*Statistical Science*
1988, Vol. 3, No. 3, 339–345

# Insurability of Hazardous Materials Activities

**Michael S. Baram**

*Abstract.* Insurance is essential to technologic advance and also serves other important social functions. "Insurance market failures" must therefore be evaluated so that appropriate remedial actions can be taken by private insurers, and in some instances, by government. The recent insurance crisis for companies producing and using hazardous materials is examined, with particular attention given to six factors: new tort liability rules, judicial interpretation of insurance contracts, declining interest rates, reluctant reinsurers, government policies based on "new federalism" concepts and inadequate attention to risk analysis. The importance of improving risk analysis techniques to promote their use by insurers is determined to be the fundamental reform needed to restore the private insurance function.

*Key words and phrases:* Insurance, tort liability, reinsurance, interest rates, risk analysis, hazard insurance.

## 1. THE INSURANCE FUNCTION—SOME BASIC CONSIDERATIONS

Insurance has played a central role in promoting technologic advances and private commerce since the 14th century when the first policies were written in Italy and Portugal.[1]

Essentially, insurance is a contractual device by which one party, the insurer, agrees to pay another party an agreed sum upon the occurrence of a contingent event (the risk). In the case of "first-party coverage," the insurer agrees to reimburse the insured for losses suffered as a result of specified perils. Under "third party coverage," the insurer agrees to assume liability to others for harms caused by the insured's activities. In either case, the insured is transferring certain economic risks to the insurer in exchange for payment of a premium.

The social importance of insurance for third party coverage stems from the social functions it serves. First, it assures that the injured will be compensated and minimal justice will be done. Second, it assures that economic losses arising from the insured's activities will be spread sufficiently so as not to seriously impair the insured. Third, it enables the insured firm to undertake new technologic initiatives and other activities of social and economic importance, despite certain risks of economic loss.

A narrower view of insurance is held by those who offer it. To insurers, any type of insurance is an investment system for their profit, wherein premiums received and invested should produce monetary yields superior to any losses that they may have to pay. When third party coverage for activities which could produce very high losses is sought by, for example, the operator of large technologic systems, coverage has traditionally been provided by an international team of insurers, including a direct insurer, several co-insurers and numerous reinsurers based in London, Munich or other reinsurance centers overseas (linked by private "treaties").[2]

In many instances where insurance is needed for compensatory justice, or to facilitate certain technologic advances or achieve other social goals, the private insurance sector has not responded with adequate coverage at affordable rates. These "insurance market failures" occur because private insurers find the risks too uncertain or their calculus indicates that profits may be inadequate. In such cases, new forms of insurance have been developed so that some sort of insurance function will be provided. Many of these new mechanisms have been structured or developed by government, as in the cases of state worker's compensation systems for workplace injuries and Price Anderson insurance for the operation of nuclear reactors.[3] However, new mechanisms for restoring the insurance function have also been developed by firms unable to secure affordable private insurance, such as the self-insurance and "captive insurance"

*Michael S. Baram is Director, Center for Law and Technology, Boston University School of Law. He is also a partner in the law firm of Bracken and Baram, 33 Mount Vernon Street, Boston, Massachusetts 02108.*

systems developed by the manufacturers of various products.[4]

## 2. THE INSURANCE CRISIS FOR INDUSTRY WITH HAZARDOUS MATERIALS

Private insurers have recently curtailed insurance coverage for many industrial firms producing, handling or using hazardous materials and for other firms disposing of wastes. This development exposes these firms to full liability, inhibits their taking new initiatives and frustrates government goals such as industrial removal and disposal of asbestos and other hazardous products. It also exposes the public to the spectre of injury without adequate compensation.

This action has been taken by private insurers for several reasons. Understanding these reasons is an essential first step for the development of strategies which could lead to a restoration of this insurance function. The major reasons include at least the following: new tort liability rules, judicial interpretation of insurance contracts, declining interest rates, the withdrawal of reinsurers, government policies based on "new federalism" concepts and inadequate attention to risk analysis tools. These will now be briefly discussed.

