance on the crisis within the Democratic Party as a "fragile basis for political success").

302. MASON, *supra* note 301, at 42 (quoting Elizabeth Drew).

303. *See id.* at 72, 97-98 (noting how central the labor vote had been to the Democrats and how Nixon urged his staff to publicize his Administration as "pro-workingman"). A memo by Pat Buchanan analyzing political strategy noted that the target constituency in 1970 would be "law and order Democrats, conservatives on the 'Social Issue,' but

political advisor, told Nixon in 1970 that they "need[ed] to identify with labor on a major substantive issue other than national security,"[304] and OSHA provided such an issue. Nixon's view of the conservativism of the voters he sought to woo included recognition that these voters opposed social engineering, not government programs they thought benefited them.[305] The strategy paid off in the 1970 mid-term elections, with large gains in areas that had supported Wallace in 1968.[306] Senate committee hearings in 1968 and 1970 were critical in both getting issues before the public and building support for the OSH Act.[307] The creation of OSHA and NIOSH in 1970 is thus consistent with the interest group perspective.

D. Regulation Under OSHA

The passage of the OSH Act dramatically changed the institutional environment, creating new incentives and interest groups and altering existing ones.

1. OSHA and Incentives

There are three key features to the regulatory regime created by the OSH Act. First, the statute separated standard-setting and enforcement from the development of technical knowledge about workplace hazards, locating the former in OSHA and the latter in NIOSH.[308] This separation of standard-

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'progressive' on domestic issues." *Id.* at 84. In pursuit of labor, Nixon "enthusiastically cultivated" union leaders, hosting a "high-profile" Labor Day dinner for union leaders in 1970. *See id.* at 97 (recounting Nixon's attempts at attracting the labor vote at a time when labor was becoming increasingly dissociated from the Democrat Party). Nixon did persuade AFL-CIO head George Meany to remain neutral in 1972. *See id.* at 173.

304. *Id.* at 97. The White House "avoided active conflict with unions on [economic issues] wherever possible." *Id.* at 134.

305. *See id.* at 49 (discussing how Nixon could reach the conservative "emerging majority"). When Nixon arrived in the White House it was "a time when mainstream political debate remained dominated by activist and not conservative proposals. . . . As Leonard Garment would note in 1971, in spite of their 'conservative philosophy,' Americans wanted 'liberal' benefits—complete health care, more social security, etc." *Id.* at 56.

306. *See id.* at 67 (observing that these gains were due largely to the Republicans' emphasis on the needs of the "silent majority"). It also paid off in 1972, with Nixon winning 57% of union household voters. *See id.* at 189 (noting that Nixon's efforts to generate support resulted in him receiving the greatest plurality in American history in the 1972 election).

307. *See* CORN, *supra* note 98, at 86 (asserting that, although the causal relationship between occupational disease and certain industries had been established, the available knowledge to remedy this problem had not been applied to preventing the problem).

308. Under the OSH Act, when NIOSH recommends that OSHA promulgate a health standard, the Secretary of Labor

> must, within 60 days after receipt thereof, refer such recommendation to an advisory committee pursuant to this paragraph, or publish such as a proposed rule pursuant to paragraph (2), or publish in the Federal Register his determination not to do so, and his reasons therefor. The Secretary shall be required to request the recommendations of an advisory committee appointed under section 812(c) of this title if the rule to be promulgated is, in the discretion of the Secretary which shall

setting and enforcement from research "has its roots in the history of earlier occupational safety and health activities and conflicts between the Department of Labor and the Public Health Service."[309] The ACGIH had to be careful in disputes over agency location in setting up OSHA because it had members in both public health and labor agencies.[310] Protecting the interests of existing bureaucracies thus explains the split between OSHA and NIOSH, a split that may have hindered OSHA's ability to set standards.[311]

Second, the statute required the agencies to act quickly to create a base of federal standards.[312] OSHA had only two years to convert existing consensus standards into legally binding ones unless the agency found that doing so would not improve safety and health.[313] This provision led to OSHA's wholesale adoption of things like the ACGIH TLVs as standards. Shortly after Congress established OSHA in 1971, the agency issued more than 4,000 general industry standards, based on national consensus standards of the American National Standards Institute and the National Fire Protection Association, as well as existing federal maritime safety standards.[314] In just four months, OSHA took more than 400 pages of standards from a variety of prior programs and voluntary organizations and converted them into regulations.[315] This change had the effect of converting a set of largely discretionary industry guidelines into mandatory workplace design standards[316] and, as noted below, changed the role of other agents in the market for health and safety.[317]

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be final, new in effect or application and has significant economic impact.
30 U.S.C. § 811(a)(1) (2000).

309. CORN, *supra* note 98, at 88 n.*.

310. Interview with Charles D. Yaffe, *in id.* at 203-04 (inferring that the ACGIH did not take an official position on a federal OSH Act).

311. *See, e.g.*, GAO, *supra* note 16, at 56-60 (criticizing the lack of cooperation in 1970s).

312. This was supplemented by a general duty provision. The OSH Act established a general duty on the part of employers to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees; and [to] comply with occupational safety and health standards promulgated under this chapter." 29 U.S.C. § 654(a)(1)-(2) (2000).

313. *See* MCGARITY & SHAPIRO, *supra* note 50, at 36 (explaining that Congress, wanting OSHA to immediately begin providing safer and healthier American workplaces, made a one-time exception allowing OSHA to promulgate already established national consensus standards and federal standards under the Walsh-Healey Act); *see also* 29 U.S.C. § 655(a) (2000) (outlining the procedure by which the Secretary would promulgate occupational safety or health standards).

314. *See* VISCUSI ET AL., *supra* note 52, at 775 (construing the nature of OSHA standards).

315. *See* MCGARITY & SHAPIRO, *supra* note 50, at 37 (describing OSHA's rush to promulgate the standards that Congress had mandated).

316. *See* VISCUSI ET AL., *supra* note 52, at 775 (criticizing OSHA's "technology-based" approach to regulation).

317. *See* discussion *infra* Section II.D.2 (examining the emergence of OSHA employees

Some have criticized OSHA for not attempting to "sort through the existing standards to weed out those that were obviously silly and outdated."[318] Salter's study and Corn's institutional biography both suggest, however, that because ACGIH members in their capacity as bureaucrats were involved in the process the explanation may not lie in a lack of knowledge about whether particular provisions were "silly or outdated" but rather in a wholesale acceptance of a broader role for TLVs than had ever been officially acknowledged as a goal by ACGIH. Reinforcing this interpretation is the recollection of an ACGIH member, who described the situation to Professor Salter as follows:

> At the time of OSHA's creation, there was a lot of soul searching at ACGIH. We wondered whether we should just fold up our tent and go home. There was a lot of encouragement in that direction coming from NIOSH. NIOSH felt that now it had legal responsibility for establishing criteria for standards, that ACGIH's TLV committee had done its job well, but that now we were in a new era and NIOSH superseded us. There were a lot of people at NIOSH who felt that way and weren't afraid to express it to the TLV committee and ACGIH itself. I was on the Board of Directors, but I think even more discussion was taking place in the TLV committees. It ended up with a wait and see attitude for a couple of years. By the mid-1970s, there was a realization that the new system was not going to be responsive to current problems.[319]

Converting the TLVs into standards served the interests of the ACGIH by giving it a rationale for continuing its work and served the interests of OSHA in getting regulations on the book quickly.

Moreover, OSHA standards did not come into existence in a vacuum. Before OSHA, there were state and local regulatory efforts as well as voluntary standards like the ACGIH TLVs. Large firms operating across jurisdictions benefited from nationalizing regulations, getting rid of conflicting local standards, and shifting the regulatory focus to Washington where they could afford to maintain lobbyists and lawyers. Indeed, the threat of conflicting state and local regulation remains a potent one. When the new Reagan Administration stopped work on a Carter Administration proposal for "right to know" rules, for example, unions began lobbying for state and local versions.[320] Worried about a patchwork of inconsistent rules, industries then sought federal rules that would preempt local standards.[321] Adopting the ACGIH TLVs, with which they were already

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as an interest group).

318. MCGARITY & SHAPIRO, *supra* note 50, at 37.

319. SALTER, *supra* note 223, at 41.

320. *See* MCGARITY & SHAPIRO, *supra* note 50, at 81 (affirming the unions' mistrust of the Regan OSHA's ability to promulgate an acceptable standard).

321. *See id.* (stating that OSHA, in an effort to appeal to the chemical and manufacturing industries, began drafting a uniform set of regulatory standards).

familiar, gave larger firms an advantage and forced their smaller competitors to incur additional costs.

Third, after the initial wave of standards copied from elsewhere, OSHA had to use its rulemaking powers to adopt new standards or modify existing ones. The "adversary-like process" of standard-setting gives those involved an incentive to produce all available evidence in support of a desired outcome.[322] "It is precisely this process that confirms the degree of uncertainty regarding the question of what is a 'safe' level of exposure"[323] in the context of hazardous substances. Unlike the relatively informal development of ACGIH TLVs, the process of OSHA standard-setting produced more vigorous participation by unions, which had largely ignored the ACGIH process, and by OSHA employees, a new interest group established by the creation of the agency. The subsequent history of OSHA and its workplace health standards is thus consistent with the interest group analysis.

2. OSHA and Interest Groups

Industrial hygienists as a group were the first major beneficiaries of the creation of OSHA and NIOSH. Passage of the OSH Act "created an intense interest in setting standards,"[324] "[j]ust as state and local industrial hygiene programs reached a low point and the profession seemed to be splintering, the federal government broadened its role in occupational safety and health."[325] The creation of NIOSH and OSHA led to "an enormous growth of professionals" in industrial hygiene: ACGIH membership boomed, and for the first time, a majority of ACGIH employees came from federal agencies.[326] Membership soared from approximately 1,000 in 1968, to over 1,500 in 1973, to almost 2,500 in 1983.[327] An organization that began in 1938 primarily consisting of 76 employees, almost all state and local agency employees, grew to 3,720 members, with a substantial federal contingent, by 1988.[328]

Creating OSHA brought an additional interest group into existence: OSHA's employees. OSHA's initial loose organizational structure gave the staff a great deal of autonomy, if not an overabundance of resources.[329]

322. BARTH, *supra* note 23, at 77 (acknowledging the interest in standard-setting that the passage of the 1970 OSH Act generated).
323. *Id.*
324. *Id.*
325. CORN, *supra* note 98, at 86.
326. *Id.* at 89.
327. *Id.* at xi.
328. *Id.* at x.
329. *See* MCGARITY & SHAPIRO, *supra* note 50, at 63-64. McGarity and Shapiro describe the first decade as follows:

> In its early years [until 1981], OSHA had in fact been a very loosely run organization. Rulemaking initiatives were generated internally in an ad hoc fashion.

As a result, when the Reagan Administration attempted to implement (de)regulatory agendas that were not those of the agency staff by exercising greater White House control (via the Office of Management and Budget (OMB)) over the agency, the agency staff found itself frustrated and turned to allies on Capitol Hill. For example, at congressional hearings in 1988, OSHA staff testified about the frustration of working on standards that were ultimately rejected by the agency or when they felt professional pressures as a result of agency positions. Working at the agency was, as one scientist put it, "extremely frustrating, and you ask yourself the question why are you doing this."[330] As McGarity and Shapiro conclude from their analysis of OSHA in the 1980s,

> Like any professional, an OSHA health scientist would like to believe that he or she is accomplishing something. But it is very hard to feel a sense of accomplishment when a regulation for which you are responsible sits on the desk of an upper-level manager or an OMB desk officer for years.[331]

Additional evidence of OSHA staff acting as an interest group comes from its practice in the 1970s of funding activist groups "that sought to educate workers about actions they could take in public forums to bring about safer workplaces,"[332] funding which created a demand for OSHA's services. (This funding stopped under President Reagan.)[333]

Not only was OSHA's staff now an interest group, but outside interest groups now had a potential ally. Unions in particular found OSHA—except during the Reagan and George H. W. Bush Administrations—to be a useful ally in some situations. For example, unions opposed Reagan Administration efforts to achieve voluntary compliance rather than to use large fines to motivate employers: "Workers preferred OSHA to be the 'tough cop' rather than a 'helpful consultant.'"[334]

> The heads of the Health and Safety Directorates had traditionally controlled standard-setting within their functional bailiwicks, with sporadic input from the assistant secretary. Loose internal work groups were assembled to draft rulemaking documents with substantial technical help from outside consultants. It was not uncommon for the head of a directorate to work directly on the rule, even to the point of typing the final version of the rule at 4 a.m. on the morning it was due. The entire agency tended to gear up for a single rulemaking effort, putting aside most other initiatives until they assumed front burner status.

