Regulating the Regulators

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I. OVERSIGHT IN A WORLD OF FINANCIAL LIMITS

Since the 1970s, there has been a tremendous growth in government regulation pertaining to risk and the environment. These efforts have emerged quite legitimately because market processes alone cannot fully address risk-related concerns.[1] Without some kind of regulation or liability, for example, firms lack appropriate incentives to restrict their pollution. Similarly, when products or activities are extremely risky, if people are not cognizant of the risks they face, the firms generating the hazards may not have adequate incentives to issue warnings. To solve these problems, regulatory agencies have mounted a wide variety of efforts to improve the quality of the air we breathe, the water we drink, the products we use, and the workplaces where we toil.

Notwithstanding the legitimate impetus for these regulatory activities, government agencies sometimes overstep their bounds. The presence of market failure creates a potential role for government action, but this action must be well conceived. A clearly misgnided and unduly burdensome regulation certainly would not be in society's best interest even if it were intended to address a legitimate social problem. As in other policy contexts, the task is to structure regulatory efforts to promote society's welfare as effectively as possible.

The importance of this task stems from the need to ensure that the substantial overall cost of regulatory policies is justified. Estimates suggest that total annual regulatory costs are in the vicinity of $400 to $500 billion.[2] Of this amount, approximately $100 billion comprises transfers that do not create a net efficien-

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[1] See generally W. Kip Viscusi, John M. Vernon, and Joseph E. Harrington, Jr., *Economics of Regulation and Antitrust* (MIT 2d ed 1995).

[2] Id at 34.

cy loss. The remaining $300 to $400 billion is divided between paperwork costs and other regulatory expenses. It is particularly noteworthy that the estimated annual cost of environmental regulations alone is $124 billion.[3]

Although these estimates show that regulatory costs are not trivial, the price tag could become even greater. Unfortunately, much more remains to be done if our objective is a risk-free society. Indeed, even if the entire gross domestic product were allocated to preventing accidental deaths, we would have available less than $60 million per fatality to be prevented.[4] Moreover, if we allocated all of our resources to preventing accidental deaths, we would have nothing left to spend to prevent cancer, or to provide food, housing, medical care, and so on. In short, regulatory expenditures could easily outstrip society's ability to pay. Eventually we must draw the line on how much we wish to allocate for risk regulation, environmental protection, and other regulatory programs. The questions are: how far should we go in these efforts, and how should we choose among them?

In some cases, an absolutist commitment to a zero-risk level may not ouly be unduly expensive, but it may also prove counterproductive. In specifying the requirements for an updated computerized air traffic control system, the Federal Aviation Administration ("FAA") insisted that such a system have a reliability of 99.99999 percent ("seven nines" reliability). This system would only fail three seconds per year on average. Some observers believe that the contractual requirements the FAA stipulated for IBM, the system's designer, violated the laws of physics.[5] The commitment to perfection paralyzed the updating of the air traffic control system and led to the old system's remaining in place, thereby leading to a higher risk than would have existed had a more fiexible approach been adopted.[6]

Although the Executive Office of the President has long exercised formal oversight to foster sounder regulation, these efforts have not been entirely successful because they have occasionally

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[3] Thomas D. Hopkins, *The Costs of Federal Regulation*, 2 J Reg & Soc Costs 16 (1992).

[4] W. Kip Viscusi, *Fatal Tradeoffs: Public and Private Responsibilities for Risk* 5 (Oxford 1992).

[5] For a full description of this policy approach and its limitations, see Matthew L. Wald, *Ambitions Update of Air Navigation Becomes a Fiasco*, NY Times A1, A11 (Jan 29, 1996).

[6] "The F.A.A. is so risk averse, it is slıod with this idea, 'We can't field anything until it's absolutely perfect.'" Id (reporting statement of Thomas C. Richards, an FAA Administrator under President Bush).

conflicted with agencies' legislative mandates. In hopes of establishing a consistent basis for assessing and selecting regulations, the current Congress has considered a series of bills designed to promote more effective regulations.[7] In some instances, these were omnibus bills that pertained to regulatory policy in general. Such broad-based reforms would supersede agencies' legislative mandates, impose benefit-cost tests, and alter the manner in which risks are assessed. Other more narrowly framed bills either would leave existing legislative mandates intact or else would simply reform the regulatory approach to a specific class of policies, such as the Environmental Protection Agency's ("EPA") hazardous waste cleanup programs under Superfund.[8] Which directions should be selected for regulatory policy and which tests are most important will be the focus of this Essay.

The guiding principle underlying the policy prescriptions advocated here is that government agencies should select those policies that are in society's best interest. Honest risk assessment and benefit-cost balancing should be our guides. After reviewing the existing legislative mandates of regulatory agencies and the role of government oversight, this Essay will explore several techniques for assessing regulatory policies, including benefit-cost analysis, cost-effectiveness tests, risk assessment, and risk-risk analysis. Each of these methodological approaches provides a different perspective on the merits of regulatory policies. These techniques are reflected in various current oversight guidelines and in guidelines proposed by various bills.

Many reformers have encountered political difficulties. Perhaps this is because many of their proposals are overly excessive grab bags of institutional and substantive reforms, while other proposals have failed to recognize the underlying deficiencies in agencies' legislative mandates. Improving regulatory efficiency will remain a salient policy objective so long as society devotes considerable resources to these efforts, and the fate of any current or future piece of legislation will not affect its underlying importance.

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[7] For discussion of these bills, see notes 89-94 and accompanying text.

[8] The legislation also could, for example, impose benefit-cost tests in the setting of drinking water standards or other narrowly defined environmental objectives rather than an omnibus approach that revamps all EPA activities.

II. THE EFFECT OF LEGISLATIVE MANDATES ON REGULATORY POLICY

It is somewhat ironic that Congress has taken the initiative in putting regulatory policies on sounder footing. Many of the problems are of Congress's own making. The underlying difficulties stem primarily from past congressional actions and legislation that circumscribed the character of regulatory policies and limited attempts to balance regulation equitably. Congress, of course, has not assumed the responsibility for drafting specific regulations, though there are some exceptions, such as the cigarette labeling requirements.[9] For the most part, the role of Congress has been to define broadly the legislative objectives of regulatory agencies. The agencies then implement these objectives subject to judicial review and the review process established within the Executive Office of the President.

One potential check on excessive regulation is judicial review. However, the success of a legal challenge to a regulation is not based on its overall economic merits but rather on whether the agency adhered to its legislative mandate in promulgating the regulation. In many instances the legislation has defined the mission of the agency so narrowly that tradeoffs between regulatory costs and risk reduction objectives are not permitted. The Clean Air Act, for example, specifically precludes the consideration of costs in the setting of national ambient air quality standards.[10] Indeed, no legislative mandates specifically require that an agency show that the economic benefits exceed the costs of a regulation, and in most instances there are specific provisions that could give the agency administrator the leeway to avoid such explicit balancing. Even if balancing is not required, if tradeoffs were explicitly permitted, administrators would have the option of promulgating more reasonable policies. Perhaps more important, OMB could better pressure them into doing so.

Most of the original controversy surrounding legislative mandates to regulatory agencies derived from litigation over proposed Occupational Safety and Health Administration ("OSHA") regulations. The restrictive terms of the Occupational Safety and Health Act of 1970 are similar to those of other agency legislative mandates in that the Act does not urge the agency to balance the

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[9] 15 USC § 1333 (1994) (specifying exact wording and format of warning labels).

[10] See *Lead Industries Association v EPA*, 647 F2d 1130, 1148-51 (DC Cir 1980) (interpreting 42 USC § 7409 (1988) to prohibit consideration of feasibility in setting air quality standards).

benefits and costs of its safety regulations and adopt those regulations that achieve the greatest net gain to society. Rather, the Act sets the agency on a single-minded mission "to assure so far as possible every working man and woman in the Nation safe and healthful working conditions."[11] The agency, of course, does not have unbridled discretion. For example, the Act also requires that the tasks imposed by OSHA regulations be "feasible."[12] Nevertheless, nothing establishes any necessary relationship between the benefits derived from the regulation and the costs imposed on society.

