CASE 8

Reforming OSHA
Regulation of Workplace Risks

W. Kip Viscusi
Northwestern University

INTRODUCTION

The Occupational Safety and Health Administration (OSHA) has perhaps been a more persistent target of criticism than all other federal regulatory agencies. Critics have not questioned the agency's fundamental objective. Promoting worker health and safety is a laudable and widely shared objective. Rather, OSHA is generally regarded as ineffective in promoting this objective and as imposing needless costs and restrictions on American business.

This branch of the U.S. Department of Labor began operation in 1971 after the Occupational Safety and Health Act of 1970 created it so as "to assure so far as possible every working man and woman in the nation safe and healthful working conditions."1 Since ensuring a no-risk society is clearly an unattainable goal, the initial OSHA mandate established the infeasible as the agency's mission. Nevertheless, a regulatory agency focusing on worker safety issues could serve a constructive function.

The early operations of OSHA did not, however, even begin to fulfill the agency's initial promise. OSHA was the object of widespread ridicule for standards that prescribed acceptable toilet seat shapes, the placement of exit signs, the width of handrails, and the

proper dimensions of OSHA-approved ladders. Many of the more frivolous standards were never among the most prominent concerns in the agency’s enforcement effort. Nevertheless, they did epitomize the degree to which the federal government was attempting to influence the design and operation of the workplace — matters that previously had been left to managerial discretion.

In recent years the stories of OSHA’s misguided regulatory efforts have been less prominent. One no longer reads amusing anecdotes such as that concerning the OSHA inspector who penalized a firm for allowing its employees to work on a bridge without the required orange life vests even though the riverbed was dry. The comparative inattention to OSHA’s recent activities does not necessarily imply that the agency should receive a clean bill of health. There has been no widely publicized reform of the agency. Moreover, unlike transportation, natural gas, oil, and airlines, there have been no legislative changes or major administrative reforms. The decrease in OSHA’s prominence may be because a continuation of past policies, however ill-conceived, is simply no longer newsworthy.

This paper focuses on a general assessment of the effort to promote worker health: why we have such policies, how the initial effort failed, whether there has been any improvement in this effort, and how these policies can be reformed. Although little more than a decade old, OSHA has been the subject of a variety of proposed reform efforts. That OSHA has already become a chief target of proposed regulatory reforms suggests the kinds of fundamental changes needed in the agency’s initial orientation.

The past two presidential administrations promised an overhaul of OSHA policies. The Carter administration sought to provide this risk regulation effort with greater legitimacy by eliminating some of the more frivolous standards and by enforcing the sounder portions of OSHA regulations more vigorously. Under the Reagan administration the attention shifted to decreasing OSHA’s confrontational character so as to foster a cooperative business-government approach to promoting workplace safety.

Although these efforts have rectified many of the more ill-conceived aspects of OSHA’s initial strategy, the need for reform continues. Regulation of workplace conditions is a legitimate role for the government, but as with other regulatory policies, a balance between competing objectives should be attained. In this case the principal trade-off is between the costs imposed by the regulation and the health and safety benefits they provide. Although the suggested reforms are often quite specific in character, many of the more promising reforms have a common element in that they represent attempts to achieve such a balance.
In addition, there may be more fundamental shortcomings whereby the government policy is failing to achieve as much safety improvement as is possible for the costs imposed. In more technical terms the difficulty may be that we are not on the frontier of efficient policies (that is, those policies that provide the greatest safety for any given cost), as opposed to simply making the wrong trade-off along such a frontier. Safety could be enhanced without any extra cost through more sensible policy design. Many of the most widely publicized standards initially promulgated by OSHA fall in the category of policies dominated by less costly and more effective alternatives. As in the case of other OSHA reforms, proper application of fundamental economic principles will illuminate the nature of the policy changes required.

HOW MARKETS CAN PROMOTE SAFETY

Before instituting a government regulation it is instructive to assess how the market functions. Basically, one should inquire whether there is any inadequacy in the way in which market forces operate. Although individual life and health are clearly valuable attributes, there are many other market outcomes that are also valued by consumers and workers but are not regulated by government. Because markets that operate well will allocate resources efficiently, there should be some perceived inadequacy in the way these forces function before interfering with their operation.

To ensure that market outcomes will be efficient, a number of stringent conditions must be met. For example, the outcome of any employment decision must affect the worker and employer only, not society at large, since these broader concerns will not be reflected in the job choice. A particularly pertinent requirement is that the job choice must be the outcome of a fully rational decision. Individuals must be cognizant of the risks they face and be able to make sound decisions under uncertainty. As discussed below, these assumptions are especially likely to be violated for many important classes of risks.

Even if there is a consensus that market outcomes are not optimal, it is essential to ascertain the extent of the market failure. It is important to understand if the operation of the market is fundamentally flawed or whether there is a narrower market failure, such as an informational shortcoming that can be remedied through an information transfer effort rather than direct control of workplace conditions.
Finally, the market mechanisms will be pertinent insofar as they establish the context in which the government regulation operates. Regulations do not dictate health and safety outcomes, since it is impossible for regulators to monitor and influence the health and safety attributes of all firms. Instead, these policies simply create incentives for firms and workers to take particular actions, such as installing new ventilation equipment. Whether regulations have any impact will hinge on the strength of the incentives created by the policy and the safety incentives the market generates for firms.

Compensating Wage Differential Theory

The fundamental economic approach to worker safety was sketched by Adam Smith over two centuries ago. Smith observed that workers will demand a compensating wage differential for jobs that are perceived as being risky or otherwise unpleasant. The two critical assumptions are that workers must be aware of the risk (which often may not be the case) and that they would rather be healthy (which is not a controversial assumption). These differentials in turn will establish an incentive for firms to promote safety, since doing so will lower their wage bill. In particular, these wage costs are augmented by reduced turnover costs and workers' compensation premium levels, both of which also provide incentives for safety improvements by the firm. In effect, it is primarily the risk-dollar trade-offs of the workers themselves that will determine the safety decision by the firm.

Figure 1 illustrates how these forces will influence the level of safety provided. Suppose that the health outcome involved is reduction of job-related accidents and that improvements in safety have diminishing incremental value to workers, just as additional units of other types of "economic goods" have diminishing importance. The marginal value of the safety curve in Figure 1 consequently is a downward sloping curve, since the initial increments in safety have the greatest value. The firm can provide greater levels of safety, but doing so entails additional marginal (or incremental) costs that increase as the level of safety becomes increasingly great. Some initial safety improvements can be achieved inexpensively through, for example, modification of existing machines or work practices. The addition of exhaust fans is one such measure for airborne risks. More extensive improvements could require an overhaul of the firm's technology, which would be more expensive. This marginal-cost curve consequently is increasing rather than staying flat because safety equipment differs in its relative efficacy, and the firm will choose to install the most effective equipment per unit cost first.
Figure 1. Determination of Market Levels of Safety

The price of safety set by worker preferences will determine where along this marginal-cost curve the firm will stop. The optimal level of safety from the standpoint of the market will be $s^*$. The shaded area under the marginal-cost curve will be the total safety-related expenditure by the firm. This level is short of the no-risk level of safety. At the level of safety provided, workers would have been willing to pay $\$V$ per expected accident to avoid such accidents. This additional safety is not provided because the cost to the firm for each extra accident avoided exceeds workers' valuation of the improvement: $\$V$ for any incremental increase in safety above $s^*$.

