Alternative Institutional Responses to Asbestos

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Abstract

The level of asbestos risk varies widely, with insulation workers facing risks many orders of magnitude greater than other groups, such as school children. After a period of regulatory neglect, asbestos risks are now among the most stringently regulated risks, with costs per case of cancer prevented on the order of $100 million. Asbestos litigation triggered much of the public action against asbestos, as asbestos cases constituted the majority of all product liability cases in the federal courts from 1988 to 1991. The litigation costs have, however, been substantial, almost three times as great as the amounts transferred to asbestos disease victims. Risk communication potentially could promote efficient risk levels and victim compensation.

Key words: asbestos, risk, tort liability, insurance

Asbestos hazards have been among the most prominent societal risks. Workers’ asbestos exposures have given rise to hundreds of thousands of tort claims against asbestos companies. Asbestos has also been a leading target of government regulation. Other societal institutions, such as workers’ compensation and market processes, also come into play.

The distinctive feature of asbestos is that asbestos risks are virtually synonymous with mass toxic torts. Since the asbestos hazards have given rise to the largest set of mass torts and to one of the most prominent examples of these torts, it is interesting to assess how the various societal institutions that could have dealt with these risks have performed. In this article, I will examine several institutions whose efforts potentially could have influenced the ultimate impact of asbestos on society—the market, workers’ compensation, government regulation, and tort liability.

In making my assessment, I will assume that our objectives are twofold. First, we would like to establish economic incentives to generate efficient levels of the risk. Second, in situations in which people will suffer injuries, it is desirable to provide them with efficient levels of insurance compensation. Because of the lagged nature of the link between asbestos exposures and the adverse outcomes, it is not surprising that the various institutions with responsibility over asbestos did not fully address the deterrence and insurance objectives for all of the populations exposed to asbestos. Nevertheless, these institutions did react to the impact of asbestos and attempt to promote a better societal outcome. How successful these institutions were in performing this task is the subject of this article.

In section 1, I will begin with an exploration of the nature of asbestos risks and their magnitude. I will then examine the role of a market in section 2, and the workers’ compensation system in section 3. After assessing the impact of direct government regu-
lation of asbestos exposures in the environment and the workplace in section 4, I will investigate the rather substantial role of tort liability in section 5. Section 6 concludes.

1. The nature of asbestos risks

Asbestos is one of most well-known carcinogens associated with large individual exposures. Indeed, the adverse health effects resulting from asbestos have given rise to such substantial litigation over the asbestos-related injuries that the rise of mass toxic torts is almost synonymous with the emergence of asbestos litigation.¹

Although asbestos has not been known to be a carcinogen throughout its use, there has long been awareness in the scientific community of the presence of health hazards associated with asbestos.² In 1906, there was documentation of 50 deaths associated with asbestos exposures in a weaving mill in France. After the development of X rays, there was documentation in 1927 of the presence of lung abnormalities among two-thirds of all asbestos workers. This ailment lead to the designation of the term “asbestosis” to describe this particular disease. It was not until 1935 that asbestos was linked to lung cancer. However, this study was not conclusive, since almost all individuals in the study also smoked. Indeed, the first reliable epidemiologic study of asbestos and its link to lung cancer was that of Doll (1955), with the first case of mesothelioma (a cancer of the lining of the lung) being documented in 1956.

The type of asbestos appears to affect the risk level. Asbestos comes in two principal varieties—blue asbestos (or amphibole) is believed to be quite harmful; white asbestos (chrysotile) is believed to pose very little risk. Regulatory efforts and other interventions have not yet reflected these distinctions.

The locus of the asbestos exposures that give rise to the adverse health effects has changed in terms of the scientific assessment of the prevalence of the risk. Whereas public health experts formerly believed that the risk was confined mainly to those subject to high exposures, such as those who work in mines, in the late 1960s, Selikoff documented a risk among insulation workers and in other contexts. More recently, there has been a hypothesis that even smaller levels of exposure to asbestos, such as that present in office buildings, may impose risks as well.

Whether small exposures actually create risks is unclear, since the nature of the dose-response relationship at low levels of dosage is not well established. In the case of asbestosis, for example, the scientific consensus is that there is a low risk threshold that must be exceeded before there is any risk. We typically assume that the asbestos-risk relationship is linear and that this curve passes through the origin, although this assumption is largely a matter of practical convenience and a reflection of official attempts to be “conservative” in the risk estimation procedure. This conservatism does, however, create an upward bias in the risk estimates, particularly at low levels of exposure.

Another distinguishing feature of asbestos risks is the long gestation period before the health effects become apparent. Although some chemical exposures may have acute effects that occur immediately, in the case of asbestos, the lag times involved are considerable. The lag for mesothelioma, for example, is at least ten years after the date of
exposure, and the risk levels for lung cancer appear to continue to increase even 30 years after exposure.

Table 1 summarizes the level of asbestos exposures for different groups. These exposure levels are in terms of the airborne concentrations of the asbestos fibers. School children, who have been the target of recent policy actions, have the lowest levels of exposures, listed at 0.001 f/ml. The highest level of exposures is for insulation workers, who have an average exposure amount of 50–500 f/ml and a maximum exposure amount of 2,000 f/ml. The third and fourth columns of table 1 list the low end of the risk-assessment range and the high end of the risk-assessment range for each category of exposure. This risk-assessment value is the annual probability of death per million exposed members of the population. In the case of school children, the risk values are those given by Mossman et al. (1990). I subsequently extrapolated these risks to the other exposed population groups, using the exposure level information in conjunction with the school children’s risk values and an assumption of a linear dose-response relationship. In making this extrapolation, school children were assumed to be exposed six hours per day for 150 days per year, and all other groups were assumed to be exposed eight hours per day for 250 days per year.

The resulting risk assessments in table 1 indicate that the probabilities of death vary quite widely. Let us consider the high risk assessment values. The lowest values follow a similar pattern, except that they are scaled down proportionately. School children face an annual risk of cancer of 0.09 per million, or a death rate of under one per 10,000,000 children, where this risk is deferred. The low levels of these risks have led some risk analysts to call into question the ambitious asbestos removal programs that may increase the risk by disrupting the asbestos now in place.