Id.

330. *Id.* at 133 (quoting Dr. Peter Infante, who discussed difficulties with OSHA administrators).

331. *Id.* at 134.

332. *Id.* at 79.

333. *See id.* (explaining the history of the program).

334. *Id.* at 143. Consider also the example of the "lockout" rule—the rule that specified procedures under which equipment is locked to prevent injury from accidental restarts during servicing—that McGarity and Shapiro use to illustrate the delays in OSHA's accomplishing even relatively straightforward rulemaking. *Id.* at 112-14. OSHA promulgated consensus standards in 1971, but these "were not uniform in their coverage and

The creation of OSHA dramatically changed the environment under which standards were created. As one observer noted,

> A rule of thumb would suffice in the 1950s; it could easily be dislodged by industry and other criticism in the 1970s [under OSHA]. The expectations of the scientific basis for standards had increased considerably in the interim. More important, the relationship of industry to the standards themselves was changed by the introduction of regulatory standards and litigation arising from them.[335]

In short, "[o]nce a coherent (albeit not necessarily adequate) body of regulatory standards existed, as they did after 1970, the environment for standard-setting changed. ACGIH, other standard-setting bodies and regulatory agencies were in competition."[336]

OSHA also changed the standards environment by allowing those dissatisfied with the results to seek relief from the courts and political process. This affected how OSHA created standards. Professors McGarity and Shapiro, for example, concluded that judicial review was "a primary cause" of OSHA's slowness in issuing standards: "The impact of having to dot every i and cross every t for fear of a judicial remand has had a dramatic effect on OSHA."[337] The history of OSHA's efforts to regulate "ergonomics" injuries illustrates the impact of the political process. OSHA issued its first directive on the subject of ergonomics in 1986[338] and began

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contained significant inconsistencies between industries and between different types of equipment in the same industry." *Id.* at 112. The United Auto Workers repeatedly petitioned OSHA for a revised, more uniform rule, but internal debates within OSHA and between OSHA and the Office of Management and Budget (OMB) delayed a final rule until 1988, more than ten years after OSHA's initial publication of a notice in the *Federal Register* that it was considering revising the consensus standard. *Id.* at 112-13. Unions did not like the final rule, primarily because it did not "incorporate the principle of 'one person, one lock, one key,' under which the worker servicing the machine must personally lock the machine's switch in the off position before beginning the maintenance work and must personally remove the lock on the way out." *Id.* at 113. Unions also wanted a broader rule, applicable to more industries, and "employee participation in the formulation of lockout/tagout procedures and training programs." *Id.* The unions' interest in these three areas is straightforward. Both the "one person, one lock, one key" principle and the greater employee participation in creating training programs increased employee control over work procedures, enhancing union control when collective bargaining agreements existed. Expanding the application of a single rule across more industries, rather than taking OSHA's preferred industry-by-industry approach, favored unions, whose national office could analyze the single rule, at the expense of industries that might benefit from the case-by-case approach. As this example suggests, OSHA became a political prize, since it could be used to assist or hinder union efforts in the workplace.

335. SALTER, *supra* note 223, at 63-64.

336. *Id.* at 64.

337. MCGARITY & SHAPIRO, *supra* note 50, at 258.

338. *See* OSHA Instruction CPL 2.78, Feb. 9, 1987 Directorate of Technical Support, *reprinted in* OSHA Notice CPL 2, May 12, 1986, *available at* http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=1655 (stating that the directive "provided direction and established goals for use by OSHA personnel in the development of an ergonomics program for technical assistance as well as broad guidelines to be followed while conducting ergonomically related enforcement activities at the

the rulemaking process to draft an ergonomics standard in 1992. The final Ergonomics Program Standard was not issued until November 4, 2000.[339] Despite years of development, the standard was still controversial, and Congress passed a Joint Resolution, signed by President George W. Bush, repealing it on March 20, 2001.[340] Concurrent with the rule development process, OSHA was bringing enforcement actions against employers under the "general duty" clause of the OSH Act, which imposes a general obligation on employers to protect workers from "recognized hazards" in the workplace. Yet, in the three cases OSHA litigated to judgment, it was unable to convince the courts that (1) a recognized hazard existed, (2) workplace activity caused the injuries, or (3) OSHA offered solutions to the hazard.[341]

3. The Silica Standards

How did silica fare under the new regime? OSHA's regulation of silica began with OSHA's adoption of the ACGIH consensus standard in 1970, which set maximum exposure levels at 0.10 mg/m^3.[342] Unfortunately that standard was obsolete by the time it was adopted. In 1968, there was a major change in how individuals estimated quartz exposures based on dust samples. This change led to the adoption of arbitrary conversion factors to account for differences between the old and new measurement standards.[343]

Also in 1970, the newly created NIOSH began a study of lower levels to understand the impact of this methodological change. The study concluded that there was a significant loss of lung function and perhaps radiographic changes at the current dust levels. This finding led NIOSH in 1974 to recommend a change to an exposure level of 0.05 mg/m^3. Because the epidemiological studies on which NIOSH relied were "called into question because of technical and procedural problems," the recommended exposure limit has not been accepted by the Department of Labor.[344]

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workplace").

339. *See id.* (ordering implementation of new standard).

340. *See* Press Release, Statement by the President (Mar. 21, 2001), *available at* http://www.whitehouse.gov/news/releases/2001/03/20010321.html (explaining that he signed the legislation because he believed regulation was too burdensome on business).

341. *See* Eugene Scalia, *OSHA's Ergonomics Litigation Record: Three Strikes and It's Out*, Cato Institute Policy Analysis, *available at* http://www.cato.org/ pub_display.php? pub_id=1229 (detailing the history of the litigation and the attempt to impose ergonomics standards).

342. *See* 29 C.F.R. § 1910.1000(c) (1971) (delineating a new standard).

343. *See* Graham, *supra* note 5, at 201 (detailing a new method of measuring quartz exposures that, for the first time, took into account the particle size and percentage of quartz in the fraction of dust, but noting that the measurement required a mathematical conversion).

344. *Id.* at 201; *see* NIOSH HAZARD REVIEW, *supra* note 31, at 3 (explaining that, in the continued effort to protect workers from exposure, the exposure limit should be lowered to 0.05 mg/m^3).

In the 1980s, new studies found crystalline silica to be a potential carcinogen, triggering OSHA's Hazard Communication Standard (HCS or HazCom standards).[345] Under the HCS, OSHA-regulated businesses using materials with 0.1 percent or more crystalline silica must follow federal guidelines on hazard communications and worker training.[346] HCS coverage did not immediately trigger new exposure regulations, but it did get the attention of the mining industry (which involves a great deal of silica exposure), mining regulators, and state legislatures.[347] The Mine Safety and Health Administration (MSHA) issued its own HazCom standards in 2002.[348] OSHA has issued several interpretive letters clarifying the standard with respect to silica and denying petitions for exclusions of certain silica applications from the HCS requirements.[349]

In the private sector, both the American Society for Testing and Materials (ASTM) and the Building Construction Trades Department of the AFL-CIO have also developed recommended practices for protecting workers who may be exposed to quartz dust.[350]

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345. *See* PRIMER, *supra* note 9, at 1 (explaining the evolution of the regulation of silica).

346. *See id.* at 12 (noting that a lot of sampling is required to prove the concentration is under the threshold in order to get out of OSHA's Hazard Communication standards). According to OSHA regulations, these "comprehensive hazard communication programs . . . are to include container labeling and other forms of warning, material safety data sheets and employee training." OSHA Hazard Communication Standards (HCS or HazCom standards), 29 C.F.R. § 1910.1200, *available at* http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10099.

347. *See* PRIMER, *supra* note 9, at 12, 16 (noting how awareness of the problem led to changes).

348. *See* Hazard Communication, 67 Fed. Reg. 42,314, 42,323 (June 21, 2002) (to be codified at 30 C.F.R. pts. 42, 46, 47, 48, 56, 57, 77) The Hazard Communication stressed the potential for exposure to substances in the determination of covered hazards:

> Almost all miners are exposed to crystalline silica, but the potential for illness is related to their exposure to the respirable fraction of dust. For example, suppose your miners work on a concrete floor and there is silica in the concrete. If no cutting, grinding, or other activities occur on the floor that would release the respirable fraction, the potential for exposure to respirable crystalline silica is remote, and the miners are not potentially exposed to a hazard. If you must remove the floor through grinding, cutting, or crushing, the potential for exposure is foreseeable and the concrete would become a hazardous chemical subject to HazCom. Base your decision to include a chemical in your HazCom program on its hazards and the potential for miner exposure.

Id.

349. *See* Letter from John Pendergrast, Assistant Secretary of Labor, to Theodore L. Garrett (Sept. 20, 1988), *available at* http://www.osha.gov/pls/oshaweb/owadisp.show document?p_table=INTERPRETATIONS&p_id=19704 (stating that OSHA denied the petition filed on behalf of the National Stone Association because it ruled that "[i]nformation regarding the evidence of carcinogenicity must be included on required labels and material safety data sheets for crystalline silica, and for products containing crystalline silica, where employee exposure to the crystalline silica may occur").

350. *See* U.S. DEP'T OF LABOR, SPRING 2005 UNIFIED AGENDA OF FEDERAL REGULATORY AND DEREGULATORY ACTIONS, *available at* http://ciir.cs.umass.edu/ua/Spring2005/agenda/DEPARTMENT_OF_LABOR_(DOL).html; ASTM INT'L, ASTM E1132-99A, STANDARD PRACTICE FOR HEALTH REQUIREMENTS RELATING TO OCCUPATIONAL EXPOSURE TO RESPIRABLE CRYSTALLINE SILICA (Aug. 10, 1999).

Recently, OSHA has moved the regulation of crystalline silica to the top of its regulatory agenda. It is one of four "high priority regulations" listed in the December 2004 Regulatory Plan.[351] In October 2003, OSHA provided for review by a Small Business Advocacy Review panel a draft rule to address exposure to crystalline silica.[352] The draft included three alternative "permissible exposure limits" (PELs): the current 0.10 mg/m^3, 0.075 mg/m^3, or 0.050 mg/m^3, all measured as an 8-hour time-weighted average (TWA) concentration of respirable crystalline silica.[353] In December 2003, the small business panel submitted a report to OSHA, commenting on OSHA's evaluation of the costs and risk-reduction potential of compliance with different standards.[354] OSHA plans to complete a peer review of its health effects and risk assessment by December 2005 and to issue a proposed regulation by April 2006.[355] The MSHA has also listed silica on its regulatory calendar.[356] Noting that "the Secretary of Labor's Advisory Committee on the Elimination of Pneumoconiosis Among Coal Mine Workers made several recommendations related to reducing exposure to silica" and that "NIOSH and ACGIH recommend a 50μg/m^3 exposure limit for respirable crystalline silica," MSHA states it "is considering several options to reduce miners' exposure to crystalline silica."[357] In its Spring 2005 agenda, MSHA proposed as its next action a "request for information" but did not establish a time table for action.[358]

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351. U.S. Dep't of Labor, 2004 Regulatory Plan, 69 Fed. Reg. 72,781, 72,781 (Dec. 13, 2004).

352. *See* Letter from Thomas M. Sullivan, Chief Counsel for Advocacy, to Robert E. Burt, Small Business Advocacy Chair, OSHA (Oct. 31, 2003), *available at* http://www.sba.gov/advo/laws/comments/osha03_1031.pdf (explaining that § 609(b) of the Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), requires OSHA and the EPA to notify the Office of Advocacy of the Small Business Administration and respond to comments by a Small Business Advocacy Review Panel before issuing regulations that may have a significant impact on small entities).

353. *See* SBREFA PANEL, 12/03 REPORT OF THE SMALL BUSINESS ADVOCACY REVIEW PANEL ON THE DRAFT OSHA STANDARDS FOR SILICA (Dec. 19, 2003) (stating that the PEL is the highest average concentration of respirable crystalline silica in the air to which an employee may be exposed over an eight-hour workday).

354. *Id.*

355. U.S. DEP'T OF LABOR, SPRING 2005 UNIFIED AGENDA OF FEDERAL REGULATORY AND DEREGULATORY ACTIONS, ENTRY 1935, OCCUPATIONAL EXPOSURE TO CRYSTALLINE SILICA, *available at* http://ciir.cs.umass.edu/cgi-bin/ua/web_fetch_doc?dataset=ua&db=agendaSpring2005&query= and&doc_id=1935.

356. U.S. DEP'T OF LABOR, SPRING 2005 UNIFIED AGENDA OF FEDERAL REGULATORY AND DEREGULATORY ACTIONS, ENTRY 1921, RESPIRABLE CRYSTALLINE SILICA STANDARD, *available at* http://ciir.cs.umass.edu/cgi bin/ua/web_fetch_doc?dataset=ua&db=agendaSpring2005&query=and&doc_id=1921.