The level of health and safety selected will not be a no-risk level since promoting safety is costly. Almost all of our daily activities pose some risk because of the costs involved in reducing the hazards. Consumers, for example, routinely sacrifice greater crashworthiness whenever they select more compact automobiles in an effort to obtain greater fuel efficiency, since the typical small car is less crashworthy than the average full-sized car. Moreover, the order of magnitude of the risks is not too dissimilar to those that we encounter in other activities. The accident risk posed by one day of work in a coal mine (a relatively hazardous pursuit) is comparable in size to the risks of smoking 3.7 cigarettes, riding 27 miles by bicycle, eating 108 table-
spoons of peanut butter, or traveling 405 miles by car. Individuals trade off these and other risks against other valued attributes, such as the recreational value of cycling.

Risk Information

The first link in the compensating differential analysis is that workers must be aware of the risks they face. For example, if there is no perception of the risks, workers will demand no additional compensation to work on a hazardous job. The available evidence suggests that there is some general awareness of many of the risks workers face. Based on data from the University of Michigan Survey of Working Conditions, there is a strong correlation between the risk level in the industry and whether workers perceive their jobs as being dangerous in some respect. This evidence is by no means conclusive, however, since the risk assessment question only ascertained whether workers were aware of the presence of some risk, not the degree of risk posed by the job.

A more refined test was developed by Charles O'Connor and the author in a survey of workers at four chemical plants. In that study workers were asked to assess the risks of the job using a continuous scale that could be compared with published accident measures. Overall, workers believed that their jobs were almost twice as hazardous as the published accident statistics for the chemical industry suggest, which is expected in view of the degree to which health hazards, such as cancer, are not reflected in the accident data. Particularly noteworthy was that after the health hazards were excluded from consideration, the risk assessments equaled the accident rate for the chemical industry.

These studies should be regarded as evidence of some reasonable perception of job risks by workers. It is unlikely that workers have completely accurate perceptions of the risks posed by their jobs. These risks are not fully known even by occupational health and safety experts.

The degree to which there will be errors in the risk assessment will not, however, be uniform across all classes of risk. As a rough generalization, one would expect safety risks (external hazards such as inadequate machine guards) to be better understood than health risks (internal risks such as excessive exposure to radiation). Safety hazards tend to be more readily visible and familiar risks, such as the chance of a worker in a sawmill losing a finger. In contrast, health hazards usually are less well understood. These risks often involve low probability events that may affect the individual decades after the
exposure. These difficulties are enhanced in some instances by the absence of any clear-cut signals that a health risk is present. The odor and color of gases emitted in the workplace, for example, are not a reliable index of their potential carcinogenicity.

Compensating Differentials

In situations where workers are aware of the hazard, the riskier jobs should be expected to command a wage premium. The risk premium part of the analysis was never successfully tested until the 1970s because of the inherent difficulties in isolating the premium for risks. As John Stuart Mill observed, the most attractive jobs in society also tend to be the highest paid. This effect does not contradict the compensating differential analysis but is a consequence of the willingness to incur job risks to boost income declines as income status increases. Compensating differentials do exist, but they do not outweigh the influence of other factors that drive individual income, such as worker education and job experience.

In some cases the levels of premiums for job risks are specified in labor market contracts. Because elephants are said to pose a risk to handlers whom they do not like, elephant handlers at the Philadelphia Zoo receive an additional $1,000 annually. Such explicit provisions are the exception. A more typical approach is to embed the wage level within the context of a complex job evaluation system. The firm scores the worker's job according to a variety of dimensions, such as working conditions and degree of responsibility, and it bases the worker's wage on the grade level corresponding to the overall job score.

The resulting risk premiums are then estimated by labor economists using statistical techniques that analyze the role played by different factors governing the worker's wage. The resulting wage premiums are substantial. Roughly $70 billion in wage premiums for risk is paid by the United States private sector each year, above and beyond the amount that is paid in workers' compensation, which adds an additional $10 billion.

Not only is workers' compensation a much smaller part of the total risk compensation package, but it also is structured in a manner that is less effective in generating incentives for health and safety. Most firms covered by workers' compensation pay insurance premiums based on the performance of their industry group rather than on their own safety record. Higher accident rates at a firm consequently do not necessarily boost workers' compensation costs in these cases. The workers' compensation system also has been structured
primarily to address accident risks, so that longer term health hazards are covered inadequately. This inadequacy stems not from an oversight in the design of workers' compensation but from the difficulty in monitoring the contribution of work experience to long-term health problems such as cancer.

An instructive measure of the rate of compensation is the amount paid per unit risk. In the case of fatalities the issue is the value of a statistical life. This value of life concept can be viewed in two equivalent ways. Consider for example 10,000 individuals, each of whom faces a risk of death of 1/10,000 — the average risk confronting a blue collar worker. Overall, there will be one expected death in this group. Suppose that they were willing to accept this risk for $200 apiece. Then the amount of money that the entire group will be compensated for the one expected death is the

Value of life = 10,000 × $200 = $2 million

Alternatively, one can view the value of life as being the value received per unit risk, or

\[
\text{Value of life} = \frac{$200}{1/10,000} = $2 \text{ million}
\]

The value of life will not be a natural constant, such as e or π. Rather one should expect different individuals to have different risk-dollar trade-offs just as they have different tastes in convertibles and television shows. This heterogeneity will be of consequence for market outcomes, because jobs in the economy are not assigned to workers on a random basis. Because of the element of choice involved, workers who place a relatively low value on life will tend to gravitate toward the higher risk jobs. They are willing to accept lower premiums per unit risk, other things being equal. The most affluent workers, who will be more likely to demand high unit levels of risk compensation, will tend to select jobs of lower risk.

These predictions are borne out in analyses of workers' implicit value of life. In a study of workers in high-risk jobs posing an annual death risk on the order of 1/1,000, Thaler and Rosen found that they received compensation associated with an implicit value of life of $600,000 (1983 prices). Based on studies by Robert Smith and the author, workers in more moderate risk jobs, such as the average annual risk of 1/10,000 facing typical blue collar workers, receive compensation associated with an implicit value of life of about $3.5 million. Finally, the author's work on the heterogeneity of the value of
life has yielded compensation levels as high as $7 to $10 million per life.\textsuperscript{11}

Estimates at the high end of the value of life spectrum are probably less reliable, since the available risk data are not sufficiently refined to make fine distinctions among jobs posing low risks. Nevertheless, they are suggestive of the range of differences in individuals' value of life.

These figures represent what workers' risk-dollar trade-offs are, given their current information about the risk, not what they would be if they had full information about the risk. In addition, the calculations assume rational decision-making, whereas in practice workers may overreact to risks or they may neglect to take them into consideration. Although market behavior may not be ideal, the substantial magnitude of compensation per unit risks does suggest that there is substantial awareness of risks and their implications.

The value of life results are bolstered by analogous findings for nonfatal job injuries. These studies suggest that there is substantial compensation for job risks, when viewed both in terms of the total wage bill (6 percent of manufacturing workers' wages) and the rate of compensation per unit risk.

The level of compensation may vary by industry. One would expect that unions with a strong interest in health and safety issues would be particularly interested in securing workers hazard pay. Unions, such as that for petroleum and chemical workers, often have specialized expertise in the health and safety area and have the ability to bargain with greater expertise than workers could individually. My early research in this area suggested that unions were a substantial force in this area, but more recent work by Robert Smith and others suggests that the magnitude of the union effect on the wage-risk trade-off is sensitive to the particular set of survey data that is used.\textsuperscript{12}

\section*{On-the-Job Experience and Worker Quit Rates}

The presence of possibly inadequate worker knowledge concerning the risks remains a potential impediment to the full operation of the compensating differential mechanism. The result will not be that market mechanisms will work less effectively, although some decreased efficacy will undoubtedly occur. Rather there will also be new market forces that may be influential.