The first major challenge to OSHA's narrow interpretation of its legislative mandate was the 1980 Supreme Court decision involving the OSHA benzene standard.[13] Although that decision did not resolve the benefit-cost tradeoff issue, it did hold that the agency cannot require employers to take costly measures that merely eliminate trivial hazards but instead must show that the hazards pose a significant risk to human health and thus the standards are "reasonably necessary or appropriate to provide safe or healthful employment."[14] The Court specifically noted that it may not be socially desirable to eliminate trivial risks:

> But 'safe' is not the equivalent of 'risk-free.' There are many activities that we engage in every day—such as driving a car or even breathing city air—that entail some risk of accident or material health impairment; nevertheless, few people would consider these activities "unsafe." Similarly, a workplace can hardly be considered "unsafe" unless it threatens the workers with a significant risk of harm.[15]

How small is too small to merit regulation is still an unresolved issue. From an economic-efficiency standpoint, it may be desirable to regulate even a minuscule risk if the cost of reducing the risk is correspondingly small. What matters is the balance between risks and costs, not necessarily the magnitude of the risk. Nevertheless, how we think about the magnitude of the risk and how we estimate this magnitude are also important. Much of the recent regulatory reform legislation before Congress is specifi-

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[11] Occupational Safety and Health Act of 1970, Pub L No 91-596, 84 Stat 1590, codified at 29 USC § 651(b) (1994).

[12] 29 USC § 655(b)(5) (1994).

[13] *Industrial Union Department, AFL-CIO v American Petroleum Institute*, 448 US 607 (1980).

[14] Id at 642.

[15] Id.

cally concerned with this risk-assessment issue since distortions in the assessment of risk produce a misleading index of the merits of the regulatory policy.

The next principal Supreme Court case on regulatory authority was the 1981 decision regarding the OSHA cotton dust standard.[16] That standard had been challenged by the textile industry as unduly burdensome and not reflecting an appropriate balance of benefits and costs. The Court ruled that the agency was not required to adopt a benefit-cost test. It interpreted the agency's legislative mandate in terms of whether the regulation was "capable of being done" rather than interpreting feasibility in terms of obtaining an appropriate safety payoff from regulatory costs.[17]

Although OSHA is not required to adopt a benefit-cost test, a 1991 decision of the D.C. Circuit indicated that OSHA may nevertheless have the leeway to incorporate more balancing in the setting of regulatory standards than it has in the past.[18] The court interpreted one provision of the Occupational Safety and Health Act permissively, finding that it could reasonably be read to require the balancing of benefits and costs.[19] In a concurring opinion, Judge Stephen Williams outlined a new test for regulatory policy—risk-risk analysis—that suggests that some regulations that are inordinately burdensome and that do not produce very substantial benefits in return for substantial costs may in fact have a net adverse effect on public health.[20] Risk-risk analysis will be considered in greater detail below.

The primary message from the various relevant court decisions is that administrative agencies enjoy wide discretion to set regulations in whatever manner they choose, since their legislative mandates usually neither prescribe nor forbid specific economic-policy tests. For example, *Chevron U.S.A. Inc. v Natural Resources Defense Council, Inc.*[21] concerned a challenge to the EPA's "bubble policy," which permitted firms to treat air pollution as if an artificial bubble surrounded the plant. Rather than complying with specific air pollution requirements for each

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[16] *American Textile Manufacturers Institute, Inc. v Donovan*, 452 US 490 (1981).

[17] Id at 508-09.

[18] See *International Union, UAW v OSHA*, 938 F2d 1310 (DC Cir 1991).

[19] Id at 1318-21.

[20] *International Union*, 938 F2d at 1326 (Williams concurring). This approach is also called health-health analysis. See, for example, Cass R. Sunstein, *Health-Health Tradeoffs*, 63 U Chi L Rev 1533 (1996).

[21] 467 US 837 (1984).

smokestack at the plant, firms could, in effect, examine the total emissions within the bubble and then select the most cost-effective means of reaching a specific air pollution target. Although the applicability of the bubble policy was limited to situations specifically approved by the agency, the Natural Resources Defense Council ("NRDC") nevertheless challenged the flexibility offered by EPA. Whereas previous court challenges had suggested that regulatory agencies had interpreted their legislative mandates too narrowly, the NRDC's challenge suggested that the EPA had interpreted its mandate too broadly, in too balanced a fashion. In particular, it gave firms flexibility in selecting the most cost-effective means for reducing pollution rather than requiring that every emissions source meet a stringent pollution standard. In *Chevron*, the Supreme Court ruled that agencies may interpret ambiguities in their legislative mandates in a reasonable manner, and so long as they are doing so, courts will not interfere with the agencies' interpretations.[22]

Because *Chevron* mandates this deferential standard of review, those attempting to reform regulatory policy cannot rely on existing legislative mandates to constrain agency action. As I will demonstrate below by examining specific regulatory policies, agencies have largely used their restrictive legislative mandates as shields to prevent judicial challenges to regulations as well as to resist internal administration efforts to achieve reasonable benefit-cost balancing. The regulatory reform bills before the 104th Congress consequently can serve as a mechanism for placing regulatory policies on more solid footing.

III. THE REGULATORY OVERSIGHT PROCESS

Regulatory agencies respond to their own constituencies within the constraints imposed by their legislative mandates and the statutes they enforce. Because agencies' parochial interests do not necessarily reflect national interests, the past six presidents have launched formal efforts to monitor and influence regulatory policies. President Nixon instituted "quality of life" reviews to examine the economic costs of regulations, a process that was formalized under the Ford administration.[23] President Ford established a new agency within the Executive Office of the President, the Council on Wage and Price Stability, that would

[22] Id at 842-45.

[23] See Exec Order No 11821, 3 CFR 926 (1974).

oversee new regulatory policies and file comments in the public record on behalf of the Administration.[24] This oversight group did not, however, have any formal veto power over regulatory policy. President Carter continued this process, adding a requirement that regulations must be cost-effective.[25] In their inflationary impact analyses, agencies had to show that the "least burdensome of the acceptable alternatives has been chosen."[26]

These tests did not require that the benefits of regulations exceed the costs. President Reagan, however, did impose such a requirement and altered the institutional mechanism for regulatory review, shifting responsibility to the Office of Information and Regulatory Affairs ("OIRA") in the Office of Management and Budget ("OMB"), where it remains.[27] The Reagan approach stipulated that "[r]egulatory actions shall not be undertaken unless the potential benefits to society for the regulation outweigh the potential costs to society."[28] This requirement was not, however, binding in instances where the agency's legislative mandate ruled out a benefit-cost test,[29] which unfortunately is the norm for most risk- and environmental-regulation agencies.

This structure remained intact under the Bush administration and has continued in place with only slight modification under the Clinton administration. The Clinton administration changed the wording of the Executive Order, making it clear that not all regulatory benefits and costs can be monetized and that nonmonetary consequences should be influential as well.[30] President Clinton also greatly expanded the openness of the review process and increased the disclosure requirements.[31]

The degree to which these benefit-cost tests lack binding force is exemplified in the profile of regulatory policies in Table 1. Let us take as our reference point for desirable regulatory policies an implicit value of $5 million per life saved, which is the wage-risk tradeoff reflected in worker decisions.[32] Put somewhat differently, if a worker is facing an average annual job risk of

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[24] See Council on Wage and Price Stability Act, Pub L No 93-387, 88 Stat 750 (1974), codified as amended at 12 USC § 1904 (1976).

[25] See Exec Order No 12044, 3 CFR 152 (1978).

[26] Id § 2(d)(3), 3 CFR at 154.

[27] Exec Order No 12291, 3 CFR 127 (1981).

[28] Id § 2(b), 3 CFR at 128.

[29] Id § 2, 3 CFR at 128.

[30] See Exec Order No 12866 § 1(a), (b)(6), 3 CFR 638, 638-39 (1993).

[31] For a description of these provisions, see Richard H. Pildes and Cass R. Sunstein, *Reinventing the Regulatory State*, 62 U Chi L Rev 1, 22-24 (1995).

[32] See generally Viscusi, *Fatal Tradeoffs* at 34-74 (cited in note 4).