## 3. NEW TORT LIABILITY RULES

Tort law barriers to claims by parties seeking compensation from industry for personal injuries and property damages have been lowered by the courts in many states; mainly in numerous cases involving asbestos[5] (product liability actions by employees of firms using asbestos brought against product manufacturers) and hazardous wastes[6] (suits by the Environmental Protection Agency (EPA) and states against generators of hazardous wastes for cleanup and cost recovery under federal hazardous waste laws, *CERCLA* and *RCRA*). As a result, plaintiffs have become increasingly successful in securing high jury awards of compensatory and punitive damages and settlements from corporate defendants.[7]

"Joint and several liability" is the most controversial of the tort reforms. It provides that "damages for a total injury are assessable against each of two or more tortfeasors whose wrong was a substantial factor in proximately causing injury ··· whenever the total injury cannot be subdivided and liability for its several parts attributed and allocated to individual tortfeasors."[8] This rule, now adopted in many states, has important consequences. For example, a plaintiff need not demonstrate what portion of the harm suffered is attributable to any particular responsible party; and the plaintiff can proceed against fewer than all responsible parties and obtain full recovery from one or more of the parties it names as defendants. This leaves to defendants the task of reallocating liability by obtaining contribution from others who may also be responsible for the harm.[9]

These and other tort reforms have been made by the courts to "do justice" for the victims of toxic exposure and other types of industrial wrongdoing. Many argue that the reforms have had a devastating economic impact on industry and its insurers, and have been the major cause of the insurance crisis facing firms which produce, handle or use hazardous materials. Others argue that these tort reforms are necessary to do justice in toxic chemical injury cases, and have not had these devastating impacts, and have pointed to the lack of convincing economic data and other proof of economic hardship.[10] At this time, proponents of both views are intensively lobbying state and federal legislators.

## 4. JUDICIAL INTERPRETATION OF INSURANCE CONTRACTS

Several types of insurance policies have been written to provide coverage for industrial activities which cause bodily injury or property damage to third parties. The Comprehensive General Liability (CGL) policy has generally provided coverage for industrial harms which arise from "occurrences that are sudden and accidental" in character. The Umbrella Insurance (UI) policy was designed to provide broader coverage also on a sudden and accidental occurrence basis. But in 1966, many insurers modified the terms of their CGL and UI policies to provide coverage for occurrences that were either sudden or prolonged. This was short-lived. By 1970, these insurers perceived that injuries from gradual pollution could become the subject of extensive litigation, and to reduce their vulnerability, modified the terms of both types of policies to exclude coverage for harms and losses due to pollution. However, their "pollution exclusion" posture led other insurers to "fill the gap" by offering new Environmental Impairment Liability (EIL) policies for gradual pollution coverage. Thus, insurers scrambled to make policies attractive to industry in order to place more coverage and thereby acquire more premiums which could be invested at high interest rates.[11]

However, since 1973, gradual pollution and latent disease problems and litigation against industry have dramatically increased, and disputes over insurance contract provisions and coverage have been brought to the courts. United States courts have traditionally construed insurance policies to favor insureds and victims, in order to assure that victims are compensated and insured industrial firms avoid the devastating effects of liability. This traditional view has been

brought to bear on disputes involving coverage for gradual pollution and its latent disease and ground water contamination consequences under CGL, UI and EIL policies written over the preceding decades. Thus, courts have consistently held that losses due to gradual, repeated or continuing pollution are covered by such policies, provided neither the pollution nor the injuries were intended. In so holding, the courts have essentially redefined any "sudden and accidental" provisions in such policies to include what they were intended to exclude, namely gradual or repeated pollution occurrences.[12]