Consider a situation in which a worker starts a job without full knowledge of the potential risks.\textsuperscript{13} After being assigned to the posi-
tion he or she will be able to observe the nature of the job operations, the surrounding physical conditions, and the actions of co-workers. Similarly, during the period of work on the job the worker learns about some particular difficulties in carrying out the job tasks, and even more directly, he or she observes whether co-workers are (or have been) injured. The worker can then use these experiences to evaluate the risk potential of the job.

If the worker’s risk perceptions become sufficiently unfavorable, given the wage paid, he or she can quit and move to another firm. Overall, job risks account for one-third of all manufacturing quit rates. Similarly, the periods of time that workers spend at hazardous firms before leaving are shorter than for safe firms. As a consequence, there will always tend to be more inexperienced workers in high-risk jobs, because the high turnover rates from these positions lead to frequent replacements.

The standard observation that younger and more inexperienced workers are more likely to be involved in accidents is not entirely attributable to greater riskiness of this demographic group. Rather the causality may be in the opposite direction, since new hires are more likely to be placed in the high-risk, high-turnover jobs. The firm will also have a strong incentive to avoid placing its most experienced workers in these positions, because it will lose the training investment if the worker is injured or quits.

All of the labor market responses by workers are simply variations of the compensating differential theme. If the job appears to be risky initially, the worker will require extra compensation to begin work on it. Similarly, once he or she acquires information about the risks that are present, the worker will reassess the job’s attractiveness and remain with it only if the compensating differential is sufficient.

### INADEQUACIES IN THE MARKET

If market operations were fully efficient, there would be no need for government regulation of health and safety. The decentralized operation of the market would be sufficient to ensure appropriate levels of the risk. Two broad classes of shortcomings limit the efficacy of market outcomes: (1) informational inadequacies and problems with individual decisions under uncertainty and (2) externalities.
Informational Problems and Irrationalities

For the compensating differential model to be fully applicable, workers must be cognizant of the risks they face and be able to make sound decisions based on this knowledge. The available evidence suggests that in many contexts workers have risk perceptions that appear plausible, but these studies in no way imply that workers are fully informed. There is a general consensus that many health risks in particular are not well understood.

With on-the-job experience, they undoubtedly will revise their perceptions of many of the risks they face. Once again, safety hazards are more likely to be treated in a reliable manner because they tend to be readily visible and to occur with much greater frequency than many health risks, which are low probability events. Thus the worker has fewer observable incidents of adverse health outcomes to use in forming his risk assessment. The long time lags involved in many health risks further impede efforts to learn about the implications of these risks through experience. A worker may get cancer two decades after job exposure to a carcinogen, but tracing the cause to the job usually is not feasible. As a rough generalization, there is probably reasonable, but not perfectly accurate perception of many safety risks and much less reliable assessment of the pertinent health risks.

Even with accurate perceptions of the risk, however, one cannot be confident that the decisions ultimately made by the workers will be ideal. Decisions under uncertainty are known to pose considerably more difficulties than decisions made in cases where the outcomes of alternative actions are known in advance. These difficulties are likely to be particularly great in situations involving very low probability events that have severe outcomes after a substantial lag. The low probabilities and substantial lags make these decisions difficult to conceptualize. How averse, for example, is a worker to take a one in 20,000 risk of cancer twenty-five years from now? Because of the high stakes involved — possibly including the worker's life — the cost of mistaken choices will be high. Once again, it is likely that health hazards pose relatively greater demands on individual rationality than safety risks.

The final class of shortcomings in individual behavior relates to the degree workers can choose from a variety of alternative risk-wage combinations. For the relatively mobile, modern United States economy there seems to be substantial range of job options for almost all workers. Certainly, the classic textbook discussions of the one-
company town no longer seem relevant and, even if true, would not have as great an impact in an era of interstate highways and substantial worker mobility. This mobility may be restricted during cyclical downturns when job opportunities are less plentiful, but since accidents move pro-cyclically, the net influence of adverse economic conditions is not clear cut.

Perhaps the most important constraint on individual mobility is related to the character of the employment relationship. Once on the job, individuals acquire skills specific to the particular firm as well as seniority rights and pension benefits that are typically not fully transferable. If workers had full knowledge of the risk before accepting the position, these impediments to mobility would not be consequential. The basic difficulty, however, is that workers may not have been fully cognizant of the implications of the position and will subsequently become trapped in an unattractive job situation. Available evidence for chemical workers suggests that the extent of serious job mismatches of this type is not high.

Externalities

An additional class of market inadequacies arises even if individual decisions are fully rational and ideal in all respects. Parties outside of the market transaction for the job may have a stake in the risky job insofar as there is a broader altruistic concern with individual health. This type of health-related altruism is probably of greater consequence than redistributional concerns in this context. Life and health are clearly quite special, as society has undertaken a variety of health-enhancing efforts, such as Medicare, to promote individual well-being.

The overall importance of these altruistic interests has not yet been ascertained, however. As we saw earlier, individuals' values of life are substantial, and it is not obvious that the external interests of society would boost these values substantially. Whether society's broader altruistic concerns are of great consequence in this area is an open empirical issue that merits further attention.

Fundamentally, however, there is the ethical issue of whether there exists in some instances an altruistic concern or simply an attempt by more affluent citizens to impose their own risk-dollar tradeoffs on others. Until these questions can be resolved, the primary impetus for regulation of occupational hazards probably should be the shortcomings of worker decisions.
OSHA'S REGULATORY APPROACH

The general approach OSHA has taken to regulating job safety is dictated at least in part by the Occupational Safety and Health Act of 1970. This legislation authorizes OSHA to set standards and to do so in a manner that will ensure worker health and safety. OSHA's enabling legislation did not, however, specify what these standards should be, what general character they should take, or how stringent they should be.

In addition, the legislation did not specify the nature of the enforcement of the standards. For example, OSHA could couple standards with a penalty for firms out of compliance, where the penalty is set at a level that could give firms some discretion as to whether compliance is desirable. For example, the penalty could be related to the health impacts on workers, and the firm could comply with the standard only if the health benefits exceeded the costs to firms. (The frequency of OSHA inspections could also influence the penalty.) In actuality, OSHA imposes an ever-escalating series of penalties on firms out of compliance; thus the standards can be viewed as rigid guidelines. Because of this binding character, the level and nature of the standards is of major consequence to firms regulated by OSHA.

Setting OSHA Standard Levels

One could characterize OSHA's general approach as that of adopting technology-based standards whose stringency is limited only by their affordability. Cost considerations enter only insofar as OSHA is concerned with shutting down affected firms. The strategy advocated by most economists is that the agency should pursue a more balanced approach that recognizes the necessity of taking into account both the costs and risk-reduction benefits in a comprehensive manner. Costs always should be a matter of concern, not simply when a firm may go out of business as a result of OSHA policies. Such a shift in emphasis need not always lead to more lenient regulations. Some very hazardous firms probably should go out of business if provision for efficient levels of safety and health will not permit them to earn a profit.

Much of the policy-oriented debate over the safety standards has concerned their stringency. Those advocating a more balanced approach note that the Occupational Safety and Health Act does not require a risk-free workplace, only one that promotes safety "as far as possible." This and other qualifiers in the Act suggest that OSHA
might have some leeway in being able to take costs into consideration. This view was bolstered somewhat by the U.S. Supreme Court's decision in the 1980 benzene case, in which it overturned the standard because OSHA had not shown that the reduction in risks would be "significant." This significant risk criterion imposes a threshold benefit level, but it does not impose a requirement that OSHA balance benefits and costs.