For office workers, the risk is considerably greater, both because their exposure concentration levels are greater and because their annual exposure time is greater as well. However, these risks continue to be among the lower asbestos hazards, ranging from under

<table>
<thead>
<tr>
<th>Population Group</th>
<th>Exposure Level f/ml</th>
<th>Low risk assessment</th>
<th>High risk assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>School children</td>
<td>0.001</td>
<td>0.005</td>
<td>0.093</td>
</tr>
<tr>
<td>Office Workers</td>
<td>0.003 - 0.050</td>
<td>0.033 - 0.550</td>
<td>0.621 - 10.4</td>
</tr>
<tr>
<td>Asbestos cement workers</td>
<td>6 - 60</td>
<td>66 - 660</td>
<td>1,242 - 12,421</td>
</tr>
<tr>
<td>Asbestos miners and mill workers</td>
<td>10</td>
<td>110</td>
<td>2,070</td>
</tr>
<tr>
<td>Textile workers</td>
<td>30 ave 300 max</td>
<td>330 3,300</td>
<td>6,210 62,100</td>
</tr>
<tr>
<td>Insulation workers</td>
<td>50 -500 ave 2,000 max</td>
<td>550–5,500 ave 22,000 max</td>
<td>10,351–103,510 414,040</td>
</tr>
</tbody>
</table>

Source: Mossman, et al. (1990), D’Agostino and Wilson (1990), pp. 200 and 203 for the exposure level and calculations by the author for the risk level, assuming a linear dose - response relationship with the school children risk as the base. Worker numbers are adjusted for different exposure levels (hours and days) than school children.
one in a 1,000,000 to one in 10,000 for the high risk assessments. Risks become considerably greater for the other categories. Asbestos cement workers, asbestos miners and mill workers, and textile workers all face risks in excess of one in 1,000 annually.

To put these risks in perspective, the annual accident fatality risk for a typical blue-collar job is 1/10,000 per year. High-risk jobs, such as construction work, pose an annual risk of 1/1,000 per year, and the average American incurs a 1/5,000 annual risk of death from motor-vehicle accidents. However, the fact that these risks are of sizes comparable to various voluntary risks does not imply that they are acceptable and do not warrant policy intervention. Driving motor vehicles and being able to work on risky jobs offers offsetting advantages and, in some cases, explicit monetary compensation. In contrast, not all asbestos exposures may be associated with situations in which there is some type of compensation provided. The highest exposure group listed in table 1 is that of insulation workers, who, at their maximum exposure amount, face an annual risk of death that is almost a 50–50 proposition. If such a risk value is accurate, it is doubtful that this risk is understood by those who bear it, and, without such understanding, competitive market forces will not be fully operative.

It should be noted that extrapolation of asbestos risk probabilities based on the risk value at low levels of exposure is a very hazardous enterprise. If one instead constructs the risk assessment directly based on the observed differential risk of people in these occupations, then one obtains a somewhat different estimate. Overall, the evidence developed by Selikoff (1982) and other researchers suggests that asbestos installation workers have a total cancer risk that is roughly three times greater than that of the rest of the population.3 The overall age-adjusted cancer rate for males in 1980 was 166 deaths per 100,000.4 If asbestos workers face triple this risk of cancer, then their overall risk is 498 per 100,000, or approximately 5,000 per million exposed population. This number is consistent with the upper bound of the low risk assessment value derived using the estimated risk level for school children presented in table 1. Consequently, to be consistent with the other evidence available pertaining to the asbestos risks, it appears that the low risk assessments in table 1 are more pertinent than the high risk assessment values indicated.

2. The role of the market

Perceived risks will generate compensating differentials if they are incurred in a market context. Since the preponderance of asbestos risks are the result of workplace exposures, these market processes are potentially operative. Even in the case of exposures that might be viewed as more purely environmental, such as asbestos in the schools, there may be a market response if taxpayers are aware of the risk levels and take these risk levels into account in deciding on the appropriate level of school expenditures.

Although there are contexts in which such market forces may be quite powerful, they tend to differ from those associated with the characteristics present in the case of asbestos exposures. Acute risks on the job that generate immediate losses, such as job injuries and accidental fatalities, lead to substantial workplace compensation for risk. On average, workers receive $3 million to $7 million per statistical life lost,5 where the midpoint of
this range of $5 million will be used as the reference point in subsequent discussion. There is also substantial evidence that characteristics of local schools vary with community characteristics, although these variations tend to be in terms of monitorable attributes such as levels of expenditures per child, test score performance records, and the quality of school facilities, rather than asbestos exposures.

Although asbestos risks do not represent a worst-case scenario for potentially effective market performance, many severe impediments are present that will limit the efficacy of market forces. The risks posed by asbestos are not readily apparent to workers or others who might face the risk. Asbestos fibers do not appear intrinsically harmful, whereas a loose handrail or a sharp object does present apparent hazards. In addition, after exposure to asbestos, one does not receive immediate feedback regarding the presence of a risk and its health effects. For many chemical exposures, there may be readily monitorable noxious fumes, and, after a short period of exposure, the workers may develop headaches or other nonfatal symptoms that serve as signals of potentially greater hazards. The series of ailments linked to asbestos, including asbestosis, may provide a similar kind of signal, but this signal does not occur immediately, and the possible link to more serious consequences will not be apparent to those experiencing the symptoms. A third factor limiting the development of market relationships is that the asbestos risk linkages are probabilistic rather than certain. If all asbestos workers died of lung cancer, then inferences would be much more clear-cut than if, for example, their lung cancer risk rates were simply elevated by a factor of three. Because of the presence of multiple causes, including the high historical rate of smoking among asbestos workers, making the linkages is difficult for scientists, much less for workers. Only in the case of mesothelioma, which is a signature disease linked to asbestos, are precise scientific judgments feasible.

Even if workers have access to the state of scientific knowledge, this knowledge has been a moving target that is difficult for them to track. There have been a large number of studies of asbestos risks, often involving quite different populations with different exposures and characteristics. Although it is reasonable to conclude based on these studies that there is a mortality risk from asbestos exposures, the extent of the risk is more difficult to ascertain. Scientific studies often report ratios of observed to expected numbers of deaths for different worker groups, but how these statistics translate into probabilities or other comparisons that are meaningful to workers is more problematic.

A critical distinguishing feature of asbestos exposures is the time lag involved between the time of the exposure and the generation of the risk. Because of the lack of immediacy, scientific and more casual inferences are complicated by the contributing role of multiple causes of the ailments. In a world with substantial worker mobility, it is infeasible for workers to track the performance of their coworkers for health outcomes which do not yield illnesses that occur in the workplace, as is the case for acute industrial accidents.

