Columbia/Wharton-Penn Roundtable on
Risk Management Strategies in an Uncertain World

Reducing Risk with Management-Based Regulation

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Efforts by government regulators to prevent incidents such as plane crashes, nuclear meltdowns, building fires, or security breaches can consist in part of efforts to specify technological or performance requirements for various components of these regulatory problems. For example, technology-based regulatory standards specify design features for how planes or reactors are built, while performance-based standards govern such things as the flammability of building materials or the reliability of security screening. Setting these technological and performance standards can be difficult. But the challenge for government regulators who seek to reduce low-probability, high-consequence events is made even more difficult when these risks arise due to complex interactions and system failures. The risk of such an event is sometimes not a risk of the failure of a single component, which could easily be regulated with a targeted technological or performance standard, but rather the risk arising out of the way that different system components interact or fail to interact.

Risks created by systemic interaction are ones for which it is difficult for government to apply conventional technological or performance standards. When risks arise from the interactions of design or technological components, their sources can vary greatly from facility to facility. Even within the same industrial sector and even among firms that utilize similar technologies, the ways that firms integrate technological processes can be highly varied. To address such risks, technology-based standards will be difficult to apply, since the problem does not arise from any specific technology, but rather how different technological, process, or human factors interact. Performance standards are also limited, because the performance that regulators seek to affect is the performance of the entire system and the avoidance of a catastrophic event. From the regulator's perspective, the loss of human life is what is to be avoided, rather than what should be used to measure a firm's performance.

How, then, should government regulate to address the possibility of systemic failures leading to extreme events? Of course, asking this question presupposes that government should regulate at all. Given the private costs to firms themselves that are associated with extreme accidents, as well as the existence of tort liability operating in the background, firms already have an incentive to reduce the risks associated with how the processes and technologies they deploy interact. Yet even though firms may have some incentive to ensure the prevention of an extreme event, this does not mean that they have adequate or socially optimal incentives. Neither the firm's private losses nor those social losses for which a firm may find itself liable through tort litigation will necessarily fully capture all the social costs associated with a low-probability, high-consequence event. Moreover, since these events are of a sufficiently low probability, firms may inadequately recognize their potential incidence and thereby inadequately analyze and develop responses for systemic failure. For these kinds of reasons, government may need to play a role in ensuring greater attentiveness on the part of firms toward the possibility of systemic problems that will lead to high-consequence events.

An emerging regulatory strategy, which I call "management-based regulation," may be the most appropriate governmental response for addressing certain extreme events. Unlike traditional, command and control regulatory strategies, management-based regulation requires firms to do their own analysis, decision-making, and internal regulating about how to achieve socially optimal levels of public safety. Management-based regulation may be the best possible strategy for addressing problems where the desired performance of regulated firms is difficult to measure or undesirable to rely upon as the sole basis for a regulatory standard (such as avoidance of a catastrophe). It may also be appropriate in settings where there is a high degree of heterogeneity among firms, which makes it difficult for a regulatory to specify an appropriate technology-based regulatory standard. Indeed, it is precisely in such settings where outputs are difficult to measure and industrial processes are heterogeneous that management based regulation has been implemented in the United States.

Management-based approaches to regulation are currently being applied in the United States to ensure food safety and to prevent chemical accidents. Food safety is now governed by a regulatory regime called HACCP – an acronym that stands for *H*azards *A*nalysis and *C*ritical *C*ontrol *P*oints. HACCP requires firms to search for potential sources of contamination in their food-handling processes and to devise strategies for monitoring, reducing, and correcting these dangers. A management-based strategy such as HACCP has been thought to be superior to the conventional performance-based inspections, by which inspectors would simply poke meat and smell it for odors associated with contamination. There are simply too many facilities that process all kinds of food for government inspection by itself to be adequate. Moreover, after-the-fact liability is imperfect, since it can be very difficult to trace specific cases of food poisoning to problems at specific food processing facilities, since food contamination can occur in food preparation and storage as well as in food processing.

A similar regulatory regime applies to the chemical industry in an effort to prevent accidents. Both EPA and OSHA have established standards for "process safety

management" or risk management of highly hazardous substances. Much as with HACCP, these process safety regulations require firms to implement a multi-step management practice to assess risks of chemical accidents, develop procedures designed to reduce those risks, and take actions to ensure that procedures are carried out in practice. Such a management-based approach seems appropriate, since chemical accidents can arise from highly heterogeneous, complex processes. The degree of heterogeneity is indicated by the fact that OSHA's process safety standard governs more than 25,000 facilities nationwide, and EPA's risk management plan requirement affects more than 70,000 facilities. When dealing with such a large number of firms and aiming to reduce system failures, a management-based approach would appear to be the superior regulatory strategy, since it enlists the firms themselves in regulatory decision-making.

In principle, management-based regulation offers several important advantages over conventional regulatory approaches that specify technologies or specific levels of outcomes. Although firms may not face an adequate incentive to manage themselves in a socially optimal way, they are almost always going to be the cheapest source of information about their own processes and about potential control methods. As a result, if government can spur firms to invest in more systematic planning then firms would otherwise choose, the resulting plans and procedures that firms adopt in response to a management-based regulation are likely to be more cost-effective than procedures or plans that the government might impose. In addition, since these plans address complex interactions that can be affected by human factors, by requiring the decision making to take place at the firm level, there may be a greater compliance with any resulting plans and standards. Finally, by giving firms discretion in planning and creating their own internal "regulations," management-based requirements allow greater room for adaptive response and innovation.

Some of my recent publications on the subject of management-based regulation include: *Regulating from the Inside: Can Environmental Management Systems Achieve Policy Goals?* (Resources for the Future Press, 2001) (with Jennifer Nash); "Bolstering Private-Sector Environmental Management," *Issues in Science and Technology* 17: 69-74 (Spring 2001) (with Jennifer Nash); and "Management-Based Regulatory Strategies," in John D. Donahue and Joseph S. Nye, eds., *Market-Based Governance* (Brookings, 2002) (with David Lazer).