357. *Id.*

358. *Id.*

4. Institutional Biases in Regulation

The measures necessary to stop silica dust from harming people are conceptually simple[359]: reduce exposure to the dust. There are four main methods of reducing exposure to dust. First, jobs might be redesigned to eliminate exposure to dust. For example, a silica product might be replaced with a different substance in a grinding application.[360] This method has limited capacity because silica is both so common and so useful. Moreover, restructuring the workplace is exactly the situation in which Hayekian local knowledge will be most needed—making it all but impossible to impose through a centralized regulatory regime without imposing unacceptable losses. Such welfare losses from a centralized approach might be borne with respect to an infrequently used substance, both because the range of uses might be small enough to reduce the losses' magnitude and because the amount of use is small enough to reduce the total loss to a bearable level. Where a substance is used as widely as silica, however, it is not possible.

Second, engineering steps might be taken to reduce exposure.[361] For example, dust suppression equipment might be deployed[362] or increased ventilation might reduce dust concentrations.[363] These engineering steps are the primary approach taken by OSHA, both with respect to silica and other hazardous air contaminants. They have the regulatory virtue of allowing OSHA to specify a level of contamination in the air that gives the impression of precision.[364] As noted earlier, however, OSHA's current

359. *See* Brian Williams et al., *Occupational Health, Occupational Illness: Tuberculosis, Silicosis and HIV on the South African Mines*, *in* OCCUPATIONAL LUNG DISEASE, *supra* note 5, at 95, 100 (opining that the prevention of silicosis can be accomplished by observing dust levels, a technical problem).

360. *See* Jones, *supra* note 5, at 221 (proposing that using less hazardous materials in lieu of dangerous materials is a viable way of reducing exposures).

361. *See id.* at 221 (suggesting that ventilation, isolation, substitution, and dust suppression by wetting are among the possibilities to reduce silica exposure).

362. *See id.* (indicating that applying water or other liquid is an adequate method of controlling dust).

363. *See id.* (detailing the ability of local ventilation systems to trap a contaminant before it reaches the general air flow).

364. Corn details one of the key problems with using the TLVs as standards by using the following example: TLV standards were intended to be room air levels, but OSHA treated them as measurements "at the nose." *See* Interview with Leonard J. Goldwater, *in* CORN, *supra* note 98, at 145-46. As Columbia Medical School Professor and longtime ACGIH member Dr. Leonard Goldwater explained in an interview, TLVs were based on room monitoring, not personal monitoring:

> Now we're doing almost entirely personal monitoring. And the values you get from personal monitoring, as you well know, have no connection whatsoever to general room air levels. I shouldn't say no connection, but they can be very far apart. In fact my experience with personal monitoring is that it gives higher levels than those in general room air. We've done some studies on this. Mercury in particular is two or three times higher at the nose than it is 6 feet away in the general room air. Now, as far as I'm aware, nothing has been done to point out the fact that these original correlations no longer hold. And that what the agencies are doing now is saying

standard (in effect since 1970) is based on outdated measurement technology.[365] Most importantly, such standards provide no incentive for increasing knowledge about the regulated workplace hazard; indeed, they may even discourage it by focusing attention on compliance with the standard rather than on harm reduction. Given the costs of changing an OSHA regulation, they certainly do not encourage investigations by private parties into categorization issues.

Third, vulnerable employees may be removed from the workplace.[366] Unions have traditionally resisted this approach,[367] and OSHA has followed their lead and generally not included such provisions in its regulations. As medical knowledge increases, however, genetic links between individuals and vulnerability to particular substances are likely to emerge.[368]

Finally, workers at risk of exposure could wear personal protective equipment, but OSHA generally prefers not to use this method of controlling occupational exposure to hazardous substances. As one reference work on the subject firmly concluded: "Personal protective equipment, and in the case of dust exposure, specifically respiratory protection, should only be considered for operations where it is not possible to control exposure by other means. They should never be considered as an alternative to engineering controls."[369] Why not? Occupational disease control specialists have three main objections: (1) the gear is not "foolproof;" (2) it depends on workers' "voluntary compliance" with the program for their use, and workers will not follow instructions on using personal equipment; and (3) it requires an ongoing maintenance

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> that you mustn't have more than, let's say, 10 parts per million at the nose when originally it was 10 parts per million in the general room air. You're dealing with a totally different system. And so they're insisting on the values of personal monitoring being the same as those of the general room air, which means that you have to reduce them by several-fold. I wrote to Elkins and Stockinger about this at the time I became aware of it. And Elkins said 'You're right'; he was on the committee. And that's where that ended. Stockinger as usual giggled . . . . OSHA misapplied these things from day one. As far as I'm aware, ACGIH has done nothing to tell OSHA: "You're off-base, you don't know what you are talking about. You're misapplying TLVs, you're misinterpreting them, you're doing everything wrong with them." To me this has done great mischief, to put it mildly.

Id.

365. *See* Graham, *supra* note 5, at 201 (detailing a new conversion method that has problems, for example, converting between parts per cubic foot and mg/m^3).

366. *See* Banks, *supra* note 71, at 8 (advocating that, once someone has an occupational lung disease, "the worker is best advised to leave the workplace").

367. *See supra* text accompanying note 232 (discussing union efforts to prevent legislation that would result in the discharge of affected employees).

368. *See* Karen Rothenberg et al., *Genetic Information and the Workplace: Legislative Approaches and Policy Challenges*, 275 SCIENCE 1755, 1755 (1997) (finding that, as technology advances, the information base on connections between genetics and susceptibility to disease has increased).

369. Jones, *supra* note 5, at 221.

program.[370] The first and third of these are not serious objections—no method of exposure control is foolproof, and all equipment requires maintenance.[371] The problematic objection is thus that workers will not properly use the equipment intended to protect them. This objection has a long history.[372] In essence, it amounts to a claim that workers make inappropriate tradeoffs of immediate comfort and long-term health (by removing uncomfortable respirators) and/or do not properly understand the risks posed by the substances from which the respirators are intended to protect them.[373]

So long as occupational health regulations forbid reliance on respirators, of course, the incentive to develop more effective, lower cost, and more comfortable equipment is eliminated. We observe a quite different rate of technical progress in other, similar areas of equipment. Scuba gear, for example, has progressed from heavy, relatively failure-prone, surplus

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370. *See* Philip Harber, *Respirators*, *in* ENVIRONMENTAL & OCCUPATIONAL MEDICINE 1757, 1757 (William N. Rom ed., 3d ed. 1998). Harber stated,

> Use of respirators is not the method of choice for controlling exposures. Respirators do not provide foolproof protection. Respirator-based protection is completely dependent on voluntary compliance by the worker. Furthermore, protection by respirator use requires an ongoing multifaceted program to assure proper maintenance and utilization. The cost of the respirator itself is only a small part of the total cost of an effective program.

Id.

371. The intent behind these objections may be to argue that respirators have a higher failure rate than engineering controls or that respirator maintenance is more costly or difficult than engineering control maintenance. If that were true, however, the claim would not be stated categorically, since it would have to be evaluated on a case by case basis.

372. *See, e.g.*, ROSEN, *supra* note 71, at 422. Rosen offered an early historical example of the problem of worker interference with safety measures:

> It has been mentioned that several authors suggested the use of respirators to prevent the inhalation of dust. However, such devices did not come into common use and Federath writing in 1899 offers some illuminating information on this subject. "At the end of the seventies," he says, "I recommended the wearing of a respirator while at work as a prophylactic measure. The miners complained, however, that they could not work with it because it interfered with their breathing. I then suggested to them at least to tie a piece of cloth in front of the nose and mouth–even in this way a large quantity of dust would be prevented from entering the lungs. I do not know whether they followed this advice—even this measure was probably too inconvenient for them. Unfortunately most of them are very indolent—the younger ones say 'we don't need that' and the older ones, 'that can't help us any more.'"

Id.

373. *See, e.g.*, Banks, *supra* note 71, at 4. Banks illuminated upon the difficulty in getting workers to comply with safety measures:

> Conveying the public health perspective that dust-related diseases are dangerous to a worker's respiratory health can be difficult, particularly when the period from first exposure to the development of disease may be 20 or more years. Furthermore, the frequently suggested solution of wearing personal respiratory protective devices throughout the workday is an unrealistic expectation. The increase in the work of breathing, the discomfort, the poor-fit sometimes attributable to facial hair, and the inability to speak and adequately communicate with one's fellow workers is almost too much too [sic] ask of any worker.

Id.

military gear to light-weight, ergonomic, comfortable, fail-safe, consumer-friendly gear. As a result, scuba gear is in widespread use in environments where the potential for immediate injury and death from equipment failure is more severe than that found in most workplaces. Again, we see the influence of regulation distorting the development of new knowledge that could provide superior protection for employees because of institutional biases.

E. Explaining Regulations

There are a number of reasons why regulating silica ought to be a reasonably easy matter. A hazardous substance, visible to the naked eye, with a documented history of causing occupational disease problems should be a straight-forward case for regulators. Indeed, some optimistic sources have even suggested that silicosis can be prevented entirely by proper regulation.[374] When the IARC identified silica as a "probable human carcinogen," regulating it should have been straightforward—standards needed to be tightened in light of the newly recognized risk. What to do to prevent silica exposure also ought to be clear. The general principle in occupational disease prevention is to prevent exposure.[375] Preventing dust exposure is neither difficult nor novel; prevention requires a combination of ventilation and dust reduction or removal.[376]

Unfortunately, regulating silica is not straightforward.[377] Relatively obvious problems include the presence of other minerals in dusts, which make interpreting data about exposures more difficult.[378] Equipment and techniques may not be competent to undertake the task of measuring at

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374. *See, e.g.*, Balaan & Banks, *supra* note 71, at 446. Balaan and Banks displayed their optimism in addressing the problem posed by silica:

> Silicosis is preventable. The extent to which this can be realized depends on education of employers and employees, strict enforcement of industrial hygiene practices, and vigilance for circumstances where unacceptable exposures to respirable silica may happen. Further research on the mechanism of lung injury in silicosis and its modulation by pharmacologic agents will contribute to our therapeutic armamentarium for this disease.

Id.; *see also* Gary R. Epler, *Clinical Overview of Occupational Lung Disease*, 30 THE RADIOLOGICAL CLINICS OF N. AM.: OCCUPATIONAL LUNG DISEASE 1121, 1127 (1992) (maintaining that "[v]igorous adherence to dust control regulations and dust count monitoring can eliminate this disorder [chronic silicosis]").

375. *See* Banks, *supra* note 71, at 7 ("Primary prevention, the backbone of prevention of all workplace disease, is best achieved by eliminating exposures.").

376. *See* Hoffman, *supra* note 71, at 536 (considering the dust safety techniques known in the early 1900s); CHERNIACK, *supra* note 71, at 38 (highlighting that "[t]he efficacy of preventative measures had also been documented" by 1915).

377. *See* Frank J. Hearl, *Identification, Monitoring and Control of Dust Exposures*, *in* OCCUPATIONAL LUNG DISEASE, *supra* note 5, at 35, 35 ("The recognition, evaluation and control of dust exposures in occupational environments can be complex.").

378. *See* PRIMER, *supra* note 9, at 16-17 (discussing the various issues inherent in diagnosing silica-related health troubles).

levels required by regulations.[379] Health and exposure records are incomplete, causing difficulties in linking individuals' conditions with workplace exposures and thereby complicating efforts at setting exposure levels.[380] There are also more complex problems related to the particular form of silica dust to which individuals are exposed.[381]

Moreover, there are serious problems in identifying the cause of lung damage from silica exposure. The successful effort to reduce exposures itself complicates attempts to identify the remaining harms by eliminating the most obvious evidence of exposure and making the health effects harder to spot.[382] Indeed, even with asbestos, where lung damage was (at

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379. *See id.* at 16 ("Under certain conditions, current techniques and equipment can't distinguish very well between its physical states at the low concentration level specified by HCS.").

380. *See* Graham, *supra* note 5, at 200. Graham commented on the added complications caused by incomplete data:

> Setting [occupational exposure] guidelines is hardly a simple task, depending as they do on animal toxicology as well as epidemiological studies, either prospective or retrospective, of exposed occupational cohorts. Often, past exposures are uncertain because of fragmentary data and constantly changing work environments. Clinical data such as chest X-rays may never have been taken systematically and maintained. Predicting a safe exposure for a working lifetime involves the conundrum of protecting workers but not establishing standards which unfairly burden the industry, although the necessary tendency is clearly to err on the side of worker health.