The courts have also been called on to resolve disputes over which policy (and insurer) must cover the loss from an insured's polluting activity which had continued through many policies placed sequentially by various insurers. Some courts have adopted an "exposure theory," under which the insurer who must indemnify for the harm is the one who provided coverage at the time of the injurious exposure—which may have been decades earlier. Other courts have favored a "manifestation theory" under which the date when the harm became manifest (or reasonably capable of diagnosis) determines which policy applies. Finally, the United States Court of Appeals for the District of Columbia has adopted a "continuous injury theory" under which each insurer on the risk between initial exposure and the manifestation of disease is liable ··· with the full insurance obligation to be divided among all the insurers ···." In addition, courts have imposed on insurers the "duty to defend" their insureds, and have penalized insurers who failed this duty.[13] Thus, insurers have incurred significant litigation costs in complex toxic tort cases, long after policies have terminated.

Insurers have not fared well in the courts, and the unexpected economic consequences allegedly have been severe with the property and casualty sector of the insurance industry reporting in 1984 its first loss ($3.55 billion) since 1906. To cope, insurers initially took steps to modify the terms and price of insurance coverage for industry handling hazardous materials. They stopped offering EIL coverage, except in some instances offering it on a "claims made" basis in order to narrow their loss exposure to the finite period of the policy. They also clarified the pollution exclusion language of CGL and UI policies to secure more favorable judicial interpretation in the future, and significantly increased the price of such insurance.[14]

Most recently, insurers have taken the more drastic step of severely reducing the availability of third party coverage for firms using hazardous materials and further increasing the cost of whatever coverage is offered. Thus, the producers, users and handlers of hazardous materials face today's insurance availability and affordability crisis, a matter which has become an important societal problem, one which has led many states to hastily enact various measures to ameliorate the economic distress of insurers in order to restore the insurance function.[15]

## 5. DECLINING INTEREST RATES

Although changes in tort liability rules and unfavorable judicial decisions on coverage issues have impacted insurers, other factors have produced even more significant economic impacts. These other factors essentially involve how insurers run their business and gain income, and the variability of interest rates.

Insurers can gain income from two sources: underwriting so that premiums exceed claims paid and related expenses and investing premiums at favorable interest rates. However, over the last decade of high interest rates (1970s), insurers put all their eggs in the investment basket. They relied on their substantial investment gains to produce net income, and used this situation as a basis for underpricing policies in order to beat out competitors and produce more premium income for investment. Essentially, insurers became money managers, abandoning their traditional role as risk managers.[16]

According to a recent federal report, "For a number of years, many companies have been willing to accept lower premiums in order to compete ··· even though claims and expenses exceeded the premiums ··· [and] expect to make up the premium shortfall through investment income ··· For instance, in 1983 the industry's claims and expenses exceeded premiums by about 12 percent, which produced an underwriting loss of about $11 billion. Even so, the industry had a net gain of about $8 billion ··· due to its pricing strategy and investment income." For many years, this strategy paid off. According to the report. "While property/casualty companies had about $46 billion in underwriting losses from 1975 through 1984, they also had about $121 billion in investment gains ··· resulting in a net gain of about $75 billion for those years."[17]

But interest rates steadily declined in the latter part of this 10-year period, diminishing investment income at a time when tort liability claims and expenses and underwriting losses were increasing. Despite these signals, insurers held fast to their money manager role and continued to forsake risk manager functions. The tide turned in 1984, when underwriting losses finally exceeded investment gains, and the insurance crisis was born.[18]

Such evaluations of the insurance industry over time have established its great dependence on interest rates and its cyclical nature. They also establish that

when insurers play money manager, and eschew the risk manager role, as they usually do when interest rates are rising, they are riding a tiger—increasing their vulnerability by underpricing their services and becoming increasingly ignorant of new risks and risk analysis methods. Thus, the current insurance crisis, like its predecessors, has multiple causes, only some of which derive from polluting industries, a litigatious society and judges and juries sympathetic to the plight of victims.[19]

To overcome problems arising from declining interest rates, we have two obvious options. One is to somehow drive interest rates up, so that prevailing management policies in the insurance sector of relying almost exclusively on investment for income will succeed, an unlikely prospect given our track record in controlling interest and given the harmful effects this would have on other societal concerns. The other is to somehow bring about a more balanced management approach in the highly competitive insurance industry, one in which the risk management role and the proper pricing of coverage would be given greater emphasis so that the significance of interest rate changes would be diminished.