1:10,000, such a worker will demand a wage premium of $500 to incur the risk. A group of ten thousand such workers, one of whom is expected to die, consequently will receive $5 million in return for this additional risk. This kind of value-of-life calculation goes well beyond the monetary loss associated with the risk of mortality and is generally accepted in the economics literature as the appropriate measure of society's willingness to pay for risk reduction.[33] Moreover, this methodology has been explicitly endorsed by the OMB for purposes of valuing risk reduction in regulatory policies.[34] A value-of-life figure of $5 million falls in the midpoint of the estimated range; most studies in the literature have estimated the value of life anywhere from $3 million to $7 million.[35]

For concreteness, let us take as an appropriate cutoff for regulatory policy the cost per statistical life saved of $5 million. Regulatory policies that save statistical lives are those addressed at preventing very small risks of death. For example, a worker safety program that reduced job risks by 1/10,000 for 10,000 workers would save one statistical life on average. The attractiveness of these efforts is quite different from those that save identified lives, such as the child trapped in a well or workers trapped in a coal mine. If the OMB succeeded in approving only those policies whose benefits exceeded the costs, then no policies with a cost per life saved in excess of $5 million would be adopted. As the statistics presented in Table 1 demonstrate, policies that meet this benefit-cost threshold are the exception rather than the norm. Indeed, very few policies actually pass the test. It is noteworthy that all of the listed regulations from the Department of Transportation ("DOT"), which is unusual in that it uses a benefit-cost approach, do meet the benefit-cost test. In particular, DOT traditionally valued lives at the present value of lost earnings and did not pursue policies when the cost per life saved exceeded that amount. Subsequently, DOT moved to a willingness-to-pay approach and currently values life in the vicinity of $3 million per statistical life.[36]

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[33] For a survey of the literature, see id at 57-74.

[34] See Office of Management and Budget, *Regulatory Program of the United States Government, April 1, 1988-March 31, 1989* 570 (US GPO 1989); Office of Management and Budget, *Regulatory Program of the United States Government, April 1, 1990-March 31, 1991* 662-63 (US GPO 1990).

[35] Viscusi, *Fatal Tradeoffs* at 51-74 (cited in note 4).

[36] The author served as a consultant to the FAA and prepared a report to the agency on value-of-life issues to facilitate the agency's recent selection of a value-of-life figure. See

Table 1: The Cost of Various Risk-Reducing Regulations Per Life Saved

Pass Benefit-Cost Test

Regulation	Year & Status	Agency
Unvented Space Heaters	1980 F	CPSC
Oil & Gas Well Service	1983 P	OSHA-S
Cabin Fire Protection	1985 F	FAA
Passive Restraints/Belts	1984 F	NHTSA
Underground Construction	1989 F	OSHA-S
Alcohol & Drug Control	1985 F	FRA
Servicing Wheel Rims	1984 F	OSHA-S
Seat Cushion Flammability	1984 F	FAA
Floor Emergency Lighting	1984 F	FAA
Crane Susp Persnl Platf	1988 F	OSHA-S
Cncrte & Masonry Constr	1988 F	OSHA-S
Hazard Communication	1983 F	OSHA-S
Benzene/Fugtve Emissions	1984 F	EPA

P, R, or F -- Proposed, rejected or final rule.

W. Kip Viscusi, *The Value of Risk to Life and Health*, 31 J Econ Lit 1912 (1993) (study based on FAA report).

Initial Annual Risk*	Annual Lives Saved	Cost Per Life Saved (millions of 1984 dollars)
2.7 in 10^5	63.000	.10
1.1 in 10^3	50.000	.10
6.5 in 10^8	15.000	.20
9.1 in 10^5	1,850.000	.30
1.6 in 10^3	8.100	.30
1.8 in 10^6	4.200	.50
1.4 in 10^5	2.300	.50
1.6 in 10^7	37.000	.60
2.2 in 10^8	5.000	.70
1.8 in 10^3	5.000	1.20
1.4 in 10^5	6.500	1.40
4.0 in 10^5	200.000	1.80
2.1 in 10^5	0.310	2.80

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* Annual deaths per exposed population. An exposed population of 10^3 is 1,000, 10^4 is 10,000, etc.

Source: Viscusi, *Fatal Tradeoffs* at 264 table 14-5 (cited in note 4). Based on information presented in John F. Morrall III, *A Review of the Record*, 10 Reg 25, 30 (Nov-Dec 1986). These statistics were updated by John F. Morrall III, via unpublished communication with the author, July 10, 1990.

Table 1 (continued)

Fail Benefit-Cost Test

Regulation	Year & Status	Agency
Grain Dust	1987 F	OSHA-S
Radionuclides/Urnm Mines	1984 F	EPA
Benzene	1987 F	OSHA-H
Arsenic/Glass Plant	1986 F	EPA
Etlıylene Oxide	1984 F	OSHA-H
Arsenic/Copper Smelter	1986 F	EPA
Urnium Mill Tlngs Inactive	1983 F	EPA
Urnium Mill Tlngs Active	1983 F	EPA
Asbestos	1986 F	OSHA-H
Asbestos	1989 F	EPA
Arsenic/Glass Mfrg	1986 R	EPA
Benzene/Storage	1984 R	EPA
Radionuclides/DOE Faclts	1984 R	EPA
Radionuclides/Elm Plısphrs	1984 R	EPA
Benzene/Etlıylbnznl Styrne	1984 R	EPA
Arsenic/Low-Arsnc Copper	1986 R	EPA
Benzene/Maleic Anhydride	1984 R	EPA
Land Disposal	1988 F	EPA
EDB	1989 R	OSHA-H
Formaldelıyde	1987 F	OSHA-H

Initial Annual Risk	Annual Lives Saved	Cost Per Life Saved (millions of 1984 dollars)
2.1 in 10^4	4.000	5.30
1.4 in 10^4	1.100	6.90
8.8 in 10^4	3.800	17.10
8.0 in 10^4	0.110	19.20
4.4 in 10^5	2.800	25.60
9.0 in 10^4	0.060	26.50
4.3 in 10^4	2.100	27.60
4.3 in 10^4	2.100	53.00
6.7 in 10^5	74.700	89.30
2.9 in 10^5	10.000	104.20
3.8 in 10^5	0.250	142.00
6.0 in 10^7	0.043	202.00
4.3 in 10^6	0.001	210.00
1.4 in 10^5	0.046	270.00
2.0 in 10^6	0.006	483.00
2.6 in 10^4	0.090	764.00
1.1 in 10^6	0.029	820.00
2.3 in 10^8	2.520	3,500.00
2.5 in 10^4	0.002	15,600.00
6.8 in 10^7	0.010	72,000.00

The costs of most of the regulations in Table 1 exceed the $5 million-per-lost-life threshold. It should be emphasized that Table 1 includes only specific regulatory policies and does not include agency actions and programs that do not result in actual regulations. For example, the Superfund program prevents cases of cancer at a cost per case avoided of almost $4 billion, but this program is not captured in the statistics reported here.[37] Table 1 includes both proposed and rejected regulations. If in fact the regulatory oversight process eliminated all regulations that did not pass a benefit-cost test, then, assuming that there were no other major categories of unquantified benefits, one would expect all regulations with a cost per life saved in excess of $5 million to be rejected. However, it is noteworthy that the agencies have not rejected all such ineffective programs. Indeed, the lowest cost-per-life-saved amount for a regulation rejected by the OMB is the one associated with the EPA's arsenic/glass manufacturing standard, for which the cost per life saved was $142 million. Thus, the OMB has succeeded in eliminating only extremely ineffective regulations. This result has not arisen because the OMB failed to implement the terms of the Executive Orders. Rather, it is a consequence of the strict nature of agencies' legislative mandates, which require or permit them to foster narrowly defined objectives, such as risk reduction or environmental protection, irrespective of maintaining a reasonable benefit-cost tradeoff.

IV. Alternative Regulatory Policy Tests

A. Benefit-Cost Analysis

The most comprehensive regulatory test from an economic efficiency standpoint is benefit-cost analysis.[38] The overall concept is straightforward and quite intuitively appealing. In particular, government agencies should adopt regulatory policies that best advance society's interests, or those that provide the greatest amount of benefits, less costs. In addition, no regulatory policy should be pursued unless the benefits exceed the costs. In the case of a regulation targeted at mortality risks, the expected

[37] The Superfund cost estimate of $4 billion per case of cancer is discussed in W. Kip Viscusi and James T. Hamilten, *Cleaning up Superfund*, Pub Int 52 (Summer 1996). This research was prepared under a cooperative agreement with the EPA.

[38] See generally Edith Stokey and Richard Zeckhauser, *A Primer for Policy Analysis* (Norton 1978).

number of lives saved multiplied by the value of life must exceed the regulatory costs for the policy to be desirable on this view.

Much of the controversy over this test arises from the frequent concern that not all benefit components are adequately considered. This difficulty is particularly great with respect to policy outcomes that lack both readily available market prices and market-based techniques to infer such prices. For example, attaching a dollar value to scarce natural resources or endangered species is not a straightforward process.

