LOGOS

Defining What to Regulate: Silica & the Problem of Regulatory Categorization

Andrew P. Morriss & Susan E. Dudley

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ABSTRACT

This article examines the history of human exposure to silica, the second most common element on earth, to explore the problem of categorizing substances for regulatory purposes and the role interest groups play in developing policy. 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, to regulations, and to 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 means that the problems of silica exposure and similar occupational hazards cannot simply be left to the legal system to resolve through individual tort actions. We suggest that by understanding market forces, regulators can harness the energy of interest groups to create better solutions to addressing the problems of silica exposure, as well as other workplace health and safety issues.

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Andrew P. Morriss[*] & Susan E. Dudley[**]

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

[*] Galen J. Roush Professor of Business Law & Regulation, Case School of Law, Cleveland, Ohio & Senior Fellow, Property & Environment Research Center, Bozeman, Montana. A.B. 1981, Princeton University; J.D., M.Pub.Aff. 1984, The University of Texas at Austin; Ph.D. (Economics) 1994, Massachusetts Institute of Technology. The authors thank Chaya Compton and Olivia Odell for research assistance; the attendees at the Sorptive Minerals Institute Spring Forum 2005 for comments on an early version of this paper; and Case School of Law Dean Gerald Korngold for research funding.
[**] Director, Regulatory Studies Program, Mercatus Center at George Mason University and Adjunct Professor, George Mason University School of Law. B.S. 1977, University of Massachusetts; S.M.M. 1981, Sloan School of Management, Massachusetts Institute of Technology.

Defendants and the judicial system."[1] At the same time, silica dust regulation is on the agenda of regulatory agencies around the world. The Occupational Safety and Health Administration ("OSHA") in the United States, as well as regulators in other countries,[2] are considering issuing new standards for silica dust, spurred on by the International Labor Organization and 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 human carcinogen.[3] (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.[4]) 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"[5] 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.[6]

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, crucial questions also arise as to the role of the tort system in regulating hazardous products.

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[1] *The Silicosis Sheriff*, W.S.J. (July 14, 2005) at A10; In re Silica Products Liability Litigation, 2005 WL 1593936 (S.D. Tex. June 30, 2005) at *95.

[2] *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 QUARTERLY NEWSLETTER (August 1999) http://envepi.med.uoeh-u.ac.jp/icoh/ICOH%20QuarterlyNesletter.htm (last visited July 15, 2005) (describing campaign).

[3] INTERNATIONAL AGENCY FOR RESEARCH ON CANCER, SILICA (IARC monograph, vol. 68) at 41 (1997) http://monographs.iarc.fr/htdocs/monographs/vol68/silica.htmIARC Vol. 68 (1997) (last visited August 7, 2005) (hereafter "IARC, SILICA").

[4] 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, Jane Y.C. Ma, Vincent Castranova, & Joseph K.H. Ma, *Dust Particles: Occupational Considerations,* HANDBOOK OF HAZARDOUS MATERIALS 213, 213 (Morton Cone, ed.) (1993) ("Pneumoconiosis is the reaction of the lungs to inspired dust."). "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, Francine Jacobson, and Kitt Shaffer, *Standard Imaging in Silicosis and Coal Worker's Pneumoconiosis,* 30 THE RADIOLOGICAL CLINICS OF NORTH AMERICA: OCCUPATIONAL LUNG DISEASE 1147, 1147-48 (1992) (describing acute, chronic, and accelerated forms of silica dust exposure).

[5] Department of Labor, UNIFIED AGENDA OF FEDERAL REGULATORY AND DEREGULATORY ACTIONS, OSHA (Spring 2005) available at http://ciir.cs.umass.edu/ua/Spring2005/agenda/DEPARTMENT_OF_LABOR_(DOL).html.

[6] Department of Labor, REGULATORY PLAN, OSHA, 69 FR 72781 (December 13, 2004).

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 the pressures agencies face and the roles interest groups play in shaping 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 facing regulation of silica and other compounds where characterization is difficult, and 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,[7] 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.[8] Some more sophisticated definition of silica is thus 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 combined chemically with another atom or molecule.[9] This is important, because only free silica is currently considered to have human health effects.[10] Further, free silica can be distinguished into amorphous and crystalline silica.[11] The former is "essentially benign," while at least some

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[7] "All soils contain at least trace amounts of crystalline silica in the form of quartz." U.S. DEPARTMENT OF THE INTERIOR, BRANCH OF INDUSTRIAL MINERALS, CRYSTALLINE SILICA PRIMER (1992) at 12. The average quartz content of igneous rocks is 12%. Id. at 13. "Because of its abundance in the Earth, silica, in both its crystalline and noncrystalline states, is present in nearly all mining operations." Id. at 15. In addition, "quartz is … the major component of sand and of dust in the air." Id. at 13.

[8] Graham, *supra* note 4, at 191 (noting that 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."). *See also* Mei-lin Wang & Daniel E. Banks, *Airways Obstruction and Occupational Inorganic Dust Exposure,* in OCCUPATIONAL LUNG DISEASE: AN INTERNATIONAL PERSPECTIVE 69, 69 (Daniel E. Banks & John E. Parker, eds., 1998) ("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.").

[9] INDUSTRIAL ACCIDENT PREVENTION ASSOCIATION, SILICA IN THE WORKPLACE (2003) at 2 (hereafter "IAPA, WORKPLACE") (available at http://www.iapa.ca/pdf/Silica-in-the-workplace-FEB03.pdf).

[10] ID. at 2.

[11] There are two states of silica: amorphous and crystalline, which are "quite different physically." PRIMER, *supra* note 7, at 5. "Only the crystalline structures are highly toxic and fibrogenic." Marlene Absher, *Silica and Lung Inflammation*, in HANDBOOK OF HAZARDOUS MATERIALS 661, 662 (Morton Cone, ed.) (1993).

forms of the latter are potentially toxic when inhaled or otherwise ingested.[12] 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.[13]

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 research has been done.[14] Unless regulators are willing to adopt a version of the precautionary principle that allows them to prevent all innovation until a substance is proven safe,[15] and so cut off huge areas of economic activity, regulators will have to operate with a great deal of uncertainty.[16] Regulators thus need a principled approach to determining how much of a distinction to draw in characterizing the subject of a regulation.

Although there are seven forms (polymorphs) of crystalline silica, 4 are "extremely rare." The three major forms are quartz, cristobalite, and tridymite. PRIMER, *supra* note 7, at 11.

[12] Graham, *supra* note 4, 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.").

[13] PRIMER, *supra* note 7, at 32 ("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 so large, is nearly impossible."). *See also* John E. Craighead, *Inorganic Mineral Particulates in the Lung,* HANDBOOK OF HAZARDOUS MATERIALS 399, 405 (Morton Cone, ed.) (1993) ("the 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.") and Absher, *supra* note 11, 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.").

[14] *See* Elena Fagotto & Archon Fung, *Improving Workplace Hazard Communication,* 19 ISSUES IN SCIENCE AND TECHNOLOGY 63, 64 (Winter 2002) (available at http://www.issues.org/issues/19.2/fagotto.htm (last visited May 29, 2005) (noting OSHA estimate that employees are exposed to 650,000 hazardous products in the workplace and problems with getting sufficient information to evaluate those); GENERAL ACCOUNTING OFFICE, DELAYS IN SETTING WORKPLACE STANDARDS FOR CANCER-CAUSING AND OTHER DANGEROUS SUBSTANCES (May 10, 1977) [HRD-77-71] at 9 ("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.").

[15] The literature on the precautionary principle is vast but generally does not assess its potential perils. For notable exceptions to this *see* INDUR M. GOKLANY, THE PRECAUTIONARY PRINCIPLE: A CRITICAL APPRAISAL OF ENVIRONMENT RISK ASSESSMENT (2001) (critical assessment of precautionary principle as having too great a reach); Jonathan H. Adler, *Biosafe or Biosorry?* 12 GEO. INT'L ENVT'L L. REV. 761 (2000) (arguing that technological advance is important to biodiversity protection); Frank B. Cross, *Paradoxical Perils of the Precautionary Principle*, 53 WASH. & LEE L. REV. 851 (1996) (arguing that countervailing risks from well-intended regulatory programs produce harms as great or greater than those the regulations are intended to prevent in many instances)**.**

[16] Uncertainty is discussed most extensively in connection with environmental, rather than workplace health and safety, issues, 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); J.B. Ruhl, *Thinking of Environmental Law as a Complex*

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.[17] 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 (e.g. distinguishing a stock from a bond).[18] 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.

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 of: 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. There is also no evidence that β-kryptonite is *not* harmful, however. 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 uses of kryptonite.[19] 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 which does not distinguish the two forms will impose unnecessary costs on users of β-kryptonite.[20] As a result, users of β-kryptonite will reduce output (since their costs have gone up), consumers of β-kryptonite products will face higher

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Adaptive System: How to Clean Up the Environment By Making a Mess of Environmental Law, 34 HOUS. L. REV. 933 (1997).

[17] Jones, Ma, Castranova, & Ma, *supra* note 4, at 218 (for silica dust, "'respirable' samplers are used. 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.").

[18] *See* Olufunmilayo Arewa, *Breaking Through the Intangibles Haze: Measuring and (Mis)Representing Economic Reality Under the Intangibles Paradigm*, working paper available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=589205 at 8 ("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.").

[19] 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.

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

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.

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[21] and animal studies[22] – requires a substantial investment of both time and money in research.[23]

Now suppose the regulator has available only a study which 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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[21] *See, e.g.,* SHEILA JASANOFF, SCIENCE AT THE BAR: LAW, SCIENCE, AND TECHNOLOGY IN AMERICA 120-121 (1995) (noting issues in epidemiological studies); PETER S. BARTH, WORKERS' COMPENSATION AND WORK-RELATED ILLNESSES AND DISEASES (1980) at 28-29 (same).

[22] BERNARD D. GOLDSTEIN & MARY SUE HENIFIN, REFERENCE GUIDE ON TOXICOLOGY, IN FED. JUDICIAL CTR., REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 401, 406-09 (2d ed. 2000) (describing the assumptions in extrapolating data from animal studies to assess human health risks), available at http://www.fjc.gov; MICHAEL D. GREEN ET AL., REFERENCE GUIDE ON EPIDEMIOLOGY, IN FED. JUDICIAL CTR., REFERENCE MANUAL ON SCIENTIFIC EVIDENCE 333, 346 (2d ed. 2000) (discussing the disadvantages of animal toxicity studies for assessing human health risks), available at http://www.fjc.gov. Although somewhat dated, Bert P. Krages II, *Rats in the Courtroom: The Admissibility of Animal Studies in Toxic Tort Cases,* 2 J. ENVTL. L. & LITIG. 229 (1987), gives a thorough analysis of potential reliability problems with animal studies.

[23] The costs of animal studies, for example, are measured in the hundreds of thousands of dollars. *See* Krages, *supra* note 22, at 234, n. 25.

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.[24]

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 question, therefore, is 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.[25] 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 seventeen forms.[26] Research on health effects focus on only four principal forms[27] 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 have already led to new theories about how silica causes health effects.[28] Future changes may lead to further development of knowledge. In its 2002 review, NIOSH recommended further research to reduce uncertainty regarding "mechanisms and the influence of particle characteristics on development of disease."[29]

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[24] This principle can also be seen in operation 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: THE JOURNAL OF LAW AND TECHNOLOGY 165, 216-217 (2005) (discussing issue of sameness in FDA regulations).

[25] *See* note 10 *supra.*

[26] Gilbert Hart, *The Nomenclature Of Silica*. 12 AM. MINERALOGIST 383, 383-395 (1927) (available at http://www.minsocam.org/MSA/collectors_corner/arc/silicanom.htm).

[27] IARC, SILICA, *supra* note 3, at 41 (Cristobalite, Quartz, Tripoli, Tridymite).

[28] *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 (D.D. Dunnom, ed. 1981) 3, 3 (noting that "[f]or 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.")

[29] National Institute of Occupational Safety & Health, HEALTH EFFECTS OF OCCUPATIONAL EXPOSURE TO RESPIRABLE CRYSTALLINE SILICA, at vii (2002).

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.[30] 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.[31] 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 reaches of the respiratory tract (alveoli or air sacs) where silicosis damage occurs.[32] 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 causes human health effects 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 health risks than freshly fractured silica.[33] The Sorptive Minerals Institute, which represents the absorptive clay industry, is studying the differences in health risk between exposure to freshly fractured and aged silica, and the "geologically ancient" clays (fractured over eons through natural geological processes) used in that industry.[34] Their initial results of their experiments suggest that the characteristics of artificially fractured quartz (pulverized, ground, blasted, etc.) 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

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[30] IAPA, WORKPLACE, *supra* note 9, at 6 (Factors include "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".)

[31] DEPARTMENT OF HEALTH AND HUMAN SERVICES, NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH, NIOSH HAZARD REVIEW: HEALTH EFFECTS OF OCCUPATIONAL EXPOSURE TO RESPIRABLE CRYSTALLINE SILICA, (2002) at vi (hereafter "NIOSH HAZARD REVIEW").

[32] IAPA, WORKPLACE, *supra* note 9, at 4

[33] Email from Vincent Castranova, Ph.D., NIOSH, August 3, 2005 ("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.") (copy on file with authors). 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 APPL. OCCUP. ENVIRON. HYG. 937 (1996); Vincent Castranova, et al., *Role of surface free in the pathogenicity of silicosis*, in SILICA AND SILICA- INDUCED LUNG DISEASES (Castranova, Vallyathan and Wallace (eds)., 1996) , at 91-106; Val Vallyathan, et al., *Freshly fractured quartz inhalation leads to enhanced lung injury and inflammation,* 152 AM. J. CRIT. CARE MED. 1003 (1995); Vincent Castranova, *Generation of Oxygen Radicals and Mechanisms of Injury Prevention,* 102 (suppl 10) ENVIRON HEALTH PERSPECT 65 (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. RESPIR. DIS. 1213 (1988).

[34] Based on discussions by the authors with SMI members at May 2005 SMI Spring Forum.

progressive, incurable disease which impairs respiratory function.[35] It takes years to develop, seldom exhibiting symptoms in under five years.[36] 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.[37]) Further, chronic exposures to high levels of certain forms of free crystalline silica have recently been associated 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 the crystalline silica or on external factors affecting its biological activity or distribution of its polymorphs."[38] 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 was involved in some early studies because distinctions now recognized were unknown or thought to be unimportant at the time the studies were done. Yet these distinctions are potentially as important as the distinction between silica dust and dust that does not contain silica. That OSHA regulates (and is considering tightening regulations on) silica is 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 or not. 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 creating and using such knowledge. We discuss these incentives in the next section.

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[35] *See* note 4 *supra.*
[36] IAPA, WORKPLACE, *supra* note 9, at 6.
[37] National Institute of Occupational Safety & Health, HEALTH EFFECTS OF OCCUPATIONAL EXPOSURE TO RESPIRABLE CRYSTALLINE SILICA, at 1 (2002)
[38] IARC, SILICA, *supra* note 3, at 41.

C. Incentives for Developing Knowledge

If we had complete knowledge about a workplace hazard, its risks and 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.[39] Examining attempts to implement regulatory solutions in economic policy, Nobel Prize-winning economist Friedrich Hayek coined the term "the knowledge problem" to explain why centralized regulatory solutions are inferior to decentralized market processes.[40] 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 & 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 thus 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.[41] Employers often have significant investments in their employees' firm-specific human capital.[42] Safeguarding that investment requires reducing turnover.[43] 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.[44] Indeed, even critics of market forces concede that market responses sometimes occur before regulatory

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[39] There is considerable uncertainty about occupational disease generally. *See, e.g.,* BARTH, WORKERS' COMPENSATION, *supra* note 21, at 15-27 (recounting problems in getting good data on occupational health and deaths).

[40] Friedrich A. Hayek, *The Use of Knowledge in Society,* 35 AM. ECON. REV. 519 (1945). *See also* Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law,* 37 STAN. L. REV. 1333, 1337 ("Such [regulatory] determinations impose massive information-gathering burdens on administrators. . . .")