Id.

381. *See, e.g.*, Hearl, *supra* note 377, at 35 (citation omitted). Hearl noted that the age of the dust further complicates the issue:

> Some studies show that freshly generated dust containing crystalline silica will exhibit increased toxicity in lung cells compared with aged dust, due to the recent creation and presence of surface free radicals. Therefore, specific knowledge about the process that generated the dust and the interactions of the aerosol with the environment provide important information.

Id. Hearl continued by explaining,

> Dust measurement and dust hazard evaluation is complex because of the need to characterize properties beyond the intensity of exposure, i.e. the dust concentration. It may be necessary to describe the exposure in terms of the particle size distribution, and the often inhomogeneous chemical or morphological properties of the dust. For fibrous materials such as asbestos, particle shape may have a profound impact on the toxicity of the material. Several descriptors of the particles may be used to characterize the concentration including: the mass of the particles, the mass of one chemical species in the particles, the active surface area, the number of particles, or the crystalline properties of the particles.

Id.

382. *See* Graham, *supra* note 5, at 192-93. Graham discussed that success in eliminating high silica exposure has made it more difficult to find other damaging exposure to silica:

> As dust levels have fallen as a result of environmental controls and governmental standards, the health effects have become more subtle: radiographic changes may be so slight that interpreting a film as "abnormal" or "normal" may be difficult and subject to disagreement, even by expert readers. Likewise, when conglomerate silicosis was often the outcome of extremely high dust exposures, pulmonary function changes were certain and inevitable. Now, however, whether quartz exposure has any effect in the absence of radiographic changes is very much in doubt.

Id.

least theoretically) more readily identifiable, there have been serious problems linking harm to the inhaled dust. For example, as part of the Manville Trust's distribution of funds to asbestos claimants, the Trust implemented an audit program. Using only personnel selected in consultation with the plaintiffs' bar, none of whom had ever testified on behalf of a defendant in an asbestos case, and a liberal rule for inclusion of claims,[383] the audit nonetheless discovered that approximately half of the claimants' radiographs had no indication of "even low-level, sub-diagnostic X-ray evidence of interstitial fibrosis."[384]

Because of the difficulties in developing adequate exposure and health records, data availability often drives regulations. In the case of silica, for example, the two primary sets of health data come from a series of studies of Vermont granite workers[385] and white South African gold miners.[386] Indeed, the history of medical knowledge about silicosis comes primarily from studies of individuals who had extraordinarily high levels of exposure, such as Nevada mill workers, Vermont granite cutters, and the workers at the Gauley Bridge, West Virginia tunnel incident.[387]

The highest quality medical evidence, therefore, comes from extremely limited sources. Given the variability in types of silica, we therefore confront the problem of how to account for this limitation. Consider, for example, the Vermont granite cutters. The Vermont studies came about because of an increase in silica-dust-related tuberculosis in Vermont after the introduction in 1900 of pneumatic chisels and surfacing machines.[388] The high degree of variance in exposure across job categories enabled

383. *See* STEPHEN J. CARROLL ET AL., ASBESTOS LITIGATION COSTS AND COMPENSATION: AN INTERIM REPORT 20 (RAND Institute for Justice ed., 2002) (citation omitted) (finding that independent readers "reviewed the X-Rays submitted by a random sample of claimants .... A claim was downgraded only if both [readers] independently determined that they saw no indication of even low-level, sub-diagnostic X-Ray evidence of interstitial fibrosis"); *see also* Lester Brickman, *On the Theory Class's Theories of Asbestos Litigation: The Disconnect Between Scholarship and Reality*, 31 PEPP. L. REV. 33, 128-37 (2003) (describing Trust experience in detail).

384. CARROLL, *supra* note 383, at 20 (citation omitted).

385. *See* Graham, *supra* note 5, at 200 ("[T]he Vermont granite industry ultimately provided the most complete epidemiologic data on the health effects of quartz through a series of landmark investigations."); Wang & Banks, *supra* note 10, at 70 ("Exposure and lung function data from [Vermont granite workers studied serially from 1979 to 1987] has formed the backbone for the silica standard in the US.").

386. *See* Wang & Banks, *supra* note 10, at 70 ("The evidence for airways obstruction, as it relates to silica, is found primarily in epidemiologic studies of South African gold miners.").

387. *See* CHERNIACK, *supra* note 71, at 38-39 (discussing the development of knowledge and citing such incidents).

388. *See* Graham, *supra* note 5, at 200 (exploring the origins of the Vermont studies on silica); *see also* Interview with Leonard J. Goldwater, *in* PROTECTING THE HEALTH OF WORKERS: THE AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS, 1938-1988, at 143 (1989) (highlighting the fact that granite workers "did not have much trouble [with silicosis] in Vermont until they started using pneumatic tools. When it was all handwork they had no problems").

creation of a dose-response relationship for granite dust.[389] The state then conducted follow-up studies through 1965, which "determined that no cases of silicosis had appeared in workers first employed after 1938."[390]

There are not only the usual dose-response questions about extrapolating from high-exposure studies to low exposures, but the granite workers were exposed to silica of particular types, which may or may not be representative of silica found elsewhere.[391] To use the language of our earlier hypothetical, we thus do not know whether the Vermont studies concerned α-kryptonite or β-kryptonite. Moreover, the Vermont granite cutters were exposed to freshly cut silica, and some silica exposures today are to aged silica. Again, turning to our earlier hypothetical's language, we must decide if the distinction between α-kryptonite and α'-kryptonite is relevant as well.

But, these are not merely hypothetical discussions. Scientists working for the Sorptive Minerals Institute have obtained samples of the ore used in the study of South African miners and examined the form of silica present.[392] They determined that there is a difference between it and the aged silica present in many absorbent products manufactured with mined silica and related minerals. What are regulators to make of such evidence? If the South African studies are the basis for a new regulatory effort, are firms using non-comparable forms of silica to be exempted from the new regulation? Or must they undertake the far more complex and likely impossible task of proving that the distinction renders their materials "safe"?

In addition to the chemical, biological, mineral, or other characterization of the regulated substance, technological change also plays a critical role in regulation by providing more sophisticated measurement techniques. Our ability to measure dust levels today, for example, is far more sophisticated than even thirty years ago. Further, our ability to diagnose health effects has taken a major step forward with the development of CT scan technology, which reveal even smaller impacts on lungs, raising important questions about a number of aspects of regulation:

> The large increase in sensitivity afforded by CT scans raises the question of whether tiny opacities, hitherto not discernible on plain chest radiographs, will become the standard for making the diagnosis of work-related lung disease. The implications are manifold, including the

389. *See* Graham, *supra* note 5, at 200 (documenting the variables allowing for a dose-response relationship for workers exposed to granite dust).

390. *Id.* (citations omitted).

391. Since the form of silica was not known to be important at the time of the studies, the reports of the studies do not include sufficient information to characterize the material as fully as is currently possible.

392. *See supra* text accompanying note 36.

> question of whether future radiographic surveys of industries should include CT, whether the more sensitive detection of abnormalities will be important in litigation or disability evaluations, and whether arguments can be made that at least part of the responsibility for these changes rests with the general exposure to environmental particles, and is not therefore strictly related to employment.[393]

The future development of institutions dealing with occupational hazards such as silica exposure need to take into account these uncertainties and technologies. These developments will increase both the fineness with which we can distinguish one form of a potentially harmful substance from another and advance the point at which we can identify small changes in human health from exposures. It is also virtually certain that these advances will occur faster than we can link the distinctions to the health effects, increasing the problem of categorization for future regulators.

Because individuals staff OSHA, its regulations reflect their motives and self-interest. Being self-interested does not mean that bureaucrats do not have altruistic goals; rather, it means that even public-spirited OSHA staff are motivated by a desire to maximize what *they* think is the public good. This innate bias may not always coincide with others' views of the public good. In addition, they may have other motives:

> Bureaucrats normally have several private motives. One is, of course, simply not to work too hard. . . . Another is to expand the size of one's own department and in the process of so doing, being willing to go along with the expansion of all the rest. A third is to improve the "perks" that accompany the particular position. . . .[394]

In general, bureaucrats have incentives to call for additional regulations and spending in support of the interests that justify their programs' existences.[395]

OSHA has had less success at expanding its authority and resources compared to many other regulatory agencies. Although staffing and spending to develop, administer, and enforce OSHA regulations have generally been increasing in real terms since Congress established the agency in 1970,[396] OSHA's growth has been less rapid than the growth of other agencies, particularly the Environmental Protection Agency (EPA)

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393. Graham, *supra* note 5, at 205.

394. Gordon Tullock, *Public Choice*, *in* THE NEW PALGRAVE: A DICTIONARY OF ECONOMICS 1043 (1998).

395. *See* BRYCE WILKINSON, CONSTRAINING GOVERNMENT REGULATION 123-24 (N.Z. Bus. Roundtable ed., 2001), *available at* http://www.nzbr.org.nz/documents/publications/publications-2001/constraining_govt.pdf (discussing the diverse benefits accruing to government officials from increased regulation).

396. *See* SUSAN DUDLEY & MELINDA WARREN, MODERATING REGULATORY GROWTH: AN ANALYSIS OF THE U.S. BUDGET FOR FISCAL YEARS 2006 AND 2007, at 5 (2006), *available at* http://www.mercatus.org/ (analyzing trends in federal regulatory agencies' budgets).

and, more recently, the Department of Homeland Security.[397] OSHA also lags behind other agencies in regulatory volume: OSHA generally issues far fewer regulations than does the EPA. In 2004, for example, OSHA issued (in proposed or final form) nine regulations, only one of which was considered economically significant,[398] compared to the EPA's 65 proposed or final regulations, 11 of which were economically significant.[399] In the first four years of the Bush Administration, OSHA issued three final economically significant regulations. Similarly, during the previous eight years of the Clinton Administration, OSHA issued only seven economically significant rules—less than one per year.[400]

Despite its relative inactivity, OSHA promulgates regulations that are costly for the economy. According to recent estimates, OSH Act regulations constitute nearly one-half of the total direct cost of workplace regulations—around $41 billion per year in 2000.[401] MSHA regulations cost another $7.4 billion.[402] It is unclear whether these costs produce commensurate benefits. Econometric studies have generally failed to find evidence that OSHA regulations have had a significant impact on job safety.[403]

What explains OSHA's relative lack of success at gaining resources and authority? Three important factors stand out. First, the primary outside interest group behind OSHA regulation is organized labor. Unions generally support OSHA regulations for three reasons: (1) the regulations raise costs for both union and non-union employers, evening the playing field; (2) the regulations give unions a tool to use in negotiations (OSHA complaints by union members can reduce productivity); and (3) the regulations, through their participation in the regulatory process, give organized employees a comparatively greater voice in workplace organization than unorganized employees, thus providing a benefit to

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397. *Id.* at 15.

398. *See* Exec. Order No. 12,866, 3 C.F.R. 639 (1993) (announcing that "economically significant" generally refers to regulations that are expected to have an impact of $100 million per year or more).

399. Data on regulations reviewed under Executive Order 12,866 are available at http://www.reginfo.gov/public/do/eoHistoricReport.

400. *See id.*

401. *See* Joseph M. Johnson, *A Review and Synthesis of the Cost of Workplace Regulations*, *in* CROSS-BORDER HUMAN RESOURCES, LABOR AND EMPLOYMENT ISSUES 433, 454-55 (Andrew P. Morriss & Samuel Estreicher eds., 2005). Johnson estimates that the cost of workplace regulation totaled $91 billion in 2000. *Id.* Figures are in year 2000 dollars. *See* Harvey S. James, Jr., *Estimating OSHA Compliance Costs*, 31 POL'Y SCI. 321 (1998) (analyzing and approximating OSHA compliance costs).

402. *See* Johnson, *supra* note 401, at 454-55.

403. *See* VISCUSI ET AL., *supra* note 52 (summarizing the econometric studies that examine the impact of OSHA). Most of the studies Viscusi used focus on accident rates, rather than diseases, however. For example, death rate trends for job-related accidents did not change after the enactment of the OSH Act.

employees who join unions.[404] Others interested in expanding state power also find the issue attractive.[405] Since 1970, union political power has declined, as union membership has fallen from 24 percent of the private labor force in 1973 to less than eight percent in 2004.[406] Moreover, since 1970, Republicans, generally unsympathetic to unions, have controlled the executive branch for 24 of the past 36 years. Even the 12 years of Democratic control came under Presidents Carter and Clinton, both of whom may be described as less than sympathetic to unions and arose from the more conservative wing of the Democratic Party. OSHA thus has lacked an effective outside ally in seeking to expand its authority and resources.