## 6. REINSURANCE COLLAPSE

In order to provide coverage for any industrial activity which has the potential for a very high "maximum credible loss," a direct insurer must put together a team of co-insurers and reinsurers on the risk. Linkages to reinsurers are generally established by private "treaties," under which reinsurers agree to assume up to 90% or more of the loss insured against in return for a proportionate share of the premiums paid to the direct insurer by the insured. Without reinsurers, direct insurers would be unable to provide third party coverage for many industrial firms.[20]

Reinsurers are investors clustered in major reinsurance centers, such as Lloyds in London and the Swiss Re in Zurich, and are not subject to American regulation. Without many of the functions of direct insurers (e.g., sales, billing, etc.), reinsurers essentially function as money managers and have been highly dependent on the risk analysis expertise of the direct insurers who select which industrial firms and activities to insure and who determine the pricing and terms of coverage. Since the late 1970s, reinsurers have borne a significant share of the losses arising from the Three Mile Island accident and other costly industrial accidents around the world, and the losses arising from hazardous waste and asbestos litigation in the United States.[21]

As a result of these losses, their fear of and distaste for American tort liability rules, declining interest rates and investment income, and their loss of confidence in the risk analysis capabilities of their American direct insurers, reinsurers have responded by refusing to continue to contract with direct insurers on coverage for the hazardous materials industry. This has had the effect of forcing American direct insurers, unable to assume large risks on their own, to substantially reduce the availability of insurance for firms handling hazardous materials.

The reinsurance world is now divided. Some reinsurers, like Lloyds, intend to persist as money managers, and to avoid providing reinsurance on hazardous materials activity subject to the jurisdiction of American courts and tort liability rules. Other reinsurers, like Swiss Re, are developing the in-house technical expertise in health and environmental risk analysis which will enable them to cautiously and rationally return to providing reinsurance for the chemical industry and other firms handling hazardous materials, without complete reliance on the expertise of direct insurers.[22]

Therefore, restoration of the insurance function for the hazardous materials industry will require restoration of the reinsurance function. Because the major reinsurance centers function outside the domain of American law, they cannot be legally required by Congress to restore their prior relationships with direct insurers in the United States. Congressional options are therefore limited to enacting changes in the American liability system which could induce re-entry by reinsurers, or to fostering the establishment of private reinsurance pools in the United States, or to establishing a federally-funded reinsurance pool similar to that created by the Price-Anderson Act for nuclear power activities.[23]

## 7. EFFECTS OF "NEW FEDERALISM"

The Reagan administration's commitment to curbing governmental growth and delegating societal problem-solving to the private sector and state government has also contributed to the insurance crisis facing the hazardous materials industry. Regulation of industrial activities which generate risks and consequent losses has been deliberately slowed and agency budgets reduced. EPA and other federal agencies now deal with newly recognized industrial hazards (such as chemical industry accidents) by formulating policies which suggest private sector and state initiatives but which avoid any use of federal regulatory authority.[24] Presidental commissions and aides have also argued against the establishment of federally funded or administered victim's compensation programs to replace tort liability.