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

[42] *See* GARY S. BECKER, HUMAN CAPITAL: A THEORETICAL AND EMPIRICAL ANALYSIS, WITH SPECIAL REFERENCE TO EDUCATION 15-44 (2D ED. 1975).

[43] Prof. 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 (1997) at 145.

[44] ADAM SMITH, THE WEALTH OF NATIONS 117-118 (1776 [GLASGOW ED. 1976]); Joni Hersch and W. Kip Viscusi, *Cigarette Smoking, Seatbelt Use, and Differences in Wage-Risk Trade-offs*, 25 J. HUM. RES. 202 (1990).

action.[45] For example, systematic medical exams of employees, an important tool in uncovering workplace diseases, were part of "paternalistic programs to care for workers' broader needs, often to wean them away from trade unions."[46]

The market failure analysis of workplace health and safety stresses obstacles to these incentives' operation. For example, some argue that employees are ignorant of the true nature of the risks they face, and so fail to demand sufficient safety.[47] 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.[48] 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, shifting the cost to employees.

2. Incentives for Categorization & 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 (e.g. 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 of increased knowledge to employers is dependent upon them convincing employees that the distinction is relevant because they 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.

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[45] *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 CIRCLES: ENVIRONMENTAL HAZARDS FROM THE WORKPLACE INTO THE COMMUNITY (Helen E. Sheehan & Richard P. Wedeen, eds. 1993) at 235 ("mining 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.").

[46] Sellers, *Prejudice, supra* note 45, at 237-238. Unions often resisted physicals. SELLERS, HAZARDS, *supra* note 43, at 119 (protests over exams "pronounced" by 1915, Samuel Gompers denounced them as a "menace for the freedom of workers.").

[47] *See, e.g.,* BARTH, WORKERS' COMPENSATION, *supra* note 21, at 53 (quoting workers in Anaconda, Montana who, when informed of risk of arsenic poisoning from copper smelter work, continue to work there because "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 (2004) at 32 ("an important obstacle to workplace safety [in the early 20th century] was the persistent and usually irrational optimism that workingmen seemed to bring to estimations of the risks they faced.")

[48] *See, e.g.,* THOMAS O. MCGARITY & SIDNEY A. SHAPIRO, WORKERS AT RISK: THE FAILED PROMISE OF THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (1993) at 17 ("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.")

Market failures affect incentives to invest in categorization, however. 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,[49] 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 20th century, workers' compensation and other forms of insurance financed through premiums paid by employers have provided incentives for workplace health and safety.[50] Insurance gives employers incentives to promote safety because employers with poor safety records face higher workers' compensation insurance premiums.[51] These incentives appear to have had an impact on the workplace: the doubling of workers' compensation premiums between 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.[52] Research suggests that if not for workers' compensation, occupational fatalities would be one third higher than they are.[53] 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.[54] Workers' compensation insurers compete among themselves for

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[49] For example, the Mine Safety and Health Administration's hazard communication standards are premised 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." Mine Safety and Health Administration, Final Hazard Communication (HazCom) Rule, 67 FED. REG. 42314 (June 21, 2002).

[50] W. KIP VISCUSI, JOHN M. VERNON AND JOSEPH E. HARRINGTON, JR., ECONOMICS OF REGULATION AND ANTITRUST (3rd ed. 2001) at 794. *See also* Sellers, Hazards, *supra* note 43, 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.")

[51] VISCUSI ET AL., *supra* note 50, at 794; BARTH, WORKERS' COMPENSATION, *supra* note 21, 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.")

[52] VISCUSI ET AL., *supra* note 50, at 794

[53] VISCUSI ET AL., *supra* note 50, at 794. The evidence on the impact of workers' compensation on injuries is less strong, and influenced by "moral hazard" because insurance provides incentives to report or even misrepresent accidents. Id.

[54] *See* Kenneth S. Abraham, *Insurance Profitability and Products Liability Law*, 19 J. LEG. STUD. 837, 838 (1990).

employer business by offering lower premiums.[55] If an insurer can discover a basis for distinguishing among high and low risk employers (e.g. 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 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 create knowledge of workplace hazards must include the incentives of repeat players such as insurance companies.

3. Government Failures & the Role of Interest Groups

Market failure theory proponents sometimes view documenting (or perhaps even simply asserting) the existence of one or both of these effects 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 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.[56] 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 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 considering 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 require government intervention.[57] 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.[58] This does not appear to be uniformly the case, however, suggesting that a richer theory of regulation is needed.[59] Many regulations do not correspond to market failures. Economic regulations, the predominate type of regulation through the 1960s, were not well correlated with

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[55] Except in North Dakota, Ohio, Washington, West Virginia, and Wyoming, where the state operates a monopoly insurer. Allison Demeritt and Paul Gruppy, *Reforming Washington's Workers' Compensation System,* Washington Policy Center (2004) (available at www.washingtonpolicy.org/laborpolicy/PBDemerittLaborReformingWorkersCompensation2004.htm).

[56] *See generally* NEIL K. KOMESAR, IMPERFECT ALTERNATIVES: CHOOSING INSTITUTIONS IN LAW, ECONOMICS AND PUBLIC POLICY 21 (1997) ("our 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.").

[57] ARTHUR C. PIGOU, THE ECONOMICS OF WELFARE (1932).

[58] VISCUSI ET AL., *supra* note 50, at 314-317.

[59] Richard A. Posner, *Theories of Economic Regulation*, 5 BELL J. ECON. & MGT. SCI. 335, 335 (1974).

identifiable market failures, and indeed, they often seemed to serve private, not public, interests.[60] 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,[61] suggesting that alternative explanations are necessary.

The understanding of regulation improved with the insights of George Stigler and James Buchanan, two Nobel prize-winning economists. Stigler and Buchanan's works developed insights for predicting when regulations will occur and the form they are 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).[62]

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). 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.[63] Public choice economics begins with the recognition that (1) individuals in government (politicians, regulators, voters, etc.) are driven by self interest, just as individuals in other circumstances, and (2) they are not omniscient.[64] Public choice theory argues that government officials cannot simply systematically maximize the public 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 policymakers are not omniscient regarding the consequences of different policy choices, so that interventions, even when designed to correct market failures, may produce "government failures."

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[60] VISCUSI ET AL., *supra* note 50, at 314-317; William A. Jordan, *Producer Protection, Prior Market Structure and the Effects of Government Regulation*, 15 J. L. & ECON. 151 (1972).
[61] See VISCUSI ET AL., , *supra* note 50, at 790 (discussing this literature).
[62] George Stigler, *The Theory of Economic Regulation*, 2 BELL J. ECON. & MGT. SCI. 3, at 4-7 *(*1971).
[63] JAMES M. BUCHANAN & GORDON TULLOCK, THE CALCULUS OF CONSENT (1962).
[64] GORDON TULLOCK, ARTHUR SELDON, & GORDON L. BRADY, GOVERNMENT FAILURE: A PRIMER IN PUBLIC CHOICE (2000) at 16.

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 sway 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 also the political players involved.[65]

II. An Interest Group-Based Account of Silica Regulation

In Part I we argued that there are significant problems that must be resolved for the design of effective regulatory measures. In this Part we turn to the role interest groups and incentives play in shaping regulatory policy, critical components of understanding regulatory outcomes through a regulatory history of silica dust.

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.[66] Silica dust is a highly visible air contaminant, unlike many other workplace hazards such as gases which are potentially carcinogenic at low concentrations and so difficult to identify in the workplace. Dust, after all, is generally visible to the naked eye even if the specific size particles which are most hazardous are not. Discussions of silica and silicosis thus often begin with a quote from a sixteenth century treatise on mining, *De Re Metallica,* by the German scholar, doctor, and founder of modern geology Georg Bauer, also known as Georgius Agricola, or a source of similar historic vintage to make the point that the hazards are well-known.[67] Such accounts are at least partially correct. By as early

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[65] As an example of not considering interest groups, consider Profs. McGarity and Shapiro's thorough account of OSHA's development through 1990. MCGARITY & SHAPIRO, *supra* note 48. Although they 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. Id. at 83-87. 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 (1996) (available at http://www.cato.org/pubs/regulation/reg19n4b.html); Jonathan H. Adler, *Clean Politics, Dirty Profits* in POLITICAL ENVIRONMENTALISM: GOING BEHIND THE GREEN CURTAIN (Terry L. Anderson, ed. 2000).

[66] PRIMER, *supra* note 7, at 4. The most common form of silica (SiO_2) in nature is quartz. Id.

[67] For a brief account of Bauer's life, see http://www.ucmp.berkeley.edu/history/agricola.html (last visited May 13, 2005). Bauer noted that "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

as the end of the nineteenth century, occupational health writers had clearly established a relationship between dusts, including silica dusts, and health.[68] Thus it is true that the hazards of silicosis are not a new discovery, although the complexities of cause and effect are still being explored today.[69]

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 there were risks to dust exposure, there was in fact little specific knowledge of 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, or 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 (e.g. mining). Even in those occupations, the technology used in pre-Industrial Revolution mining was different 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

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rot away . . . ." Quoted in Daniel E. Banks, *The world-wide problem of occupational lung disease,* in OCCUPATIONAL LUNG DISEASE: AN INTERNATIONAL PERSPECTIVE 2 (Daniel E. Banks & John E. Parker, eds., 1998). *See also* Marvin R. Balaan & Daniel E. Banks, *Silicosis,* in ENVIRONMENTAL & OCCUPATIONAL MEDICINE 435, 435 (William N. Rom, ed.) (3rd 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 (Hippocrates reported on miners suffering from silicosis.); GEORGE ROSEN, THE HISTORY OF MINERS' DISEASES (1943) at 3 ("The earliest evidences of occupational diseases in miners reach far back into prehistoric times."); Absher, *supra* note 11, at 661 ("Silicosis is a disease of ancient origin."); Stark, Jacobson, & Shaffer, *supra* note 4, 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 (1986) at 37 ("The patriarchs of occupational medicine, Agricola in the sixteenth century and Ramazzini in the eighteenth, associated [silicosis] with the dusts created in tool manufacture, as well as in mines and quarries.").

[68] "The specific name silicosis was introduced in 1870 by Visconti," showing knowledge of the problem of silica dusts. Stark, Jacobson, & Shaffer, *supra* note 4, at 1147. 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 in 1902 by Sir James Crichton-Browne included the statement that "The 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 67, at 525. Similarly, an 1879 article in "Buck's Hygiene and Public Health" by Dr. Roger S. Tracy dealt with dust issues at length, including noting problem of chronic and progressive disease. Id. at 527-528.

[69] Graham, *supra* note 4, at 191 (silicosis was a well documented problem in the 1700s, although term silicosis dates to 1870).

theories that have since been proven wrong (e.g. the connection between "miasmas" and disease.)[70] We cannot conclude from Agricola's writings that the conditions he observed were widely understood to cause disease or 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.

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 brought the United States a sharp increase in accidental deaths and injuries.[71] Throughout the late 19th century and early 20th century, 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.[72] The initial response to the increased accident rate was an "outpouring" of new tort litigation despite the restrictive tort doctrines which 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.[73] Complaints about 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.[74]

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.[75] 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.[76] The new technologies meant there was more dust made up of smaller particles.[77] Although there were no systematic measurements, federal Bureau of Mines' studies of mines in Joplin, Missouri and Butte, Montana found dust

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[70] *See* Elizabeth B. Cooper, *Social Risk and the Transformation of Public Health Law: Lessons from the Plague Years,* 86 IOWA L. REV. 869, 881-883 (2001) (discussing changes in theories of disease).
[71] WITT, *supra* note 47, 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.")
[72] ID. at 37 ("around the turn of the twentieth century, the industrial accident emerged in the United States as among the most visible of social ills.")
[73] ID. at 59.
[74] ID. at 62 (quoting original sources).
[75] *See, e.g.,* DAVID ROSNER AND GERALD MARKOWITZ, DEADLY DUST: SILICOSIS AND THE POLITICS OF OCCUPATIONAL DISEASE IN TWENTIETH-CENTURY AMERICA (1991) at 38 ("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 higher risk from power tools).
[76] PRIMER, *supra* note 7, at 25. *See also* ALAN DERICKSON, WORKERS' HEALTH, WORKERS' DEMOCRACY: THE WESTERN MINERS' STRUGGLE, 1891-1925 (1988) at 40 (describing spread of power tools in mining and increase in silicosis as a result).
[77] DERICKSON, *supra* note 76, at 41.

levels more than 100 times the levels allowed under the OSHA standards imposed in the 1970s.[78] Even in states with laws requiring ventilation of dusty workplaces, there was insufficient knowledge to allow the laws to specify any meaningful exposure or ventilation levels.[79]

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[80] 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.[81] For example, scientists had trouble distinguishing tuberculosis from lung scarring caused by dust exposure.[82] (Even today, radiographic techniques cannot distinguish silicosis from multiple other respiratory diseases.)[83] Similarly, variation in individual susceptibility to various industrial hazards discouraged investment in general mitigation measures solely because some employees became ill.[84] Medical standards changed rapidly in the first quarter of the twentieth century, becoming

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[78] ID. at 42.

[79] SELLERS, HAZARDS, *supra* note 43, at 38.

[80] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 32.

[81] *See* SELLERS, HAZARDS, *supra* note 43, at 114-115 (describing impact of new medical advances). Field 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 the 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, 1916-1939 (1987) at 12. Solving these problems required understanding them, thus producing a demand for medical knowledge that spilled over into industrial contexts. This produced 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 through the defeat of yellow fever and malaria. Id. at 16-17. 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. Id. at 18. 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 4 pages to industrial concerns, compared to 300 on contagious diseases. While Field suggests that the profession took a wrong turn by focusing on individual disease causing agents rather than larger social contexts (id. at 21-22), it appears to us 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.

[82] *See* American Lung Association, Interstitial Lung Disease, http://www.cheshire-med.com/programs/pulrehab/ipf.html (last visited July 14, 2005). *See also* BARTH, WORKERS' COMPENSATION, *supra* note 21, at 87 (noting that there are no pulmonary function tests specific to silicosis.)

[83] BARTH, WORKERS' COMPENSATION, *supra* note 21, at 87.

[84] SELLERS, HAZARDS, *supra* note 43, at 28.

more science-based and making much greater use of technology.[85] This included expansion of information technology such as punch cards that enabled the tracking of patterns of disease.[86]

Pre-twentieth century understanding of dust hazards was primitive by modern standards and improving that understanding ultimately resulted from technological change (the invention of radiography in 1895[87]) and scientific breakthroughs in medicine (the germ theory's impact on medicine in the 1870s and 1880s).[88] Although the discovery of the 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[89] – it took time for the practical application of it to spread beyond major urban centers.[90] It also took time for the new technology to become accepted as a vital part of diagnosis even for such obvious conditions such as broken bones.[91] Finally, although the technology was certainly available by 1900, major innovations in reducing the cost of its use did not come about until the demands of World War I prompted innovation.[92]

In addition, before the twentieth century public health was "still largely the province of amateurs and gentlemen,"[93] 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

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

[86] ID. at 41-42. The use of such methods reflected more than technological change, they also reflected the growth of the same scientific management techniques reorganizing factories. Id. at 42, 55.

[87] ID. at 103.

[88] *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 impact of changes brought about by discovery of bacteriological basis for tuberculosis).

[89] HOWELL, *supra* note 85, at 104.

[90] ID. at 108-109 (noting that it took "decades" for .technology to spread to where it was near "most Americans").

[91] ID. at 108 (quoting a medical paper 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 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. ID. at 110-111, 119-120. 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.

[92] ID. at 118-119 (war created shift to film from glass plates, spurred creation of portable units, and led to development of faster film).