Second, OSHA lacks the political capital of other regulatory agencies. Early missteps, particularly connected to its transformation of voluntary consensus standards into mandatory regulatory standards, gave the agency a bad reputation both on Capitol Hill and among the public. The lack of highly publicized events that spur public demand for regulation also hampers the agency's quest for additional resources and authority. Compare OSHA's record to the creation of state and federal programs for black lung, a disease among coal miners similar to silicosis. Like silicosis, diagnosis of black lung was highly controversial. Miners pointed to the high levels of dust visible in mines; mine owners and many medical professionals insisted on objectively verifiable diagnoses, such as radiographic evidence.[407] Not until the combination of several unrelated historical events—industry conditions that weakened the union Welfare and Retirement Fund's finances, the rise of a dissident United Mine Workers group that seized on the black lung issue as a vehicle for challenging the established union leadership, and a disastrous mine explosion attributed to high dust levels—however, did a coalition capable

404. *See* Rosner & Markowitz, *supra* note 130, at 467 (discussing the history of workplace health and safety measures and union organizing as well as quoting an early twentieth-century analyst that the campaign for workplace health and safety was "part and parcel of the movement for labor legislation"); *id.* at 477 (describing the role of unions and noting that the New York bakers' union in 1909 had a strike in which "the union identified unsanitary workshops and the spread of disease with nonunion bakeries").

405. *See id.* at 479 ("[I]ndustrial accidents and diseases proved to be an attractive issue [at the start of the twentieth century] for progressives interested in expanding the role of the state.").

406. *See* Unionstats.com, http://www.unionstats.com (last visited May 6, 2006); Bureau of Labor Statistics, Union Members in 2004, http://www.bls.gov/news.release/archives/union2_01272005.pdf; *see also* Orly Lobel, *Beyond Experimentation: Governing Occupational Safety in the United States* 5 (University of San Diego Legal Studies Research Paper No. 07-32, 2006), *available at* http://ssrn.com/abstract=874837 ("OSHA practices and the limits of its reach no doubt epitomize the relative power of business interests and the political weakness of labor interests in the United States.").

407. *See* Fox & Stone, *supra* note 250, at 33-34 (commenting that these owners and physicians were more concerned with political complacency than with the limits of medical knowledge).

of obtaining regulatory action coalesce.[408] The result was both state and federal legislation. As two prominent commentators have noted, "What appeared to be radical demands of a vocal minority [of miners] became Federal policy because members of Congress coalesced around their interest in reelection and their need to ally with colleagues."[409]

Third, OSHA regulations greatly affect the industries it regulates. The threat of OSHA regulation spurs these firms to organize collective resistance to OSHA activity. As a result, OSHA is a relatively weak institutional actor compared to other federal regulatory agencies. OSHA has been unable to expand its authority and resources as rapidly as other agencies have been able to do, in part because it has been hampered by a lack of political capital, opposed by highly-motivated interest groups, and lacking in effective outside interest group allies.[410]

Silica virtually disappeared as a subject of regulatory interest in the period between World War II and the creation of OSHA. The combination of voluntary efforts through the ACGIH TLVs and workers' compensation coverage "solved" the silicosis problem by creating a mechanism to compensate those injured that, in turn, provided employers with an incentive to improve workplace conditions (to lower premiums). The TLVs provided a benchmark, allowing employees to compare their employer's practices with an industry standard and facilitating market pressures for improving health and safety. That exposures did not continue to fall during this period may reflect the preferences of employees and employers to maintain silica dust exposure at a level above zero because the marginal cost of the reductions to zero were too high for either group to accept.

This regime appears to have been successful enough that we could drop the quotation marks from the word *solved* in the preceding paragraph. Silicosis declined in the United States after World War II, as best we can tell, and remained a problem primarily in a few high exposure industries.[411] The primary flaw was not employers ignoring health effects, but the flaw rested instead with unions deciding not to engage in the ACGIH process, which left it to the interests of large firms and bureaucrats. Union

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408. *See id.* at 36-37 (explicating the situation in the late 1960s, including the Farmington disaster, which prompted legislative action on the black lung problem among miners).

409. *Id.* at 40.

410. *See* Cynthia Estlund, *Rebuilding the Law of the Workplace in an Era of Self-Regulation*, 105 COLUM. L. REV. 319, 385 (2005) (pointing to OSHA's structural and political weaknesses).

411. *See* NIOSH HAZARD REVIEW, *supra* note 31, at 1, and tbl. 1, at 5 (showing industries with workers potentially exposed to silica and noting that "[s]ince 1968, reported mortality associated with silicosis has declined; however, 200 to 300 such deaths were reported each year during the period 1992–1995").

participation would have introduced an interest group to challenge their data and conclusions, thus improving the ACGIH process. Unions, however, had other fish to fry.

Knowledge of silica's health effects grew after World War II, largely through a combination of public and private investment. NIOSH and IARC both pulled together a great deal of research on silica, but that research came from a mixture of private, nonprofit, and public-sector-funded researchers.[412] Post-war problems with silica stem largely from OSHA's involvement. By ossifying the ACGIH standard, OSHA eliminated the flexibility of the ACGIH process without adding any compensating benefits (such as more comprehensive analysis) to the near universal acceptance of the TLV. OSHA's failure to respond to NIOSH and IARC since NIOSH first warned of the existing standard in 1974 is a textbook example of government failure.

The inability of regulators to keep pace with the growing knowledge of silica exposure risks created an opportunity for the issue to be addressed through another venue: the courts. The role of the courts and interest groups that participate in the resulting litigation are discussed in the next Section.

III. REGULATION BY LITIGATION

In addition to the regulatory interest groups described above, there is an additional interest group that can play, and already has played, a major role in regulatory debates: the plaintiffs' bar. Suits over silica-related diseases have a long history.[413] While workers' compensation covers occupational exposure to silica, silica's use is so widespread that suits against product manufacturers are not implausible.[414] In this Section, we consider the history of asbestos litigation as a potential model for predicting how tort law might implicitly regulate silica.

The mass tort litigation over asbestos dates to the Fifth Circuit's 1973 decision in *Borel v. Fibreboard Corp.*[415] In that case, the court recognized

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412. *Id.* at 3.

413. *See* DAVIS, *supra* note 167, at 74. The author goes on to describe the major players in silica-related suits:

> Two great groups are very much interested in silicosis. One is the employers who are conducting industries in which there is exposure to dust. The other groups consist of the thousands of people who work in these industries. Lawyers and legislators make up another group—one that buzzes around the other two.

Id.

414. *See* Brickman, *supra* note 383, at 46 n.29 (describing parallels between silicosis and asbestosis and concluding that "the principal difference ensuing from identifying a fibrosis as asbestosis, that is, caused by exposure to asbestos, rather than one of the other causes of fibrosis, does not lie in the medical realm"). The author goes on to explain that "it is a function of the compensation system." *Id.*

415. Borel v. Fibreboard Paper Prods. Corp., 493 F.2d 1076 (5th Cir. 1973); *see also*

a products liability theory that enabled injured employees to avoid the exclusive remedy provisions of workers' compensation schemes and sue the manufacturers of asbestos products used in the workplace.[416] Workers' compensation systems had trouble handling occupational disease claims for diseases with long latency periods and whose cause lay in employees' exposures to multiple sources of asbestos at a variety of employers over decades.[417] Thus, allowing suits against the manufacturers of the product was an important doctrinal innovation in compensating individuals who had suffered serious harms,[418] such as mesothelioma, a form of lung cancer closely linked to asbestos exposure.[419] As one commentator noted, "Modern asbestos litigation was born when courts, having lost confidence in workers' compensation schemes, developed doctrines of products

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John C. Coffee, Jr., *Class Wars: The Dilemma of Mass Tort Class Action*, 95 COLUM. L. REV. 1343, 1385 (1995) (observing the effect the first major asbestos decision had on subsequent litigation); FREDERICK M. BARON, HANDLING OCCUPATIONAL DISEASE CASES 2 (1981) (noting that before *Borel* "occupational disease law amounted to a group of cases and articles discussing recovery under the various state workers' compensation acts").

416. *See Borel*, 493 F.2d at 1091, 1095-96 (holding that strict liability may apply in this case because the use of the product was "unreasonably dangerous" and that the tortfeasors may be held jointly and severally liable for the total damages).

417. *See* Patrick M. Hanlon & Julie S. Lehrman, *Developments in Premises Liability Law*, *in* ASBESTOS LITIGATION IN THE 21ST CENTURY 162 (2004) (remarking on the lack of confidence in workers' compensation systems).

418. A classic example of this attitude toward *Borel* is provided by Professor Harold Southerland's essay, *Law, Literature and History*:

> Law is at its best, I think, when used to restrain the exertion of external power by one person over another, at its worst when used, as it so often is, to legitimize, to make possible, the exertion of such power. It is hard to think of a better example than Paul Brodeur's account of the long struggle of dying plaintiffs against the asbestos industry, in particular Ward Stephenson's Herculean labors on behalf of Clarence Borel, which culminated in the Fifth Circuit's ground-breaking decision in *Borel v. Fibreboard Paper Prods. Corp.*, the case which would effectively break the back of the asbestos industry.

Harold P. Southerland, *Law, Literature, and History*, 28 VT. L. REV. 1, 82 n.255 (2003) (citation omitted). Southerland goes on to quote Paul Brodeur's account to support his point:

> a society that cannot summon up the sense to protect the lungs and the lives of its workers cannot hope to protect the lungs and lives of its other citizens, including its children . . . . The health hazard posed by . . . [asbestos] has called into question the conduct of a huge cross-section of the institutions that make up the private-enterprise system, including many of its manufacturing corporations, insurance companies, investment houses, law firms, trade unions, and governmental regulatory agencies, as well as many members of the medical and legal professions, the scientific community, and Congress.

Id. at 82 (quoting PAUL BRODEUR, OUTRAGEOUS MISCONDUCT 348-49 (1985)). Southerland's comment, simply an illustration for an unrelated point in his essay, is representative of the academic legal literature's view of asbestos litigation. It is difficult to square this account with the economic devastation and fraud given in more modern accounts of asbestos litigation. *See, e.g.*, CARROLL, *supra* note 383. Brickman offers an interest-group-based explanation for the academy's uncritical attitude toward asbestos litigation. Brickman, *supra* note 383, at 166-70.

419. *See* Brickman, *supra* note 383, at 44-46 (giving a thorough summary of the literature on asbestos and cancer).

liability to provide tort remedies to injured workers as a substitute for workers' compensation benefits."[420]

Asbestos litigation soon became something quite different than what the early commentators anticipated. It is now "the longest running mass tort in U.S. history."[421] Some have compared it to "a massive, unending river,"[422] or "a malignant enterprise."[423] It has spread far beyond the original suits against the manufacturers of asbestos products to "virtually all parts of the U.S. economy,"[424] involving defendants in 75 of the 83 two-digit Standard Industrial Classification codes.[425] Its scale dwarfs even major regulatory impacts, natural disasters, and terrorist attacks; former Attorney General Griffin Bell contends that asbestos litigation's estimated costs to the economy are greater than the estimated costs of "all Superfund cleanup sites combined, Hurricane Andrew, or the September 11 terrorist attacks."[426]

Asbestos litigation's evolution is relevant because it illustrates how an interest group comes into being and influences subsequent events.[427] Indeed, some have argued that the asbestos bar is attempting to expand into silica suits, and the goal of the asbestos plaintiffs' bar is "to keep the asbestos-litigation gravy train alive."[428] The scale of asbestos litigation and the amount of money involved has continued to grow at a pace even the most pessimistic analysts did not anticipate. A RAND Corporation study of the litigation in 1983 made the "shocking" prediction that the litigation