Although the impediments to market performance are severe, there nevertheless may be some role for market forces. Unions represent one institution that could play a constructive role, by acting collectively on behalf of workers in obtaining asbestos risk information and using this information in promoting safer workplaces. It is noteworthy that unions contributed financial support for Selikoff’s work and served as a primary impetus for putting asbestos risks on the workplace risk agenda. In other contexts, unions play an
important role in generating hazard premiums for risky workplace conditions.\textsuperscript{7} There is no available evidence on whether unions have generated similar differentials for asbestos exposures. Moreover, even if effective, unions also have the disadvantage that they only represent a minority of workers—roughly 18\% of the nation’s workforce.\textsuperscript{8}

For over a decade, the Occupational Safety and Health Administration has required that hazardous chemical exposures in the workplace be accompanied by a hazard warning. Figure 1 presents a draft of a hazard warning that has been prepared to be consistent with standard industry practice for the preparation of hazard warnings. This warning was utilized in a worker survey by Viscusi and O’Connor (1984) to ascertain workers’ responses to risk. It is noteworthy that this warning does not convey the probability that is involved. Such quantitative information is not the norm in hazard-warning contexts. Indeed, the only warnings that include such quantitative information tend to be the adverse reaction probabilities associated with certain prescription drugs. In that case, the target recipient of the information is not the individual consumer but rather the learned intermediary—the physician, who has taken courses in pharmacology and who has been trained in the processing of this information. The issue to be explored here is whether risk information of the type included in figure 1 could generate reasonable market responses.

Table 2 presents the effect of this hazard warning on worker beliefs and risk premiums. Before receiving the asbestos warning, workers were asked to rate the severity of the risks on their job on a scale ranging from zero to 1.0, where the scale was in terms of the equivalent annual nonfatal job injury risk that was comparably risky to the worker’s job. Workers at four different chemical plants not currently exposed to asbestos assessed their job risk as being 0.09, where this is the equivalent annual risk of nonfatal injury. After

![Figure 1.](image-url)
Table 2. Hazard warnings for asbestos and worker behavior

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial risk assessment (0-1 probability scale)</td>
<td>0.09</td>
</tr>
<tr>
<td>Risk assessment after warning (0-1 probability scale)</td>
<td>0.26</td>
</tr>
<tr>
<td>Workers refusing to stay on job at any wage (fraction)</td>
<td>0.11</td>
</tr>
<tr>
<td>Workers intending to quit if no wage increase (fraction)</td>
<td>0.65</td>
</tr>
<tr>
<td>Workers who would take the job again if no wage increase (fraction)</td>
<td>0.11</td>
</tr>
<tr>
<td>Additional wage premium for risk required ($1982)</td>
<td>$2,996</td>
</tr>
<tr>
<td>Implicit value of an injury (value per statistical injury) in $1982</td>
<td>$17,624</td>
</tr>
</tbody>
</table>

being given the asbestos risk warning and being told that this chemical would replace the chemical with which they now worked, workers assessed the risk equivalent as being 0.26. Chemical workers exposed to asbestos consequently believed that their risk level would be tripled by asbestos exposures. The first prerequisite for market operation, that there be perceptions of the risk, consequently is well-founded, although there is no assurance based on the results presented thus far that the level of the risk response is correct.9

Workers indicated that the hazard warning would affect their attitude toward the job. Overall, 11% indicated that they would refuse to work with asbestos under any circumstances, 65% indicated that they would quit if their wage were not increased, and only 11% indicated that they would take the job again if no wage increase were given.

The critical factor here is the additional wage premium which the workers would have requested. In 1982 dollars, the value of these premiums was $2,996. For the injuries, on the standardized job injury scale, one can obtain an implicit value for each statistical injury. For example, a worker who requires $2,000 to face an added risk of 1/10 has an implicit value of each expected injury of $2,000/(1/10), or $20,000. Viewed somewhat differently, a group of ten workers, each of whom faced an identical injury risk of 1/10, would face an expected death in their group, but would be willing to bear the risk in return for $20,000 compensation. Using the implied compensation values obtained using a regression analysis of the change in wage compensation required for a change in risk, one obtains an implicit value per injury of $17,624, which is in line with other market estimates for injury values.10

Let me utilize the wage premium results to assess whether workers are valuing the risk adequately. If markets provide too little incentive for safety, the value of risks will be too low. When converted to December 1993 prices, the amount of compensation workers require to face asbestos risks totals $4,527 per year. Suppose that workers place a $5 million value on their statistical life, as is consistent with the midpoint of the estimated range found in the literature, as reported in Viscusi (1992, 1993). Then the compensation figure amount is appropriate if the annual risk of death from asbestos exposures is 900 deaths per million workers exposed. This calculation, however, assumes that the death risk is immediate. If, however, there is a 20-year lag before the risk and if workers have a real discount rate of 3%, then the implicit annual risk needed to generate compensation levels of this magnitude is 1,600 deaths per million workers. The time lag involved in the generation of asbestos risk affecting the life expectancy that will be lost will be less as well, and this factor must also be considered before making a comparison to workers who
suffer acute accidents. If workers who are the victims of asbestos-related exposures suffer half of the discounted expected life expectancy losses of workers who are killed by acute injuries on the job, then the critical risk level needed to generate the observed compensation amounts, based on rational risk-taking decisions, would be an annual risk of 3,200 deaths per million workers. An asbestos risk level of this amount coupled with the required compensation levels would yield results consistent with existing estimates in the value-of-life literature.

Whether these numbers are reasonable depends on the reference point which one uses for the risk and the level of exposure for the job. The results in table 1 for insulation workers, for example, have a midpoint exposure level that is much greater than that of office workers exposed to asbestos. Where the exposure level of the chemical workers in the survey falls along this continuum is unclear. However, in practice, one can manipulate the character of the warning by strengthening the language and the prominence of the asbestos warning to make it more context-specific. Based on the estimates in table 1, which were based on extrapolations from the risks of school children, the implied risk assessment is greater than that for office workers and comparable to the midpoint of the low risk assessment range for insulation workers—the highest risk group in the table. As was noted above, consistency with explicit estimates of cancer rates suggests that, for insulation workers, the low risk range is more reflective of the actual risk.