[93] FEE, DISEASE AND DISCOVERY, *supra* note 81, at 2. Fee notes that

> "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 public health, it seems a fair conclusion to attribute similar characteristics to those few interested in the relationship between work and illness.

systematic work on workplace safety and health begin.[94] The demand for more knowledge about dust-related health hazards also grew because of the changes introduced by the industrial revolution 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 attributable to nonoccupational rather than workplace causes. Even for those diseases more specifically connected with certain occupations, like lead poisoning, recognition could be difficult. . . .[95]

A close look at when knowledge developed supports this account. An article published in 1900 in the *Journal of the American Medical Association* was the first major U.S. medical publication to identify silica dust as the cause of fibrosis.[96] It discussed elevated death rates following introduction of mechanical milling equipment in a Nevada gold milling firm.[97] British researchers also documented problems in South African mines in this same period.[98] Significantly, dust hazards were first documented in the context of high exposure occupations (mining and milling) where new techniques increased the hazard at the same time as new medical technology and knowledge made diagnosis possible.

The reaction to the new knowledge was a demand for 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.[99] 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.[100] And insurance policies for factory workers had boomed in the preceding decades – estimates run as high as 3.5 million policies by 1900.[101] New knowledge was produced – "[b]y the 1920s, silicosis was established as an

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[94] For example, the first systematic investigations of accidents were done in Pennsylvania as part of the Russell Sage Foundation's Pittsburgh Survey. JACQUELINE KARNELL CORN, PROTECTING THE HEALTH OF WORKERS: THE AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS, 1938-1988 (1989) at 2. The first survey of industrial disease in the United States was done in 1910 by the Illinois Occupational Disease Commission. Id. at 3.

[95] SELLERS, HAZARDS, *supra* note 43, at 22.

[96] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 31.

[97] 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 67, at 38 ("An aggressive, often fatal form of silicosis, caused by milling of the quartz dust, was identified in Nevada in the 1890s.")

[98] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 31-32.

[99] ID. at 33. *See also* SELLERS, HAZARDS, *supra* note 43, at 60-61 (discussing importance of insurance statisticians); BARTH, WORKERS' COMPENSATION, *supra* note 21, at 6 (noting end of sales of insurance to asbestos workers in 1918 as proof of knowledge of hazards).

[100] DERICKSON, *supra* note 76, at 52.

[101] SELLERS, HAZARDS, *supra* note 43, at 25.

important industrial disease."[102] The new knowledge was far from complete: "silicosis was perceived as a problem affecting rural, relatively isolated populations in widely scattered communities" rather than as a widespread problem.[103] Knowledge about silicosis grew together with more general knowledge about work-related disease – Prof. Sellers concludes, for example, that the field of industrial hygiene "coalesced between the 1910s and 1930s."[104]

Viewed in light of contemporary knowledge and technology, the market reaction to the unprecedented increases in silica dust exposure brought about by the new technologies around the turn of the twentieth century was a demand for 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.[105] For example, in the nineteenth century foundry industry, mould making was a skilled occupation[106] supported by a great deal of semi-skilled and unskilled labor.[107] 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."[108] Craft workers generally resisted employer control over their work,[109] which limited employer knowledge about hazards. For example, Sellers reports that

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[102] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 48. A Department of Labor report addressed "The Problem of Dust Phthisis in the Granite-Stone Industry" in May 1922. CORN, *supra* note 94, at 7.
[103] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 48.
[104] SELLERS, HAZARDS, *supra* note 43, at 2.
[105] SELLERS, HAZARDS, *supra* note 43, 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.") Not all technological change increases hazards. *See* BARTH, WORKERS' COMPENSATION, *supra* note 21, at 51-52 (giving examples of technological change reducing hazards); id. at 54 (discussing some improvements in occupational health from technological change).
[106] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 54 ("The nineteenth-century molders saw themselves as artists as well as artisans.").
[107] ID. at 51.
[108] ID. at 52.
[109] DAVID MONTGOMERY, WORKERS' CONTROL IN AMERICA: STUDIES IN THE HISTORY OF WORK, TECHNOLOGY, AND LABOR STRUGGLES (1979) at 16-17 (on craft workers' resistance to attempts to limit their autonomy); id. at 23 (describing battle between stove companies and molders' union); id. at 26 ("most

> "the Wheeling nail manufacturers rented out nail-making machines on their premises and paid nail makers 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."[110]

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.[111] The biggest change was the introduction of molding machines that replaced the skilled mold makers.[112] These innovations also created greater silica exposure, since the power and pneumatic tools both made more dust and blew more of the dust made into the air.[113] The increased production they made possible also raised exposures as did the expansion of the industry made possible 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.[114] 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.)[115] 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 centuries,[116] 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.[117] (The craft-basis of early twentieth century American unionism limited its effectiveness by fragmenting workers in each shop.[118])

The early twentieth century also saw the creation of state laws and agencies investigating factory conditions and occupational health issues, part of the Progressive

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important of all, new methods of industrial management undermined the very foundation of craftsmen's functional autonomy.")

[110] SELLERS, HAZARDS, *supra* note 43, at 26 (footnotes omitted).

[111] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 52.

[112] ID. at 56.

[113] ID. at 62.

[114] ID. at 60. *See also* id at 63 (noting union arguments against allowing mechanized processes); id. at 73 (noting that "[l]abor and management defined silicosis in terms increasingly removed from the discourse of public health and medicine"); DERICKSON, *supra* note 76, at 162 (noting major role played by mining unions on 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 dragging down American womanhood so that the foundrymen can increase their profits.'" ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 61.

[115] WITT, *supra* note 47, at 32.

[116] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 64.

[117] ID. at 64-65.

[118] ROBERT H. ZIEGER, AMERICAN WORKERS, AMERICAN UNIONS (1994) at 32.

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.[119] It held its first national conference on industrial disease in 1910.[120] The organization also sponsored publication of papers on the topic, pushing Americans ahead of the former leaders, the British and Germans, in number of articles when the results of the second AALL conference were printed.[121] The AALL made occupational diseases one of its top priorities.[122] The policy entrepreneurs of the AALL, who included Richard Ely and John Commons, sought to define a "scientific" path to legislation that would increase welfare.[123] In doing so, they helped create a "more coherent field of study" dealing with occupational disease.[124] Undoubtedly motivated by concern for the general welfare, these experts also "aimed to secure a place for their professions" in public policy.[125]

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.[126] State factory inspectors grew in number, from fewer than 300 in 1907 to 425 in 1911.[127] In the process, they helped create a constituency for legislation.[128] Organizations representing a variety of interest groups sprang up in the 1910s.[129] By 1914, there were factory inspection bureaus in thirty-three states;[130] fifteen states had passed legislation requiring reporting of occupational diseases by all physicians;[131] and twenty-four had workers' compensation statutes.[132] World War I stimulated even greater interest in industrial hygiene.[133]

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[119] CORN, *supra* note 94, at 5.
[120] ID. at 5-6.
[121] SELLERS, HAZARDS, *supra* note 43, at 61.
[122] ID. at 50-53.
[123] ID. at 52.
[124] ID. at 53.
[125] ID. at 60.
[126] David Rosner and 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 (3rd ed., rev., Judith Walzer Leavitt & Ronald L. Numbers, eds.) (1997), at 467, 469 ("The publishers of these books and magazines were not printing this material as a public service. Rather, they recognized that it could sell magazines . . . ")
[127] SELLERS, HAZARDS, *supra* note 43, at 72.
[128] Rosner & Markowitz, *Early Movement, supra* note 126, at 478 ("For almost a decade, exposes of inhumane working conditions and demands for reform were regular features in newspapers and magazines across the country.")
[129] These included: the National Council for Industrial Safety (1912), the Industrial Hygiene Section of the American Public Health Association (1914), the Conference Board of Physicians in Industry (1915), the American Association of Industrial Physicians and Surgeons (1916). CORN, *supra* note 94, at 6-7. The physicians group's membership soared from 125 in 1916 to 600 by the end of World War I. SELLERS, HAZARDS, *supra* note 43, at 145.
[130] Sellers, *Prejudice, supra* note 45, at 236.
[131] Id. at 237.
[132] Id. at 238. *See also* CHERNIACK, *supra* note 67, at 38 ("In 1915 the first workmen's compensation laws provided implicit, though not explicit, coverage for silicosis.")
[133] CORN, *supra* note 94, at 8. *See also* SELLERS, HAZARDS, *supra* note 43, at 145-146 (discussing interest spurred by labor shortages).

While these first agencies' capabilities were rudimentary, reflecting the scientific standards of the time,[134] their creation meant that there was now a state bureaucracy invested in documenting occupational diseases. Not surprisingly, these new agencies were quick to expand: 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 industrial hygienist on its staff by 1930.[135] The federal government also funded studies aimed at occupational disease.[136] 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."[137] This interest by governments spurred further market responses: the first American textbooks on occupational medicine appeared in 1914[138] and Harvard appointed the first full time professor of industrial medicine in 1919.[139] The initial state response to this 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.[140] Employees wanted compensation; employers and insurance companies wanted limited liability; and social reformers wanted more state intervention in the workplace. Moreover, reformers often believed regulatory solutions were likely to be inadequate, turning to the financial incentives offered by the insurance approach.[141] The primary result in the United States was the development of the workers' compensation system for industrial accidents (although not, initially, for workplace diseases), a compromise which limited employers' liability and increased employees' certainty of recovery.[142] Other new initiatives were the

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[134] Sellers, *Prejudice, supra* note 45, at 236.
[135] Id. at 253.
[136] Id. at 239; CHERNIACK, *supra* note 67, at 38 ("By 1914 the Federal Bureau of Mines had begun to recommend yearly physical examinations for workers exposed to dusts containing silica.").
[137] Id. at 246.
[138] Id. at 240. No mention of occupational factors which might lead to fibroid phthisis, a silicosis predecessor, appeared in a widely used medical textbook in the 1880s, for example. SELLERS, HAZARDS, *supra* note 43, at 32.
[139] Sellers, *Prejudice, supra* note 45, at 247.
[140] *See* Rosner & Markowitz, *Early Movement, supra* note 126, at 478 ("The movement to control workplace hazards was widespread, encompassing a variet of different groups.")
[141] WITT, *supra* note 47, at 100-101.
[142] BARTH, WORKERS' COMPENSATION, *supra* note 21, 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's report for the Russell Sage Foundation, which helped build public support for workers' compensation systems, explicitly discussed the quid pro quo. CRYSTAL EASTMAN, WORK ACCIDENTS AND THE LAW 216-220 (2nd ed., 1916). 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, WORKERS AT RISK, *supra* note 48, at 17. Left unspecified, however, 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,

establishment and expansion of state labor agencies, the creation of the federal Department of Labor, and various acts regulating working conditions in specific industries.[143]

The first wave of workers' compensation statutes 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.[144] Second, mass industrial disease, as opposed to isolated incidents, was still relatively unrecognized. The long latency periods (as much as twenty years for silicosis)[145] and relatively primitive understanding of medicine made diagnosis of non-acute conditions challenging.[146] The industrial changes that increased exposures combined with the latency period to make the real boom in disease be recognized only after the first wave of workers' compensation statutes was passed.[147] One key result of the introduction of workers' compensation insurance, however, was that statistics began to be gathered on the causes of injuries.[148] "Workmen's compensation acts had moved analysis of work accidents from the close specificity of individualized inquiries into particular accident cases to a higher plane of statistical generality."[149] Insurers sought to introduce preventative measures to lower risks.[150] 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."[151]

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 were a mere 3% of gross national product that year.[152]

The 1920s were a time of economic growth and advancement for employees. Industrialization brought new material wealth: "Throughout the 1920s surveys of consumer habits marveled at the wide range of purchases made by working-class people,

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in our view, because it explains the rise of the legislation without resort to episodic defiance by legislatures of powerful interests who are otherwise believed to control events.

[143] Rosner & Markowitz, *Early Movement, supra* note 126, at 479.

[144] *See* John M. Kleeberg, *From Strict Liability to Workers' Compensation: The Prussian Railroad Law, the German Liability Act, and the Introduction of Bismarck's Accident Insurance in Germany, 1838-1884,* 36. N.Y.U. J. INT'L L. & POL. 53 (2003) (describing innovations in creating workers' compensation).

[145] BARTH, WORKERS' COMPENSATION, *supra* note 21, at 67 (noting latency period for silicosis is 4-20 years).

[146] BARTH, WORKERS' COMPENSATION, *supra* note 21, at 63 (discussing problems long latency periods pose for workers' compensation generally).

[147] 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. ARTHUR LARSON & LEX K. LARSON, LARSON'S WORKERS' COMPENSATION LAW §2.07-2.08 (2003).

[148] WITT, *supra* note 47, at 127.

[149] ID. at 142.

[150] ID. at 145.

[151] ID. at 187.

[152] DAVID M. KENNEDY, THE AMERICAN PEOPLE IN THE GREAT DEPRESSION (1999) at 55. 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 GNP. Id.

many of them involving durable goods such as radios, washing machines, and even 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."[153] Consumer goods' prices were falling rapidly, putting them within the reach of an ever-widening proportion of the country's population.[154] Labor peace largely prevailed, with strike activity reaching historic lows.[155] "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.[156] Not everything was perfect; unemployment remained a concern for many, reaching 8% in mid-1929.[157] Nonetheless, the success of so many during the 1920s meant there was little demand for tackling hard to understand problems like silicosis. The one interest group that might have spurred public interest, unions, was preoccupied with declining membership – a sympathetic observer says the AFL "languished in torpor and apathy throughout the 1920s"[158] – and losing ground because it had not yet cracked the mass production industries.[159] 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.[160] 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 mechanism explains why neither state nor market responded more quickly.

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,[161] 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."[162]) Lawsuits over silicosis from workplace exposures

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[153] ZIEGER, *supra* note 118, at 5-6. *See also* KENNEDY, *supra* note 152, at 22 ("in the pulsing industrial cities, virtually all Americans dramatically improved their standards of living over the course of the post-World War I decade.")

[154] KENNEDY, *supra* note 152, 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.")

[155] ZIEGER, *supra* note 118, at 6.

[156] KENNEDY, *supra* note 152, at 27; MONTGOMERY, *supra* note 109, at 33.

[157] ZIEGER, *supra* note 118, at 7.

[158] ID. at 23.

[159] ID. at 23.

[160] KENNEDY, *supra* note 152, at 25. *See also* ALAN BRINKLEY, THE END OF REFORM: NEW DEAL LIBERALISM IN RECESSION AND WAR (1995) at 202 (noting AFL's "historic reluctance to rely on government assistance (a reluctance born or the conviction that once labor became dependent on the state it could be—and would be—oppressed by the state.")

[161] BARTH, WORKERS' COMPENSATION, *supra* note 21, at 92-93.

[162] SELLERS, HAZARDS, *supra* note 43, at 146.

began to proliferate in the 1930s;[163] thousands of such suits created a liability crisis[164] and made silicosis "an issue of national import."[165] Insurers reported that they faced "the most serious claim problem ever encountered" as a result of silicosis suits.[166] More than a billion dollars of silicosis suits were pending in 1934,[167] the equivalent of over $14 billion in today's dollars. 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.[168] "And as workers won their suits, it emboldened more of the unemployed and their lawyers."[169]

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 equipment in various industries.[170] Silicosis was less well understood 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."[171] 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."[172] "[M]any workers in the dusty trades turned to the courts"[173]

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[163] GEORGE G. DAVIS, ELLA M. SALMONSEN, & JOSEPH L. EARLYWINE, THE PNEUMONOKONIOSES (SILICOSIS) LITERATURE AND LAWS OF 1934 (1935) at 7 ("It is estimated that at this time, March, 1934, there are suits in the United States for injury and deaths which it is claimed resulted inhaled silica amounting altogether to at least three hundred million dollars."); ID. at 50 (Manufacturers in NY state in 1925 tried to get law passed to get the "hundreds" of common law suits over silicosis stopped; "hundreds of thousands of dollars" already spent by then in settlements.).

[164] *See* ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 3 (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, SALMONSEN, & EARLYWINE, *supra* note 163, at 30. *See also* ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 91-96 (describing crisis in New York). In Massachusetts, the costs of covering silicosis claims required a $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. ID. at 51.

[165] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 4.

[166] ID. at 79 (quoting Employer's Mutual's twenty-fifth annual report).

[167] DAVIS, SALMONSEN, & EARLYWINE, *supra* note 163, at 75.

[168] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 78-79; BARTH, WORKERS' COMPENSATION, *supra* note 21, 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.")

[169] ID. at 81.