Administration representatives have even testified before Congress in favor of joint and several liability for firms responsible for hazardous waste problems, in

order to push the costs of cleanup as fully as possible on private firms and their insurers. Without joint and several liability, the federal government would be able to recover from each firm only that portion of the total cleanup costs which it can prove was caused by the firm's wastes, an inefficient process marked by enormous technical difficulty and cost and requiring substantial federal budget increases. Further, without joint and several liability, the government would be precluded from recovering the cleanup costs for wastes caused by unknown or insolvent parties, making full recovery difficult, if not impossible, further increasing federal budget growth.[25]

Finally, proponents of a reduced federal government and a "new federalism" have recommended that some federal regulatory functions for protecting health and environment be borne by insurers. According to the Cato Institute:

> There are many business activities that place third parties, employees, or consumers at risk. The traditional response has been government regulations ··· There remains a need to find a better way to control business behavior ··· we would raise the hypothesis that private insurers should provide a more efficient, effective alternative.
>
> ··· insurers who protect third parties have strong incentives to police the behavior of firms whose actions directly affect the financial exposure of the insurer. Consequently, we would expect insurance companies to develop risk assessment procedures and to use these to mandate risk management strategies for their customers.[26]

Thus, political forces have been at work adding to the burdens of insurers, in order to avoid the development of new federal functions and the enlargement of the federal budget. Insurers have been less than enthusiastic about assuming such social control responsibilities, and "new federalism" has therefore also contributed to the current insurance crisis.

## 8. RISK ANALYSIS FOR RESTORING THE INSURANCE FUNCTION

To restore the private insurance function, the foregoing causes of the current insurance crisis must be dealt with. All signs point to the need for increased use of risk analysis by industrial firms involved in risky activities and by private insurers and reinsurers. If risk analysis is good enough and actually used in risk management, its predictive capability will enable these users to reduce hazards, exposures, injuries, liability and other losses.

Industrial firms using good risk analysis could take steps to prevent risks, and thereby blunt the economic effects of new tort liability rules. Some have argued that the joint and several liability doctrine makes risk analysis meaningless as a loss control measure, because no matter how careful a firm may be in managing its risks, the firm and its insurer may still bear the burden of paying for the full loss arising from less careful co-defendants. However, this argument against risk analysis is weakened by the fact that the careful firm can subsequently take legal action to secure contributions from the less careful co-defendants.

Insurers using good risk analysis could make better decisions as to which firms to insure, set appropriate prices and terms which would reduce underwriting losses, and clarify ambiguous policy provisions. These actions could blunt other causes of the insurance crisis, namely unfavorable judicial interpretations of insurance policy ambiguities, and insurer reliance on investment income and vulnerability to changes in interest rates. Although it may be too much to realistically expect, insurers may also be induced to assume some of the social control functions proposed by "new federalism" advocates if insurers develop confidence in the predictive capabilities of risk analysis.[27]

So the key questions are whether risk analysis can become good enough in terms of predictive capability as to risks and losses for potential users in the industrial, insurance and reinsurance sectors; and if it does, whether the potential users would rely on it and restore the private insurance function.

Over the last decade of accident losses and gradual pollution losses, prevailing methods of risk analysis have been shown to be inadequate. These methods, based primarily on safety engineering, have failed to adequately consider several nonengineering aspects of *accident risk*: for example, the training of key personnel, turnover of skilled employees, use of untrained part timers (e.g., on weekends, when many industrial accidents occur), the need to limit exposure by exercising continuing efforts to limit population density around chemical plants and other risky sites, the need for emergency response planning and actual rehearsals in the site community to reduce post-accident losses.

Thus, risk analysis for industrial accident prevention must be sequential and not "synoptic": it must view risk as an ongoing operational problem requiring ongoing monitoring and control, not as a one time task for design engineers to create a "Maginot Line" against risk.[28] For these and other reasons, risk analysis has been particularly inadequate in dealing with *gradual pollution and its loss consequences*—latent disease, property damage and resource contamination. Gradual pollution has been viewed by risk analysts as a "routine" industrial activity to be conducted in compliance with any relevant government and industrial

standards. Because risk analysis has been practiced by industrial safety personnel, it has tended to ignore the chronic disease and other health hazards which may become manifest even if activities are in compliance with standards and has ignored "downstream" consequences of hazardous materials in commerce. Thus, the sale of hazardous products without adequate warnings and instructions for safe use and disposal, and the "downstream" distribution of hazardous materials in commerce without careful consideration of the management capability of downstream users and foreseeable misuse of products and wastes have led to numerous harms and losses (e.g., asbestos, urea formaldehyde, EDB, etc.). Risk analysis of these routine activities should involve more careful development of risk and loss scenarios over the life cycle of hazardous chemical products, and involve greater reliance on new disciplines in the health and social sciences, such as biostatistics, epidemiology and risk communication, for example.[29]