Although, in practice, it would be feasible to run tests of alternative warnings for different contexts so as to generate differences in risk perceptions, pinpoint precision does not seem to be warranted based on the lack of precision in our underlying scientific knowledge. The overall objective of these warnings should be to develop a market in response that alerts workers to the potentially severe consequences of the risk, generates compensating differentials of a broadly appropriate magnitude, and provides the financial incentives to firms so that they will make appropriate safety decisions. The evidence presented here suggests that hazard-communication methods could serve a constructive role in that regard. However, before one would want to pursue this approach in a policy context, it would be important to examine other aspects of the hazard-communication policy. In addition to determining the efficacy of different types of warnings for differing severities of asbestos exposure, it would also be desirable to examine how responsive workers were to taking asbestos-related precautions when presented with appropriate warnings, as opposed to being mandated to take these precautions through government regulations. In addition, these results are conditional upon workers being presented the information and processing it. Efforts would be needed to ensure that these critical informational linkages were not overlooked in the development of the risk-communication system. It should also be emphasized that this potential role for the market is largely a prospective possibility. The current wave of asbestos-related illnesses and the illnesses that will be experienced for decades to come will largely be the result of exposures during an earlier informational regime. The most that is feasible is to align current exposure levels with the amounts that workers would choose if cognizant of the risk and if they made rational decisions with respect to these hazards.
3. Workers’ compensation as an ex post remedy

Even if workers are not aware of the risks, they potentially could receive compensation after the fact through workers’ compensation. In the case of risks generated by workplace exposures, workers are not permitted to bring tort actions against their employers. Instead, they must rely upon the administrative compensation remedy of workers’ compensation, which is a social insurance system that is run by the individual states. Victims of job-related diseases associated with asbestos can, however, still bring tort actions against companies such as the asbestos suppliers, that manufactured products used in the workplace. The first wave of asbestos claims were workers’ compensation claims, and these were followed by tort actions. The role of these tort actions will be considered in section 5.

In the case of workers’ compensation claims, the requirements are not as stringent as for a tort action. In particular, the worker need not prove that the asbestos injury was the result of the employer’s negligence. If, however, the worker is successful in his or her claim, then the level of compensation received will not fully replace the economic loss, as would be the intent of a court award in a tort judgment. Workers’ compensation awards generally consist of an amount that equals two-thirds of the worker’s wage level, although this amount is subject to various caps and floors. As a result, workers’ compensation awards are typically significantly smaller than the recovery amounts in successful tort suits.11

The workers’ compensation system not only provides income benefits to workers, but it also creates considerable financial incentives for firms. These incentives are a pivotal force in leading firms to make workplaces safe. Indeed, workplace fatalities would be 27% higher than they are today if it were not for the financial incentives created by workers’ compensation.12 However, if this compensation is denied for a class of diseases such as asbestos, because disease victims are unable to qualify for benefits, then there will not be a comparable incentive affect.

Unfortunately, the characteristics of asbestos hazards are strongly linked to contexts in which workers’ compensation does not perform adequately. The first requirement for receiving workers’ compensation is that the worker must show that the injury arose out of and in the course of employment. Meeting this causation requirement is possible in the case of a signature disease, such mesothelioma, but, for lung cancer, determining causality is not feasible. The most that can be done is to assess some probability that the lung cancer was job-related. However, doing so requires detailed information on the worker’s history of exposure and personal activities, such as smoking status and broader environmental risk exposures. Since most workers’ compensation systems require that the disease be “peculiar to the worker’s occupation” rather than simply one of the “ordinary diseases of life,” then workers face the task of making what may be a difficult linkage. The problems of multiple causation coupled with the long time lag before asbestos exposures generate adverse health outcomes consequently impede workers’ efforts to meet the job-relatedness test.

A second impediment to workers obtaining a recovery is that there are often specific time limits for filing claims. This statute of limitations may begin at the time of the initial
exposure to the chemical hazards rather than at the time of the onset of the adverse health effects resulting from these hazards. Thus, the statute of limitations may be set in such a way that this statute is run before the worker is aware that he or she has, in fact, experienced an illness attributable to asbestos exposures.\textsuperscript{13}

Because of impediments such as these, workers' compensation has generally been an effective remedy for illnesses, as opposed to acute accidents. Employers, for example, are six times more likely to contest a workers' compensation claim pertaining to a disease than to an accident claim.\textsuperscript{14} If successful with the suit, workers with accident claims generally receive workers' compensation benefits within two months, whereas victims of occupational disease wait an average of one year before receiving benefits.\textsuperscript{15} Overall, occupational illnesses have lower payoff rates than do occupational accidents, where this discrepancy incurs, in part, because disease victims will often negotiate workers' compensation settlements at a lower level because of the poorer prospects that their claims have.\textsuperscript{16} The net result is that many workers simply do not file these claims at all.

Because of the high risk levels associated with asbestos, as well as the presence of some signature disease aspects of asbestos-related illnesses, the performance of asbestos cases in the workers' compensation system has been much more successful than for illnesses overall. The majority of workers—61% who file claims—obtain full workers' compensation awards for their illnesses, and 25% receive modified compensation levels.\textsuperscript{17} Only 3% of the asbestos-related claims are denied, and 1% are dropped. The level of workers' compensation for asbestos is consequently quite substantial and may, in fact, represent a best-case scenario for the performance of workers' compensation in dealing with illnesses.

What these results do not take into account is the number of workers who do not file claims, because they believe that their prospects are too adverse. Moreover, since a full workers' compensation award only partially compensates for the economic loss and does little to address the overall adverse effects on workers' health, even a fully effective workers' compensation system will not create adequate incentives for safety. To do so, the awards would have to be on the order of $5 million per statistical life, where one should also make the appropriate adjustments for the quantity of life that is being lost. However, this deterrence value-of-life figure dwarfs the amount that is appropriate from the standpoint of compensation or that is, in practice, awarded to workers under the workers' compensation system.

The basic difficulty is that under workers' compensation, the funds are paid to workers ex post—after they have suffered the illness, rather than before the adverse outcome. If workers face a one chance in a thousand risk of death and have a value of a statistical life of $5 million, then a $5,000 annual wage premium will provide both appropriate compensation to them as well as efficient incentives for safety. In contrast, a $5-million workers' compensation award to a worker who has contracted lung cancer will provide efficient financial incentives, but the compensation levels will be excessive. In effect, too much insurance will be provided to workers in a situation in which the marginal utility of income is relatively low. This incompatibility between setting compensation levels that create appropriate incentives for safety and efficient levels of insurance is an inherent
weakness of all ex post compensation systems that maintain a link between the costs imposed by the firm and the ex post awards to the victims.