Indeed, such benefit-cost tests were explicitly ruled out in the 1981 U.S. Supreme Court decision regarding the OSHA cotton dust standard. The court upheld the OSHA cotton dust standard and interpreted the feasibility provisions of the Occupational Safety and Health Act as meaning "capable of being done." It is the technical possibility of compliance rather than benefit-cost trade-offs that should guide OSHA decisions.

In fact, however, in this instance OSHA had based its cotton dust standards on cost-effectiveness concerns, not simply affordability. Specifically, the standard is varied across different stages of processing because of difference in the severity of the risk in these areas and differences in the cost of reducing the risk. Further reductions in the risk were clearly "capable of being done," and in fact many firms have already achieved cotton dust levels well below those specified in the standard.

Clearly, technological feasibility cannot be divorced from cost considerations, since almost any risk can be reduced at sufficiently large costs. Drivers, for example, would face a lower risk of injury in an auto accident if everyone drove full-sized cars at speeds under thirty-five miles per hour. Such measures have not been undertaken because the safety benefits do not justify the increased travel time and loss in fuel efficiency. Likewise, OSHA varied the cotton dust standard because the severity of cotton dust exposures differs according to the stage of processing (since different types of fibers and dust are airborne at different stages) and because compliance costs differ.

Indeed, under the Reagan administration, OSHA now routinely calculates the costs and benefits of its proposed regulations. The agency does not, however, explicitly compare these magnitudes when discussing the reasons for its policy recommendations. Inevitably, some comparisons of this type are made by OSHA, the Office of Management and Budget, and other players in the regulatory process. There would be greater likelihood of balanced policies if the Supreme Court reversed its narrow and unrealistic interpretation of OSHA's mandate or if Congress amended OSHA's legislation. In the absence of such a change, primary emphasis will continue to be placed on the level of risk reduction rather than the associated costs. Regulations sometimes may impose costs that appear to be well out of line...
with any reasonable values, such as almost $70 million per expected life saved by the OSHA arsenic standards.\textsuperscript{22}

The Nature of OSHA Standards

The structure of OSHA's regulatory approach also has been overly restrictive, as the agency has adopted a narrow technology-based approach to safety regulation. Ideally, OSHA should permit firms to achieve any given level of safety in the least expensive manner possible, consistent with having well-defined regulations that are enforceable. Instead, OSHA has typically adopted uniform standards that attempt to prescribe the design of the workplace.

This orientation derives in part from the pattern set in OSHA's initial standard-setting activity.\textsuperscript{23} Shortly after beginning operations, OSHA issued over 4,000 general industry standards for health and safety, the preponderance of which were safety related. These standards, which continue to constitute most of OSHA's safety policies, were derived from the national consensus standards of the American National Standards Institute, the National Fire Protection Association, and some existing federal standards for maritime safety. In doing so, OSHA converted a set of discretionary guidelines into a mandatory prescription for workplace design.

The upshot of this effort was to establish OSHA as a leading object of ridicule for its portable toilets for cowboys and other seemingly trivial standards. Perhaps more significant than these well-publicized OSHA horror stories was the \textit{specification} character of the regulations. The OSHA handrail regulation specifies their required height (thirty to thirty-four inches), spacing of posts (not to exceed eight feet), thickness (at least two inches for hardwood and one and one-half inches for metal pipe), and clearance with respect to the wall or any other object (minimum of three inches).\textsuperscript{24} Likewise, in its requirements for band guards for abrasive wheels, OSHA specifies the required thickness, the minimum diameter of rivets, and the maximum distance between the centers of rivets.\textsuperscript{25}

In each case the specification standard approach may have imposed greater costs than equally effective alternatives. To provide guidelines for how such flexibility could be achieved, President Ford's Task Force on OSHA headed by Paul MacAvoy designed a model standard for machinery and machine guarding that indicated, for example, several alternative ways to guard a punchpress.\textsuperscript{26} This flexibility also may enhance the safety that could be achieved through a performance-oriented approach. A performance-oriented approach would stress the need for firms to achieve a particular health and
safety level through whatever means they chose rather than being required to install a particular type of technology. The present OSHA specification standards are so narrowly defined that they pertain to only 15 percent of all machines. This model standard has not yet been adopted, but it provides an operational example of how OSHA could achieve greater flexibility in its regulatory approach without jeopardizing worker safety.

It is also noteworthy that the primary orientation of the standards remains in the safety area. Externally visible aspects of the workplace, such as handrail width, are given comprehensive and meticulous treatment. In contrast, only a small fraction of the carcinogens in the workplace have been addressed by OSHA standards. There are some health standards, such as those for radiation exposure, but for the most part the standards have been dominated by safety concerns.

In view of the earlier discussion of market inadequacies, this emphasis seems misplaced. Health risks rather than safety risks are handled least effectively by the market. The greatest potential gains from OSHA regulation are likely to come from addressing the dimly understood health risks that pose the most severe difficulties for worker decision-making.

Moreover, the structure of the health standards is also more likely to be conducive to more effective promotion of worker health. The health standards typically limit worker exposure rather than specifying particular technologies. For example, the cotton dust standard specifies permissible exposure limits to airborne concentrations of respirable cotton dust in different stages of processing, and it indicates the circumstances under which protective equipment must be worn. Respirators are needed during cleaning operations because of unusually high levels of cotton dust in that period. The standard does not specify how the lower levels of cotton dust are to be achieved, whether through use of exhaust fans, new machines for drawing and carding the cotton, or some other approach.

THE REFORM OF OSHA STANDARDS

The ideal economic reform of OSHA standards should consist of three components. First, there should be a shift in emphasis from safety to health. Second, there should be greater opportunities for firms to find less expensive techniques for promoting safety. Standards should consequently be more performance oriented when that
is feasible. Finally, the level of the standards should be set in a more balanced fashion that attempts to recognize the health benefits to workers and the costs to firms.

Recent Regulatory Initiatives

Compared with its initial activity, OSHA’s standard setting has been relatively modest in the past decade. During the Carter administration, much new regulation was stymied by the uncertainties caused by the court challenges of OSHA’s legislative mandate in the cotton dust and benzene cases. The Reagan administration’s emphasis has been on slowing the pace of new regulation, so that OSHA has been somewhat less active than in previous years. Nevertheless, OSHA has not been completely dormant in the standards area.

The dollar price tag of new OSHA regulations proposed from 1975–1980 is $94 to $492 billion. This wide range results almost entirely from the 1978 OSHA carcinogen policy, which alone had a cost of $69 to $448 billion. This policy represented a generic approach to carcinogens; that is, it established a framework by which OSHA would set carcinogen standards, thus relieving OSHA of the task of going through the lengthy process of issuing a new regulation in each case. The overall emphasis was to regulate carcinogens with strong scientific support to a zero risk level and to set standards for other carcinogens on a case-by-case basis.

This policy does not take into account the strength of the carcinogen, the size of the affected population, or the costs of compliance. Although the prospect of a major initiative against health hazards would have been an important addition to OSHA’s arsenal of safety-oriented standards, the carcinogen policy was not well designed. Under the Carter administration, OSHA never utilized this cancer policy for regulating carcinogens, and the Reagan administration rescinded the policy.