Risk and its control is a sequential or continuing problem of considerable complexity, and risk analysis is still an art form and incomplete in many respects. As developed by academic and regulatory experts, its limitations for industrial and insurer use are apparent. Academic and agency approaches emphasize the statistical probability of injury occurrence, whereas industrial and insurer concerns are focussed on the "maximum credible loss" which may threaten their economic survival. Thus, industrial and insurance views are focussed on risk and loss magnitude, as it may arise from a single event or the aggregation of many events over time, and further, recognize that losses may arise even without actual injury—as in the case of numerous property damage suits now brought to secure over $73 billion for removal of asbestos insulation from buildings under strict products liability and breach of warranty theories.

Methods of risk analysis must be substantially improved and modified to include loss considerations if they are to become useful to industrial firms and their insurers, and promote a restoration of the private insurance function. The same considerations apply if alternative methods for developing necessary insurance functions are to be fostered (e.g., government insurance and reinsurance, industrial self insurance and captive insurance pools).

## 9. CONCLUSION

Restoring the insurance function may come about from the current lobbying efforts of industry and insurers. If they are successful, state and federal legislators will modify tort liability rules. But it is unlikely that this negative approach to the insurance crisis will lead to a restoring of the private insurance function because many other contributing factors, such as those discussed above, will not have been dealt with.

Risk analysis, if improved and put to use, has the potential for dealing with all the contributing factors and restoring the private insurance function, or alternatively facilitating the development of alternative insurance functions by government and industry. A positive approach should therefore be taken jointly by government, industry and insurers to meet the recurring insurance crisis problem by improving risk and loss predictive capability and putting the results to good use.

## ACKNOWLEDGMENT

This paper is derived from research supported in part by National Science Foundation Grant PRA-81-16657.

## NOTES

[1] VANCE, W. (1907). The early history of insurance law. *Columbia Law Rev.* **8** 1.

[2] WEBB, B. (1984). Reinsurance as a social tool. *Issues in Insurance* **II**. Amer. Institute Property and Liability Underwriters, Malvern, Pa. See also MUNDAY, G. (1986). Evolving trends in environmental audit and risk assessment for environmental liability insurance in Europe. *Avoiding and Managing Environmental Damage*, Proceedings, Air Pollution Control Association, Pittsburgh, Pa.

[3] Some of these government-fostered insurance programs are discussed in BARAM, M. (1982). *Alternatives to Regulation*. Lexington Books, D. C. Heath, Boston.

[4] The federal *Product Liability Risk Retention Act*, 15 U.S.C. 3901 (1981), facilitated the formation of "captive insurers" by various product manufacturers faced with the product liability insurance crisis in the 1970s. It may be amended soon to deal with the current insurance crisis. See H.R. 4442 (March 18, 1986) for one of several proposed amendments before Congress.

[5] BRODEUR, P. (1985). The asbestos industry on trial. A four part series in the *New Yorker* (June, July) for documentation of asbestos litigation.

[6] See *Superfund—Litigation and Cleanup*, Special Report, Bureau of National Affairs, Inc., Washington (1985), for documentation of hazardous waste litigation.