To address our two societal objects of efficient levels of safety and efficient levels of insurance, one can break the linkage. The government could impose financial incentives on firms that did not necessarily lead to higher benefits to workers, such as an injury and illness tax or a penalty for high levels of workplace exposures. Such remedies, which have been frequently suggested by economists, have never yet been adopted. Instead, the government has relied upon direct regulatory remedies through the health and safety regulations administered by the U.S. Occupational Safety and Health Administration. Setting safety standards through the use of government regulation can generate efficient levels of safety. The role of such regulation will be explored in the next section.

4. Asbestos regulation

The major wave of exposures to asbestos occurred during World War II, when thousands of workers in shipyards were exposed to asbestos in the course of ship construction. Although spraying the inside of ships with asbestos led to fewer asbestos fibers being airborne than if the asbestos were applied in dry form, the substantial amounts of asbestos used, as well as the size of the population exposed, led to a considerable risk. Other groups, such as insulation workers and office workers, continued to be exposed to asbestos even after the war was concluded.

In contrast, the principal agencies with the responsibility for health and safety regulation had not even come into existence at that time. Both the U.S. Occupational Safety and Health Administration and the U.S. Environmental Protection Agency began operation in the early 1970s. Although the federal government did have some preexisting groups responsible for environmental issues before that time, such as in the area of water quality, it was only in the 1970s that comprehensive responsibility for individual health and safety became an important governmental concern.

In the case of both OSHA and EPA, the primary regulatory approach has been to adopt health, safety, and environmental standards that mandate the adoption of particular technologies or establish upper limits for permissible exposure or pollution amounts. Other alternative approaches could have been used, such as the imposition of fines for high risk exposure levels or fines linked to a firm’s record of worker injuries and illnesses. Rather than levying financial sanctions or utilizing permit-type systems in which there would be explicit pricing of risk, the emphasis has been on quite specific health and safety mandates.

To set such standards efficiently, ideally one would want to trade off the cost of more stringent regulation against the expected benefits to strike a balance reflecting society’s willingness to pay for the risk reduction. Suppose that the pertinent risk-dollar tradeoff is $5 million per statistical life, where this is the midpoint of the estimated range in the labor-market, value-of-life literature. In addition, in this particular example, let us also assume that this value reflects the level of stringency that OSHA has set for asbestos regulation. In particular, suppose that the agency has limited the concentration of asbestos
fibers in the air such that any additional reduction in these concentrations would cost $5 million for each statistical life that would be saved. If the agency were to set regulations in this manner, they would be in line with economists’ usual recommendations for efficient levels of safety.

However, how does the existence of additional safety incentives provided through workers’ compensation alter this result? Would the standard value-of-life guideline be appropriate, given the existence of workers’ compensation as an additional mechanism for creating safety incentives? Suppose, for example, that, after a fatality workers receive workers’ compensation valued at $200,000. Does the presence of this compensation imply that the OSHA regulation is excessively stringent, or can this compensation be ignored? Unless the value of the workers’ compensation benefit per statistical life exceeds the $5 million per life saved threshold, it will not affect a firm’s decisions.19 From the standpoint of the firm, if it were to reduce asbestos exposure levels to reduce its workers’ compensation burden, then doing so would save lives at a cost of $5 million per statistical life or more. So long as the value of workers’ compensation benefits is less than this amount, workers’ compensation will not provide an incentive for workplaces to do more than is required by the technologically specified OSHA standards. Because the OSHA standard is, in effect, the floor on required safety levels, not a financial penalty per statistical death, the presence of additional financial incentives will not be pertinent.

OSHA’s efforts to regulate the asbestos area began almost immediately after the establishment of the agency. OSHA’s enabling legislation was the Occupational Safety and Health Act of 1970, which established the agency which began operation on April 28, 1971. Shortly after beginning operations, OSHA established a permissible exposure limit for asbestos of 12 fibers per cubic centimeter of air in 1971.20 Later that year OSHA issued a emergency temporary standard of 5 fibers per cubic centimeter. The 1972 OSHA standard was phased in over time.21 Initially, beginning in mid-1972 the eight-hour, time-weighted average employee exposure was limited to 5 fibers, no longer than 5 micrometers, per cubic centimeter of air. The second phase of this standard, effective in 1976, limited exposure amounts to 2 fibers per cubic centimeters of air. The 1972 asbestos regulation prevented worker deaths at a cost in 1993 dollars of $35.6 million per statistical life saved.22 Thus, based on any reasonable notion of economic efficiency, the 1972 OSHA standard was excessively stringent, in terms of striking appropriate balance between the costs imposed by the regulation and the associated benefits.

Notwithstanding the excessive stringency of the initial OSHA standard, OSHA tightened the standard in 1986. In 1986, OSHA increased the stringency of the asbestos standard, reducing the permissible exposure limit from 2 fibers per cubic centimeter to 0.2 fibers per cubic centimeter.23 The 1986 asbestos regulation imposed a cost of $124.1 million per statistical life saved. The most recent lightening of the OSHA standard in 1994 decreased the permissible exposure limit further to 0.1 fibers per cubic centimeter.24 Although asbestos was under-regulated during the pre-OSHA era, the agency, in effect, overreacted after initiating its regulatory efforts. Compared to other opportunities for enhancing safety, current asbestos regulation is a very extreme allocation of societal resources. The U.S. Department of Transportation, for example, does not pursue safety
measures if their cost is $3 million or more. More vigorous transportation safety efforts would be a beneficial substitute for excessive safety efforts of OSHA.

The OSHA standards were not alone in being excessively stringent. EPA has also undertaken an overly zealous effort against asbestos. The EPA asbestos regulation promulgated in 1986 had an associated cost per statistical life saved of $144.8 million. This cost makes the EPA asbestos standard one of the least cost-effective risk regulations ever issued by a government risk-regulation agency.

The substantial regulatory attention devoted to asbestos seems to have been stimulated by the widespread media attention devoted to asbestos risks. The emergence of mass toxic torts and the surge in product liability cases associated with asbestos put asbestos risks prominently on the national risk-regulation agenda. However, the risks that were in evidence in the 1970s and 1980s were risks that had been generated by exposures many years earlier. Although asbestos has clearly been identified as a “bad actor,” not all risks in society should be reduced to zero. Asbestos is a well-known flame retardant and has many beneficial uses, such as in brake linings. In effect, asbestos has been eliminated as an industrial product because of the risks that it created in an earlier era when exposure levels were much lighter. The level of the risks and the costs of reducing the risks cannot account for the excessive regulation that was imposed on asbestos.