[170] 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. ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 15-21. 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. Id. at 21-22.

[171] SELLERS, HAZARDS, *supra* note 43, at 204.

[172] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 5; ID. at 76 (in Depression, "[a]s workers were thrown out of work and families forced to support the disabled on meager or no income, the arguments for industrial disability took on a new urgency and meaning.").

[173] ID. at 77.

and "[t]he lawsuits brought silicosis within the range of practical politics."[174] Faced with "actuarial potential for disaster," there was enormous pressure to find a solution.[175] 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,[176] agencies which then assembled information on the state of occupational diseases in various industries. Finally, the Gauley Bridge disaster (discussed in more detail below) in which hundreds of men lost their lives to acute silicosis, spurred congressional hearings and litigation in 1935-1936.[177]

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 support doubtful claims based on unskilled readings of radiographs.[178] Silicosis suits brought with them bitter disputes over alleged fraudulent claims such as those detailed in articles like "The Dust Hazard Racket"[179] in legal publications and fights between insurance companies and their insured over coverage.[180] As one observer in the 1930s complained, people without injuries took advantage of some states' looser standards to bring fraudulent claims:

> 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.[181]

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[174] ID. at 78, quoting James D. Hackett, *Silicosis*, 11 NEW YORK DEPARTMENT OF LABOR INDUSTRIAL BULLETIN 475 (Dec. 1932).

[175] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 87.

[176] CHARLES LEVENSTEIN & GREGORY F. DELAURIER, THE COTTON DUST PAPERS: SCIENCE, POLITICS, AND POWER IN THE "DISCOVERY" OF BYSSINOSIS IN THE U.S. (2002) at 43. (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, DEADLY DUST, *supra* note 75, at 126. *See also Interview with Leonard J. Goldwater,* in CORN, *supra* note 94, at 147 (state programs made possible by Social Security money).

[177] *See* notes 194 to 200 and associated text *infra* for a discussion of the Gauley Bridge disaster.

[178] SELLERS, HAZARDS, *supra* note 43, at 204.

[179] DAVIS, SALMONSEN, & EARLYWINE, *supra* note 163, at 52.

[180] *See, e.g.*, Frederick Snow Kellog, *Silicosis Claims—A New Problem in the Insurance Field,* N.J. L. J. (July 25, 1935) at 1; ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 70 (foundry industry "under pressure from the insurance industry, which was threatening to withdraw its coverage.")

[181] DAVIS, SALMONSEN, & EARLYWINE, *supra* note 163, at 33. *See also* ID. at 73 ("An epidemic of suits aggregating $974,000 against one company alone, have been filed in Missouri" for work-related silicosis claims.).

Eventually the "crisis" abated with the shifting of silicosis suits to the workers' compensation system beginning in the mid-1930s.[182] 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[183] led insurers to seek substantial rate increases (from $11/$100 of payroll to $22.25/$100 of payroll in the case of underground gold mines, for example)[184] and prompted legislative action. The wave of suits, partially 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.[185] Life insurance companies were worried that they had coverage of people now likely to die far earlier than the companies had predicted. Covering industrial diseases became in the interest of a wide range of groups, including both employees and employers.[186] 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.[187] Led by Hugh Johnson, who envisioned the agency as "a giant organ through which he could play on the economy of the country,"[188] 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."[189]

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[182] *See* U.S. DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS, LABOR LAW INFORMATION SERVICE, OCCUPATIONAL-DISEASE LEGISLATION IN THE UNITED STATES, 1936 (1938) (BULLETIN NO. 652) at 1-3 (describing initiation of occupational disease coverage for "dust diseases".)

[183] Marsh v. Industrial Accident Commission of California, 18 P.2d 933, 938 (Cal. 1933).

[184] *Silicosis,* TIME (Jan. 6, 1936) at 58. *See also The Silicosis Problem*, N.Y. TIMES (Apr. 22, 1936) at 22 ("Few liability companies will assume a silicosis risk at any but a prohibitive premium.")

[185] 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,* LIT. DIG. (Dec. 15, 1934) at 15.

[186] *Committees for Prevention of Silicosis in Industry,* 42 MONTHLY LAB. REV. 1545, 1546 (Jun. 1936) (quoting Labor Sec. Francis Perkins on interests of all sectors in resolving liability crisis).

[187] KENNEDY, *supra* note 152, at 179.

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

[189] ID. at 185. *See* BRINKLEY, *supra* note 160, at 39 (summarizing complaints about NRA codes).

These codes cartelized "huge sectors of American industry."[190] Trade associations and large producers dominated the NRA codes.[191] Despite the varied efforts and alphabet soup of agencies and statutes, the New Deal was spluttering by 1935. Unemployment remained at 20% and opposition on both the right and the left began to grow.[192] 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 the populists Father Charles Coughlin and Senator Huey Long.[193]

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.)[194] The tunnel route, unfortunately, ran through a vein of almost pure quartz, producing extremely high exposures.[195] The story broke nationally in 1936.[196] As one account noted, "Popular interest in silicosis, stimulating social and legislative activities and affecting judicial decisions, was notably accentuated by the newspaper notoriety of the Gauley Bridge

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[190] KENNEDY, *supra* note 152, at 184.
[191] ID. at 184.
[192] ID. at 218-219.
[193] ID. at 242.
[194] Balaan & Banks, *supra* note 67, at 435. Civil suits by the workers were largely settled out of court. *See Silicosis: Tunneling Through an Atmosphere of Deadly Dust,* NEWSWEEK (Jan. 25, 1936) at 33, 34.
[195] Balaan & Banks, *supra* note 67,, at 435 (deaths); PRIMER, *supra* note 7, at 25 (pure quartz). The most thorough account is CHERNIACK, *supra* note 67. Cherniack notes that estimates of the silica content was at least 90%. Id. at 41. He also suggests that the death toll may have been as high as 764. Id. at 104.
[196] 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. Learning of the "village of the living dead," where many still-living tunnel workers with silicosis lived, the playwright wrote up "a grim short of a miner slowly suffocating" from silicosis for the *New Masses,* a radical paper. A labor paper, the *People's Press*, then picked up the story and published a non-fiction account. *Village of Living Dead,* Lit. Dig. (Jan. 25, 1936) at 6. Rep. Vito Marcantonio (R. N.Y.), "dark-haired, outspoken, simple in dress, . . . [and 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*, Vito Marcantonio: A Recognition and Celebration. http://users.rcn.com/redpost/life.html (last visited July 7, 2005). (The most comprehensive biography of Marcantonio termed him "frequently the sole spokesman in Congress for America's radical left" from 1936-1950. ALAN SCHAFFER, VITO MARCANTONIO, RADICAL IN CONGRESS (1966) at 1. Marcantonio read the story in the *People's Press*, which spurred the hearings. *Silicosis: Tunneling Through an Atmosphere of Deadly Dust,* NEWSWEEK (Jan. 25, 1936) at 33. Marcantonio later termed the Rinehart & Dennis Co., which constructed the tunnel, as "worse than Dillinger and Al Capone." *Silicosis Deaths Assailed in the House*, *Committees for Prevention of Silicosis in Industry*, 42 MONTHLY LAB. REV. 1545, 1546 (Jun. 1936) (Feb. 8, 1936) at 5. 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" who 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 94, at 142.

episode."[197] Indeed, some federal officials felt that the Gauley Bridge disaster advanced occupational disease legislation "almost a decade."[198]

Congressional hearings were held in 1936[199] 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 Gauley Bridge hearings concluded.[200] By creating a national debate over the subject of silicosis, bringing together both labor and industry representatives in a forum created by the federal government, the government attempted to make it possible for the parties to bargain their way to a mutually advantageous solution,[201] in keeping with the administration's corporatist approach to labor issues.[202] The combination of the threat of silica suits against employers, ambiguity in many states' workers compensation laws on occupational disease coverage,[203] causation issues for plaintiffs,[204] and unions' interests in using the issue to expand their role in the workplace[205] made gains from cooperation possible: employers could eliminate the threat of civil suits and unions could expand their

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[197] L.G. COLE AND W.G. COLE, PNUEMOCONIOSIS (SILICOSIS): THE STORY OF DUSTY LUNGS (1940) at 3 quoted in CHERNIACK, *supra* note 67, at 109.

[198] Carlton Skinner, *Silicosis Deaths to Hasten Legislation Controlling Occupational Diseases*, WALL STREET J. (Feb. 29, 1936) at 4.

[199] House Committee on Labor , *Investigation Relating to Health Conditions of Workers Employed in the Construction and Maintenance of Public Utilities*,74th Cong. 1st sess., (Jan. 16, 1936)

[200] OCCUPATIONAL DISEASE LEGISLATION, *supra* note 182, at 5 (describing conferences) CHERNIACK, *supra* note 67, at 109 (noting timing); *Committees for Prevention of Silicosis in Industry,* 42 MONTHLY LAB. REV. 1545, 1546 (Jun. 1936) (describing conferences).

[201] 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 75, DEADLY DUST, 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 the National Industrial Recover Act as unconstitutional. ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, 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." *Program for Prevention and Compensation of Silicosis,* 44 MONTHLY LAB. REV. 909, 913 (Apr. 1937).

[202] BRINKLEY, *supra* note 160, at 35 (discussing corporatist ideology of many New Deal reformers); id. at 40 (discussing Roosevelt's attempts to sponsor cooperative business-labor partnerships in 1938).

[203] *See* OCCUPATIONAL DISEASE LEGISLATION, *supra* note 182, at 4 (discussing debate over whether state statutes covering "injuries" rather than "accidents" included occupational disease coverage). *See also* ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 86 (noting problems for compensation system of handling silicosis where there was a lack of agreement on diagnosis, 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* ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 94-95.

[204] ID. at 86 (noting that silicosis "was extremely hard to diagnose.")

[205] *See* ID. at 7 ("some of the new industrial unions added health and safety issues to more traditional demands for shorter hours and better wages."); Sellers, *Prejudice, supra* note 45, at 237 (noting that unions in the first part of the twentieth century created their own medical clinics for workers); MONTGOMERY, *supra* note 109, at 163 (noting unions used health and safety issues as bases for "quickie" strikes during periods of high relatively labor demand in 1936 and 1937). The United Mine Workers, for example, fought long and hard for inclusion of safety provisions in union contracts, finally gaining their inclusion in the Appalachian Wage Agreement of 1941. CHARLES ANTHONY MORTON, THE UNITED MINE WORKERS AND THE ESTABLISHMENT OF COAL MINE SAFETY REGULATIONS (Master's Thesis, Ohio State University, 1954) at 83.

influence over the workplace[206] through a new federal agency.[207] Indeed, "[i]n the midst of the Depression, silicosis was frequently defined as a labor and management problem, not solely as a health issue."[208] Unions in the mid-1930s were on the upswing; after dramatic declines to under 3 million over the 1920s and early 1930s, union membership reached 9 million in 1939.[209] However the unions were also divided by the disputes between the AFL and the CIO, which weakened their political clout.[210] Economic conditions were also turning against the unions. (In 1937 the recovery collapsed, the "Roosevelt Recession" began, which ended the active phase of the New Deal.[211])

Employers 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.[212] Faced with the threat of moves to create another of the New Deal "alphabet" agencies (the leading Congressional figure in the Gauley Bridge hearings advocated federal solutions),[213] employers opted for the devil they knew: workers' compensation. "By the end of 1937, forty-six states had enacted laws covering workers afflicted with silicosis."[214] By way of comparison, only 15 states covered some or all occupational diseases at the start of 1936.[215]

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[206] The primary issues for unions in the 1930s were gaining control over the workplace. *See* ZIEGER, *supra* note 118, at 28 ("Workers in the 1930s resolved to limit managerial authority and to safeguard their standards and status with clear contractual guarantees.").

[207] 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 governments, 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, DEADLY DUST, *supra* note 75, at 82.

[208] ID. at 107. Unions at this time generally did not have industrial hygienists on staff. *Interview with Warren A. Cook,* in CORN, *supra* note 94, at 135.

[209] ZIEGER, *supra* note 118, at 26. *See also* BRINKLEY, *supra* note 160, at 201 ("The rise of the American labor movement had been one of the most striking social developments of the 1930s.")

[210] ZIEGER, *supra* note 118, at 45, 55; KENNEDY, *supra* note 152, at 301-303. Brinkley notes that Roosevelt vacillated over appropriate policies at this point. BRINKLEY, *supra* note 160, at 86-87. Within the Administration, the period was referred to as the "struggle for a program." ID. at 97.

[211] BRINKLEY, *supra* note 160, at 3, 23.

[212] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 133 ("The National Silicosis Conference had not resolved the silicosis issue. Rather, it spurred the contending groups to organize nationally.")

[213] Carlton Skinner, *Silicosis Deaths to Hasten Legislation Controlling Occupational Diseases*, WALL STREET J. (Feb. 29, 1936) at 4. 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 152, at 278. The main threat to Roosevelt lay to the left in 1935 and so his shift leftward was aimed at Coughlin and Gerald L.K. Smith, the successor to the assassinated Huey Long's political program. KENNEDY, *supra* note 152, at 283. Roosevelt may not have meant it, as Kennedy concludes (noting that Roosevelt "substituted insult *for* injury"), but his rhetoric was undoubtedly alarming at the time. Id. at 284-285.

[214] CHERNIACK, *supra* note 67, at 110. *See also* ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 92 (noting that New York employers introduced bill making silicosis coverable under the workers' compensation system).

[215] Carlton Skinner, *Silicosis Deaths to Hasten Legislation Controlling Occupational Diseases*, WALL STREET J. (Feb. 29, 1936) at 4.

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: nineteen states established industrial hygiene departments in 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."[216] Federal spending on industrial hygiene rose quickly, from $100,000 in 1936 to almost $750,000 in 1938.[217] State budgets rose to $589,000 in 1938, with 161 employees across twenty-six states.[218] Importantly for future activity, the Temporary Conference of Official Industrial Hygienists organized in 1936, soon to become the influential National Conference of Governmental Industrial Hygienists (NCGIH) and in 1946, the American Conference of Governmental Industrial Hygienists (ACGIH), which continues today.[219]

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.[220] Employers saw union efforts to control the workplace as a serious threat to the productivity gains of the first part of the twentieth century.[221] The opening years of the New Deal had made clear the stakes and the Roosevelt Administration's likely approach to labor issues.[222] The Air Hygiene Foundation was quickly established to serve as a clearinghouse and establish voluntary standards.[223] It conducted "virtually all" silicosis research after its establishment.[224] And given Roosevelt's status as a "diffident champion of labor, especially of organized labor unions,"[225] the Administration did not resist strongly.

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[216] CORN, *supra* note 94, at 10-11; *Third National Conference on Labor Legislation, 1936,* 43 MONTHLY LAB. REV. 1438, 1442 (Dec. 1936).
[217] CORN, *supra* note 94, at 11.
[218] ID. at 12-13.
[219] ID. at 15. The permanent organization organized in 1938. LIORA SALTER, MANDATED SCIENCE: SCIENCE AND THE SCIENTISTS IN THE MAKING OF STANDARDS (1988) at 37.
[220] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 106 (describing initial meeting of industry coalition the day before Congressional hearings on Gauley Bridge began).
[221] ZIEGER, *supra* note 118, at 28.
[222] 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. *See* Louis Stark, *44 States Prepare Model Labor Code,* N.Y. TIMES (Feb. 16, 1934) at 20. These conferences pushed for "leveling up" 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. *Washington Conference on Labor Legislation, February 1934,* 38 MONTHLY LAB. REV. 779, 780-781 (Apr. 1934). A second conference was held in 1935 reached similar conclusions. *National Conference on Labor Legislation, Asheville, N.C., October 4-5, 1935,* 41 MONTHLY LAB. REV. 1247, 125-1253 (Nov. 1935). The third 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 Sec. of Labor Perkins, who argued it was too broad. *Labor for Change in Constitution,* N.Y. TIMES (Nov. 12, 1936) at 2.
[223] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 108.
[224] ID. at 129.
[225] KENNEDY, *supra* note 152, at 297 (Roosevelt "was more interested in giving workers purchasing power than in granting them political power.")