The practical alternative to market-based pricing is a contingent valuation approach in which respondents to survey questions assume hypothetical markets for these commodities and indicate their willingness to pay for the commodities' preservation.[39] As the debate over the Exxon *Valdez* oil spill valuation indicated, there is no clear-cut basis for establishing these values in a noncontroversial manner.[40]

Even when what is at stake is individuals' lives, regulatory policy debates are subject to a variety of uncertainties. To assess the statistical lives lost from a given danger, one must assess the risk probability as well as the total population exposed. Moreover, one must attach a value to the lives at stake. All three of these enterprises are, to say the least, tricky. The scientific evidence pertaining to risk-probability values is often hotly debated.[41] As a result, government agencies frequently assess the magnitude of the risk in broad terms, reflecting the conflicting scientific evidence. That is, agencies have responded to this uncertainty by using "conservative" risk assessments that focus on upper-bound values, a controversial step that will be considered in greater detail below.[42]

The second component of the risk assessment is the magnitudes of the populations exposed. In the case of risk assessment for Superfund sites, the EPA considers not only current populations but also potential future populations in currently unpopulated areas.[43] Hypothetical future populations should not receive

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[39] See generally W. Michael Hanemann, *Valuing the Environment Throngh Contingent Valuation*, 8 J Econ Persp 19 (Fall 1994).

[40] The main debate was over whether public opinion surveys could yield reliable estimates of the value of nonuse environmental damages. The plaintiffs had confidence in these techniques, whereas Exxon challenged their validity. See generally id.

[41] See generally Kenneth R. Foster, David E. Bernstein, and Peter W. Huber, eds, *Phantom Risk: Scientific Inference and the Law* (MIT 1993).

[42] Albert L. Nichols and Richard J. Zeckhauser, *The Perils of Prudence: How Conservative Risk Assessments Distort Regulation*, 10 Reg 13 (Nov-Dec 1986) (describing the distortions in regulatory policy caused by the use of "conservative" risk assessments).

[43] See James T. Hamilton and W. Kip Viscusi, *Human Health Risk Assessments for*

the same weight as current populations actually exposed to the risk since there may never be such residents exposed to toxic hazards. Ideally, one should weigh future exposed groups by the probability that such groups will in fact exist to be exposed. Moreover, other policy actions, such as the imposition of deed restrictions and the capping and fencing of hazardous waste sites, might prevent these hypothetical exposures.

Surprisingly, the third aspect of risk assessment—valuing the lives that will be lost—may be the most precisely estimated component of the regulatory analysis.[44] Difficulties arise, however, in making judgments regarding people whose durations of future lifetime differ. For example, should society be willing to spend more to save the life of a twenty-three-year-old than someone who is ninety-five? This problem is simplified to some extent when one realizes that regulatory policies do not confer immortality but rather simply extend lifetimes.[45] Adjusting for the quality and quantity of lives saved is, however, a degree of refinement that no doubt will continue to be problematic. However, given the failure of policymakers even to incorporate first principles of efficient targeting, as exemplified by the regulatory expenditure levels in Table 1, nuances such as distinguishing among populations in valuing life need not be resolved at the outset.

A typical assumption in benefit-cost analysis is that the agencies' assessment of benefits is most uncertain, whereas the costs are fixed. However, closer examination reveals that even the cost components are quite uncertain. For example, Superfund cleanup costs have considerably exceeded EPA's original estimates,[46] and in the case of the controversial cotton dust regulation, OSHA greatly misestimated both the costs and benefits of the regulation.[47]

What then should policymakers do when benefits and costs are highly uncertain? One possibility is to do nothing at all until further information clarifies these values. Deferring decisions is sometimes an appropriate strategy, particularly when informa-

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Superfund, 21 Ecol L Q 573, 586-88 (1994).

[44] See Viscusi, *Fatal Tradeoffs* at 34-74 (cited in note 4).

[45] See generally Richard Zeckhauser and Donald Shepard, *Where Now for Saving Lives?*, 40 L & Contemp Probs 5 (Autumn 1976).

[46] See generally Milton Russell, E. William Colglazier, and Mary R. English, *Hazardous Waste Remediation: The Task Ahead* (Tennessee 1991).

[47] See Viscusi, *Fatal Tradeoffs* at 161-77 (cited in note 4); see generally Paul W. Kolp and W. Kip Viscusi, *Uncertainty in Risk Analysis: A Retrospective Assessment of the OSHA Cotton Dust Standard*, 4 Advances in Applied Microeconomics 105 (1986).

tion is likely forthcoming and when correcting an erroneous regulatory decision is expensive. However, inaction may also have major costs of its own. If government agencies were to wait until all scientific uncertainties were fully resolved, they would seldom undertake any initiatives. The extent of the risks associated with health hazards, such as the risks posed by airborne carcinogens, remains a matter of debate. Should these be ignored? Safety hazards, such as the risk of an automobile accident, are known with much greater precision. However, even for accident risks, particular information crucial to regulatory policy may not be known. What, for example, will be the safety benefit of installing side air bags in cars? Scientists are unlikely to be able to estimate these mortality reductions with precision, as was shown by their highly inaccurate predictions regarding the effect of seat belts on auto safety.[48]

In general, a lack of information should not cause policy paralysis. We make decisions daily involving substantial uncertainties, and the government should do likewise.[49] By a similar token, the existence of uncertainties is not a rationale for ignoring the known benefit and cost consequences of policy. Policymakers should not, in effect, abandon rational thought about policy impacts and rely on their instincts simply because they have encountered complexities and uncertainties. Indeed, one might well argue that policy analysis is particularly useful when the ramifications of the policy are sufficiently complicated that the policy choice is not obvious.[50]

B. Cost-Effectiveness Analysis

A weaker variant of benefit-cost analysis is cost-effectiveness analysis. Under this approach the agency must show that it has adopted the cheapest way of achieving a specific objective, such as a pollution reduction. Under benefit-cost analysis the agency must do more. It must also show that achieving the specified

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[48] For a review of these policy assessments and their divergence from actual accident-rate patterns, see Sam Peltzman, *The Effects of Automobile Safety Regulation*, 83 J Pol Econ 677 (1975).

[49] Indeed, in many cases one could argue that the government should be bolder than we are as individuals, since at least in terms of cost uncertainties it can often spread these uncertainties across the entire United States population.

[50] The importance of dealing with uncertainty from the standpoint of government policy and using policy analysis are major themes in the principal textbook in the field. See Stokey and Zeckhauser, *Primer for Policy Analysis* (cited in note 38).

objective makes sense, that is, the benefits of doing so exceed the costs.

Cost-effectiveness analysis takes as given that the policy objective is worthwhile. Such an assumption may not be warranted if, for all policy options, the costs of meeting that objective exceed the benefits, or if there are other possible policy objectives that are preferable. An agency may select the cheapest method for reducing benzene emissions to a particular level, but the level chosen may be excessively stringent. Until we have some mechanism for ascertaining the wisdom of the underlying policy objective, then mere cost-effectiveness is not a sufficient test of policy adequacy.

Nevertheless, promoting cost-effective achievement of policy objectives remains a salient policy concern. Policymakers have employed cost-effectiveness as a guide in developing performance-oriented standards. Traditionally, government regulatory agencies such as EPA and OSHA have promulgated technology-forcing standards that specify particular means of compliance that must be adopted by the firm. The disadvantage of the technology-forcing approach is that it eliminates the firm's discretion to choose the least-cost mechanism of compliance. By specifying a performance objective and giving firms leeway to select the means to achieve this objective (instead of specifying a particular means of compliance), agencies can enable firms to reduce their costs.

Two examples illustrate this phenomenon. First, the OSHA grain dust standard gave firms several specific options for cleaning up grain dust levels in grain elevators to prevent risks of explosion.[51] If sweeping up the grain dust whenever it exceeded one-eighth of an inch were cheaper than using pneumatic dust-control equipment, then firms could reduce their compliance costs by choosing the sweeping route. It is noteworthy, however, that despite this flexibility, the grain dust standard still fails (albeit barely) a benefit-cost test.[52] Perhaps the greatest success story for a performance-oriented standard is the EPA bubble policy. Rather than requiring that each smokestack at a firm meet a particular emission level, the EPA permitted firms to operate as if surrounded by an artificial bubble.[53] The question then be-

[51] For a description of this regulation, see Viscusi, *Fatal Tradeoffs* at 275 (cited in note 4).