Changes in OSHA Standards

The chief legacy of the Carter administration in the area of regulatory reform was its overhaul of the safety standards. The primary emphasis was not on a general restructuring of the standards approach but on eliminating those portions of the standards that were most extraneous and ill-conceived. This emphasis was quite appropriate, in view of the importance of establishing the agency’s credibility. The Assistant Secretary of Labor for Occupational Safety and
Health, Eula Bingham, eliminated or modified 928 OSHA regulations in all in October 1978. In many cases these changes were only editorial and had no major substantive impact. Nevertheless, the net effect of the elimination of the "nitpicking" features of OSHA regulation was to reduce some of the harsher criticisms of the agency's regulatory approach. Because of the magnitude of OSHA's credibility problem, the importance of even cosmetic changes in the standards should not be underestimated.

The most important structural change in regulatory policy was OSHA's chemical labeling regulation, which was proposed at the end of the Carter administration. By providing workers with information, this regulation represented an effort to utilize market forces to promote safety. The chief forms of information provision required were labels on the chemicals and a program for training workers in the handling of chemicals. This regulation addresses the primary source of market failure directly and, as a consequence, preserves the constructive aspects of the health-related decisions by firms and workers. In addition, the focus of the regulation is strongly oriented toward health hazards rather than safety risks.

Indeed, much of the impetus for this regulation came from the inability of direct regulatory controls to address the entire range of chemical hazards. Setting standards for all of the thousands of carcinogens in the workplace was viewed as infeasible.

In addition to addressing long-term health impacts and acute health effects (for example, skin rashes from chemical exposures), the regulation will also affect accidents from fires and explosions. These safety hazards also are likely to merit greater attention than more visible workplace characteristics, since the safety-related properties of chemicals will not be well understood in the absence of some information about the risk.

While providing an innovative approach to regulation, the chemical labeling standard is also a strongly performance-oriented regulation. Since different formats may be appropriate in different contexts, firms are permitted to design their own labeling system. This flexibility will, for example, permit the paint and coating industry to retain the labeling system that has been adopted on an industry-wide basis. This opportunity for discretion contrasts with the approach that OSHA took in its standard for radio frequency hazard warnings, which specify the sign's shape, the background color, the words and location of the warning, and the size and color of all letters.

Whether the informational approach will be effective is not known. Much remains to be learned about the efficacy of such efforts and about workers' ability to process such information. The limited
evidence available suggests that this strategy is promising, provided that the information represents new knowledge about the risks encountered rather than general exhortation to act safely.\textsuperscript{32}

The chief new safety standard proposed by the Reagan administration is a set of extensive rules intended to decrease the risks associated with grain handling.\textsuperscript{33} These hazards are often well publicized, since explosions in grain-handling facilities may lead to the deaths of dozens of workers.\textsuperscript{34} Perhaps in part because of this publicity and the safety incentives created by the market and workers' compensation, there were no deaths from explosions in 1983.\textsuperscript{35}

The 1984 OSHA proposal is intended to reduce this risk further by decreasing the dust levels in grain elevators, which in turn will reduce the risk of explosions. What is noteworthy about this standard is that firms are given several alternative options to decrease the dust: (1) to clean up the dust whenever it exceeds one-eighth inch; (2) to clean up the dust at least once per shift; or (3) to use pneumatic dust control equipment. This flexibility represents a major innovation in the design of OSHA safety standards. The regulation provides an opportunity for firms to select the most cost-effective option and will lead to lower compliance costs than would a uniform specification standard. OSHA's effort to utilize the advantage of a performance-oriented approach represents a significant, constructive contribution to OSHA policy development.

Overall, there has not been a dramatic change in the structure of OSHA safety standards since OSHA's initial standard-setting efforts. Some of the extraneous and more frivolous standards have been pruned; other standards have been updated to take into account technological changes; and a few new standards have been added.

Further reform in standards that have already been promulgated is expected to be minimal, since there is not a strong constituency for such changes. To the extent that more firms comply with the revisions of the OSHA standards, any impetus for relaxations or modifications of existing regulations will be diminished.

Some progress may be made with respect to future standards in the form of greater recognition of the costs of the regulations and the introduction of innovative approaches to regulation. Recent OSHA efforts, such as the chemical labeling standard and the grain-handling standard, represent significant advances in OSHA's regulatory approach. Further policies of this type should be encouraged. On balance, however, the level of activity in the standards area has not been great over the past decade, as OSHA has retained most of its original approach.
OSHA'S ENFORCEMENT STRATEGY

To design and enforce its standards, OSHA now has over 2,300 employees, ranking second behind the EPA among social regulation agencies. This staff, in conjunction with the inspectors from states that choose to enforce OSHA regulations with state inspectors, come to the workplace, ascertain whether there are any violations, and penalize violators. The inspectors may return for a follow-up inspection, continuing to assess penalties until compliance is ensured.

Firms will choose to comply with OSHA standards if OSHA establishes effective financial incentives for doing so. The firm must consequently find it more attractive financially to make the safety improvements than to risk an adverse OSHA inspection. The penalties that result include fines levied by OSHA as well as possible adverse effects on the firm's reputation, which may in turn affect worker turnover or wages. To assess whether these safety incentives are strong, consider each link in the OSHA enforcement process.

Before OSHA can affect a firm's policies, it either must inspect the firm or create an effective threat of possible enforcement. OSHA undertakes four types of inspections: (1) inspections of imminent dangers, (2) inspections of fatalities and catastrophes, (3) investigations of worker complaints and referrals, and (4) programmed inspections. This priority ranking has remained virtually unchanged over the past decade. Somewhat surprisingly, complaint inspections produce few violations per inspection, which suggests that disgruntled workers may be using the OSHA inspection threat as a means of harassing the employer. This pattern is unfortunate, since the role of workers and unions in promoting safety could potentially have been instrumental.

The three different eras of OSHA enforcement are reflected in the patterns shown in Table 1. The Nixon and Ford administrations established the general inspection approach, and there was little change in emphasis except for a gradual expansion in the enforcement effort. Under the Carter administration there was an attempt to eliminate some of the less productive aspects of the enforcement policy. The number of inspections and less important violations declined, and penalties for violations increased. The Reagan administration marked the start of a less confrontational approach and a more conscious inspection targeting. The biggest change was that the level of penalties assessed for OSHA violations plummeted.
Table 1. Characteristics of OSHA Enforcement

<table>
<thead>
<tr>
<th></th>
<th>Fiscal Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspections (thousands)</td>
<td>28.9</td>
</tr>
<tr>
<td>Employees covered by inspections (millions)</td>
<td>—</td>
</tr>
<tr>
<td>Proportion of health inspections</td>
<td>—</td>
</tr>
<tr>
<td>Proportion of inspections with serious citations</td>
<td>—</td>
</tr>
<tr>
<td>Violations (thousands)</td>
<td>89.6</td>
</tr>
<tr>
<td>Proportion of serious violations</td>
<td>—</td>
</tr>
<tr>
<td>Penalties (millions of dollars)</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: Based on calculations by the author using data from OSHA computer printouts.

*Data are not available or are not reliable.

Inspection Policies

The specific components of Table 1 reflect these shifts in emphasis. The total number of inspections rose steadily through fiscal year 1976, after which it dropped by one-third as a result of the Carter administration's attempt to reduce the less productive inspections. The present level of inspections of below 70,000 annually may seem substantial, but it covers very few workplaces. At this rate of inspection an enterprise would be inspected less than once every two centuries.