To the extent that they sought to use the incident to create federal authority over occupational health, the unions overreached.[226] And organizing was the top union priority in 1936-1937.[227] The unions were also resisting provisions of industrial disease legislation that might lead to afflicted employees losing their jobs.[228] Although labor interests succeeded in getting legislation introduced in Congress in the late 1930s to implement their approach,[229] by that time a conservative coalition had emerged in Congress with strength to block legislation[230] and the White House did not push the legislation through.[231] Moreover, the Supreme Court had not yet "switched" to allowing the Roosevelt reforms,[232] and Secretary of Labor Francis Perkins was worried over the Court's possible attitude toward labor legislation generally.[233]

Another reason that more radical solutions were not adopted was that the problem was largely seen as solved. Perkins,[234] 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"[235] 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."[236] Moreover, experts thought that only two percent of the workforce was at risk, and only half that number at serious risk.[237]

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.[238] 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. Where the plaintiffs' bar gained relaxed proof and pleading standards, *de facto* if not *de jure*, fraudulent claims could prevail as well as

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[226] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 129-130.
[227] KENNEDY, *supra* note 152, at 289.
[228] *See, e.g., The Silicosis Bill,* N.Y. TIMES (Apr. 3, 1936) at 22 (noting that in crafting a N.Y. 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) (quoting AFL spokesman that need for x-ray examination was unquestioned "where silicosis exists" but that employees should not be discharged or assigned to lower paying jobs if they were discovered to have silicosis.)
[229] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 131.
[230] KENNEDY, *supra* note 152, at 339.
[231] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 133. 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.
[232] KENNEDY, *supra* note 152, at 335 (describing Supreme Court's reversal on constitutionality of New Deal legislation in 1937.
[233] ID. at 265.
[234] 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.
[235] *Bars to Silicosis Cited by Experts,* N.Y. Times (Feb. 4, 1937) at 23.
[236] *Silicosis Problem in State at 'Crisis',* N.Y. Times (Apr. 15, 1936).
[237] *Program for Prevention and Compensation of Silicosis,* 44 MONTHLY LAB. REV. 909, 909 (Apr. 1937).
[238] *See* note 95 and associated text *supra.*

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.[239] The insurance companies also developed the data that unseated the bacteriological theory.[240] 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.'"[241] 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.[242] Causation issues plagued both common law and workers' compensation solutions, as silicosis and tuberculosis often went hand in hand.[243] Moreover, susceptibility to silicosis is related in part to characteristics of the exposed individual, including both voluntary (e.g. smoking) and involuntary (e.g. genetics),[244] 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.

To summarize, by 1940 the legal treatment of silica dust had undergone several key changes. Although the notion that breathing dust was unhealthy had been recognized much earlier, 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, workers' compensation systems were created to spread the costs of accidents.

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[239] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 24 (describing how statisticians at Metropolitan Life and Prudential, who together handled eighty percent of the $3 billion market for "industrial insurance" policies sold to workers.); ID. at 75 (quoting Anthony Lanza's 1939 account that "Out of a clear sky and with dramatic suddenness, the insurance companies were faced with a situation that was in many respects terrifying.").

[240] ID. at 25-26 (Prudential analyst Frederick "Hoffman's work was critical to the unmasking of silicosis as a distinct condition in the United States.")

[241] SELLERS, HAZARDS, *supra* note 43, at 20. It took time before the insurance companies developed accurate information. *See* id. at 29.

[242] DAVIS, SALMONSEN, & EARLYWINE, *supra* note 163, at 30 (describing fiscal crisis in New York); 52 (describing fiscal crisis in Massachusetts).

[243] 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 silcosis. Graham, *supra* note 4, at 200. *See also* DERICKSON, *supra* note 76, at 52 ("the most important source of misunderstanding [in the early 20th century] was the pervasive failure to differentiate silicosis from tuberculosis.")

[244] Absher, *supra* note 11, at 663 ("confounding factors include genetics, smoking habits, and underlying diseases such as tuberculosis and rheumatoid arthritis."); Craighead, *supra* note 13, 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 8, at 70 ("[i]n the general population, cigarette smoking accounts for the overwhelming proportion of patients with severe airways obstruction.").

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, the extension of workers' compensation to cover silicosis and other industrial diseases), and the interplay of interest groups produced compromises and innovation.

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.[245] The outcome of the debate, however, was to introduce a legal distinction between the two types of disease.

Implementing the distinction proved difficult, however. Diagnosis was a challenge (and remains so); 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.[246] By awarding benefits for a subset of employees with reduced lung capacity, the institutions that grew out of the 1930s experience created incentives for employees to be diagnosed with silicosis and other covered diseases and for employers to seek different diagnoses for claimants, to eliminate the need to pay compensation. Since the categorization issue could not be settled objectively, the line of division became a politically determined one.

C. World War II to OSHA

During the war, labor became, "in effect, a ward of the state."[247] The Roosevelt Administration protected unions from decertification, but demanded and got a "no strike" pledge and wage restraint in return.[248] Labor demands after the end of the war centered on wages.[249] The passage of the Taft-Hartley Act in 1947 made union organizing more difficult.[250] After the war, "national labor leaders in both [the AFL and the CIO] came to

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[245] *See* Rosner & Markowitz, *Early Movement, supra* note 126, at 475-477.
[246] *See* Daniel M. Fox and Judith F. Stone, *Black Lung: Miners' Militancy and Medical Uncertainty, 1968-1972,* in SICKNESS AND HEALTH IN AMERICA: READINGS IN THE HISTORY OF MEDICINE AND PUBLIC HEALTH (3rd ed., rev., Judith Walzer Leavitt & Ronald L. Numbers, eds.) (1997), at 32, 39 (describing controversy in 1960s over this requirement for diagnosis of black lung.)
[247] BRINKLEY, *supra* note 160, at 212.
[248] ID. at 209-211.
[249] ZIEGER, *supra* note 118, at 104 ("for most workers, the relatively straightforward question of wages remained the first priority.")
[250] ID. at 110.

see the labor movement's political goals as broadly conceived support for lower- and middle-class Americans."[251] Politically, the union movement "align[ed] itself squarely with the larger liberal agenda of countercyclical public spending and generous programs of social protection."[252] 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 which dulled the union movement's appetite for institutional reform.[253] 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.[254]

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,[255] began to receive requests from firms for standards governing workplace exposure.[256] The organization formed a 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.[257] A separate Technical Standards Committee also considered the issues, and took over the project.[258] 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."[259]

ACGIH then published its maximum allowable concentrations as "Threshold Limit Values."[260] The organization insisted that the TLVs were merely guides and not "fine lines between safe and dangerous concentrations."[261] Despite regular repetition of such warnings, however, many states used TLVs as legal limits in state-level workplace regulatory schemes.[262] (They continue in widespread use around the world.)[263] 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

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[251] ID. at 120.
[252] BRINKLEY, *supra* note 160, at 223.
[253] ZIEGER, *supra* note 118, at 137.
[254] ID. at 154.
[255] CORN, *supra* note 94, at 29.
[256] ID. at 32-34.
[257] ID. at 33-34. Three values for silica were established: 5 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.
[258] ID. at 35.
[259] ID. at 43.
[260] MACs replaced by TLVs because of concern over the terminology. SALTER, MANDATED SCIENCE, *supra* note 219, at 57. "Threshold Limit Value" and TLV are both copyrighted terms. ID. at 36.
[261] CORN, *supra* note 94, at 60 (quoting Committee on Threshold Limits).
[262] ID. at 61.
[263] SALTER, MANDATED SCIENCE, *supra* note 219, at 43-44; *Occupational Exposure Limits: Summary of Information from EU Member States and Other Sources.* Health and Safety Homepages www.healthandsafety.co.uk/OELs_Summary_of_information.html#us (2005).

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 where dust exposures increased dramatically was coal mining, where the United Mine Workers encouraged mechanization[264] and the industry became virtually completely mechanized after the war.[265] 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.[266] The International Union of Mine, Mill, and Smelter Workers, working with Montana Democratic Congressman Lee Metcalf, was a major force behind these bills.[267] In 1958, Congress appropriated funds ($128,000) for a Public Health Service study [268] and in 1961, authorized a federal study of health and safety hazards in mines (excluding coal mines) and quarries.[269]

As with silicosis, lung injuries from coal dust (referred to as black lung) had long been well known but not yet the focus of government action.[270] 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.[271] Ralph Nader, for example, began

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[264] WILLIAM N. DENMAN, THE BLACK LUNG MOVEMENT: A STUDY IN CONTEMPORARY AGITATION (Ph.D. Dissertation, Ohio State University, December 1974) at 8-9 (noting miners union supported mechanization and quoting a *Fortune* magazine article labeling John L. Lewis "the best salesman the machinery industry ever had.").

[265] ID. at 6 ("the 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.")

[266] These included: 84th Congress: H.R. 2622, to provide for silicosis compensation (introduced by Rep. Lee Metcalf (Mont.); S. 2299 to study silicosos, (introduced by Herman Welker (Idaho) and supported by Sen. Mike Mansfield (Mont.)); S. 3097 to investigate health conditions in mines (introduced by William Langer (N.D.), Estes Kefauver (Tenn.), Wayne Morse (Or.), Pat McNamara (MI), Hubert Humphrey (Minn.), Matthew Neely (W.Va.), and Mike Mansfield (Mont.). 85th Congress: S. 764 for compensation for silicosis (introduced by Langer); H.R. 1240 to authorize federal mine and quarry inspections (introduced by John P. Saylor (Pa.)); H.R. 4111 to authorize federal mine and quarry inspections (introduced by Samuel McConnell, Jr. (Pa)); H.R. 9483 to authorize federal mine and quarry inspections (introduced by James Fulton (Pa.); S. 828 to authorize federal mine and quarry inspections (sponsors the same as S. 3097 in prior Congress); and H.R. 3394 to investigage health conditions in mines and quarries (introduced by Augustine Kelly (Pa.)). 86th Congress: S. 403 for federal silicosis compensation (introduced by Langer); S. 811 to provide federal mine and quarry inspections (Humphrey, Murray, Byrd, Church, Gruening, Hart, Hennings, Jackson, Javits, Johnston, Langer, Magnuson, Neuberger, Randolph, Yarborough, Mansfield, Morse, McCarthy, Moss, Proxmire); H.R. 3741 to authorize federal mine and quarry inspections (Metcalf); H.R. 3760 to authorize federal mine and quarry inspections (Saylor); H.R. 6295 to authorize federal mine and quarry inspections (Bennett (MI)).

[267] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 200-201.

[268] ID. at 206.

[269] H.R. 8341, P.L. 87-300; 75 Stat. 649.

[270] Denman, *supra* note 264, at 24.

[271] ID. at 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 Senate Subcommittee on Labor of the Committee on Labor and Public Welfare, 90th Cong. (1968) at 59-60 [hereafter "1968 OSHA Hearings"] (Testimony of David S. Black, Undersecretary of the Interior, noting ACGIH will be adopting mine dust standard and recounting Interior's activities on dust issues); 64 (Testimony of Secretary of Labor W. Willard Wirtz, discussing dust issues in

a public campaign in 1968 to spur federal action on black lung with an article in the *New Republic* and a public letter to Interior Secretary Stewart Udall.[272] Coupled with a heavily publicized West Virginia coal mine explosion later that year,[273] 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.[274] 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.[275] The coal companies, many of which had recently been bought by oil companies, accepted regulation to help head off strikes over the issue.[276]

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 silica or related diseases. Indeed, after the war, government funding for industrial hygiene fell[277] and the profession declined despite the new technologies that posed new dangers in the workplace.[278] Nevertheless, the ACGIH was active. Between 1961 and 1970, it issued 220 TLVs, bringing the total to 500.[279] ACGIH, and within ACGIH the TLV committees,[280] had considerable autonomy. The organization rejected the consensus approach of the American Standards Association because its members asserted that health standards should be set by experts, without interference from outsiders and that ACGIH members' governmental employment freed them from conflict of interest.[281] But public choice theory makes us ask, 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 and to raise the profession as a whole.[282] (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.[283]) Its role in setting standards adopted by state and, eventually the federal,

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mining); 229 (Comments by Sen. Randolph on silicosis); 245 (Testimony of William Naumann, Associated General Contractors of America, discussing silicosis exposure from rock work); 272 (Testimony of Paul Hafer, National Association of Manufacturers, discussing coal miners' dust diseases, "the greatest single group of occupational diseases in the US in terms of disability and compensation costs").

[272] ID. at 27-28.

[273] ID. at 51.

[274] ID. at 175.

[275] ID. at 141.

[276] 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.

[277] CORN, *supra* note 94, at 51 (state industrial hygiene programs declined through the 1950s); *Interview with Charles D. Yaffe,* in ID. at 195-196 (describing impact of declining federal funds after war on state programs, "when the war ended, a depression set-in in industrial hygiene. A number of programs folded for lack of funds.")

[278] ID. at 29.

[279] SALTER, MANDATED SCIENCE, *supra* note 219, at 39.

[280] ID. at 44 (TLV committee membership has been stable – from 1961 to 1983, only fifty-seven different people served on the committee.); id at 47 (TLV committee membership is controlled by the chair; substances are selected generally based on industry requests.).

[281] ID. at 38.

[282] ID. at 60.

[283] ID. at 44.

governments enhanced that status. Second, the adoptions gave the organization influence: firms followed its recommendations and government agencies adopted its TLVs. That the organization and its members tolerated such uses over long periods, which directly contradicted the TLV's stated purposes, is strong evidence that the organization derived some benefit from their use.[284]

The ACGIH also played an important role for large firms, who in turn took key roles in creating and determining the TLVs. As one study noted, "It is easy to document the influence of industry, and of industry consultants in ACGIH,"[285] since unions have generally not participated in the TLV process[286] and TLVs were developed largely in response to industry requests.[287] 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 even more than the role of the

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[284] 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." CORN, *supra* note 94, at 91.ACGIH did not attempt to stop OSHA's inappropriate use of the TLVs. ID. at 92. "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. at 92. In the one discussion recorded in the minutes, ACGIH seems to have been resigned to OSHA's inappropriate use of the TLVs. ID. at 92. 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." 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, 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."

There was some discussion in ACGIH about whether to adopt a consensus method, but ACGIH did not do so. 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."

SALTER, MANDATED SCIENCE, *supra* note 219, at 42.

[285] ID. at 59. ACGIH and its members, however, deny that they are biased toward industry. Id.

[286] ID. at 47; MCGARITY & SHAPIRO, *supra* note 48, at 124 (Unions refused to participate in ACGIH, believing the organization was "industry dominated.").

[287] SALTER, MANDATED SCIENCE, *supra* note 219, at 47-48.

Baptists (to large firms "Bootleggers") in a "Bootleggers and Baptists" regulatory coalition,[288] 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. (Unsurprisingly, ACGIH had endorsed the OSH Act.[289]) 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 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?[290]

Another factor 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 business.[291] 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.[292]

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[288] 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*, REGULATION (May/June 1983) at 12 (available at http://www.mercatus.org/pdf/materials/560.pdf). Like the bootleggers in the early 20th 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.

[289] CORN, *supra* note 94, at 90.

[290] SALTER, MANDATED SCIENCE, *supra* note 219, at 42.

[291] JOHN MORTON BLUM, YEARS OF DISCORD: AMERICAN POLITICS AND SOCIETY, 1961-1974 (1991) at 402.

[292] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 210.

The optimism expressed at the silicosis conference seemed to have been borne out.[293] 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.[294] "The 1950s were the 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."[295] Third, there was no new Gauley Bridge to focus public attention on the issue.[296] The anti-communism of the 1950s and the growth of the civil rights movement in the 1960s focused public attention elsewhere.[297] Lacking a scientific breakthrough, vigorous efforts by interest groups, or a salient public event, little change in regulation came about. When action did come in the 1970 passage of OSHA, it came as part of the contest between the Nixon Administration and Democratic Party for blue collar voters.[298] Nixon had an "acute political sensitivity" and virtually every policy discussion was followed by "a presidential expatiation which begins: '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.'"[299] Labor votes were central to Nixon's plan, even if its leadership

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[293] *See, e.g.,* 1968 OSHA Hearings, *supra* note 271, at 59-60 (Testimony of David S. Black, Undersecretary of the Interior, noting department's programs had had "a marked effect over the last 30 years in steadily decreasing the number of cases of silicosis"); 461 (Testimony of Andrew Kalmykow, Counsel for American Insurance Association, that "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.")