[52] See Table 1.

[53] For a description of the EPA bubble policy, see Robert W. Crandall, *Controlling Industrial Pollution: The Economics and Politics of Clean Air* 83-84 (Brookings 1983).

came whether the total emissions from the plant were excessive, thus permitting the firm to choose which emission sources to reduce. This flexibility enabled firms to adopt the most cost-effective mechanism for pollution reduction, leading to over $400 million in cost savings.[54] The more recent extensions of flexible policy options such as the bubble policy and tradeable permits increase this discretion by enabling firms to effectively bid for pollution rights, producing annual savings of compliance costs estimated at approximately $1 billion.[55]

C. Risk Assessment

Rather than become embroiled in economic controversies such as the appropriate amount to spend on risk reduction, why not simply focus on risks alone? As indicated earlier, society lacks the resources to eliminate all risks. Nevertheless, it is feasible to prioritize policies based on risk by focusing our regulatory energies first on the riskiest areas and then turning to less risky activities.

In thinking about this approach, it is important to reiterate what we mean by a risk level. Risk is the product of both the probability and the severity of harm as well as the number of people exposed. Unfortunately, in many instances, government agencies simply focus on the probability and overlook the risk exposure. In the case of the Superfund program, there are two critical risk triggers.[56] For Superfund sites with chemical risk pathways that pose a cancer risk exceeding 10-4,[57] EPA regulations suggest that cleanup is warranted. For risk levels smaller than 10-6, cleanup is not warranted, and for risk levels in the intermediate range between 10-4 and 10-6, cleanup is the subject of a discretionary decision by EPA officials.[58]

What is noteworthy about this precision with respect to risks is the total absence of population considerations. EPA assesses

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[54] The cost savings from the EPA bubble policy are documented in Robert W. Hahn and Gordon L. Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 Yale J Reg 109, 138 (1989).

[55] See Alan Carlin, *The United States Experience with Economic Incentives to Control Environmental Pollution* 5-6, 5-12 to 5-13 (US EPA 1992).

[56] See Hamilton and Viscusi, 21 Ecol L Q at 578-81 (cited in note 43).

[57] Risk levels are expressed as the likelihood of one person developing cancer over a lifetime. A risk level of "10-4" would predict one additional cancer case per ten thousand exposed individuals; "10-6" would predict one additioual case per one million exposed individuals.

[58] Hamilton and Viscusi, 21 Ecol L Q at 578-81 (cited in note 43).

risk levels to current populations now and in the future (designated current risk pathways), as well as risk levels to hypothetical future populations resulting from a change in land use, such as vacant land becoming residential (designated future risk pathways). Real and potential risks are treated symmetrically, and in each case the size of the population exposed to the risk does not enter the calculations.

Even if population exposures were considered, risk alone is not a sufficient guide. Consider the risk information in Table 2.

Table 2: Risks That Increase the Annual Death Risk by One in One Million

Activity	Cause of Death
Smoking 1.4 cigarettes	Cancer, heart disease
Drinking 0.5 liter of wine	Cirrhosis of the liver
Spending 1 hour in a coal mine	Black lung disease
Spending 3 hours in a coal mine	Accident
Living 2 days in New York or Boston	Air pollution
Traveling 6 minutes by canoe	Accident
Traveling 10 minutes by bicycle	Accident
Traveling 150 miles by car	Accident
Flying 1000 miles by jet	Accident
Flying 6000 miles by jet	Cancer caused by cosmic radiation
Living 2 months in Denver	Cancer caused by cosmic radiation
Living 2 months in average stone or brick building	Cancer caused by natural radioactivity
One chest X-ray taken in a good hospital	Cancer caused by radiation

Living 2 months with a cigarette smoker	Cancer, heart disease
Eating 40 tablespoons of peanut butter	Liver cancer caused by aflatoxin B
Drinking Miami drinking water for 1 year	Cancer caused by chloroform
Drinking 30 12-oz. cans of diet soda	Cancer caused by saccharin
Living 5 years at site boundary of nuclear power plant in the open	Cancer caused by radiation
Drinking 1000 24-oz. soft drinks from banned plastic bottles	Cancer from acrylonitrile monomer
Living 20 years near PVC plant	Cancer caused by vinyl chloride (1976 standard)
Living 150 years within 20 miles of nuclear power plant	Cancer caused by radiation
Eating 100 charcoal-broiled steaks	Cancer from benzopyrene
Risk of accident by living within 5 miles of nuclear reactor for 50 years	Cancer caused by radiation

Source: Richard Wilson, *Analyzing the Daily Risks of Life*, 81 Tech Rev 41, 45 table (1979).

A risk of death of one in a million arises every time we spend one hour in a coal mine (black lung disease), spend two days in Boston (air pollution), travel six minutes by canoe, eat forty tablespoons of peanut butter, or drink Miami drinking water for one year. Which risk is most deserving of regulation? Should we target environmental exposures and give them higher priority than recreational risks?

One approach might be to look at total body counts rather than risk probabilities. If our concern is with accidental deaths, then the leading candidate for regulation would be automobiles, as motor vehicles now account for roughly forty-two thousand of

the ninety thousand accidental deaths per year.[59] However, we have already expended considerable resources for a variety of automobile safety devices, so our willingness to redesign automobiles to improve safety or our willingness to abandon automobiles altogether is likely to be quite limited.

If instead we wish to focus on all causes of death in the United States, the three leading candidates would be personal consumption decisions—tobacco, diet/activity patterns, and alcohol. Together, these activities contribute to 38 percent of all deaths.[60] Yet, are we willing to abandon smoking and drinking and undertake a vigorous exercise program to reduce these risks substantially? Or, alternatively, would we prefer the government to target toxic agents? Toxic agents are estimated to account for only 3 percent of all deaths—less than one-tenth of the amount caused by the three leading risky consumption activities.[61]

In his recent book, Justice Stephen Breyer advocates using a variety of reference points, such as the risk level posed by cigarettes or automobiles, to help policymakers think more sensibly about risk.[62] However, his most compelling comparisons emphasize costs. He observes that expenditure levels for asbestos removal would only be consistent with our other private expenditures on safety if we were willing to spend much more than we now do for automobile safety:

> We can translate the [asbestos removal] figure into a more intuitively accessible number by recalling that auto accidents kill about fifty thousand people each year. We might then imagine how much we would willingly pay for a slightly safer car, a car that would reduce auto deaths by, say, 5 percent, to 47,500. Would we pay an extra $1,000 for such a car? An extra $5,000 for that added contribution to safety? To spend $100 billion as a nation to save ten lives annually assumes we value safety so much that each of us would pay $48,077 extra for any such new, slightly safer car.[63]

Ultimately, some comparison of risks and costs is necessary to assess whether the beneficial aspects of the regulatory policy

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[59] See National Safety Council, *Accident Facts, 1994 Edition* 1 (1994).

[60] See J. Michael McGinnis and William H. Foege, *Actual Causes of Death in the United States*, 270 JAMA 2207, 2207-08 (1993).

[61] Id at 2208-09.

[62] See Stephen Breyer, *Breaking the Vicious Circle: Toward Effective Risk Regulation* 3-10 (Harvard 1993).

[63] Id at 13-14.

warrant the cost. Making such comparisons is not necessarily detrimental to regulatory policy. The FAA decided not to require wing modifications for the DC-10 because the risk reduction achieved would decrease the risk of a plane crash by only one chance in a billion. However, the cost of the modification—two thousand dollars—was small enough that on a benefit-cost basis over the life of the plane it would have been worthwhile to require the necessary changes.[64]

Risk levels alone are not a sufficient guide to policy. Probabilities of the hazard and numbers of people exposed to the risk are surely consequential. However, our unwillingness to forego all risky personal consumption activities, whether it be slothfulness or eating red meat, and our similar unwillingness to invest in risk-free but very fuel-inefficient cars that might resemble tanks, suggests that ultimately we do wish to select the risks we face in a manner that recognizes tradeoffs.