[7] BARAM, M. (1985). "Chemical industry hazards: Liability, insurance and the role of risk analysis" for discussion of major changes in tort law and its liability rules, including modifying the statute of limitations, providing for strict liability theory, providing for imposition of liability on a "joint and several" basis, permitting the introduction of circumstantial scientific evidence of causation and expanding the "duty to warn" concept. Paper presented at Annual Meeting, Geneva Association, Twelfth General Assembly, Oslo, Norway (June 1985). To be published in *Conference Proceedings on Hazardous Materials*, International Institute of Applied Systems Analysis, Vienna, Austria.

[8] *New Jersey Department of Environmental Protection v. Ventron*, 19 ERC 1505 at 1510 (1983).

[9] Some states have dealt with this burden: e.g., New Jersey has its *Joint Tortfeasor Contribution Act*, N.J.S.A. 2A:53A-1, *et seq.* to provide a framework for apportionment of liability in such cases.

[10] A pro-industry view of these tort reforms and their insurance

implications is set forth in *Report of the Tort Policy Working Group on the Causes, Extent and Policy Implications of the Current Crisis in Insurance Availability and Affordability*, U.S. Attorney General, Washington, D.C. (Feb. 1986). A pro-victim view is presented in *An Analysis of the Causes of the Current Crisis of Unavailability and Unaffordability of Liability Insurance*, National Association of Attorneys General (May 1986).

[11] See M. Baram, note 7. Also see *Insurance Coverage and Practice*, Defense Research Institute, Chicago (1985).

[12] *Id.* In the words of one court: "In construing whether or not a certain result is accidental, it is customary to review the casualty from the perspective of the insured, and applying the ordinary and proper meaning of the term, determine whether it was unexpected, unusual and unforeseen ··· if there was no intent to cause harm, then any injury resulting from ordinary negligence is considered to be accidental ··· The word "sudden" as used in liability insurance need not be limited to an instantaneous happening." *Allstate Insurance v. Klock Oil*, 426 N.Y.S. 2d 603 (4th Dept. 1980) at 605.

[13] See note 11.

[14] *Id.* Also see, for example: DIAMOND, S. (1985). Insurance against pollution is cut. *The New York Times* (March 11) 1; and numerous articles in insurance trade journals.

[15] *Id.*

[16] See G. Munday, note 2.

[17] "Profitability of the property/casualty insurance industry," Statement of Wm. Anderson, Director, General Government Division of the U. S. General Accounting Office, before the Subcommittee on Oversight, Committee on Ways and Means, U. S. House Rep. (Mar. 13, 1986).

[18] *Id.*

[19] See "Report of the investment income task force" in *Issues in Insurance* **II**, note 2.

[20] See B. Webb, "Reinsurance as a social tool," note 2.

[21] At Risk: Survey of International Insurance. *The Economist* **284** n.7256 (Sept. 25, 1982).

[22] Personal communications with reinsurer representatives, 1985–86. Also see A. Klaus, "Practical Aspects of Environmental Impairment Liability" (Swiss Reinsurance Company, Zurich), paper presented at Conference on Hazardous Materials, International Institute for Applied Systems Analysis, Laxenberg, Austria (July 1–6, 1985), to be published in Conference Proceedings by IIASA.

[23] 42 U.S.C. s. 2011–2281. Also see discussion in M. Baram, *Alternatives to Regulation*, note 3.

[24] For example, EPA's response to chemical accident hazards since Bhopal has been to conduct extensive research and issue a guidance to state and local officials rather than assert its regulatory authority directly on the problem. See *Chemical Emergency Preparedness Program*, U.S. EPA (Dec. 1985).

[25] See for example, "New debates on superfund liability," *Chemical Week* (June 19, 1985) 40.

[26] "Risk management: Through regulation or insurance," Conference Proceedings, Cato Institute, Washington (May 1985) 1.

[27] Private insurers have cautiously reentered the flood insurance market within the federal legal framework for the National Flood Insurance Program, due in part to federal development of flood risk analysis methods.

[28] See M. Baram, "Chemical industry hazards: Liability, insurance and the role of risk analysis," note 7. Also see papers in APCA Proceedings, note 2.

[29] *Id.*