It may, of course, be the case that a substance is too risky to be used in our economy. The mortality costs associated with a product may be so great that society should not permit its use. However, such a judgment will be apparent, if indeed it is correct, after one sets an appropriate risk-money tradeoff threshold when promulgating the risk regulation. If EPA and OSHA had regulated asbestos exposures to a level at which the cost per life saved was in the vicinity of $5 million per statistical life, then there would have been an explicit market test of whether asbestos was a viable product, once its risk level had been reduced to efficient levels. It may have been that once the level of asbestos exposures had been limited in this manner that it would have been economically efficient to substitute other products, such as fiberglass, for asbestos for some uses, but to retain asbestos for others. However, since this market experiment was not carried out, it is unlikely that the virtual elimination of the asbestos industry which followed the promulgation of these standards was a socially efficient outcome. Rather, this action seems more likely to be an alarmist overreaction to a well-publicized risk that was a convenient target for excessively stringent government regulation.

5. Asbestos and tort liability

Although asbestos regulations have been among the most stringent government regulations, perhaps the dominant institutional player with respect to asbestos has been the courts. Indeed, asbestos litigation has been so prevalent that the tort liability crisis of the 1980s might not even have reached levels meriting the “crisis” designation had it not been for the wave of asbestos-related suits.

Figure 2 gives a profile of the trends and personal-injury, product-liability cases in federal courts and those cases excluding asbestos. After 1980, the trend in federal cases
The Relative Shares of Asbestos and Nonasbestos Litigation, 1975-1992

![Graph showing the relative shares of asbestos and nonasbestos litigation, 1975-1992.](image)


excluding asbestos is relatively constant, apart from a dip in 1984 and a subsequent increase in 1985. In contrast, the overall personal-injury, product-liability total caseload rose steadily until 1988. After a modest dip in 1989, the asbestos caseload peaked in 1990, after which there has been a dramatic decline. By 1992, the asbestos caseload of cases commenced had dropped to its lowest level since 1985, with a value of less than half of its peak amount only two years earlier. The year 1992 was also first year since 1986 when asbestos cases commenced did not outnumber nonasbestos cases commenced in the federal courts. If these trends continue, it appears that the brunt of the asbestos crisis has already been addressed by the courts. Lower levels of asbestos exposures, which are the result of almost two decades of stringent government regulation, will decrease these amounts further. Beginning in 1987, there were more asbestos-related cases in the federal courts than those not involving asbestos. In 1975 and 1976, there were fewer than 100 asbestos cases commenced annually, and, by 1989, this number had reached 8,230.

This dominant role of asbestos in the 1980s is even more apparent in figure 3 in which the percentage share of asbestos cases is indicated, as is the percentage share of cases not involving asbestos. Whereas asbestos cases constituted 2% of all federal product-liability litigation in 1975, by 1981, its share had increased to one-fifth, and, by 1989, 61% of all federal product-liability cases were asbestos-related. After a brief decline in 1989, the asbestos case share peaked at 73% in 1990, after which it plummeted to 41% in 1992.

The rising trend in asbestos cases over the 1980s dwarfs that of other product-liability cases. Moreover, when compared to the overall pace of civil litigation more generally, as shown in figure 4, asbestos cases remain an outlier. Personal-injury, product-liability cases not involving asbestos have generally comprised from 2% to 3.5% of all civil cases. The

asbestos share was close to 0% in 1975, and it reached a high of 6.3% in 1990. The role of asbestos consequently became not only important relative to other personal injury cases, but within the context of all civil cases being handled in the federal courts.

The relative size of the asbestos litigation relative to other mass toxic torts is exemplified in the statistics presented in figure 5, which are based on a report prepared for the American Bar Association. The Manville cases and the other asbestos cases involved a total of 340,000 personal-injury claimants at the time of this tally, which is roughly equal to the total number of claimants involved in all of the other mass toxic tort cases indicated, including the Dalkon Shield, Agent Orange, DES, and Bendectin litigations.

Figure 5. The number of personal claimants in mass torts litigation. Source: Rheingold (1990), p. 150.
The character of the asbestos litigation was quite different from that of the standard manufacturing-defect case that dominated the product-liability agenda before asbestos. Unlike case-specific defects, asbestos affected an entire product line as well as all uses of the product. Miners, insulation workers, shipyard workers, brake mechanics, and school children were among the many groups who had asbestos exposures. Although there are also large consumer groups in the case of mass-marketed consumer products, defects in these products typically can be identified rather quickly. Reports of explosions involving rear impact with the Ford Pinto and more recently with side impacts on the General Motors trucks have created substantial awareness of the presence of a risk. In the case of asbestos, there was no immediate feedback, as there were very large populations exposed to the risk for decades before the extent of the risk became apparent. As a result, once the liability became apparent, there was a wave of cases because of the backlog of exposures and the gestation period involved in the disease.

This backlog had two practical consequences. First, because any compensation paid would be handed out long after the initial exposure, the incentives that this compensation provided for safety would be diminished. Companies in the case of asbestos could not anticipate the extent of the liability. For example, a 1982 insurance company worst-case scenario estimate of 81,000 claims was exceeded by an actual claims-to-date estimate in 1990 of 180,000. Indeed, the scientific relationship between asbestos and cancer had not been well-established at the time of much of the exposure that was the subject of the litigation. Because companies did not have a state-of-the-information defense, but instead faced the situation of retroactive liability, they were liable for substantial costs, but were unable to reverse their earlier actions that had led to the asbestos exposures. Asbestos companies and those exposed to asbestos certainly were not ignorant of the presence of some health risks associated with asbestos, as the effect of asbestos exposures on lung-related morbidity effects was well-known. However, there is no reason to believe that companies were aware of the full extent of the cancer hazards while scientists still remained ignorant of these risks.

The substantial mass tort cases that resulted have had a second consequence as well. The magnitude of the compensation may exceed a company’s ability to pay for the losses. As a consequence, the insurance objective of tort liability will not be met. One can impose costs on a company to cover previous risk exposures, but if these costs were not anticipated at the time of the initial exposure, they will only serve as a lump-sum tax. They will not create efficient incentives for safety. The costs of the asbestos suits were so great that, at one point, the estimated value of the claims against the asbestos industry exceeded the total financial resources of all asbestos producers and insurers.