The magnitude of a risk is, however, potentially instructive, particularly as an input to benefits analysis—provided that the risk is properly assessed. Unfortunately, current risk assessment practices throughout the federal government typically do not yield unbiased risk judgments. Rather, current practices emphasize upper bounds of the possible risk values, or what has been designated a "conservatism" bias.[65] In the case of the EPA Superfund program, there is a focus on upper bounds of the potential risk. EPA analysts often use parameter estimates from the ninety-fifth percentile of the parameter distribution. Thus, the emphasis in each stage of the calculations is on how bad the risk could be under a worst-case scenario that might occur 5 percent of the time rather than on the expected consequences.[66] If, however, one uses the ninety-fifth percentile for each component of a calculation and then compounds these risk-parameter estimates when calculating the total risk, the degree of conservatism will be much greater. EPA calculations of groundwater ingestion risks, for example, use upper-bound values for ingestion rate, exposure frequency, exposure duration, chemical concentration, and toxicity. The net effect of compounding these upper-bound

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[64] See W. Kip Viscusi, *Risk by Choice: Regulating Health and Safety in the Workplace* 112-13 (Harvard 1983).

[65] For a more detailed discussion of this bias, see generally Nichols and Zeckhauser, 10 Reg at 13 (cited in note 42).

[66] W. Kip Viscusi, James T. Hamilton, and P. Christen Dockins, *Policy Consequences of Conservative Risk Assessments for Hazardous Waste Sites*, Duke University Working Paper (on file with U Chi L Rev).

values for five different parameter estimates is that the overall degree of conservatism for the total risk assessed at Superfund sites is beyond the ninety-ninth percentile of the risk distribution.

Consider how these biases could become compounded within the context of a simple example. Suppose that EPA assumes that the concentration of hazardous chemicals at a site is at the upper bound of what it could possibly be so that there is only one chance in twenty that the chemicals could be this risky. Also assume that we make worst-case scenario assumptions regarding the total amount of the hazardous chemicals that will be ingested through ground water contamination, where this ingestion will also occur with a probability of 1 in 20. Then the probability that we will have a worst-case scenario in terms of the concentration of the chemical as well as the amount of the chemical that is ingested will be 1 in 400, or the product of these two 1 in 20 probabilities if the events are independent. By focusing on the worst-case scenario for every parameter that is used to assess the risk, EPA is in effect assuming that everything that could possibly go wrong will go wrong simultaneously, which is much more unlikely than any one thing going wrong individually.

Focusing on upper-bound values creates a variety of distortions. First, the exact extent of the conservatism is generally not known to policymakers. The degree of conservatism varies by parameter and across policy-decision contexts, making comparative judgments difficult. We know that the risk assessments are "conservative," but not how conservative or whether the degree of conservatism is the same in every instance. Second, focusing on conservative risk parameters creates a bias in favor of regulating uncertain risks. Consider two different chemical hazards. Chemical A poses a known risk of cancer of 2 in 100,000. Chemical B has uncertain properties. Scientists have differing opinions over the relative risk of the two chemicals, as nine scientists out of ten believe that chemical B is without risk and one out of ten believes that the risk may be as high as 6 in 100,000. Adopting the conservative approach, government officials would focus on chemical B since it poses the greatest *potential* risk. However, we would save a greater expected number of lives if we focused on chemical A, for which the mean predicted risk is greater.[67]

[67] For a defense of using conservative risk values, see James E. Krier, *Risk and Design*, 19 J Legal Stud 781 (1990).

The third, more general problem with a conservatism bias is that it institutionalizes an irrational form of economic behavior. A well known form of irrationality in economics is the Ellsberg paradox.[68] Suppose that you win a prize if you draw a red ball from urn 1, which contains 50 red balls and 50 white balls. Similarly, suppose that you win an identical prize if you can draw a ball of the color you named from urn 2, which contains an unspecified mixture of 100 red and white balls. Which urn do you prefer? Respondents generally prefer the urn offering the known probability of success even though the risk probabilities are equivalent.[69] Similarly, when faced with the prospect of losses, individuals would rather face a known probability of incurring a loss rather than an imprecise probability.[70] These various forms of ambiguity aversion comprise a well known class of anomalies in economics that contradicts usual models of expected utility theory.[71] The government should not mimic these shortcomings in individual behavior, but rather it should make the kinds of rational and balanced decisions that people would make if they could understand risk sensibly. Paying excessive attention to the worst possible outcome while ignoring much more probable risk levels distorts policy-making and diverts our risk reduction resources from truly substantial hazards to minuscule risks that are not well understood.

Some of the impetus for conservative risk assessment may stem from past unfavorable experiences with risks that were underestimated. In the case of the space shuttle program, NASA authorities estimated the risk of a disaster before the *Challenger* explosion as 1 flight in 100,000.[72] In 1988, the agency had raised the estimated risk of a catastrophe over the entire mission to 1 in 50. Recent safety investments have led to a midpoint risk estimate of 1 in 145, with the risk range extending from 1 in 76 to 1 in 230 missions.

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[68] For a description of this paradox as well as the counterpart of ambiguity aversion in the case of losses, see Viscusi, *Fatal Tradeoffs* at 135-36, 143-45 (cited in note 4).

[69] One can, for example, turn the "soft" probability of urn 2 into a "hard" probability by flipping a fair coin and then selecting the ball color based on the outcome.

[70] See Viscusi, *Fatal Tradeoffs* at 143-45 (cited in note 4).

[71] For a review of this literature, see Colin Camerer and Martin Weber, *Recent Developments in Modeling Preferences: Uncertainty and Ambiguity*, 5 J Risk & Uncertainty 325 (1992).

[72] These statistics as well as the subsequent statistics in this paragraph are drawn from William J. Broad, *Risks Remain Despite NASA's Rebuilding*, NY Times 1, 12 (Jan 28, 1996).

The main message from this experience is not that we should undertake risk assessments as if Murphy's Law (if anything can go wrong it will) operates. Rather, the experience should highlight the dangers that may arise from excessive optimism, particularly when overly optimistic assumptions are compounded. In responding to this experience, however, we should not necessarily adopt the opposite approach of compounding overly pessimistic assumptions. The proper task for risk assessors is to use the best information currently available to assess the true range of the risk, and then to determine which risk level is the most reliable mean estimate of the actual risk. If our risk assessments are truly unbiased, then we should expect an equal number of overestimations and underestimations. Thus, there is no danger of systematic underestimation.

D. Risk-Risk Analysis

A single-minded commitment to risk reduction is not only an overly narrow approach to evaluating a regulatory policy, but it is also potentially harmful even from the standpoint of reducing risk. Perhaps somewhat paradoxically, overzealous policies can actually increase societal risk rather than decrease it.

This observation formed the basis of a judicial commentary on an expensive OSHA regulation in which Judge Williams of the D.C. Circuit observed that excessive regulatory expenditures would make society poorer, potentially worsening individual health.[73] Perhaps inspired by this opinion, the OMB raised with agencies the issue of the potentially counterproductive effects of excessive regulatory expenditures.[74] This Section will explore the different variants of what has come to be known as risk-risk analysis,[75] indicating how even if risk reduction is the only objective of a regulatory policy, we must do more than focus on the direct risk effects of the policy alone.

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[73] See *International Union, UAW v OSHA*, 938 F2d 1310, 1326-27 (DC Cir 1991) (Williams concurring).

[74] The opening salvo in this administrative battle was a March 10, 1992, letter from James B. MacRae, Jr., Acting Administrator of OIRA, to Nancy Risque-Rohrbach, Assistant Secretary for Policy, United States Department of Labor. For a discussion of this letter and the ensuing controversy, see Ralph L. Keeney, *Mortality Risks Induced by the Costs of Regulations*, 8 J Risk & Uncertainty 96, 96-97 (1994).

[75] See generally Lester B. Lave, *The Strategy of Social Regulation: Decision Frameworks for Policy* (Brookings 1981); John D. Graham and Jonathan Baert Wiener, eds, *Risk versus Risk: Tradeoffs in Protecting Health and the Environment* (Harvard 1995).

The first form of risk-risk tradeoff to appear in the economics literature pertains to risk offsets associated with regulatory policies, or what recent proposed legislation refers to as "substitution risks."[76] Regulations that ban activities or products almost invariably create substitution risks. This occurs when the commodities that replace those that are banned carry their own risks, so that the net risk change is not as great as it might seem initially. If, for example, we require that infants riding in airplanes not sit in their parents' laps but rather have their own seat and safety belt, then the cost of an additional ticket will lead some parents to drive, which is a riskier mode of travel. Similarly, eliminating pesticides from our diet by eating organic produce will reduce the risk of cancer from pesticides, but if the result is that we eat fewer fruits and vegetables, our overall cancer risk may increase.[77] To prevent the risk of fire-related burns, the Consumer Product Safety Commission ("CPSC") required that children's sleepwear be coated with the flame retardant Tris, but later discovered that this chemical was potentially carcinogenic.[78] This risk-risk tradeoff is a type of substitution risk.