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420. Hanlon & Lehrman, *supra* note 417, at 162.
421. CARROLL, *supra* note 383, at v.
422. Coffee, *supra* note 415, at 1384.
423. Brickman, *supra* note 383, at 35.
424. CARROLL, *supra* note 383, at 49.
425. *Id.* at 50.
426. Victor E. Schwartz, Mark A. Behrens, & Rochelle M. Tedesco, *Congress Should Act to Resolve the National Asbestos Crisis: The Basis in Law and Public Policy for Meaningful Progress*, 44 S. TEX. L. REV. 839, 861 (2003) (quoting the Honorable Griffin B. Bell, *Asbestos Litigation and Judicial Leadership: The Courts' Duty to Help Solve the Asbestos Litigation Crisis*, 6 BRIEFLY 4 (2002)), *available at* http://www.nlcpi.org/books/pdf/Vol6Number6June2002.pdf.
427. There are numerous similarities between asbestosis and silicosis that make the comparison particularly apt. Both diseases feature long latency periods, widespread exposure, and well-documented harms of exposure. *See* CARROLL, *supra* note 383, at 14 ("That workplace exposure to asbestos can be dangerous was known well before World War II."). The two substances share some physical and chemical characteristics—asbestos is a silicate. *See* Balaan & Banks, *supra* note 71, at 435 (describing the chemical composition of silica and offering examples of types of silicates). Further, both diseases have long latency periods. *See* CARROLL, *supra* note 383, at 16 (noting that there is a 20 to 40 year latency period for asbestos disease). Lastly, both produce a chronic disease that can be present in an asymptomatic version as well as more serious versions. *See* Jones, *supra* note 5, at 215 ("Chronic silicosis occurs 20-40 [years] after initial exposure to crystalline silica.").
428. David Hechler, *Silica Plaintiffs Suffer Setbacks*, 27 NAT'L L.J. 1, 18 (2005) (quoting *Asbestos: Mixed Dust and FELA Issues: Hearing Before the S. Comm. on the Judiciary*, 109th Cong. (2005) (testimony of Lester Brickman, Professor of Law, Cardozo Law School)).

and subsequent compensation expenses would total $1 billion through 2001, with more than 21,000 lawsuits and three major corporations in Chapter 11 bankruptcy.[429] Other analysts predicted that the total costs could ultimately reach as much as $38 billion.[430]

These estimates proved wildly off the mark. By 2000, more than 600,000 people had filed claims, generally against multiple defendants,[431] over 6,000 entities had been sued,[432] and $54 billion had been spent on compensation and litigation costs.[433] Another measure of the unexpected size of awards for asbestos is the rapid exhaustion of the $5 billion Manville Trust, set up to fund payments to claimants against the Johns Manville Company; less than two years after it was created in 1988, the trust was effectively insolvent.[434] Reasonable estimates of total costs now range from $200 to $265 billion, an over five-fold increase in twenty years.[435]

Asbestos litigation has changed markedly in character as well. The litigation has spread from suits by plaintiffs who had contracted a rare form of cancer closely linked to asbestos exposure against the manufacturers of asbestos products to now "touch almost every type of economic activity in the U.S."[436] and include plaintiffs without any symptoms. Plaintiffs with cancer no longer bring most of the claims: 65 percent of compensation has gone to nonmalignant claimants.[437] The number of defendants sued by each plaintiff soared from 20 in the 1980s to between 60 and 70 in the 1990s.[438] Asbestos litigation has grown from a problem of large asbestos manufacturers into a problem for even firms "with as few as 20 employees and just a few million dollars in annual revenues."[439] By the 1990s, "nontraditional" defendants accounted for over 60 percent of asbestos

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429. *See* JAMES S. KAKALIK ET AL., COSTS OF ASBESTOS LITIGATION (1983); CARROLL, *supra* note 383, at 51 ("In 1982, people were shocked to learn that over 21,000 claimants had filed claims for asbestos-related injuries and that the litigation had spread to about 300 defendants. Today, we believe that through the year 2000 over 600,000 claimants had filed against about 6,000 defendants.").

430. *See, e.g.*, CARROLL, *supra* note 383, at 6.

431. *See id.* at 40 (noting that the statistics given were probably underestimated).

432. *Id.* at 49.

433. *Id.* at vii.

434. *See* Coffee, *supra* note 415, at 1387 (noting that bankruptcy reorganization did little to help defendants who were targets of mass asbestos litigation).

435. *See* CARROLL, *supra* note 383, at vii. Asbestos litigation has costs well beyond the payments by individual defendants. Estimates of job losses from the financial weakening of the defendants range from 128,000 to 423,000 and $10-78 billion in lost investment capital. *Id.* at 73-74.

436. *Id.* at vii; *see also id.* at 68 (noting the change in the type of defendants due to bankruptcies of traditional defendants).

437. *Id.* at vii.

438. *Id.* at 41.

439. *Id.* at 49.

expenditures.[440] Some of these developments may have been the result of a court-imposed expansion of insurance policies to provide unlimited coverage for asbestos claims, which had the effect of making "allies" of the plaintiffs' bar and the asbestos defendants: To avoid bankruptcy, asbestos defendants agreed to mass settlements and default judgments and then made insurance claims, without subjecting the claims to a great deal of scrutiny, resulting in some meritless claims.[441]

Relatively few asbestos cases actually went to trial.[442] In the 1980s and 1990s, the litigation "matured" into quasi-administrative proceedings that handled claims in bulk.[443] As one observer has described the flood of litigation,

> The leading asbestos manufacturers had been sued in tens of thousands or hundreds of thousands of cases and had evolved strategies for managing the litigation. A large fraction of the cases were being filed by a small number of plaintiff law firms. Over time, the litigation became more and more concentrated in a small number of firms. By 1992, ten firms represented half the annual filings against the defendants who provided data to us. By 1995, ten firms (many, but not all, of the same firms that had been in the 1992 'top ten') represented *three-quarters* of the annual filings against these defendants, which had themselves grown by a third. The leading firms had standing settlement agreements with the major defendants. Virtually all the cases settled.[444]

This process generated enormous gains for the law firms involved: The Dallas law firm Baron & Budd had reportedly grossed more than $800 million from asbestos cases by 1998.[445] Transactions costs have consumed more than half of the spending on asbestos claims, with the majority going to plaintiffs' law firms.[446] In a sign of their power, the share of spending

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440. *Id.* at 50.

441. *See* Brickman, *supra* note 383, at 55-56 (noting that meritless claims were often accommodated by "*en masse*" settlements and default judgments).

442. *See* CARROLL, *supra* note 383, at 56 (demonstrating that, from 1993 to 2001, only 527 cases out of 1,598 resulted in trial verdicts).

443. *See* Coffee, *supra* note 415, at 1356 ("Mass tort actions matured in the 1980s.").

444. CARROLL, *supra* note 383, at 30.

445. *See* Christine Biederman et al., *Toxic Justice*, DALLAS OBSERVER, Aug. 13, 1998, *available at* http://www.dallasobserver.com/issues/1998-08-13/news/feature_1.html.

446. *See* CARROLL, *supra* note 383, at vii. Other scholars have commentated on the motivation of the bar and the disproportionate amount of revenue attorneys generated through the settlement process. As one scholar wrote,

> The obstacle that plaintiff lawyers faced in the mid 1980s is that while they had crafted the proverbial sorcerer's stone that could turn base metal into gold, they could not yet conjure up enough claimants to take full advantage of the unique opportunities that beckoned. The need for masses of claimants that would enable attorneys to fully exploit the multi-billion dollar asset pools was met by the initiation of attorney-sponsored asbestos screenings in the mid-1980s.

Brickman, *supra* note 383, at 63; *see also* Francis E. McGovern, *The Tragedy of the Asbestos Commons*, 88 VA. L. REV. 1721, 1726 (2002) ("The transaction costs associated with this massive transfer of wealth from stockholders to plaintiffs are outrageous. Lawyers

going to plaintiffs' firms held steady, while defense firms' share fell over time (with the savings going to the plaintiffs).[447] In the case of the Manville Trust, in which the claims "were paid out under a bankruptcy plan which was largely designed by plaintiff lawyers," plaintiffs' claims "generated approximately $250 million in fees at an effective hourly rate of $5,000 per hour for largely administrative claiming."[448]

The process created a powerful economic interest: the asbestos plaintiffs' bar.[449] Ralph Nader, lauding their efforts, noted, "Personal injury lawyers must know that they could soon be defeated as a group precisely because of the corporate reaction to their judicial successes as individuals. Defeated, that is, unless they organize as a group to preserve and expand the emerging legal order regarding the area of toxic tragedies."[450] These firms, which invested considerable sums in developing expertise in asbestos-related matters, will naturally seek to increase the return on their investment by expanding the range of claims, claimants, and defendants.[451] This dynamic can be seen in the expansion

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receive a grossly disproportionate share of the total amount of monies spent in the litigation process.").

447. *See* CARROLL, *supra* note 383, at 60-61 (noting that over time the plaintiffs' share of recovery grew from 37 to 43 cents on the dollar, with the plaintiffs' bar getting the same percent of recovery while defense costs fell).

448. Brickman, *supra* note 383, at 138.

449. The plaintiffs' bar is an organized lobbying group. The Association of Trial Lawyers of America (ATLA), the major national plaintiffs' bar organization, has contributed almost $11 million to political campaigns (over 90% to Democratic candidates) over the 2000-2004 election cycles. *See* Center for Responsive Politics, Donor Profiles, *available at* http://www.opensecrets.org/orgs/summary.asp?ID=D000000065 (last visited May 6, 2006) (outlining ATLA's political contributions). ATLA's donations "routinely rank[ ] among the top five PACs in federal campaign contributions." *See* CENTER FOR LEGAL POLICY, TRIAL LAWYERS INC.: A REPORT OF THE LAWSUIT INDUSTRY IN AMERICA 2003, at 20 (2003), *available at* http://www.manhattan-institute.org/pdf/triallawyersinc.pdf (discussing PAC contributions and where among PACs ATLA ranks). Two major asbestos law firms, Baron & Budd and the Law Offices of Peter Angelos, themselves contributed more than $3 million. *See id.* (outlining the large asbestos firms and their contributions to various political candidates); *see also* Daniel LeDuc & Michael E. Ruane, *Orioles Owner Masters Political Clout*, WASH. POST, Mar. 28, 1999, at C1. LeDuc and Ruane report that

> [o]ver the years, Angelos has used his amassed power to change laws that have benefited his law practice and helped ensure that his cases come out on top. At his request, more judges have been named to hear asbestos cases in Baltimore, and significant alterations in state law have made it easier to sue asbestos makers and tobacco companies.

Id. Asbestos defendants (at least the solvent ones) also organized. *See* PUBLIC CITIZEN, FEDERAL ASBESTOS LEGISLATION: THE WINNERS ARE . . . (2005), *available at* http://www.citizen.org/documents/master%20report.pdf (describing lobbying campaigns by defendants).

450. *See* Ralph Nader, *Forward* to BARON, *supra* note 415, at xi.

451. *See* Coffee, *supra* note 415, at 1360 ("Plaintiffs' firms specializing in the field also have a special incentive to search for claimants in order to realize continuing returns from their investment in human capital. The asbestos litigation illustrates this tendency."); Christopher F. Edley, Jr. & Paul C. Weiler, *Asbestos: A Multi-Billion Dollar Crisis*, 30 HARV. J. ON LEGIS. 383, 384 (1993). Edley and Weiler argued that

> [l]awyers then cast the litigation net further to find corporate pockets deep enough

of claims to include non-malignancy and asymptomatic claims,[452] the aggressive search for claimants,[453] and the extraordinary expansion of defendants in asbestos litigation.[454]

Viewing the history of asbestos litigation in retrospect, it becomes clear that the plaintiffs' bar had an incentive to invest in developing evidence[455]

> to satisfy the vast numbers of pending and future tort claims. Judicial legerdemain helped fill that gap with doctrinal innovations that imposed liability on firms (or their insurers) whose "misdeed," for example, was buying asbestos-related companies in the 1960s and early 1970s–after the human tragedy but before the litigation disaster.

Id.; *see also* CARROLL, *supra* note 383, at 47-48 (discussing how there have recently been claims from "people who were exposed to asbestos while working at job sites where asbestos was present in the atmosphere but not to the degree typical of the traditional industries"). Carroll cites, as an example, the "large numbers of claims have recently been brought by workers in the textile industry. Textile workers sometimes work with machines run by motors with gaskets that contain asbestos or in facilities ventilated by ducts lined with asbestos." *Id.*; *see also* Richard C. Field & Ronald F. Frank, *Indemnity, Contribution, and Third Party Practice in Occupational Disease Litigation*, *in* OCCUPATIONAL DISEASE LITIGATION 89, 91 (Sheila L. Birnbaum & Jerold Oshinsky eds., 1983) ("Plaintiffs bringing civil actions for occupational injury will consider suing a number of entities which may be alleged to have contributed to the harm."). Among those the plaintiff may choose to sue include "the employer, the owner and/or lessor of the premises, the general contractor, the manufacturer of a machine or other product involved in the injury, and other parties in the product's distributional chain." *Id.*

452. *See* CARROLL, *supra* note 383, at 45 ("Claims for nonmalignant injuries grew sharply through the last half of the decade. Almost all the growth in the asbestos caseload can be attributed to the growth in the number of these claims, which include claims from people with little or no current functional impairment."); *see* Brickman, *supra* note 383, at 59-62 (describing the rise of unimpaired claimant claims and concluding that "[t]he weight of the evidence . . . [demonstrates] that asbestosis as diagnosed by attorney-sponsored asbestos screenings exists primarily if not exclusively as a function of the compensation system").