[294] CORN, *supra* note 94, at 65 (noting that unions lagged behind management and government in industrial hygiene issues).

[295] ROSNER & MARKOWITZ, DEADLY DUST, *supra* note 75, at 212.

[296] BARTH, WORKERS' COMPENSATION, *supra* note 21, at 5-6 (discussing importance of disasters that gain public notice in spurring change in workplace regulation).

[297] CORN, *supra* note 94, 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.")

[298] MCGARITY & SHAPIRO, *supra* note 48, at 34. Nixon sought an electoral realignment. ROBERT MASON, RICHARD NIXON AND THE QUEST FOR A NEW MAJORITY (2004) at 3. Nixon had beaten Humphrey in 1968 by only 500,000 votes out of 72 million votes cast, an election in which unions had worked vigorously for Humphrey. ZIEGER, *supra* note 118, at 182-183. 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*, 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 291, at 314; MASON, *supra*, at 33. 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*, at 191. The 1968 election results demonstrated two key facts. First, "the 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*, 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. MASON, *supra*, at 6. There was no guarantee that the crisis within the Democratic Party, which played to Nixon's advantage in 1968, would continue into the 1970s. ID. at 36.

[299] MASON, *supra* note 298, at 42.

could not be completely won over.[300] Charles Colson, a key political advisor, told Nixon in 1970 that "We need to identify with labor on a major substantive issue other than national security"[301] 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.[302] The strategy paid off in the 1970 mid-term elections, with large gains in areas that had supported Wallace in 1968.[303] Senate committee hearings in 1968 and 1970 were critical in getting issues before the public and building support for the OSH Act.[304] 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.[305] This separation of standard 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."[306] 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.[307] Protecting the interests of

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[300] ID. at 72, 97. A memo by Pat Buchanan analyzing strategy noted that the target constituency in 1970 would be "law and order Democrats, conservatives on the 'Social Issue,' but '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, for example. ID. at 97. Nixon did persuade AFL-CIO head George Meany to remain neutral in 1972. ID. at 173.

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

[302] ID. at 49. "Nixon arrived at the White House at 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.

[303] ID. at 67. It also paid off in 1972, with Nixon winning 57 percent of union household voters. ID. at 189.

[304] CORN, *supra* note 94, at 86.

[305] 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 102(c) if the rule to be promulgated is, in the discretion of the Secretary which shall be final, new in effect or application and has significant economic."

30 U.S.C. §811(a)(1).

[306] CORN, *supra* note 94, at 88, n. *.

[307] *Interview with Charles D. Yaffe,* in ID. at 204.

existing bureaucracies thus explains the split between OSHA and NIOSH, a split which may have hindered OSHA's ability to set standards.[308]

Second, the statute required the agencies to act quickly to create a base of federal standards.[309] 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.[310] This provision led to OSHA's wholesale adoption as standards of things like the ACGIH TLVs: 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.[311] 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.[312] This had the effect of converting a set of largely discretionary industry guidelines into mandatory workplace design standards,[313] and, as we see below, changed the role of other agents in the market for health and safety.[314]

Some have criticized OSHA for not attempting to "sort through the existing standards to weed out those that were obviously silly and outdated."[315] 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 a lack of knowledge about whether particular provisions were "silly or outdated" but a wholesale acceptance of a broader role for TLVs than had ever been officially acknowledged as a goal by ACGIH. This interpretation is reinforced by the recollections of an ACGIH member, who described the situation to Prof. 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.[316]

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[308] *See, e.g.*, GAO, Delays, *supra* note 14, at 56-60 (criticizing lack of cooperation in 1970s).

[309] This was supplemented by a general duty provision. The 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 […] comply with occupational safety and health standards promulgated under this Act." 29 USC 654(b)

[310] MCGARITY & SHAPIRO, *supra* note 48, at 36; 29 U.S.C. 655.

[311] Viscusi et al., *supra* note 50, at 775.

[312] MCGARITY & SHAPIRO, *supra* note 48, at 37.

[313] VISCUSI ET AL., *supra* note 50, at 775.

[314] *See discussion in II.D.2, infra.*

[315] MCGARITY & SHAPIRO, *supra* note 48, at 37.

[316] SALTER, MANDATED SCIENCE, *supra* note 219, at 41.

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 regulation, 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. Worried about a patchwork of inconsistent rules, industries then sought federal rules that would preempt local standards.[317] Adopting the ACGIH TLVs, with which they were already 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 desired outcome.[318] "It is precisely this process that confirms the degree of uncertainty regarding the question of what is a 'safe' level of exposure"[319] 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 created 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."[320] "Just 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 health and safety."[321] NIOSH and OSHA's creation led to "an enormous growth of professionals" in industrial hygiene and ACGIH membership boomed and, for the first time, a majority of ACGIH employees came from federal agencies.[322] Membership soared from approximately 1,000 in 1968 to over 1,500 in 1973 to almost 2,500 in 1983.[323] An organization that had started with 76 members, almost all state and local agency employees, in 1938 had 3,720 members in 1988.[324]

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[317] MCGARITY & SHAPIRO, *supra* note 48, at 81.
[318] BARTH, WORKERS' COMPENSATION, *supra* note 21, at 77.
[319] ID.
[320] BARTH, WORKERS' COMPENSATION, *supra* note 21, at 77.
[321] CORN, *supra* note 94, at 86.
[322] ID. at 89.
[323] ID. at xi.
[324] ID. at x.

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.[325] 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 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 where 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."[326] 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."[327] 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;"[328] funding which created a demand for OSHA's services. (This funding stopped under President Reagan.[329])

Not only was OSHA's staff now an interest group, but outside interest groups now had a potential ally worth fighting over. 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.'"[330]

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[325] 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. 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.

MCGARITY & SHAPIRO, *supra* note 48, at 63-64.

[326] Dr. Peter Infante, quoted in ID. at 133.

[327] ID. at 134.

[328] ID. at 79.

[329] ID.

[330] ID. at 143. Consider also the example of the "lockout" rule (which specified procedures under which equipment is locked to prevent injury from accidental restarts during servicing), which McGarity and Shapiro use to illustrate the delays in OSHA's accomplishing even relatively straightforward rulemaking. ID. at 112-114. OSHA promulgated consensus standards in 1971, but these "were not uniform in their coverage and 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 OMB delayed a final rule until 1988, more than ten years after OSHA's initial publication of a notice in the *Federal Register* that

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."[331] 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."[332]

OSHA also changed the standards environment by allowing those dissatisfied with the results to seek relief from the courts and political process. This had effects on how OSHA created standards. Profs. McGarity and Shapiro, for example, concluded that judicial review was "a primary cause" of OSHA's slowness in issuing standards: "[t]he impact of having to dot every i and cross every t for fear of a judicial remand has had a dramatic effect on OSHA."[333] 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 n 1986,[334] and began the rule-making process to draft an ergonomics standard in 1992. The final Ergonomics Program Standard was not issued until November 4, 2000. Despite years of development, the standard was still controversial, and the Senate issued a Joint Resolution, signed by President George W. Bush, repealing it on March 20, 2001. 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 work place. Yet, in the three cases OSHA litigated to judgment, it was unable to convince the courts that (1) a recognized hazard

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it was considering revising the consensus standard. ID. at 112-113. 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 where 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.

[331] SALTER, MANDATED SCIENCE, *supra* note 219, at 63-64.

[332] ID. at 64.

[333] MCGARITY & SHAPIRO, *supra* note 48, at 258.

[334] OSHA Instruction CPL 2.78 FEB 9 1987 Directorate of Technical Support, republished in OSHA Notice CPL 2, May 12, 1986, which "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 workplace." Available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=1655

existed, (2) workplace activity caused the injuries, or (3) it offered solutions to the hazard.[335]

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.[336] Unfortunately that standard was already obsolete when adopted, as a major change in how quartz exposures were estimated based on dust samples occurred in 1968, necessitating the creation of some arbitrary conversion factors to apply the standard based on the old technology to the new measurements.[337]

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 led NIOSH in 1974 to recommend a change to an exposure level of 0.05 mg/m^3. Because the epidemiologic studies on which NIOSH relied were "called into question because of technical and procedural problems," the recommended exposure limit was not been accepted by the Department of Labor.[338]

In the 1980s new studies found crystalline silica to be a potential carcinogen, triggering OSHA's Hazard Communication Standard ("HCS").[339] Under the HCS, OSHA-regulated businesses using materials with 0.1% or more crystalline silica must follow federal guidelines on hazard communications and worker training.[340] HCS coverage did not immediately trigger new exposure regulations, but it did get the attention of the mining industry (which has a great deal of silica exposure), mining regulators, and state legislatures.[341] The Mine Safety and Health Administration (MSHA) issued its own HazCom standards in 2002.[342] OSHA has issued several interpretive

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[335] 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 (last visited August 7, 2005).
[336] 29 C.F.R. §1910.1000(c) (1971).
[337] Graham, *supra* note 4, at 201.
[338] Id. at 201; NIOSH HAZARD REVIEW, *supra* note 31, at 3.
[339] PRIMER, *supra* note 7, at 1.
[340] ID. at 32 (to get out of HCS, have to prove that concentration is under the threshold, have to do a lot of sampling). 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 29 CFR 1910.1200 http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10099
[341] PRIMER, *supra* note 7, at 25, 31.
[342] The MSHA HazCom standard stresses 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." 67 Fed. Reg. 42314, 42323 (June 21, 2002).

letters clarifying the standard with respect to silica, and denying petitions for exclusions of certain silica applications from the HCS requirements.[343]

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.[344]

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.[345] In October 2003, OSHA provided for review by a Small Business Advocacy Review panel a draft rule to address exposure to crystalline silica.[346] 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.[347] 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.[348] 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.[349] The Mine Safety and Health Administration has also listed silica on its regulatory calendar.[350] 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 50ug/m^3 exposure limit for respirable crystalline silica," MSHA states it "is considering several options to reduce

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[343] In denying a petition filed on behalf of the National Stone Association, OSHA ruled, "[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. September 20, 1988 Letter from John Pendergrast, Assistant Secretary of Labor to Theodore L. Garrett, available at http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=19704

[344] Department of Labor, Spring 2005 Unified Agenda of Federal Regulatory and Deregulatory Actions, OSHA, (http://ciir.cs.umass.edu/ua/Spring2005/agenda/DEPARTMENT_OF_LABOR_(DOL).html);. ASTM INTERNATIONAL, *ASTM E1132-99a "Standard Practice for Health Requirements Relating to Occupational Exposure to Respirable Crystalline Silica*," (August 10, 1999).

[345] Department of Labor, Regulatory Plan, OSHA, 69 Fed. Reg. 72781 (December 13, 2004).

[346] Section 609(b) of the Regulatory Flexibility Act, as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA) requires OSHA and 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. *See letter at:* http://www.sba.gov/advo/laws/comments/osha03_1031.pdf

[347] "The PEL is the highest average concentration of respirable crystalline silica in the air to which an employee may be exposed over an 8-hour workday. Since the PEL represents an 8-hour TWA, employees may be exposed to short term concentrations above the PEL so long as the 8-hour TWA does not exceed the PEL." SBREFA panel 12/03 Report of the Small Business Advocacy Review Panel on the Draft OSHA Standards for Silica December 19, 2003 http://www.sba.gov/advo/laws/is_silicarpt.pdf .

[348] Id.

[349] Department of Labor, Spring 2005 Unified Agenda of Federal Regulatory and Deregulatory Actions, Entry 1935, *Occupational Exposure To Crystalline Silica.*

[350] Department 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 .

miners' exposure to crystalline silica."[351] In its Spring 2005 agenda, MSHA proposed as its next action a "request for information," but did not establish a time table for action.[352]

4. Institutional biases in regulation

The measures necessary to stop silica dust from harming people are conceptually simple:[353] reduce exposure to the dust. There are four main types of methods of doing so. First, jobs might redesigned to eliminate exposure to dust. For example, a silica product might be replaced with a different substance in a grinding application.[354] 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 as widely used as silica, however, it is not possible.

Second, engineering steps might be taken to reduce exposures.[355] For example, dust suppression equipment might be deployed[356] or increased ventilation might reduce dust concentrations.[357] This is the primary approach taken by OSHA, both with respect to silica and other hazardous air contaminants. It has the regulatory virtue of allowing OSHA to specify a level of contamination in the air that gives the impression of precision.[358] As noted earlier, however, OSHA's current standard (in effect since 1970) is

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[351] Id.
[352] Id.
[353] Brian Williams, Catherine Campbell, Nokuzola Mgogi, & Immo Kleinschmidt, *Occupational Health, Occupational Illness: Tuberculosis, Silicosis and HIV on the South African Mines,* in OCCUPATIONAL LUNG DISEASE: AN INTERNATIONAL PERSPECTIVE 95, 100 (Daniel E. Banks & John E. Parker, eds., 1998) ("The prevention of silicosis requires the monitoring and reduction of dust levels. This is primarily a technical problem . . . ").
[354] Jones, Ma, Castranova, & Ma, *supra* note 4, at 221 ("Substitution of hazardous materials with less harmful ones is also a means for controlling occupational exposures.").
[355] Id. at 221 (Engineering controls include: "ventilation, isolation, substitution, and dust suppression by wetting.").
[356] Id. ("Dust suppression can often be accomplished by the application of water or other suitable liquid.").
[357] Id. ("In local ventilation systems, the contaminant is captured near the point of generation. In general ventilation systems, the entire room is supplied with intake and exhaust air to dilute concentrations within the area. Local exhaust has the advantage of lower air flow requirements and the contaminant is captured before it enters the general workroom air. General ventilation is usually restricted to the removal of low levels of relatively nontoxic contaminants from decentralized sources.").
[358] The problems with this approach can be seen in the following example of one of the key problems with using the TLVs as standards was that they were intended to be room air levels and OSHA treated them as measurements "at the nose." As Columbia Medical School Professor and longtime ACGIH member Dr. Leonard Golberg 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

based on an outdated measurement technology.[359] 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.[360] Unions have traditionally resisted this approach[361] 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.[362]

Finally, workers at risk of exposure could wear personal protective equipment, generally not OSHA's preferred 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."[363] Why not? Occupational disease control specialists have three main objections: (1) the gear is not "foolproof;" (3) 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 program.[364] The first and third of these are not serious objections – no method of exposure control is

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> 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 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.

Interview with Leonard J. Goldwater, in CORN, supra note 94, at 145-146.

[359] *See* note 337 *supra*.

[360] Banks, *supra* note 67, at 8 (Once someone has an occupational lung disease, "the worker is best advised to leave the workplace.").

[361] *See* note 228 *supra.*

[362] *See* Karen Rothenberg, et al. *Genetic Information and the Workplace: Legislative Approaches and Policy Challenges*, 275 SCIENCE 1755 (Mar. 1997).

[363] Jones, Ma, Castranova, & Ma, *supra* note 4, at 221.

[364] Philip Harber, *Respirators* in ENVIRONMENTAL & OCCUPATIONAL MEDICINE 1757, 1757 (William N. Rom, ed.) (3rd ed. 1998) ("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.")

foolproof and all equipment requires maintenance.[365] The problematic objection is thus that workers will not properly use the equipment that is intended to protect them.

This objection has a long history.[366] 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.[367]

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 military gear to light-weight, ergonomic, comfortable, fail-safe, consumer-friendly gear.[368] 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 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.[369] When the IARC identified it as a "probable human

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[365] It may be that the intent behind these objections is 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 evaluated on a case by case basis.

[366] *See, e.g.,* ROSEN, *supra* note 67, at 422 ("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.'").

[367] *See, e.g.,* Banks, *supra* note 67, at 4 ("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.").

[368] Personal knowledge of author (Morriss), a certified diver.