Since many firms are small businesses with few employees, a more accurate index of coverage is the inspection rate per worker. At present, almost three million employees are covered annually by OSHA inspections. This figure represents the number of workers at sites covered by inspections, not the number of workers whose particular job conditions were analyzed. Yet, even this generous estimate of OSHA coverage does not suggest a large-scale inspection effort, since a worker at a site covered by an OSHA inspection will see an inspector only once every thirty-four years. Moreover, there has been a substantial drop in the rate of coverage of employees.

The drop in employee coverage may also reflect a failure of OSHA to target large firms sufficiently. During its early operations, OSHA was the object of criticism for focusing on small firms where few workers could be protected as a result of OSHA inspections. This misallocation of resources diminished somewhat, as OSHA be-
gan to cite an equal number of violations per hour of inspection time in small firms as in large firms.\textsuperscript{40} Since more workers are affected per violation in large firms than small firms, this shift toward larger firms was still not sufficient. Under the Reagan administration the low level of employees covered by inspections suggests the need to continue boosting the coverage of large firms.

Two aspects of inspections that reflect desirable changes in emphasis pertain to the emphasis on health rather than safety and the emphasis on serious violations. Health violations merit relatively more attention, since there are greater inadequacies in the way these risks are treated. Safety risks are often well known to workers and generate compensating wage differentials, higher quit rates, and larger workers' compensation premiums — all of which establish incentives for firms to promote safety. In contrast, health hazards are less well understood and, because of difficulties in monitoring causality, are not covered as effectively by workers' compensation.

The role of health inspections doubled under the Carter administration, in part because the decline in overall inspections in fiscal year 1977 primarily represented a drop in safety inspections. The pattern through fiscal year 1981 is one of a gradual rise in the absolute number of health inspections. This increase was reversed under Reagan, not so much because of a conscious decision to abandon the health area but because of the shift toward construction inspections, which are primarily safety related.
Ideally, inspections also should identify serious violations rather than less consequential threats to worker safety. This emphasis on serious violations escalated considerably under the Carter administration, as almost one-third of all inspections began to generate serious violations. The frequency of serious violations under the Reagan administration is roughly the same as under the Carter administration.

Upon entering the workplace the OSHA inspector attempts to identify violations of OSHA standards for which he will assess penalties. In determining whether or not a firm is in compliance an OSHA inspector cannot consider costs of meeting the standard, only technical feasibility. More specifically, it is "the existence of general technical knowledge" that guides the compliance judgment.42

In fiscal year 1977, when OSHA eliminated less important inspections and citations for trivial violations, there was a dramatic drop in the number of OSHA violations. Thereafter there has been a gradual and steady decline in the number of violations, with an additional small downward shift under Reagan in fiscal year 1981–1983. At present, each inspection results in just under two violations of OSHA standards. A welcome change has been the emphasis upon violations for serious threats to worker health which, as the data in Table 1 suggest, now include over one-third of all standards violations.

OSHA Penalties

The ultimate determinant of the financial impact of an OSHA inspection is the amount of penalties that are assessed for noncompliance. Notwithstanding the widespread notoriety of the enforcement effort, these penalty levels have always been inconsequential. Annual penalties have always been below $26 million and are now down to $6 million.

One change in the penalty structure occurred in the reforms of fiscal year 1977 when, at the insistence of Congress, OSHA eliminated penalties for firms with fewer than ten nonserious violations.43 The overall level of penalties, however, increased under the Carter administration to more than double its earlier level.

Under President Reagan OSHA has adopted a less confrontational approach in which penalties are well below their earlier levels. A particularly noteworthy change is that firms can obtain reductions in the assessed penalties by up to 30 percent if they make a serious effort to comply with the standards.44

The resulting financial incentives for safety are not great. Penalties now average $57 per violation, and total OSHA penalties are just over $6 million. In contrast, higher worker wages generated by job
OSHA's Enforcement Strategy

risks are $70 billion, and workers' compensation premiums are in excess of $10 billion.\footnote{45} OSHA enforcement efforts represent at best a modest addition to policies intended to promote workplace safety. These penalties are also dwarfed by the anticipated costs of compliance.

The level of the OSHA enforcement has declined by most measures of intensity, and this has been accompanied by a fundamental change in its character. Because of the reduction in penalties for firms that remedy OSHA violations, there is little threat from a random OSHA inspection. A firm need do little to promote safety, but simply await the OSHA inspector. The firm will avoid correcting safety problems that the inspector may not identify, and it will face few penalties if it makes the suggested changes. The elimination of the expected losses from inspections suggest that OSHA will have little impact on the great majority of firms that are not inspected, since inspections now have little deterrence value. Since the expected penalties have always been quite low, this loss may not be significant, however.

Enforcement Targeting

In addition to changes in the level of OSHA enforcement, there have also been shifts in the focus of the enforcement effort. Perhaps the most controversial recent change in OSHA enforcement policies was the introduction of records check inspections in October 1981. In these programmed safety inspections the OSHA inspector first examines the firm's lost workday accident rate for the past two years (three years for very small firms).\footnote{46} If this rate is below the most recently available national manufacturing lost workday rate, the firm is not formally inspected. For example, a firm inspected in 1986 would have available its 1984 and 1985 lost workday accident rates for comparison with the 1984 manufacturing rate, since there is a two-year lag in publishing the Bureau of Labor Statistics data. Records check inspections now constitute one-seventh of all OSHA inspections.

Ideally, OSHA should target riskier firms. Inspecting these outliers provides greater opportunities for safety gains. One might expect that OSHA would simply examine the injury reports submitted by the firm each year to the Bureau of Labor Statistics and use this information to target the inspections. In what appears to be a parochial dispute within the U.S. Department of Labor, the Bureau of Labor Statistics has refused to give OSHA access to the individual firm data on the grounds that doing so would undermine the confidentiality of the data, possibly tainting their quality. Since the Inter-
The Internal Revenue Service uses data submitted by taxpayers to enforce tax policies, and federal wage and price control efforts have elicited similar information to enforce these income policies, it would not be unprecedented to use such risk data for purposes of enforcement. The present practice of in effect gathering the data manually under the guise of a records check represents a highly inefficient means of acquiring pivotal information regarding accident rates.

Once the risk information has been acquired, it is clearly desirable to use the data to target OSHA inspections. The present procedure is an overly simplistic approach to doing so, however. Ideally, one would like to identify the risky outliers from the standpoint of what is achievable within a particular context, based on the costs of compliance for that industry. OSHA's procedure of targeting firms based on whether their record is better than the national manufacturing average does not incorporate this heterogeneity in the costs of promoting safety. A sawmill with an accident rate above the national manufacturing average may have a very safe technology for that industry, whereas a garment manufacturer with an injury rate just below the manufacturing average may be a high-risk outlier for that industry.

It is instructive to examine a performance measure of the efficacy of inspections to assess whether the increase in targeting has been beneficial. In the case of both safety and health inspections the citation rate per inspection has risen to levels that are only exceeded by the early OSHA years when trivial violations were often cited. Improved inspection targeting may have led to as much as a 50 percent increase in the citation rate per inspection.

The changing character of the OSHA enforcement effort is exemplified as well by the change in the mix of violations cited by OSHA inspectors. Although the OSHA standards have not changed dramatically over the past decade, the role of different violation categories has undergone many significant modifications. In OSHA's initial years violations for walking and working surfaces (for example, misplaced exit signs) constituted about one-fifth of all violations. Many of these violations were for less important risks, some of which were readily visible to workers as well. The roughly 50 percent drop in this category suggests that OSHA's resources have been redirected from a less profitable area.