The class of risk-offset effects that has particularly captured the attention of economists involves product users' diminished safety precautions in response to regulatory protections. If the government regulates products or activities in a way that makes them less dangerous, then users will have diminished incentives to take care. Initial research on the safety effects resulting from seat belt use suggested that the use of these belts may have led drivers to go faster, thus partially offsetting some of the safety gains.[79] Debate over the magnitude of this phenomenon continues, as researchers remain uncertain as to whether the diminished care is sufficient to offset the beneficial effect of seat belts. Nevertheless, broad evidence indicates at least some diminished precaution taking, as reflected in the increased risk to pedestri-

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[76] HR 1022 contains a particularly extensive treatment of substitution risk, requiring that agencies recognize this phenomenon and incorporate analyses of substitution risks in their assessments of regulatory policies. See Risk Assessment and Cost-Benefit Act of 1995, HR 1022 § 105(4), 104th Cong, 1st Sess (Feb 23, 1995), in 141 Cong Rec H2261, H2263 (Feb 27, 1995).

[77] For a discussion of this tradeoff, see Bruce N. Ames and Lois Swirsky Gold, *Environmental Pollution and Cancer: Some Misconceptions*, in Kenneth R. Foster, David E. Bernstein, and Petor W. Huber, eds, *Phantom Risk: Scientific Inference and the Law* 153, 176-78 (MIT 1993).

[78] See W. Kip Viscusi, *Regulating Consumer Product Safety* 111 (American Enterprise Institute 1984).

[79] See Peltzman, 83 J Pol Econ at 703-05 (cited in note 48).

ans and motorcyclists in the aftermath of the seat belt regulations.[80]

Although people might quite rationally choose to take fewer precautions after safety technologies have reduced the risks, diminished care also may result from the public's overassessment of the adequacy of these safety efforts. One possibility, which I have termed the "lulling effect," is that consumers may be lulled into a false sense of security and diminish their care by too great an extent.[81] CPSC officials frequently refer to child-resistant caps as being child-proof. But the introduction of these caps did not result in the expected diminishing in poisonings. Because of the difficulty of grappling with the caps, many parents left the caps off the bottles; indeed, almost 50 percent of poisonings resulted from open bottles.[82] In addition, some parents may permit children greater access to the products because of an apparent belief that the products are safer, a phenomenon consistent with the observed failure of safety caps to decrease poisoning rates below the level expected in the absence of the regulation.

The "lulling effect" is visible in parental behavior following the recent regulation mandating child-resistant cigarette lighters.[83] Parents report that the child-resistant mechanism gives them greater peace of mind and decreases their safety concerns. There is also evidence, based on actual placements of lighters in households, that the introduction of the child-resistant mechanism has led parents to leave lighters in locations more accessible to children. In this instance, the net prediction is that on balance the child-resistant mechanism will enhance safety since the safety benefits of the lighter feature outweigh the consequences of the diminished care. Nevertheless, there is clear-cut evidence that the diminished precaution taking will decrease the extent of the risk improvement that would otherwise occur. These responses highlight the importance of alerting consumers and workers to the continued need for precautionary behavior even in the presence of safety regulations.

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[80] See Glenn C. Blomquist, *The Regulation of Motor Vehicle and Traffic Safety* 55-74 (Kluwer 1988).

[81] For discussion of this phenomenon, see W. Kip Viscusi, *The Lulling Effect: The Impact of Child-Resistant Packaging on Aspirin and Analgesic Ingestions*, 74 Am Econ Rev 324 (May 1984); Viscusi, *Fatal Tradeoffs* at 224-27 (cited in note 4).

[82] In particular, the open-bottle share of poisonings in 1978, the last year for which data are available, was 49 percent for aspirin and 47 percent for aspirin and analgesics. See Viscusi, *Fatal Tradeoffs* at 238 (cited in note 4).

[83] See W. Kip Viscusi and Gerald O. Cavallo, *The Effect of Product Safety Regulation on Safety Precautions*, 14 Risk Analysis 917 (1994).

A second type of risk-risk tradeoff is an inevitable consequence of all economic activity. Quite simply, all economic activity is risky. Workers are injured daily in construction, manufacturing, and even in white-collar work. Regulatory requirements trigger a variety of economic activities, whether it be producing scrubbers for the reduction of air pollution, removing asbestos from schools, or driving a car back to the dealer after an automobile recall. Injuries and deaths resulting from these activities are inevitable. If we place a dollar value of $50,000 on each statistical injury and $5 million on each statistical fatality, then 3 to 4 percent of all industry expenditures comprise the costs associated with worker injuries.[84] If our only concern is with risk, we should surely be cognizant of the fact that regulatory expenditures will generate economic activity, which itself will be risky. If the regulations are extremely ineffective, then these expenditure-related risks alone would render the regulatory effort counterproductive.

For concreteness, suppose that a regulation saves one statistical life through its direct effect on safety. At what expenditure level will the regulation generate economic activity that will lead to more health risks than the regulation prevents? Suppose that the safety improvement resulting from the regulation is valued at $5 million. Then the health risk arising from regulatory expenditures will just equal this amount if the cost per statistical life saved is $167 million (if injuries comprise 3 percent of regulatory costs) or $125 million (if injuries comprise 4 percent of regulatory costs).

Applying this approach to the regulatory cost levels in Table 1, the expenditure-related health costs of regulation imply that all regulations at or below the arsenic/glass manufacturing standard will be counterproductive at the lower end of this cost range, and all regulations below the benzene storage regulations will be counterproductive at the upper end.

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[84] These estimates are derived by W. Kip Viscusi and Richard J. Zeckhauser, *The Fatality and Injury Costs of Expenditures*, 8 J Risk & Uncertainty 19 (1994). That article also presents industry-specific estimates of both the injury costs and the fatality costs of regulatory expenditures. In many respects these estimates are simply the flip side of the estimates of compensating differentials that workers receive for incurring risks. The fact that workers are compensated for many of these risks may affect how society views them from a benefit-cost standpoint. To the extent that markets provide for compensation of these risks, the rationale for regulation will not be good. However, if our only concern is with health effects, to be consistent agencies should consider all health effects of policies, both good and bad.

The third form of risk-risk analysis was the focus of Judge Williams's concurrence and has been the focus of efforts by the OMB. The underlying idea is that regulatory expenditures represent opportunity costs to society that divert resources from other uses. These funds could have provided for greater health care, food, housing, and other goods and services that promote individual longevity. The economics behind this relationship is not controversial.[85] Being richer is safer than being poorer.

Estimating the magnitude of the tradeoff is more difficult. Table 3 summarizes a recent set of studies that have identified this linkage.

Table 3: Summary of Income-Mortality Studies

Study	Nature of Relationship	Income Loss Per Statistical Death $ millions (Nov 1992 dollars)
Hadley and Osei (1982)	1 percent increase in total family income for white males age 45-64 leads to .07 percent decline in mortality.	33.2
U.S. Joint Economic Committee (1984)	3 percent drop in real per capita income in 1973 recession generated 2.3 percent increase in mortality.	3.0
Anderson and Burkhauser (1985)	Longitudinal survey, Social Security Administration Retirement History Survey, 1969-79. $1 difference in hourly wage levels in 1969 generates 4.2 percent difference in mortality rates over next 10 years.	1.9

[85] For derivation of these relationships, see W. Kip Viscusi, *Mortality effects of regulatory costs and policy evaluation criteria*, 25 RAND J Econ 94 (1994).

Duleep (1986)	Social Security mortality data 1973-78 for men aged 36-65 imply a higher mortality rate of .023 for income group $3,000-$6,000 compared to income group $6,000-$9,000.	2.7
Keeney (1990), based on Kitagawa and Hauser (1973)	Mortality rate-income level data fit expositional curve relating mortality rates to income, employing 1959 data on mortality of whites, age 25-64, death certificate information.	12.5
Lutter and Morrall (1994)	International data on mortality-income relationship from the World Bank, 1965 and 1986.	9.3
Chapman and Hariharan (1994)	Social Security Administration Retirement History Survey, 1969-1979, controlling for initial health status; tradeoff of $12.2 million per life in 1969 dollars.	13.3

For the most part, researchers have used regression analyses to assess the role of individual and family income on mortality. Some of these studies focus on specific events that led to decreases in income, such as recessions, whereas others utilize national or international data over a longer period. The range reflected in these estimates is quite broad; the income drop needed to generate one expected death has been placed at anywhere between $1.9 million and $33.2 million.