[369] *See, e.g.,* Balaan & Banks, *supra* note 67,, at 446 ("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."). Gary R. Epler, *Clinical Overview of*

carcinogen," then, regulating silica should have been straightforward – standards needed to be tightened in light of the newly recognized risk. What to do to prevent silica exposure ought also to be clear. The general principle in occupational disease prevention is to prevent exposure.[370] How to do that with respect to dust is not rocket science and was known by the beginning of the twentieth century: a combination of ventilation and dust reduction or removal.[371]

Unfortunately, regulating silica is not straightforward.[372] There are relatively obvious problems, such as the presence of other minerals in dusts, which make interpreting data about exposures more difficult. [373] Equipment and techniques may not be adequate to the task of measuring at levels required by regulations.[374] Health and exposure records are incomplete, making linking individuals' conditions with workplace exposures challenging and so complicating efforts at setting exposure levels.[375] There are also more complex problems related to the particular form of the silica dust to which individuals are exposed.[376]

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

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Occupational Lung Disease, 30 THE RADIOLOGICAL CLINICS OF NORTH AMERICA: OCCUPATIONAL LUNG DISEASE 1121, 1127 (1992) ("Vigorous adherence to dust control regulations and dust count monitoring can eliminate this disorder [chronic silicosis].").

[370] Banks, *supra* note 67,, at 7 ("Primary prevention, the backbone of prevention of all workplace disease, is best achieved by eliminating exposures.").

[371] Hoffman, *supra* note 67, at 536; CHERNIACK, *supra* note 67, at 38 ("The efficacy of preventative measures had also been documented" by 1915).

[372] Frank J. Hearl, *Identification, Monitoring and Control of Dust Exposures* in OCCUPATIONAL LUNG DISEASE: AN INTERNATIONAL PERSPECTIVE 35, 35 (Daniel E. Banks & John E. Parker, eds., 1998) ("The recognition, evaluation and control of dust exposures in occupational environments can be complex.").

[373] PRIMER, *supra* note 7, at 32.

[374] PRIMER, *supra* note 7, at 32 ("Under certain conditions, current techniques and equipment can't distinguish very well between its physical states at the low concentration level specified by HCS.")

[375] Graham, *supra* note 4, at 200 ("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.").

[376] *See, e.g.*, Hearl, *supra* note 372, at 35 (citation omitted) ("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.") and id. ("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.").

exposure and making the health effects harder to spot.[377] Indeed, even in the case of asbestos, where lung damage was (at 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,[378] 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."[379]

Because of the difficulties in developing adequate exposure and health records, regulations are often driven by data availability. In the case of silica, for example, the two primary sets of health data come from a series of studies of Vermont granite workers[380] and from studies of white South African gold miners.[381] Indeed, the history of medical knowledge about silicosis comes primarily from extraordinarily high exposure incidents, such as the Nevada mill workers, the Vermont granite cutters, and the Gauley Bridge, West Virginia tunnel incident.[382]

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.[383] The high degree of variance in exposure across job categories enabled creation of a dose-response relationship for granite dust.[384] The state then did follow-up studies through

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[377] Graham, *supra* note 4, at 192-193 ("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.").

[378] Stephen J. Carroll, et al., *Asbestos Litigation Costs and Compensation: An Interim Report* (RAND Institute for Justice 2002) at 20 (citation omitted) (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 Theory of Asbestos Litigation: The Disconnect Between Scholarship and Reality,* 31 PEPP. L. REV. 33, 128-137 (2003) (describing Trust experience in detail).

[379] Carroll, et al., *supra* note 378, at 20 (citation omitted).

[380] Graham, *supra* note 4, at 200 ("the 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 8, 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.").

[381] Wang & Banks, *supra* note 8, at 70 ("The evidence for airways obstruction, as it relates to silica, is found primarily in epidemiologic studies of South African gold miners.").

[382] *See* CHERNIACK, *supra* note 67, at 38-39 (discussing development of knowledge and citing such incidents).

[383] Graham, *supra* note 4, at 200. *See also Interview with Leonard J. Goldwater,* in CORN, *supra* note 94, at 143 ("they did not have much trouble [with silicosis] in Vermont until they started using pneumatic tools. When it was all handwork they had no problems.")

[384] Graham, *supra* note 4, at 200.

1965, which "determined that no cases of silicosis had appeared in workers first employed after 1938."[385]

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. (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.) 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 thus must decide if the distinction between α-kryptonite and α'-kryptonite is relevant as well.

These are not merely hypothetical discussions. Scientists working for the Sorptive Minerals Institute have obtained samples of the ore used in the South African miners' studies and examined the form of silica present.[386] They have 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 made it possible to see 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 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.[387]

The future development of institutions dealing with occupational hazards such as silica exposure needs to take into account these uncertainties and technologies. It is virtually certain that future developments will increase both the fineness with which we can distinguish one form of a potentially harmful substance from another and advance the

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[385] Id. (citations omitted).
[386] *See* note 34 *infra.*
[387] Id. at 205.

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 OSHA is staffed by individuals, 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 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 …[388]

In general, bureaucrats have incentives to call for additional regulations and spending in support of the interests that justify their programs' existence.[389]

OSHA's success at expanding its authority and resources is less than 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,[390] OSHA's growth has been less rapid than the growth of other agencies, particularly the Environmental Protection Agency and, more recently, the Department of Homeland Security.[391] OSHA also lags other agencies in regulatory volume: OSHA generally issues far fewer regulations than does the Environmental Protection Agency. In 2004, for example, OSHA issued (in proposed or final form) nine regulations, only one of which was considered economically significant,[392] compared to EPA's 65 proposed or final regulations, 11 of which were economically significant.[393] In the first four years of the Bush administration, OSHA issued three final economically significant regulations. During the previous eight years of the Clinton administration OSHA's track record was similar; it issued seven economically significant rules, or less than one per year.[394]

Despite its relative laggardness compared to other regulators, OSHA's regulations are costly for the economy. According to recent estimates, OSH Act regulations contribute nearly one-half of the total direct cost of workplace regulations—around $41

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[388] Gordon Tullock , *Public Choice* in THE NEW PALGRAVE: A DICTIONARY OF ECONOMICS, at 1043 (1998).
[389] Bryce Wilkinson, *Constraining Government Regulation* (N.Z. Business Roundtable Discussion Paper) (November 2001) at 123, available at http://www.nzbr.org.nz/documents/publications/publications-2001/constraining_govt.pdf (last visited August 7, 2005).
[390] Susan Dudley& Melinda Warren, *Upward Trend in Regulation Continues: An Analysis of the U.S. Budget for Fiscal Years 2005 and 2006*, (2005) at 7,available at http://www.mercatus.org/pdf/materials/1246.pdf (last visited August 7, 2005)
[391] Id. at 15.
[392] "Economically significant" generally refers to regulations that are expected to have an impact of $100,000 per year or more. Executive Order 12866.
[393] Data on regulations reviewed under Executive Order 12866 are available at http://www.reginfo.gov/public/do/eoHistoricReport
[394] Id.

billion per year in 2000.[395] MSHA regulations cost another $7.4 billion. [396] 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.[397]

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 because the regulations raise costs for both union and non-union employers, evening the playing field; give unions a tool to use in negotiations (OSHA complaints by union members can reduce productivity); and give organized employees a comparatively greater voice in workplace organization than unorganized employees, through their participation in the regulatory process, thus providing a benefit to employees who join unions.[398] (Others interested in expanding state power also find the issue attractive.)[399] Since 1970, union political power has declined, as union membership has fallen from 24% of the private labor force in 1973 to less than eight percent in 2004.[400] Moroever, since 1970 Republicans, generally unsympathetic to unions, have controlled the executive branch for 22 of the 34 years. Even the twelve years of Democratic control were under Presidents Carter and Clinton, both of whom came from the less-sympathetic to unions, more conservative wing of the Democratic party. OSHA has thus 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, for example, 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

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[395] Joseph M. Johnson, *A Review and Synthesis of the Cost of Workplace Regulations,* in CROSS-BORDER HUMAN RESOURCES, LABOR AND EMPLOYMENT ISSUES (ANDREW P. MORRISS & SAMUEL ESTREICHER, EDS. 2005) at 433, 454-455. Figures are in year 2000 dollars. Johnson estimated the total cost of workplace regulation at $91 billion in 2000. *See also* Harvey S. James, Jr., *Estimating OSHA Compliance Costs*, 31 POL'Y SCI. 321 (1998).

[396] Johnson, *supra* note 395, at 454-455.

[397] VISCUSI ET AL., *supra* note 50, summarizes econometric studies that examine the impact of OSHA. Most of these focus on accident rates, rather than diseases, however. For example, death rate trends for job related accidents did not change on the enactment of the OSH Act.

[398] *See* Rosner & Markowitz, *Early Movement, supra* note 126, at 467 (discussing history of workplace health and safety measures and union organizing, and quoting an early twentieth century analyst that campaign for workplace health and safety was "part and parcel of the movement for labor legislation…"); id. at 477 (describing role of unions and noting that New York bakers' union in 1909 had a strike in which "the union identified unsanitary workshops and the spread of disease with nonunion bakeries.")

[399] Rosner & Markowitz, *Early Movement, supra* note 126, at 479 ("Industrial accidents and diseases proved to be an attractive issue [at the start of the 20th century] for progressives interested in expanding the role of the state.')

[400] *See* Unionstats.com, http://www.unionstats.com/; Bureau of Labor Statistics, *Union Members in 2004,* available at http://www.bls.gov/news.release/archives/union2_01272005.pdf.

as radiographic evidence.[401] Not until the combination of 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 of getting regulatory action coalesce.[402] The result was both state and federal legislation. "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."[403]

Third, OSHA regulations have a major impact on the industries it regulates. The threat of OSHA regulation is an effective spur to 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. Hampered by a lack of political capital, missing effective outside interest group allies, and opposed by highly motivated interest groups, OSHA is unable to expand its authority and resources as rapidly as other agencies have been able to do.

What we observed in the period between World War II and the creation of OSHA is the virtual disappearance of silica as a subject of regulatory interest. 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, enabling employees who wished to do so to compare their employer's practices with an industry standard, facilitating market pressures for improving health and safety. To the extent that exposures did not continue to fall during this period, we suggest that it reflected 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 simply too high for either group to accept.

This regime appears to have been successful enough that we could drop the scare quotes from the word solved in the preceding paragraph. Silicosis declined after World War II, as best we can tell, and remained a problem in the United States primarily in a few high exposure industries.[404] The primary flaw came not from employers' ignoring health effects but from unions' decision not to engage in the ACGIH process, leaving it to the interests of large firms and bureaucrats. Union participation would have improved the ACGIH process by introducing an interest group to challenge the others' data and conclusions. Unions, however, had other fish to fry in this period.

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.[405] The post-war problems with silica

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[401] Fox & Stone, *supra* note 246, at 33-34.
[402] Id. at 36-37.
[403] Id. at 40.
[404] *See* NIOSH HAZARD REVIEW, *supra* note 31, at 2, and Table 1 at 5 ("Since 1968, reported mortality associated with silicosis has declined; however, 200 to 300 such deaths were reported each year during the period 1992–1995.")
[405] Id. at 3.

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 are 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 addressing the issue through another venue, the courts. The role of the courts and interest groups that participate in 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 who can play, and already has played, a major role in regulatory debates: the plaintiffs' bar. Suits over silica-related diseases have a long history.[406] While workers' compensation covers occupational exposure to silica, silica's use is so widespread that suits against product manufacturers are not implausible.[407] 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.*[408] In that case, the court recognized 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. Because the 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, this appeared to be an important doctrinal innovation in compensating individuals who had suffered serious harms[409] – early asbestos plaintiffs generally had

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[406] *See* DAVIS, SALMONSEN, & EARLYWINE, *supra* note 163, at 74 ("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.").

[407] *See* Brickman, *supra* note 378, 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. Rather, it is a function of the compensation system.")

[408] Borel v. Fibreboard Paper Products Corp., 493 F.2d 1076 (5th Cir. 1973). *See* John C. Coffee, Jr., *Class Wars: The Dilemma of Mass Tort Class Action,* 95 COLUM. L. REV. 1343, 1385 (1995); FREDERICK M. BARON, HANDLING OCCUPATIONAL DISEASE CASES (1981) at 2 (noting that before *Borel* "occupational disease law amounted to a group of cases and articles discussing recovery under the various state workers' compensation acts.")

[409] A classic example of this attitude toward *Borel* is given in Prof. 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*], the case which would effectively break the back of the asbestos industry.

contracted mesothelioma, a form of lung cancer closely linked to asbestos exposure.[410] Indeed, as one commentator noted, "[m]odern asbestos litigation was born when courts, having lost confidence in workers' compensation schemes, developed doctrines of products liability to provide tort remedies to injured workers as a substitute for workers' compensation benefits."[411]

Asbestos litigation soon became something quite different than the early commentators anticipated. It is now "the longest running mass tort in U.S. history;"[412] one commentator compared it to "a massive, unending river"[413] and another termed it "a malignant enterprise."[414] It has spread far beyond the original suits against the manufacturers of asbestos products to "virtually all parts of the U.S. economy,"[415] involving defendants in 75 of the 83 two digit SIC codes.[416] Its scale dwarfs even major regulatory impacts, natural disasters, and terrorist attacks; former Attorney General Griffin Bell contends that estimates of asbestos litigation's costs to the economy are greater than the estimates of the costs of "all Superfund cleanup sites combined, Hurricane Andrew, or the September 11 terrorist attacks."[417]

The evolution of asbestos litigation is relevant because it illustrates how an interest group comes into being and influences subsequent events.[418] Indeed, some have

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Harold P. Southerland, *Law, Literature, and History,* 28 VT. L. REV. 1, 82, n. 255 (2003). Southerland goes on to quote 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 (1985) at 348-49.) 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, et al., *supra* note 378. Brickman offers an interest-group-based explanation for the academy's uncritical attitude toward asbestos litigation. Brickman, *supra* note 378, at 166-170.

[410] *See* Brickman, *supra* note 378, at 44-46 (thorough summary of the literature on asbestos and cancer).

[411] Patrick M. Hanlon & Julie S. Lehrman, *Developments in Premises Liability Law* in Asbestos Litigation in the 21st Century (2004) [SK040 ALI-ABA 173] at 162.

[412] Carroll, et al., *supra* note 378, at v.

[413] Coffee, *supra* note 408, at 1384.

[414] Brickman, *supra* note 378, at 35.

[415] Carroll, et al., *supra* note 378, at 49.

[416] Id. at 50.

[417] Quoted in 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, 862 (2003).

[418] There are numerous similarities between asbestosis and silicosis that make the comparison particularly apt. Both diseases feature long latency periods, there has been widespread exposure to both substances, the harms of exposure are well documented in each case, (Carroll, et al., *supra* note 378, at 14 ("That workplace exposure to asbestos can be dangerous was known well before World War II.")); the two substances share some characteristics (asbestos is a silicate) (Balaan & Banks, *supra* note 67,, at 435); both diseases have long latency periods (Carroll, et al., *supra* note 378, at 16 (20-40 year latency period for asbestos disease)); and both produce a chronic disease which can be present in an asymptomatic version as

argued that the asbestos bar is attempting to expand into silica suits: the goal of the asbestos plaintiffs' bar is "to keep the asbestos-litigation gravy train alive."[419] The scale of asbestos litigation, and the amount of money involved, has continued to grow at a pace unanticipated by even the most pessimistic analysts. A RAND Corp. study of the litigation in 1983 made the "shocking" prediction that the litigation would cost $1 billion in compensation and litigation expenses through 2001, with more than 21,000 lawsuits and three major corporations in Chapter 11 bankruptcy.[420] Other analysts predicted that the total costs could ultimately total as much as $38 billion.[421]

These estimates proved wildly off the mark. By the year 2000, more than 600,000 people had filed claims, generally against multiple defendants, [422] over 6,000 entities had been sued,[423] and $54 billion had been spent on compensation and litigation costs.[424] 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 Co.; less than two years after it started in 1988, the trust was effectively insolvent.[425] Reasonable estimates of total costs now range from $200 to $265 billion, an over five-fold increase in twenty years.[426]

Asbestos litigation has changed markedly in character as well. From litigation by plaintiffs who had contracted a rare form of cancer closely linked to asbestos exposure against the manufacturers of asbestos products, litigation "spread to touch almost every type of economic activity in the U.S."[427] and to include plaintiffs without any symptoms. The dominant claims are no longer by plaintiffs with cancer; 65% of compensation has gone to nonmalignant claimants.[428] The number of defendants sued by each plaintiff soared from twenty in the 1980s to 60 to 70 in the 1990s.[429] From a problem of large manufacturers of asbestos, asbestos litigation has grown into a problem for even firms

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well as more serious versions. (Silica: Jones, Ma, Castranova, & Ma, *supra* note 4, at 215 ("Chronic silicosis occurs 20-40 yr after initial exposure to crystalline silica.").)