In making their claims, plaintiffs face an unusually stringent burden in the case of toxic tort exposures. The plaintiff must first show that asbestos is unreasonably dangerous, which is the simplest of the tasks that must be met. Much more difficult is showing that asbestos was the proximate cause of the disease. Making a linkage is clear-cut in the case of mesothelioma, which is a signature disease that occurs very rarely, except in the case of asbestos exposures. However, lung cancer is much more problematic, as there are multiple causes, of which asbestos is but one. A final critical linkage is demonstrating that the particular manufacturer’s product led to the injury. A mechanic who installed brakes
with asbestos linings of uncertain origin is much less well-positioned to identify the manufacturer than is an insulation worker who installed Manville insulation.

The difficulties inherent in the asbestos litigation have led to substantial transaction costs associated with the litigation of these cases. One survey indicated that plaintiffs incurred litigation costs that averaged $25,000 per claim, with defendants incurring an expenditure of $95,000 per closed claim. Indeed, the plaintiffs' take from the total liability award is only 59% of the compensation award, as the remainder is devoted to legal fees. Defendants spent an amount that was equal to 58% of the average award. The combined litigation costs exceed the amount received by plaintiffs, so that, for every dollar which plaintiffs received, there is a total cost, involving litigation costs to both parties, of $2.71.

These results have been corroborated in other samples as well. An examination of 513 asbestos claims resolved from 1980 to 1982 indicated that the average expenditures per case was $101,000, of which only $39,000 was the net compensation received by the plaintiff. The remainder consisted of $37,000 for the litigation expenses of the defense and $25,000 for the litigation expenses of the plaintiff. For each $1 in compensation received, there is a total societal expenditure of $2.56.

This is a much more inefficient loading rate than with any line of insurance offered by the insurance industry. Quite simply, if the objective of tort liability for asbestos is insurance, it compares quite unfavorably with other insurance-type remedies that are present in other contexts. In the case of workers' compensation, for example, workers receive roughly $0.80 in compensation for every $1 in premiums. Although this estimate excludes litigation costs, there is little doubt that social insurance programs such as this are much more efficient income-transfer mechanisms.

The substantial size of the compensation resulting from the asbestos litigation had practical consequences for the affected firms. The largest share of the asbestos litigation was for the company now known as the Manville Corporation. As was indicated in figure 5, this firm accounted for over half of all asbestos litigation.

These claims did not, however, emerge immediately, as the caseload trends in figures 2–4 have indicated. The long trail of liability claims facing the company raises two problems. First, claimants who filed claims later in the claims process, because of lags before their diseases became apparent, incurred a risk of not being compensated at all for their claims if the company’s resources proved to be insufficient. Second, from the standpoint of the company, it became difficult to continue operations in a viable manner when facing such a continuing financial drain from the litigation.

To address these financial pressures, Manville reorganized under federal bankruptcy provisions and established a $2.6 billion trust fund to be used to compensate the asbestos victims. To generate these resources, all the insurance payments received by payments received from Manville’s insurance, as well as 80% of the company’s net worth, were devoted to the fund’s resources. In addition to these amounts, Manville also set aside a $300-million fund to address the property-value claims associated with asbestos. Although there was a wide range of settlement levels, on average, the initial settlements were in the vicinity of $40,000 each.
The difficulty with establishing any fund intended to cover long-run financial effects is that it is difficult to predict reliably the extent of the ultimate liability. Moreover, unless the scheduling is quite precise and one also has a reliable breakdown of the distribution of the severity of the claims, there were will be additional uncertainties as well.

The important role of such uncertainties did not take long to emerge. Less than a year after the fund was established, the claims filed exceeded the available cash resources. One difficulty is that not all of the resources provided by Manville were liquid. The only amounts that were on hand were the funds received by Manville from its insurers, which totaled only $670 million. After paying off 15,000 pre-bankruptcy claimants an average amount of $40,000 per claim, Manville began to experience cash-flow problems with respect to its trust fund. With new claims arriving at a rate of 11,000–12,000 per month, the long-term prospects for the fund were not bright.

To meet these needs, in 1990, Manville offered recipients a mixture of an immediate return and a long-term obligation. In particular, the settlements offered consisted of up to 40% of the amount of the claim in cash, with the rest being in nonmarketable long-term notes that would be payable in the next year or thereafter. Pushing off the obligation over time did not, however, resolve the issue of the long-term viability of the fund, since the average settlement level of $41,907 exceeded the average value of $25,000, which was the estimate that was used to determine the original financial viability of the fund.

The stopgap nature of altering the mixture of payments soon seemed inadequate. The remaining resources in the asbestos trust fund (not all of which were liquid) were believed to be, at most, $1.5 billion in 1990, whereas the estimated claims and administrative costs faced by the fund were five times that amount, or $7.5 billion. These dim financial prospects led one judge to observe: “The trust cannot pay one widow in Brooklyn today and a widow living elsewhere, whose husband died of the same disease, 20 years from now... A national uniform plan is required.” In an effort to meet the financial needs of the claimants, Judge Jack B. Weinstein pressured Manville into augmenting the fund with an additional $520 million over the next seven years. However, since there were an estimated 130,000 claims remaining to be paid at the time that these additional funds were added, the long-term viability of the fund remains in question.

6. Conclusion

In many respects, toxic torts represent a worst-case scenario facing institutions with responsibilities over risk. At the time of the original individual exposures to asbestos that generated the wave of asbestos disease, there was little knowledge of the extent of the risk or the strength of the link between asbestos exposures and cancer. As a result, the market forces could not function effectively, because the exposed workers were not cognizant of the risks which they faced. Government agencies that could potentially have controlled the risk were not created until about a quarter of a century after the large-scale exposures during World War II. The pertinent elements of tort liability that ultimately would prove to be pivotal in subsequent asbestos litigation had not been established in the 1940s, and only became resolved several decades later. As a result, companies could not anticipate the
ultimate cost which they would face and take these costs into account when setting the level of workplace safety. The ultimate levels of compensation consequently did not provide safety incentives to the earlier era, as they would have if they had been anticipated.

This period of comparative ignorance was followed by a surge of asbestos-related diseases that resulted from a combination of the high potency of asbestos exposures and the large numbers of individuals exposed. The prevalence of these cases, coupled with the attention that the asbestos litigation received in the media, focused substantial public attention on asbestos risks.