453. *See* Coffee, *supra* note 415, at 1359 ("[D]uring the 1980s . . . asbestos plaintiffs' attorneys arranged with labor unions for portable x-ray trucks to screen union workers for telltale lung scars suggesting asbestos."); *see also* Brickman, *supra* note 383, at 59 ("Plaintiff lawyers are able to maintain a near inexhaustible supply of such claimants by use of attorney-sponsored mass screenings to identify thousands who are then diagnosed by the processes used in the screenings, to have asbestos-related lung conditions."); *id.* at 62-103 (describing screenings in detail); Biederman, *supra* note 445, at *4-9 (describing mass screenings and lax controls on identification of harm).

454. *See* CARROLL, *supra* note 383, at 49 ("Because most of the traditional defendants are in bankruptcy and are not making payments any more, the litigation has moved on to a wide variety of new defendants. The number of defendants typically named in claims is growing as well."); *see also id.* at 31 (discussing how, in the 1990s, plaintiffs' firms sought new defendants and more money from types of defendants which they had previously treated as peripheral); Biederman, *supra* note 445, at *3 ("Thanks to the bankrupting of the biggest asbestos companies, the targets of [the asbestos bar's] lawsuits are a host of smaller manufacturers–among them brake manufacturers, turbine manufacturers, paint manufacturers, even the makers of the first generation of respiratory equipment intended to protect workers from asbestos.").

455. A classic example is the investment by the asbestos plaintiffs' bar in locating 1930s Johns-Manville General Counsel Vandiver Brown, who had retired to Scotland. Manville resisted the "introduction of damaging correspondence between Brown and Sumner Simpson, President of Raybestos Manhattan, as trial evidence by arguing that Brown was dead and therefore his signature could not be authenticated. However, this tactic proved futile after plaintiff's lawyers found Brown alive and well in Scotland." *See* Barbara Pfeffer Billauer, *How To Survive Workplace Litigation*, *in* HANDBOOK OF OCCUPATIONAL SAFETY

and legal theories,[456] since both could be used in multiple cases. They had the incentive to search for the most favorable jurisdictions for asbestos suits[457] and for jurisdictions with rules that eased procedural problems[458]—exactly what we have observed. During the 1990s, asbestos cases migrated to Mississippi, New York, West Virginia, Ohio, and Texas from California, New Jersey, Pennsylvania, and Illinois, where the majority of claims had been filed in the 1970s and early 1980s. The latter group of states' market share fell from 60 percent of all cases in the period between 1970 and 1987, to seven percent between 1998 and 2000, while the former group's market share rose from nine percent to 66 percent during the same periods.[459]

The sheer volume of asbestos litigation gives the plaintiffs' bar several significant advantages. First, by overwhelming the courts, plaintiffs' attorneys are freed from the close supervision of their fees and settlement practices, which are normally available to courts to control potentially abusive practices.[460] As Seventh Circuit Judge Richard Posner noted, the volume "exert[ed] a well-nigh irresistible pressure to bend the normal

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AND HEALTH 687, 691 n.† (Lawrence Slote ed., 1987).

456. *See* Coffee, *supra* note 415, at 1360 (discussing how the advice for potential defendants echoes this point and noting that liability theories "continue to grow in the hands of creative plaintiffs' lawyers"); *see also* Billauer, *supra* note 455, at 687.

457. *See* BARON, *supra* note 415, at 37 ("Forum shopping, however, takes on added significance in an occupational disease case because of the substantial variation in the law, from state to state . . . .").

458. For example, Mississippi allowed the joinder of out-of-state plaintiffs to cases filed by in-state plaintiffs, allowing firms to bring claims in the Mississippi courts for non-Mississippi residents. CARROLL, *supra* note 383, at 34. Similarly, Texas passed a statute that gave asbestos cases special access to the Texas courts during the 1990s, a statute drafted in part by one of the leading asbestos lawyers. Biederman, *supra* note 445, at 7. A 1998 news report on the statute identified the problem:

> This small exception quickly became a gaping hole. Between 1990 and 1992, after the Texas Supreme Court made it more difficult to get rid of nonresidents' suits, the number of nonresidents filing asbestos lawsuits in Texas grew rapidly, according to numbers compiled by the Texas Civil Justice League. There were 580 claims filed by nonresidents in 1990, and 3,121 in 1992. After the 1993 bill, the numbers multiplied even more rapidly. Between 1993 and the end of 1995, more than 35,000 nonresidents filed asbestos-related claims in Texas, as lawyers in states with shorter limitations' statutes than Texas referred their cases here. Though the loophole was closed last year, there are nearly 42,000 asbestos claims filed in Texas by out-of-state plaintiffs awaiting resolution.

Id. (discussing the loophole and asbestos lawsuit filings in detail); *see also* Dow Chem. Co. v. Castro Alfaro, 786 S.W.2d 674 (Tex. 1990); Act of February 23, 1993, S.B. 2, § 1, 73d Legis. 1st R.S. (codified at Tex. Civ. Prac. & Rem. Code Ann. § 71.051 (1993)). California had a special statute of limitations for asbestos claims that tolled the running of the limitations period until the plaintiff's ability to work at his or her ordinary occupation is impaired. *See* CAL. CIV. PROC. CODE. § 340.2(a) (2006) (creating a limitations period that does not begin until impairment occurs); CARROLL, *supra* note 383, at 24 (recognizing California's "relaxed" limitations program).

459. *See* CARROLL, *supra* note 383, at 32 (providing a chart listing the change in litigation share).

460. *See* Coffee, *supra* note 415, at 1350 (discussing the impact on courts of "docket inundation").

rules."[461] Second, the volume creates a demand by the courts for innovative means of processing cases to reduce costs. The lower "price" of litigation, in turn, attracts additional cases.[462] Third, the defense bar is unable to adopt vigorous defense strategies because it is overwhelmed. Fourth, the small number of major asbestos firms on the plaintiffs' side of the litigation have acquired an enormous amount of resources, which can be deployed to influence courts and legislators to protect the gravy train.[463] Fifth, because of the massive numbers and indefinite nature of many of the claims, individual plaintiffs have little control over their attorneys.[464] Finally, "[i]n practice . . . mass tort litigation is reduced to battles between repeat players who have litigated and negotiated settlements in similar cases many times in the past."[465] Converting the process into a repeat player game weakened the check on plaintiffs' counsel provided by the adversarial system.[466]

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461. *In re* Rhone-Poulenc Rorer, Inc., 51 F.3d 1293, 1304 (7th Cir. 1995); *see also* Norfolk & Western Ry. Co. v. Ayers, 538 U.S. 135, 166 (2003) (quoting Ortiz v. Fibreboard Corp., 527 U.S. 815, 821 (1999)) ("The elephantine mass of asbestos cases lodged in state and federal courts, we again recognize defies customary judicial administration and calls for national legislation."); Field & Frank, *supra* note 451, at 127 ("The pressure of immensely overcrowded dockets has encouraged legislatures to adopt a posture towards settling multi-defendant cases that appears to deprive defendants of the fair exercise of their right to a trial.").

462. *See* Schwartz, *supra* note 426, at 867 (quoting Francis McGovern of Duke Law School, who stated, "If you build a superhighway, there will be a traffic jam" on reducing transaction costs of filing); *see also* CARROLL, *supra* note 383, at 26 (stating how "reduce[d] per-case transaction costs made filing small claims financially viable for more people, thereby encouraging mass filings").

463. *See* Hechler, *supra* note 428, at 18 (quoting *Asbestos: Mixed Dust and FELA Issues: Hearing Before the S. Comm. on the Judiciary*, 109th Cong. (2005) (testimony of Lester Brickman, Professor of Law, Cardozo Law School)).

464. *See* Coffee, *supra* note 415, at 1346 (discussing how individual plaintiffs have little control over attorneys in mass tort cases, particularly when claims concern potential future medical problems rather than immediate concerns).

465. *Id.* at 1365. *See generally* Biederman, *supra* note 445 (holding out Baron & Budd as the epitomy of the repeat player). Biederman quotes a defense attorney, who claims, "'My client is a very small player,' explains one defense lawyer, who asked that his name not be used because, as he puts it, 'when you irritate [Baron & Budd], they have a tendency to retaliate.'" *Id.*

466. The RAND study of asbestos litigation found that the pooling of claims helped induce defendants to settle even weak claims:

> By the mid-1980s, however, plaintiff law firms in areas of heavy asbestos exposure (such as jurisdictions with shipyards or petrochemical facilities) had learned that they could succeed against asbestos defendants by filing large numbers of claims, grouping them together and negotiating with defendants on behalf of the entire group. Often defendants would agree to settle all of the claims that were so grouped, including those claims that were questionable, to reduce their overall costs of litigation. By agreeing to pay questionable smaller-value claims in exchange for also settling stronger and larger-value claims, defendants could also contain their financial risk. Some plaintiffs might receive lower values for claims that were settled as part of a group. But litigating claims en masse lowered the cost and risk per claim for plaintiff law firms.

CARROLL, *supra* note 383, at 23; *see also* Coffee, *supra* note 415, at 1373-76 (discussing "new" collusion between parties' attorneys in mass tort litigation made possible by repeat

The asbestos bar turned to silica cases, using some of the same techniques.[467] Perhaps because they learned from the asbestos experience, silica defendants have proven more resistant.[468] In early 2005, the asbestos-like approach of several prominent plaintiffs' firms ran into trouble in a multi-district litigation proceeding in front of a medically sophisticated federal district court judge, Judge Janis Graham Jack.[469]

In the course of resolving pre-trial motions, Judge Jack uncovered a pattern of improper diagnoses of silicosis based on inadequate medical evidence. Among the problems were multiple plaintiffs diagnosed with both silicosis and asbestosis (sometimes by the same physician, in different cases),[470] rapid diagnosis (measured in minutes) and radiograph readings,[471] failure to follow the doctor's own procedures as documented in academic writings authored by the doctor,[472] and improper financial incentives (doctors and screening companies paid only for positive diagnoses).[473] Moreover, as Judge Jack noted, the pattern of silicosis

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player aspects).

467. *See* Hechler, *supra* note 428, at 18 (finding that the silica plaintiffs' bar was using the "[s]ame methodology, same screening companies, same B-readers," according to a defense attorney). One problem was that many silica plaintiffs were discovered to have been previously diagnosed with asbestosis by the same screening companies and doctors. *Id.* Approximately half of the 10,000 plaintiffs in the Texas MDL proceeding, for example, had prior asbestos claims. *Id.*

468. In response to discovering possible fraud, the defense firms in the Houston MDL proceeding filed a motion seeking $1.1 million in sanctions from the plaintiffs' lawyers, and some speculate that some defendants who previously paid claims based on diagnoses that are now suspect will seek to reopen the issue. *See id.*

469. Judge Janis Graham Jack has received training as a nurse. *Id.*

470. *See In re* Silica Prod. Liab. Litig., 398 F. Supp. 2d 563, 607-09 (S.D. Tex. 2005). The court noted that the rate of reversal of diagnosis of one of the plaintiff's screening doctors "can only be explained as a product of bias—that is, of Dr. Harron finding evidence of the disease he was currently being paid to find." *Id.* at 638. The two diseases produce different patterns on radiographs. As the court noted, citing testimony from Senate hearings, "[b]ecause asbestosis and silicosis have such different appearances on an x-ray, in a clinical setting, 'confusion between silicosis and asbestosis does not occur.'" *Id.* at 595.

471. *See id.* at 612 (noting that one diagnosing doctor spent less than four minutes per case on average). A more objective expert estimated that "the entire process of determining whether an individual has silicosis takes between 60-90 minutes." *Id.* at 594.