Somewhat surprisingly, the other chief violations category—machinery and machine guarding—has exhibited an increase in violations: over one-third of all violations are in this group. Since the same standards have been enforced by OSHA for over a decade, the continued high violation rate appears to reflect a lack of compliance with OSHA standards. In contrast, there has been a dramatic improvement in electrical hazard violations.
The Impact on Worker Safety

The two categories that displayed the greatest relative increases are health related. The role of health and environmental control (for example, noise, ventilation, and radiation) has risen to 8 percent, and violations for toxic and hazardous substances (for example, asbestos and coke oven emissions) now include a similar amount. Although some of these increases are the result of an increase in the number of health standards, there has been a noteworthy upward shift in the role of health violations. OSHA enforcement policies remain primarily safety related, but health hazards no longer constitute a nontrivial portion of the enforcement effort.

THE IMPACT OF OSHA ENFORCEMENT ON WORKER SAFETY

Firms will choose to make the necessary investments in health and safety if the OSHA enforcement policy in conjunction with market incentives for safety makes it in the firm's financial self-interest to do so. More specifically, a firm will comply with an OSHA regulation if

\[
\text{Expected costs} = \text{Probability of compliance} \times \text{Expected No. of violations} \times \text{Average penalty per violation per inspection}
\]

As discussed, the three links in establishing these incentives — inspections, violations, and penalties — are all relatively weak. A firm has less than one chance in 200 of being inspected in any given year. If inspected, it expects to be found guilty of less than two violations of the standards, and for each violation the average penalty is under $60. Overall, the financial cost per worker is only 57 cents. The cost of continued noncompliance is, of course, potentially greater. In contrast, market forces through compensating differentials in combination with workers' compensation premiums impose costs in excess of $800 per worker. Quite simply, OSHA's enforcement effort is too modest to create truly effective financial incentives for safety.

Even if these incentives were strong, not all risks could be eliminated. Many accidents stem from aspects of the work process other than the specific technological characteristics regulated by OSHA. That most workplace risks have not been readily amenable to the influence of OSHA regulations is in stark contrast to the optimistic
projections of the framers of OSHA's legislative mandate, who anticipated a 50 percent drop in workplace risks. 47

The chief contributing factor relates to worker actions. Although the estimates of the role of the worker in causing accidents vary, in part because of the difficulty in assigning accidents caused jointly by worker actions and technological deficiencies, it is clear that worker actions play a substantial role. OSHA found that over half of all fatal accidents on oil/gas well drilling rigs were caused by poor operating procedures, 48 and worker actions also have been found to be a major contributor to 63 percent of the National Safety Council's accident measure, 49 45 percent of Wisconsin workers' compensation cases, 50 and the majority of accidents among deep sea divers in the North Sea. 51

Recent studies reinforce the view that at best OSHA regulations could have a significant but not dramatic effect on workplace safety. One recent statistical analysis estimated that if there were full compliance with OSHA standards, workplace accidents would drop by just under 10 percent. 52 A recent detailed analysis of workplace accidents in California presented somewhat more optimistic conclusions. At most 50 percent of all fatal accidents were contributed to by violations of OSHA standards that potentially could have been detected by an OSHA inspector visiting the day before the accident. 53

Injury Trends

Because of these limitations and the weakness of the OSHA enforcement effort, it is not surprising that OSHA has no substantial impact on workplace safety. Table 2 summarizes the injury rate trends for the 1972–1983 period for both the manufacturing industry and the entire private sector. The two risk measures are the overall workplace injury rate and the rate for cases that involved at least one lost workday. During the initial years of OSHA operations, firms tended to overreport injuries because they had to adapt to a new reporting system. Nevertheless, the overall trend is clearly downward in the case of overall injuries. Such a decline is not unexpected, since worker accident rates have been declining by about 2 percent annually over the past half century. 54

The pattern exhibited by lost workday accident rates is more erratic. These more serious accidents increased throughout the 1970s, after which they have declined. Although some observers have pointed to the recent declines as evidence of OSHA's effectiveness, much of the decline is no doubt caused by cyclical factors. The years 1981–1982 were periods of escalating unemployment, as total civilian
Table 2. Injury Rate Trends, 1972–1981

<table>
<thead>
<tr>
<th>Year</th>
<th>All Manufacturing</th>
<th>All Private Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall Injury Rate</td>
<td>Lost Workday Injury Rate</td>
</tr>
<tr>
<td></td>
<td>(Incidence Rates per 100 Full-Time Workers)</td>
<td>(Incidence Rates per 100 Full-Time Workers)</td>
</tr>
<tr>
<td>1972</td>
<td>15.6\textsuperscript{a}</td>
<td>4.2\textsuperscript{a}</td>
</tr>
<tr>
<td>1973</td>
<td>15.3</td>
<td>4.5</td>
</tr>
<tr>
<td>1974</td>
<td>14.6</td>
<td>4.7</td>
</tr>
<tr>
<td>1975</td>
<td>13.0</td>
<td>4.5</td>
</tr>
<tr>
<td>1976</td>
<td>13.2</td>
<td>4.8</td>
</tr>
<tr>
<td>1977</td>
<td>13.1</td>
<td>5.1</td>
</tr>
<tr>
<td>1978</td>
<td>13.2</td>
<td>5.6</td>
</tr>
<tr>
<td>1979</td>
<td>13.3</td>
<td>5.9</td>
</tr>
<tr>
<td>1980</td>
<td>12.2</td>
<td>5.4</td>
</tr>
<tr>
<td>1981</td>
<td>11.5</td>
<td>5.1</td>
</tr>
<tr>
<td>1982</td>
<td>10.2</td>
<td>4.4</td>
</tr>
<tr>
<td>1983</td>
<td>9.7</td>
<td>4.2</td>
</tr>
</tbody>
</table>


\textsuperscript{a}Data for agricultural production, all of mining except oil and gas extraction, and railroads were not included in 1972 estimates.

\textsuperscript{b}Excludes firms with fewer than eleven employees.

unemployment rates climbed to 7.5 percent and then to 9.5 percent.\textsuperscript{55} Since workplace accidents are less frequent during cyclical downturns, the recent declines may result in part from shifts in macroeconomic policy.

To distinguish the impact of OSHA from that of cyclical factors and other determinants of health and safety, one can undertake econometric studies that control for these influences. The general consensus of these studies is that there is no evidence of a substantial impact in the 1970s. The author analyzed the 1972–1975 period and failed to find any significant OSHA impact.\textsuperscript{56} Smith found a drop in the lost workday rate at firms inspected in 1973, but not for firms inspected in 1974.\textsuperscript{57} A replication of Smith’s analysis by McCaffrey for the 1976–1978 period failed to yield any significant effects on manufacturing firms.\textsuperscript{58} Similarly, Bartel and Thomas’s analysis of the

Preliminary estimates for the 1973–1982 period suggest that there may have been a modest decline in the rate of accidents as a result of OSHA enforcement. Such an effect is suggestive of a possible increase in the efficacy of OSHA's activities. What was particularly striking is that the OSHA policy variable that seemed most instrumental was the rate of OSHA inspections rather than the penalty level. The degree of OSHA's presence in the workplace and the threat of penalties for continued noncompliance appear to be the fundamental determinants of OSHA's impact.

The possibility of a favorable impact of OSHA on workplace conditions is also borne out in a recent retrospective assessment of the OSHA cotton dust standard. Although compliance with this 1978 standard was not required until 1984, by the end of 1982 the majority of the exposed workers were in work situations in compliance with OSHA standards. Firms' investments in cotton dust controls from 1978–1982 will lead to an annual reduction of about 6,000 cases of byssinosis (a lung disease) annually. The standard remains controversial, however, because it is a costly means for promoting worker health. For example, the cost per case year of total disability prevented will be $1.2 million.