Government regulatory agencies seem to have reacted to this concern, as both EPA and OSHA enacted extremely stringent asbestos standards. With costs per statistical life saved well in excess of $100 million, the asbestos regulations rank among the most stringent risk regulations ever enacted. Whereas government efforts to control asbestos exposures were nonexistent during the greatest period of exposure, after the fact, the government overreacted, perhaps in an effort to compensate for its past inattention. This strong government overreaction is somewhat ironic, since much of the original asbestos exposure can be attributed to work in shipyards during World War II, in which the contractors followed the specifications requiring the use of asbestos that were mandated by the U.S. government. As in the case of Agent Orange, the government should be regarded as a principal contributor to the emergence of the asbestos-disease epidemic, as opposed to simply being guilty of regulatory inattention.

The epidemic of asbestos-related illnesses put strains not only on the workers’ compensation system, but also on the tort system. The preponderance of all product-liability cases in the federal courts was related to asbestos. Rather than simply being a significant line of litigation, asbestos cases threatened to dominate the courts altogether. Court awards will do little to create financial incentives retroactively, but they may create prospective incentives if companies can anticipate these awards in future cases of this type. Because of the surge in litigation, the compensation needs of the asbestos victims have continued to outpace the financial resources available to meet these needs. As a result, the long-run financial viability of the asbestos compensation funds remains in question.

The funds transferred as a result of these actions may do more than simply transfer resources to those who have experienced illnesses and the lawyers who represent them. Incentives for safety may change as well.

Although little can be done to correct past errors, society can establish mechanisms that will address risks such as those related to asbestos prospectively if there is information pertaining to the presence of the hazard. In a world in which government agencies are charged with responsibility for environmental and workplace exposures to risk, failure to take action against risks that merit attention, based on existing scientific evidence, would represent a regulatory failure, not simply a failure on the part of a corporation. These government agencies can establish efficient levels of safety by setting worker and individual exposure standards efficiently. Based on past performance, coupled with the fact that these agencies’ legislative mandates prohibit setting standards based on benefit-cost considerations, the net outcome is that, when these regulations are set, they are typically excessively stringent. As a consequence, government regulation is potentially a very
effective mechanism for ensuring that the level of risk exposures is not too great when judged from the standpoint of trading off the cost of additional risk control against the health benefits.

Even if the risk level is set efficiently, that effort will only address the efficient risk objective, not the compensation objective. Individuals exposed to risk and who are not compensated for their losses still might be viewed as meriting additional attention. It is possible to meet their compensation needs using various risk-communication mechanisms. If hazard warnings are provided to individuals exposed to risks in market contexts, as in the workplace, they will demand additional compensation to bear the risks or else will seek work elsewhere. This type of effect has been well-documented for workplace risks. How successful this risk-communication effort could be depends, in large part, upon whether the risk could be communicated effectively. In the case of low-probability events, there is often the danger that there will be an alarmist reaction to risk and an excessive societal response. Although excessive complacency is often the danger in the absence of risk information, the dominant form of market failure that is observed in the presence of risk information is the overreaction to highly publicized risks or small risks that are difficult for individuals to conceptualize. As a result, considerable care must be exercised in the design and pretesting of an effective hazard-communication system. Moreover, it may not be the case that the risk can be communicated effectively and in a manner that will generate efficient levels of market compensation in all instances. Nevertheless, it is worthwhile to explore this approach and to assess it viability, since doing so will lead to the provision of compensation to people exposed to risk, thus augmenting the influence of government regulation in controlling the risk level.

Remedies after the fact include both tort liability and workers’ compensation. However, in each case, these remedies are hindered by problems of multiple causality. Except in the case of signature diseases, such as mesothelioma, it is not possible to ascertain whether the adverse outcome is due to the particular risk exposure or to some other broader environmental risk. Compensating all disease victims will be inordinately expensive and will lead to the same kinds of infeasible financial structures that arose in the course of asbestos litigation.

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<th>Table 3. Comparative efficacy of different social institutions</th>
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The provision of compensation not explicitly linked to diseases caused by identifiable parties who are responsible for the costs, in effect, makes these efforts more similar to a broadly based insurance effort. In that instance, one might view compensation of asbestos workers and not other workers with lung cancer or similarly grave ailments as creating an unjustifiable inequity across deserving groups.

Notes

1. As noted by Sinfield (1994) and others, the 1974 asbestos decision in *Borel v. Fibreboard* was pivotal in the emergence of mass toxic torts.
2. This review draws extensively on the information presented in D’Agostino and Wilson (1993).
3. These studies by Selikoff (1982) as well as the related literature are incorporated into the analysis of the ratio observed to expected cancer cases presented in D’Agostino and Wilson (1993), p. 194.
7. See Viscusi (1979) for documentation of the union effect.
9. Since the risk equivalent is a nonfatal accident risk, and the asbestos risk of concern is fatal, one must first establish an equivalency scale to convert nonfatal risk perceptions into fatal risk beliefs.
13. In some states, individuals can obtain workers’ compensation benefits only if the adverse health effects occur within a specific period of the last exposure to the risk. The Georgia statute, for example, disallows asbestos-related claims unless the death or disability occurs within three years after exposure to workplace hazard. See Georgia Code Ann§34-9-281(B) (1982).
15. See Interim Report, p. 3.
19. This result assumes, of course, that we are dealing in a world with complete enforcement of government regulations. In a world of incomplete enforcement, workers’ compensation will help to establish safety incentives in situations in which there is not effective enforcement by the agency.
26. By one estimate, potential asbestos industry liability, expressed in current dollars, is $38.2 billion. The net worth of the asbestos industry at that time was approximately $25.6 billion. The combined net worth of the
insurance companies that were involved in asbestos claims so far was $11.5 billion. See MacAvoy, Karr, and Wilson (1982), pp. 76–78. The tremendous scientific uncertainties and difficulties involved in demonstrating causality create a substantial potential variance of the true cost around these estimates.

27. This result and the data in the rest of the paragraph are drawn from Kakalik et al. (1983), except when noted otherwise.


30. Bureau of National Affairs, Product Safety & Liability Reporter (September 15, 1989), pp. 901–902. The other statistics in this paragraph are also based on this article. Of the $2.6 billion trust fund, $2.5 billion was dedicated to personal injuries.


References