[419] Prof. Lester Brickman's testimony before the Senate Judiciary Committee, February 2, 2005, quoted in David Hechler, *Silica Plaintiffs Suffer Setbacks,* NAT. L. J. (Feb. 28, 2005) at 1, 18.

[420] James S. Kakalik, Patricia A. Ebener, William L. F. Felstiner, and Michael G. Shanley, *Costs of Asbestos Litigation* (Rand Corp. 1983); Carroll, et al., *supra* note 378, 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.").

[421] Carroll, et al., *supra* note 378, at 6.

[422] Id. at 40. The study noted that this was probably an underestimate. Id.

[423] Id. at 49 (Identifying "6,000 entirely independent entities that have been named as defendants on an asbestos personal injury claim.").

[424] Id. at vii.

[425] Coffee, *supra* note 408, at 1387 (Manville Trust opened in 1988 with $5b in assets. "Two years later, it was effectively insolvent.").

[426] Carroll, et al., *supra* note 378, 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 billions in lost investment capital. Id. at 73-74 (giving lost job estimates and estimating $10-78 billion in lost investment).

[427] Carroll, et al., *supra* note 378, at vii. *See also* id. at 68 (noting change in type of defendants in response to bankruptcies of traditional defendants).

[428] Id. at vii.

[429] Id. at 41.

"with as few as 20 employees and just a few million dollars in annual revenues."[430] By the 1990s, over 60% of asbestos expenditures were by "nontraditional" defendants.[431] 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 entered into arrangements with plaintiff lawyers . . . to settle [claims] en masse or not contest them in court and accept default judgments and then tender these liabilities to the insurance companies for payment. In some cases, this appears to have encouraged plaintiff lawyers to put forward meritless claims secure in the knowledge that defendants would not give them close scrutiny."[432]

Relatively few asbestos cases actually went to trial.[433] The litigation "matured" in the 1980s and 1990s into quasi-administrative proceedings that handled claims in bulk.[434]

> 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.[435]

This process generated enormous gains for the law firms involved: the Dallas law firm of Baron & Budd had reportedly grossed more than $800 million from asbestos cases by 1998.[436] Transactions costs have consumed more than half of the spending on asbestos claims, with the majority going to plaintiffs' attorneys' firms.[437] In a sign of their power, the share of spending going to plaintiffs' firms held steady, while defense firms' share

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[430] Id. at 49.
[431] Id. at 50.
[432] Brickman, *supra* note 378, 55-56.
[433] Carroll, et al., *supra* note 378, at 56 (Only 527 trial verdicts from 93-01, 1598 plaintiffs).
[434] Coffee, *supra* note 408, at 1356 ("Mass tort actions matured in the 1980s.").
[435] Carroll, et al., *supra* note 378, at 30.
[436] Christine Biederman, Thomas Korosec, Julie Lyons & Patrick Williams, *Toxic Justice,* DALLAS OBSERVER (Aug. 13, 1998) (available at http://www.dallasobserver.com/issues/1998-08-13/news/feature_1.html (last visited May 30, 2005) at *1.
[437] Carroll, et al., *supra* note 378, at vii. On the bar's motivations, *see also* Brickman, *supra* note 378, at 63 ("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."); 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 receive a grossly disproportionate share of the total amount of monies spent in the litigation process.").

fell over time (with the savings going to the plaintiffs.)[438] In the case of the Manville Trust, where 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."[439]

The result was the creation of a powerful economic interest: the asbestos plaintiffs bar.[440] As Ralph Nader noted, in lauding their efforts, "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."[441] These firms, which have 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.[442] This dynamic

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[438] Carroll, et al., *supra* note 378, at 60-61 (In early cases, plaintiffs got 37 cents on the dollar spent, now get 43 percent. The difference reflects falling defense costs, the plaintiffs' bar got same percent of recovery).

[439] Brickman, *supra* note 378, at 138.

[440] 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, Open Secrets, http://www.opensecrets.org/orgs/summary.asp?ID=D000000065 (last visited May 29, 2005). ATLA's donations "routinely ranks among the top five PACs in federal campaign contributions." Manhattan Institute, Center for Legal Policy, *The Best Friends Money Can Buy,* TrialLawyersInc.Com (2003) http://www.triallawyersinc.com/html/part10.html (last visited May 29, 2005). Two major asbestos law firms, Baron & Budd and the Law Offices of Peter Angelos, themselves gave more than $3 million. Id. *See also* Daniel LeDuc and Michael E. Ruane, *Orieles Owner Masters Political Clout,* Washington Post (March 28, 1999) at C1 (available at http://www.washingtonpost.com/wp-srv/local/longterm/mdleg/angelos032899.htm (last visited May 29, 2005) ("Over 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."). Asbestos defendants (at least the solvent ones) also organized. *See* Public Citizen, *Federal Asbestos Legislation: And The Winners Are…*(May 2005) (available at http://www.citizen.org/documents/master%20report.pdf , last visited May 29, 2005) (describing lobbying campaigns by defendants).

[441] Ralph Nader, *Foreword* in BARON, *supra* note 408, at xi.

[442] Coffee, *supra* note 408, 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) ("Lawyers then cast the litigation net further to find corporate pockets deep enough 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."); Carroll, et al., *supra* note 378, at 47-48 (Recently have 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. For example, 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."); Richard C. Field & Ronald F. Frank, *Indemnity , Contribution, and Third Party Practice in Occupational Disease Litigation,* 89, 91 in OCCUPATIONAL DISEASE LITIGATION 1983 (Sheila L. Birnbaum & Jerold Oshinsky, eds. 1983) (PLI Litigation and Administrative

can be seen in the expansion of claims to include non-malignancy and asymptomatic claims,[443] the aggressive search for claimants,[444] and the extraordinary expansion of defendants in asbestos litigation.[445]

Viewing the history of asbestos litigation in retrospect, it becomes clear that the plaintiffs' bar had an incentive to invest in developing evidence[446] and legal theories,[447] since both could be used in multiple cases. They had the incentive to search for the most favorable jurisdictions for asbestos suits[448] and jurisdictions with rules that eased procedural problems, [449] exactly what we have observed. Asbestos cases migrated to

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Practice Series, Litigation Course Handbook Series, No. 237) ("Plaintiffs bringing civil actions for occupational injury will consider suing a number of entities which may be alleged to have contributed to the harm. The injuries arguably may have been the responsibility of 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.").

[443] Carroll, et al., *supra* note 378, 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."); Brickman, *supra* note 378, at 59-62 (describing rise of unimpaired claimant claims and concluding that "The weight of the evidence presented in this article is that asbestosis as diagnosed by attorney-sponsored asbestos screenings exists primarily if not exclusively as a function of the compensation system.").

[444] Coffee, *supra* note 408, at 1359 ("during the 1980s when asbestos plaintiffs' attorneys arranged with labor unions for portable x-ray trucks to screen union workers for telltale lung scars suggesting asbestos.") ; Brickman, *supra* note 378, 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. Special asbestos law further facilitates meritless claiming by allowing claims of unimpaired persons to get to juries if there is a doctor's statement that the X-ray is "consistent with asbestosis" even though that is not a diagnosis of illness or injury."); Id. at 62-103 (describing screenings in detail); Biederman, *supra* note 436, at *4-9 (describing mass screenings and lax controls on identification of harm).

[445] Carroll, et al., *supra* note 378, 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."); Id. at 31 (In 1990s, plaintiffs firms sought new defendants and more money from types of defendants which they had previously treated as peripheral.); Biederman, et al., *supra* note 436,, at *2 (noting that "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.").

[446] A classic example is the investment by the asbestos plaintiff's bar in locating 1930s Johns-Manville general counsel Vandiver Brown, who had retired to Scotland. Manville had resisted "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." Barbara Pfeffer Billauer, *How To Survive Workplace Litigation*, in HANDBOOK OF OCCUPATIONAL SAFETY AND HEALTH (Lawrence Slote, ed. 1987) at 687, 691, note †.

[447] Coffee, *supra* note 408, at 1360. Advice for potential defendants echoes this point, noting that liability theories "continue to grow in the hands of creative plaintiffs' lawyers." *See* Billauer, *supra* note 446, at 687.

[448] *See* BARON, *supra* note 408, 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 . . . .")

[449] 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, et al., *supra* note 378, at 34. Similarly, Texas passed a statute that gave asbestos cases special access to the Texas courts

Mississippi, New York, West Virginia, Ohio, and Texas during 1990s from California, New Jersey, Pennsylvania and Illinois where the majority of the claims had been filed in the 1970s and early 1980s. From sixty percent of cases in the period 1970-1987, the latter group of states' market share fell to seven percent for 1998-2000, while the former group's market share rose from nine percent to sixty-six percent.[450]

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 that are normally available to courts to control potentially abusive practices.[451] As Seventh Circuit Judge Richard Posner noted, the volume "exert[ed] a well-nigh irresistible pressure to bend the normal rules."[452] 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.[453] 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.[454] Fifth, because of the massive numbers and indefinite nature of many of the claims, individual

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during the 1990s, a statute drafted in part by one of the leading asbestos lawyers. Biederman, *supra* note 436,, at *7. A 1998 news report on the statute found that

> 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.

Biederman, *supra* note 436,, at *7. *See* Dow Chemical Co. v. Castro Alfaro, 786 S.W.2d 674 (Tex. 1990); Act of February 23, 1993, S.B. 2, §1, 73rd Legis. 1st R.S. (codified at Tex. Civ. Prac. & Rem. Code Ann. §71.051).

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* Calif. C.C.P. §340.2(a); Carroll, et al., *supra* note 378, at 24.

[450] Carroll, et al., *supra* note 378, at 31.

[451] Coffee, *supra* note 408, at 1350.

[452] In the Matter of Rhone-Poulenc Rorer, Inc., 51 F.3d 1293, 1034 (7th Cir. 1995) *See also* Justice Ruth Bader Ginsburg's comment in Norfolk & Western Ry. Co. v. Ayers, 538 U.S. 135, 166 (2003) that "The 'elephantine mass of asbestos cases' lodged in state and federal courts, we again recognize 'defies customary judicial administration and calls for national legislation.'" (quoting Ortiz v. Fibreboard Corp., 527 U.S. 815, 821 (1999). *See also* Field & Frank, *supra* note 442, 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.")

[453] Schwartz, Behrens, & Tedesco, *supra* note 417, at 867 (Quoting Francis McGovern of Duke Law School: "If you build a superhighway, there will be a traffic jam" on reducing transactions costs of filing); Carroll, et al., *supra* note 378, at 26 ("reduced per-case transaction costs made filing small claims financially viable for more people, thereby encouraging mass filings.").

[454] Prof. Lester Brickman's testimony before the Senate Judiciary Committee, February 2, 2005, quoted in Hechler, *supra* note 419, at 18.

plaintiffs have little control over their attorneys.[455] 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."[456] Converting the process into a repeat player game weakened the check on plaintiffs' counsel provided by the adversarial system.[457]

The asbestos bar turned to silica cases, using some of the same techniques.[458] Perhaps because they had learned from the asbestos experience, silica defendants have proven more resistant.[459] 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, Janis Graham Jack.[460]

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,[461] rapid (measured in minutes) diagnoses and

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[455] Coffee, *supra* note 408, at 1346 (Individual plaintiffs have little control over attorneys in mass tort cases, particularly when claims concern potential future medical problems rather than immediate concerns).

[456] Id. at 1365. *See also* Biederman, *supra* note 436, at *3 ("'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.'")

[457] 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, et al., *supra* note 378, at 23. *See also* Coffee, *supra* note 408, at 1373-1376 (discussing "new" collusion between parties' attorneys in mass tort litigation made possible by repeat player aspects).

[458] Hechler, *supra* note 419, at 18 (the silica plaintiffs bar was using the "[s]ame methodology, same screening companies, same B-readers" according to a defense attorney). One problem is that many silica plaintiffs were discovered to have been previously diagnosed with asbestosis by the same screening companies and doctors. Id. Approximately half the 10,000 plaintiffs in the Texas MDL proceeding, for example, had prior asbestos claims. Id.

[459] 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. at 18.

[460] Judge Jack is a nurse. Id. at 18.

[461] 2005 WL 1593936 at *33-36. 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 *63. 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 *23.

radiograph readings,[462] failure to follow the doctor in question's own procedures as documented in academic writings the doctor had written,[463] and improper financial incentives (doctors and screening companies paid only for positive diagnoses).[464] Moreover, as Judge Jack noted, the pattern of silicosis claims in the 111 cases with more than 10,000 individual plaintiffs[465] before her was anomalous when population and regional variations in silica exposure were considered.[466] Moreover, the astonishing rate of silicosis in Mississippi represented by these cases had attracted no press or regulatory attention.[467] 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.[468]

Although not part of the court's analysis of the validity of the expert testimony, the court did note that "If 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."[469]

Thus, while a common law approach to problems like silica or asbestos exposure, where 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 that is not the case. The court

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[462] Id. at *38 (noting Dr. Levy 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 *22.

[463] Id. at *41-42. Another physician testified that Dr. Levy'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 *63.

[464] Id. at *28 ("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.'")

[465] Id. at *1.

[466] Id. at *5 ("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.")

[467] Id. at *5 ("Mississippi's apparent silicosis epidemic has been greeted with silence by the media, the public, Congress and the scientific communities.")

[468] Id. at *95.

[469] Id. at *45.

system does not appear to be the best way to ensure that silica exposure is neither over-regulated or under-regulated.

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 hit. Even accounting for the lag due to silicosis' 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, to regulations, and to 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 to resolve through individual action.

Many OSHA-reform proposals focus on unblocking OSHA's regulatory process and speeding up the issuance of new standards.[470] 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.[471] Lack of information, particularly due to the long latency period for silicosis and lung cancer, may dampen these incentives, however. If the problem is 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 where market

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[470] *See, e.g.*, MCGARITY & SHAPIRO, *supra* note 48, at 185 ("If OSHA is to fulfill its statutory mandate to protect workers, a way must be found to increase its regulatory output.")

[471] *See* notes 41- 46 *supra and related text.*

forces are trusted,[472] 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 be a consumer. Just as it did under the Walsh-Healey Act before OSHA's creation in 1970,[473] the government can demand that its 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've learned from the history of silica, 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 (e.g., 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.[474] 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 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,[475] and have successfully improved quality in a number of areas.[476]

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[472] *See, e.g.,* ROSEN, *supra* note 67, at 423 (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.").

[473] *See* note 284 *supra.*

[474] *See* note 344 *supra.*

[475] See REGULATION WITHOUT THE STATE for a discussion of standards and certification programs set by non-governmental bodies. The authors note that Underwriters Laboratory, for example, faces competition for 12 other certification organizations, and thus has strong incentives to maintain the quality and reliability of its testing methods and standards.

[476] 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." ISO In Brief 2005. (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

In contrast to flexible standards that respond to different information, a uniform standard proves hard to adjust as new information comes available, as is evidenced by the current OSHA exposure limit of 0.10 mg/m^3.[477] 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.[478]

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 don't 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 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.

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implemented by 634 000 organizations in 152 countries. See ISO 9000 and ISO 14000 In Brief (http://www.iso.org/iso/en/iso9000-14000/understand/inbrief.html)

[477] *See* note 337 *supra*

[478] *See* note 363 - 368 *supra and related text.*