In addition, there remain a number of advocates of the greater use of more performance-oriented alternatives to control cotton dust. One possible policy alternative is to require the use of lightweight cotton dust masks for low to moderate cotton dust levels, which would produce the same benefits as engineering controls at negligible cost. Since byssinosis is a progressive disease that moves through a series of grades and is reversible in its early stages, disposable masks could be coupled with a worker rotation policy. Only for severe cotton dust levels would respirators or engineering controls be required. To date, protective equipment alternatives have not been treated as a viable policy option because of union opposition to such efforts.

The available empirical results for the overall OSHA impact and in the cotton dust case suggest that OSHA enforcement efforts may be beginning to enhance workplace safety. An improvement over the early OSHA experience should be expected, as the standards have been refined and there is more systematic targeting of the inspection
effort. The overall impact remains relatively modest, however, as job
risks continue to be largely dictated by forces other than government
regulation.

AGENDA FOR POLICY REFORM

Since OSHA’s performance continues to fall short of its potential,
there remains a continued need for reform of its efforts. Even with
these reforms, OSHA will not be the dominant force influencing
worker safety. The role of the market in determining safety will con-
tinue to be instrumental. OSHA can augment the existing forces for
safety, but even full compliance with all current OSHA regulations or
those likely to be promulgated will not markedly reduce workplace
risks. The no-risk society that some might envision as OSHA’s ulti-
mate goal is simply unattainable.

Nevertheless, constructive reform of OSHA could enable this
agency to better foster the interests of workers and at the same time
diminish the associated burden on society. A number of specific re-
forms have been advocated in the literature. Rather than review each
of these proposals, the following focuses on changes for which there is
likely to be a broad consensus about the nature of OSHA’s inadequacy
or the proposed remedy.

The first area where reform is needed is the area of emphasis. In
over a decade of regulation OSHA policies have exhibited a slight
shift toward health but have remained largely safety oriented. The
emphasis of both the structure of new regulations and OSHA en-
forcement has continued to be predominantly in the safety area. This
emphasis is misplaced, since market forces are best equipped to ad-
dress safety risks through compensating differentials and related
mechanisms. In addition, the incentives created by workers’ com-
pensation premiums already augment to some extent the market in-
centives for safety. Health hazards are handled less adequately by
both the market and workers’ compensation. Moreover, the coupling
of substantial uncertainties with low probability events involving po-
tentially catastrophic outcomes makes health risks a promising target
for governmental regulation.

The second class of reforms is the need to ensure that we are “on
the frontier” of efficient policies, that is, that we are achieving as much
health and safety improvement as possible for the costs imposed.
Much of the adverse reaction to OSHA’s initial wave of regulations of
toilet seat shapes and the like stemmed largely from the belief that the
regulatory mechanisms had not been well chosen. Much more beneficial improvements in safety and health could have been achieved if OSHA had focused its efforts on issues of more consequence.

Some of the most extraneous features of OSHA policy have been pruned, but there is continued need to find ways to promote safety at less cost. The use of performance standards rather than narrowly defined specification standards could, for example, enable firms to select the cheapest means of achieving the health and safety objective. Such flexibility would reduce compliance costs and increase the incentive of firms to develop innovative technologies to foster health and safety. Moreover, if structured appropriately, as in the grain dust standard, a performance standard need not greatly increase firms' uncertainty regarding whether they are in compliance.

The final reform target is the need for striking a more explicit balance between the health improvements and the costs imposed on society. Labor market estimates of the value of life are now being used to provide guidance in terms of the appropriate trade-off. Such exercises remain controversial, but the need for making some kinds of trade-offs is apparent. It is unlikely that economic research will soon be able to pinpoint the compensatory value of a case of cancer, decreased lung function capacity, or a partial work disability. Nevertheless, if policymakers viewed regulatory alternatives in light of the cost per health benefit achieved, they would at least confront explicitly the nature of the trade-offs and ideally would pursue only those policies that they judged to be in society's best interest.

Although reforming OSHA's regulatory strategy remains a major item on any agenda of important regulatory reforms, it would be an oversimplification to say that OSHA has not improved its efforts over the past decade. The agency has introduced several promising new regulations, has eliminated some of the worst initial regulations, and has better targeted enforcement efforts than they once did.

The future OSHA policies no doubt will continue to exhibit the need for reflecting the three classes of reform elements suggested above, since they are at the heart of any regulatory strategy for workplace health and safety. As a result, complete regulatory reform will never be achieved with the same finality as economic regulation, where, for example, deregulation has transformed the airline industry into a more strictly competitive situation. The need in the health and safety area is for better regulation, not deregulation, and opportunities for improvement will always remain.
NOTES


4These calculations were made by the author using data from Richard Wilson, "Analyzing the Daily Risks of Life," Technology Review, 81, 4 (1979), 40–46.


7The health risks were in effect excluded by informing one subsample of the workers that the chemicals with which they worked would be replaced by sodium bicarbonate (household baking soda).

8The theoretical and empirical basis for the role of wealth effects is provided in Viscusi, note 5.

9See Viscusi, note 2.


11A 3.6 million estimate is the midpoint of the range in Viscusi, note 5. An earlier estimate of $3.4 million was obtained by Smith, note 2, using 1973 data. He also estimated a value of life figure of over $7 million using 1967 data. Lower estimates than these were obtained by Charles Brown, "Equalizing Differences in the Labor Market," Quarterly Journal of Economics, 94, 1 (1980), 113–134. Higher estimates were obtained by Craig Olson, "An Analysis of Wage Differentials Received by Workers on Dangerous Jobs," Journal of Human Resources, 16, 2 (1981), 167–185. For a discussion of heterogeneity in the value of life, see Viscusi, note 2. This analysis has been replicated success-


13 The subsequent discussion of worker experience and quit behavior is based on Viscusi, note 5.

14 For a diverse set of essays on the empirical aspects of decisions under uncertainty, see Daniel Kahneman, Paul Slovic, and Amos Tversky (eds.), *Judgment and Uncertainty: Heuristics and Biases* (Cambridge, Mass.: Cambridge University Press, 1982).


16 Section 3(b), part 7 of 29 U.S.C. 651 (1976).


19 See Viscusi, note 2, pp. 124–126.


21 See, for example, the proposed rulemaking for grain-handling facilities, *Federal Register*, 49, 4 (January 6, 1984), 1004–1007.

22 Viscusi, note 2, p. 124.

23 For a more detailed discussion of the development of OSHA, see Zeckhauser and Nichols, note 2; Laurence Bacow, note 2; Robert S. Smith, note 2; John Mendeloff, note 2; and Viscusi, note 2.


28 See Viscusi, note 2, p. 144.

29 These changes are discussed in the unpublished briefing notes prepared for OSHA officials. See Viscusi, note 2, p. 11.

30 *Federal Register*, 48, 228 (November 28, 1983), 43280.


34 This prominence often is reflected in the academic literature as well. See the opening paragraph of Bacow, note 11, p. 3.

Because of the random nature of major explosions, however, one should not conclude that the risk has been eliminated.


40 U.S. Department of Labor, note 38.

41 Ibid.


43 This change was mandated by a rider to the fiscal year 1977 OSHA appropriations bill.

44 OSHA, note 42, pp. VI–10, VI–11.

45 Viscusi, note 2.


54 See Viscusi, note 2, Chap. 2.