472. *See id.* at 615-16. Another physician testified that one diagnosing doctor's procedures "came nowhere near meeting what his own methodology was that he spelled out. And I have both the Third and Fourth Edition of his textbooks. And in no way does it relate to that methodology." *Id.* at 616, 639. The doctor's opinion was excluded because "the result driven methodology . . . is rife with error and speculation." *Id.*

473. *See id.* at 601 ("Because of this fee structure, Mr. Mason [owner of the screening company] testified that the emphasis was on attracting as many people as possible to the screenings and creating as many positive diagnoses as possible; as he stated, '[f]rom a business standpoint of mine, you had to do large numbers.'"); *see also* Press Release, House Committee on Energy and Commerce, Doctors Refuse to Testify at Silicosis Hearing; Others Recount Diagnoses 'Manufactured for Money,' *available at* http://energycommerce.house.gov/108/News/03092006_1810.htm (recounting the March 8, 2006 testimony of Heath Mason, co-owner of N&M, Inc., before the House Energy and Commerce Committee that ". . . in the case of the Campbell Cherry law firm of Houston, his company was only paid for positive diagnoses"), *available at* http://energycommerce.house.gov/108/News/03092006_1810.htm; Lester Brickman, Comments

claims in the 111 cases with more than 10,000 individual plaintiffs[474] before her was anomalous when population and regional variations in silica exposure were considered.[475] Moreover, the astonishing rate of silicosis in Mississippi represented by these cases attracted no press or regulatory attention.[476] The court concluded that

> the clear motivation for [plaintiff's attorney, the O'Quinn firm's] micro-management of the diagnostic process was to inflate the number of Plaintiffs and claims in order to overwhelm the Defendants and the judicial system. This is apparently done in hopes of extracting mass nuisance-value settlements because the Defendants and the judicial system are financially incapable of examining the merits of each individual claim in the usual manner.
>
> The Court finds that filing and then persisting in the prosecution of silicosis claims while recklessly disregarding the fact that there is no reliable basis for believing that every Plaintiff has silicosis constitutes an unreasonable multiplication of the proceedings. When factoring in the obvious motivation–overwhelming the system to prevent examination of each individual claim and to extract mass settlements–the behavior becomes vexatious as well.[477]

Judge Jack's opinion caught the attention of members of the House Energy and Commerce Subcommittee on Oversight and Investigations, who sent letters and subpoenas to physicians and medical screening companies identified in her opinion, asking for records and information about their roles in diagnosing patients with silicosis.[478] At a March 2005 hearing, three doctors who were responsible for almost 2,000 diagnosed silicosis claims invoked their constitutional right against self-incrimination and refused to answer the Committee's questions.[479]

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on NIOSH's Proposed 'B-Reader Code of Ethics,' (Dec. 2005) (unpublished manuscript), *available at* http://ssrn.com/abstract=871965 (discussing the problems of mass screenings).

474. *See In re* Silica Prod. Liab. Litig., 398 F. Supp. 2d at 567.

475. *See id.* at 572 ("This explosion in the number of silicosis claims in Mississippi suggests a silicosis epidemic 20 times worse than the Hawk's Nest incident. Indeed, these claims suggest perhaps the worst industrial disaster in recorded world history.").

476. *See id.* ("Mississippi's apparent silicosis epidemic has been greeted with silence by the media, the public, Congress and the scientific communities.").

477. *Id.* at 676.

478. The House Committee on Energy and Commerce composed several letters in connection to the Texas silicosis litigation requesting records and information. These letters are dated between February 17, 2006 and March 6, 2006 and are available at http://energycommerce.house.gov/108/letters/letters.htm.

479. The doctors invoked their Fifth Amendment rights in response to this question asked by Subcommittee Chairman Ed Whitfield: "Will you certify that each of these diagnoses and all others that you made in this litigation are accurate and made pursuant to all medical practices, standards and ethics?" Press Release, House Committee on Energy and Commerce, Doctors Refuse to Testify at Silicosis Hearing; Others Recount Diagnoses 'Manufactured for Money,' *available at* http://energycommerce.house.gov/108/News/03092006_1810.htm; *see also Silicosis Clam-Up*, WALL ST. J., Mar. 13, 2006, at A18.

Although not part of the court's analysis of the validity of the expert testimony, the court did note that

> [i]f searching for an explanation in the legal field, one might focus on the fact that most of the cases were filed just prior to the effective dates of a series of recent legislative "tort reform" measures in Mississippi. One might also focus on the decline in asbestosis lawsuits, leaving a network of plaintiffs' lawyers and screening companies scouting for a new means of support.[480]

Seeking additional information from state health officers in 13 states with "litigation hot spots," the Congressmen expressed concern that the health benefits of screening for silicosis are undermined

> when the screening process identifies serious medical conditions but the medical professionals involved disavow responsibility for informing the patient of the finding, explaining its significance, and discussing follow-up and treatment options. It is hard to imagine circumstances where leaving such tasks to lawyers could be considered acceptable medical practice or serving the interests of public health. The health benefit of even a competent screening may well be negated by the lack of medical follow-up.[481]

Thus, while a common law approach to problems like silica or asbestos exposure, when injured parties can claim compensation from responsible parties, might appear to provide incentives for optimal efforts to reduce exposures, the history of asbestos litigation and this initial foray into silica litigation suggest otherwise. The court system does not appear to be the best way to ensure that silica exposure is neither over- nor under-regulated.

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480. *See In re* Silica Prod. Liab. Litig., 398 F. Supp. 2d at 620 (analyzing why the mortality rate in silicosis patients has steadily declined, yet the number of lawsuits is significantly rising).

481. Press Release, House Committee on Energy and Commerce, Committee Broadens Silicosis Investigation, *available at* http://energycommerce.house.gov/108/News/02172006_1784print.htm; *see also* Letter from the House Committee on Energy and Commerce to State Health Officials (Feb. 17, 2006), *available at* http://energycommerce.house.gov/108/Letters/02172006_1786.htm. The letter expressed concern about the medical procedures employed by these doctors:

> Medical monitoring or surveillance—including mobile facilities—can play an important part in protecting and promoting public health. The practices described in the opinion of Judge Jack, however, raise concerns that the public health purposes of these screenings are lost in a push only to identify prospective plaintiffs for a law firm. We are particularly concerned with the apparent lack of medical supervision and follow-through associated with the mass diagnostic screenings described in *In Re: Silica*. As such, we must fully understand the facts and legal frameworks involved in such practices.

Id.

IV. WHAT TO DO?

If we step back and take a long view of the history of silica in the workplace and workplace hazards more generally, we can see a pattern emerge. Governments pay attention only when events facilitate the formation of a coalition seeking action. At the turn of the twentieth century, the growth of tort suits spurred both employers and employees to seek a compromise in the form of workers' compensation legislation, initially dealing only with accidents—the issue of greatest public appeal. Although the same technological change that increased accident rates also increased silica exposures, silica and dust diseases did not become an issue until the liability crisis of the 1930s. Even accounting for the lag due to silicosis's long latency period, the timing of that crisis appears more related to the onset of the Depression than to any actual increase in silicosis. Again, employers and employees compromised, extending the workers' compensation system to cover at least some industrial diseases, including silicosis. The issue again slipped off the regulatory radar screen, emerging again only with the beginnings of the post-asbestos wave of silicosis suits in this century.

The regulatory history of silica teaches three important lessons. First, the most compelling account of the cycle of action and inaction on the part of regulators is the one based on interest groups. Second, knowledge about hazards is endogenous—it arises in response to outside events, regulations, and interest groups. Accepting particular states of knowledge as definitive is thus a mistake, as is failing to consider the incentives for knowledge production created by regulatory measures. Third, the rise of the trial bar as an interest group and the asbestos litigation experience means that the problems of silica exposure and similar occupational hazards cannot simply be left to the current legal system for resolution through individual action.

Many OSHA-reform proposals focus on unblocking OSHA's regulatory process and speeding up the issuance of new standards.[482] Our account suggests that regulatory speed and volume are not the only problems that need to be addressed. A faster OSHA that did not accurately identify the substances that cause harm would simply be imposing costs more quickly.

We suggest a three-pronged approach to silica and occupational health issues generally. First, before issuing new regulations, OSHA should clearly define what market failures, if any, impede efficient solutions to address health risks. Both employers and employees have incentives to protect health and safety in the workplace.[483] The lack of information,

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482. *See, e.g.*, MCGARITY & SHAPIRO, *supra* note 50, at 185 ("If OSHA is to fulfill its statutory mandate to protect workers, a way must be found to increase its regulatory output.").

483. *See supra* text accompanying notes 43-48 (discussing the financial incentives to

particularly due to the long latency period for silicosis and lung cancer, may dampen these incentives. If the problem is a lack of information on risks and remedies, OSHA and its research counterpart NIOSH should focus on generating and dispersing better information. Although occupational health is not a field in which market forces are trusted,[484] the serious problems with the current system cannot be solved without recognition of the important role played by the Hayekian knowledge problem.

The federal government can play two important roles in this information market place. It can be a supplier. Through entities like NIOSH, the government can sponsor and conduct research that will influence standards. It can also be a consumer. Just as it did under the Walsh-Healey Act before OSHA's creation in 1970,[485] the government can demand that its information suppliers meet standards the government believes are effective.

Second, any regulatory action must recognize the diversity in exposure and response across the varied workplaces. Given the varying forms of silica to which workers may be exposed, and the problems of characterizing those forms and their associated health risk, a uniform national standard would unlikely be optimal in all situations. Heeding the lessons we have learned from the history of silica in the workplace, it is important to contrast the interest group incentives provided by a regulatory effort aimed at developing a uniform standard with those of a policy aimed at generating and disseminating information. The uniform standard provides incentives to interest groups to invest resources in influencing the standard to suit private goals (for example, gain advantage over competitors). In contrast, a focus on information provides incentives for interest groups to compete to develop and provide better information in support of their views of the risks and remedies.

The "market" for standards that existed before OSHA consisted of groups like the ACGIH, unions, trade associations, and others.[486] NIOSH's entry into this market changed the dynamics, primarily because of the influence of NIOSH criteria documents in initiating OSHA standards. Encouraging the development of competing standards for occupational

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providing a healthy and safe environment to employees).

484. *See, e.g.*, ROSEN, *supra* note 71, at 442-23 (noting that, despite "[t]he great technical accomplishments of the engineers" in improving occupational health in mines, which led to "the disappearance of the more extreme forms of pulmonary disease towards the end of the century," these accomplishments were nonetheless problematic because "[t]he motivation underlying the development of mining engineering was fundamentally economic and therefore only indirectly concerned with creating more healthful working conditions for the miners").

485. *See supra* note 287 (discussing in detail how TLVs were incorporated into OSHA consensus standards and how some were based on inadequate documentation).

486. *See supra* note 350 and accompanying text.

health would create market pressure for increasing knowledge about harms. If a standard-setting organization could identify a distinction like the α / β kryptonite example discussed earlier and show that the distinction mattered, it could issue a more effective and less costly standard. Competitive standards have operated successfully in a number of areas, including organic food certification and kosher labeling,[487] and have successfully improved quality in a number of areas.[488]

In contrast to flexible standards that respond to different information, a uniform standard proves hard to adjust as new information becomes available, as is evidenced by the current OSHA exposure limit of 0.10 mg/m^3.[489] Knowledge is dynamic, and uniform standards necessarily lock in expectations based on the level of knowledge available at a given time. In particular, regulations that specify which remedies are acceptable or unacceptable discourage innovation into better solutions.[490]

Finally, the tort system needs to be controlled. Judge Jack's efforts are a good start, but adequate legal process must depend on more than the fortunate accident of the judge in charge of mass tort litigation having a medical background. We do not pretend to know the answers to the many questions raised by tort reform, from federalism to fee-shifting, but we contend that the asbestos experience makes clear the inadequacy of modern tort law to the task of providing appropriate incentives for industrial health. Defining what to regulate is critical to avoiding both over- and under-regulation. If the history of silica in the workplace teaches anything, it is that our knowledge of even obvious hazards is highly dependent on medical knowledge, available technology, and a host of other factors. Increasing that knowledge depends on the incentives for knowledge creation. Unfortunately, locking current knowledge into a regulation does

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487. *See* John Blundell & Colin Robinson, REGULATION WITHOUT THE STATE . . . THE DEBATE CONTINUES 18-29 (2000) (discussing the standards and certification programs set by non-governmental bodies). The authors note that Underwriters Laboratory, for example, faces competition from 12 other certification organizations and thus has strong incentives to maintain the quality and reliability of its testing methods and standards.

488. Probably the most well-known private standards are set by the International Organization for Standardization (ISO), which describes itself as "a global network that identifies what International Standards are required by business, government and society, develops them in partnership with the sectors that will put them to use, adopts them by transparent procedures based on national input and delivers them to be implemented worldwide." *See* ISO, ISO IN BRIEF: INTERNATIONAL STANDARDS FOR A SUSTAINABLE WORLD (2005), *available at* http://www.iso.org/iso/en/prods-services/otherpubs/pdf/isoinbrief_2005-en.pdf. ISO 9000 sets standards for product quality, and ISO 14000 sets standards for protecting environmental quality. Together, these two generic standards are implemented by 760,900 organizations in 154 countries. *See* ISO, ISO 9000 and ISO 14000—In Brief, http://www.iso.org/en/iso9000-14000/understand/inbrief.html.

489. *See supra* note 337.

490. *See supra* text accompanying notes 364-69.

not provide adequate incentives for improving understanding of workplace hazards. Market-based methods create superior incentives to develop knowledge about what is regulated, a powerful tool for improving the quality of regulatory efforts.