Perhaps the greatest limitation of these studies is the correlation between income and health. Higher income levels promote healthy consumption patterns and individual longevity. On the other hand, improved health enhances one's earning capabilities. Disentangling this linkage may be particularly difficult, espe-

cially given that income is correlated with other health-enhancing variables, such as knowledge of how to decrease health risks.

To eliminate these statistical controversies, I developed an alternative approach that does not utilize direct estimates of the mortality-income relationship.[86] Instead, it exploits the theoretical linkage between the amount of money that people are willing to spend to save a statistical life—approximately $5 million on average—and the amount of expenditures that will lead to the loss of a statistical life. Surely individuals would not be willing to undertake expenditures that are counterproductive with respect to risk. Thus, it is implausible that workers could reveal a value of life of $5 million in their job safety decisions, while at the same time society loses a statistical life every time $1.9 million (the lowest estimate in Table 3) is spent. If that were the case, firms investing $5 million per statistical life in improved safety conditions would kill more than two workers in doing so because spending $5 million on the usual mix of goods would save more than two lives. Using the theoretical linkage between the value of saving a statistical life and the regulatory expenditure that will lead to the loss of a statistical life, I showed that this amount will be approximately ten times the implicit value of saving a statistical life, or $50 million.[87] Thus, for every regulatory policy in Table 1 below the uranium mill tailings-inactive standard, the income loss-mortality linkage suggests that the regulation will produce a net health loss.

There are consequently three risk-risk effects that cut across regulatory policies and limit their effectiveness. The first effect, substitution risk, varies from context to context and cannot be assessed on any general level. However, an overall assessment of the other two risk-risk effects is possible. The bad news for government regulators is that both of these risk-risk offsets are at work. Suppose that the regulators are considering a $100 billion regulatory program. Using a midpoint estimate that the direct health costs of expenditures are 3.5 percent of the total expenditure, there will be $3.5 billion in direct health losses. The second adverse consequence—income loss-mortality effect—will be the loss of two thousand statistical lives when the government

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[86] This approach was originally developed for the Executive Office of the President in the Bush Administration. The 1992 Report by the author to OMB, *Wealth, Health Investments, and the Value of Life*, was refined in Viscusi, 25 RAND J Econ at 94 (cited in note 85).

[87] See Viscusi, 25 RAND J Econ at 105-07 (cited in note 85).

spends $100 billion. Using a value of $5 million to assess the value of each life lost leads to a total cost of $10 billion. In all, there will be $13.5 billion in health losses from $100 billion in regulatory costs. Unless the regulation generates at least $13.5 billion in health benefits, individual health will be made worse off by the regulation.

This result can be used to calculate the critical cost per life threshold that must be met for a regulation to have beneficial effects on individual health. For any regulatory expenditure of $37 million or more per statistical life, there will be a net loss of life and health due to the combined effect of the expenditure-health linkage and the income loss-mortality linkage. In terms of Table 1, the counterproductive range of regulatory policies begins just below the uranium mill tailings-inactive regulation.

A regulation that increases risk is not in society's interest. Such a regulation is extremely counterproductive in that it does not even meet the narrow test of enhancing society's health. Surely regulatory agencies should be concerned with this broader effect of regulatory policy since their mandate is to improve the health and welfare of citizens generally, not simply within the narrow confines of a particular regulatory policy. If a policy unduly harms individual health in ways not considered by the regulators, it should not be pursued.

As a practical matter, much of the appeal of risk-risk analysis stems from its ability to provide a quantitative test for regulatory policy in a world in which strict benefit-cost analysis is not always feasible. Should this approach ever gain widespread acceptance within the government, it could potentially eliminate some of the most counterproductive regulations. However, it is not a substitute for a more comprehensive benefit-cost analysis that takes into account the fuller implications of regulatory policy.[88]

V. REGULATORY REFORM LEGISLATION

The 104th Congress has considered a variety of regulatory reform bills in 1995 and 1996. These bills seek to restructure the way in which government agencies approach regulations. In some instances, the proposed legislation consists of omnibus bills ap-

[88] The existence of the risk-risk relationship does, however, require that one modify the traditional benefit-cost test. For a discussion of the necessary modifications, see generally Viscusi, 25 RAND J Econ at 94 (cited in note 85).

plying to all regulatory agencies.[89] In other instances, the bills are more narrowly focused and address only a single regulatory area, such as Superfund[90] or energy risk management.[91]

The content of these bills is quite diffuse, as they include not only numerous guidelines for policy analysis but many institutional reforms as well. Three components, present in all the bills, seem most critical to improving economic efficiency in regulatory policy: inclusion of a supermandate, imposition of a benefit-cost test requirement, and a stipulation that risk assessments be honest and unbiased.

The supermandate assumption is perhaps most important. The provisions of some of the bills (for example, S 343) would not be binding on an agency if they were inconsistent with the agency's existing legislative mandate. However, since most of the risk and environmental regulatory agency legislation either expressly precludes a benefit-cost test or else gives the agency administrator leeway to interpret the mission-oriented nature of its mandate as if it did, there may be a great many cases in which the reform bill provisions simply will not be binding. The practical advantage of a sweeping reform bill is that it can impose a broadly accepted criterion for policy assessment in all domains of regulatory policy, eliminating the need to revise legislation on a case-by-case basis, which is less politically feasible. The potential disadvantage is that such legislation may not give special consideration to particular problem areas that might arise; these areas, however, can best be addressed within the substantive provisions of the legislation discussed below.

The second provision common to all of the regulatory reform legislation, and the most important of the substantive provisions, is a benefit-cost requirement. In particular, the focal point of all these bills is a stipulation that the agency demonstrate that the benefits of the regulation exceed the costs. For this standard to work in all policy contexts, however, it is necessary to include the appropriate qualifier that not all benefit and cost components

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[89] Bills of this type include the Risk Assessment and Cost-Benefit Act of 1995, HR 1022 (cited in note 76); Risk Assessment and Cost-Benefit Analysis Act of 1995, HR 690, 104th Cong, 1st Sess (Jan 25, 1995); Restructuring a Limited Government Act, HR 1923, 104th Cong, 1st Sess (June 22, 1995); Comprehensive Regulatory Reform Act of 1995, S 343, 104th Cong, 1st Sess (Feh 2, 1995) in 141 Cong Rec S2056 (Feh 2, 1995).

[90] See Superfund Reform Act of 1995, HR 228, 104th Cong, 1st Sess (Jan 4, 1995) (comprehensive reform of Superfund, including provisions for ranking hazards).

[91] See Department of Energy Risk Management Act of 1995, S 333, 104th Cong, 1st Sess (Feb 2, 1995) (requiring risk assessment procedures).

may be quantifiable in monetary terms. Particular difficulties arise with respect to endangered species and passive-use environmental benefits. However, requiring that the agency administrator find that the benefits to society exceed the costs, including both monetized and nonmonetized variables, would at least cast the regulatory policy decision in an appropriate light. True, such a standard loses the bright-line status of a monetary benefit-cost test. However, the advantage gained is that the benefit-cost analysis will indeed be truly comprehensive and reflect all the pertinent effects on society.[92]

The third critical provision of the regulatory reform legislation pertains to risk assessment. Rather than relying on upper-bound risk assessment values, agencies would be required to present information regarding mean levels of risks. Moreover, if agencies nevertheless supplied upper-bound values, they would also be required to provide lower-bound values so that policymakers could assess the extent of the risk range.[93] Since the lower bound of the risk range is frequently zero risk, policymakers could better distinguish the hazards that are truly present from those that are more speculative.[94]

These three components alone could constitute a sweeping regulatory reform bill that would put regulatory policy on sound analytic footing. However, the current regulatory reform proposals go well beyond these simple provisions, as various members of Congress pursue complex analytical and institutional changes. Certain provisions are more attractive than others, but apparently no combination has yet done the trick; the new Congress has yet to pass a regulatory reform bill.

VI. THE FAILURE OF LEGISLATIVE REFORM

Congress's inability to pass a regulatory reform bill to date may reflect the proposed legislation's overly ambitious scale and its inclusion of some provisions designed, perhaps in part, to

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[92] Including nonmonetized effects in the benefit-cost analysis may make court challenges to regulatory decisions more difficult, but the OMB can provide a countorvailing influence to promote sound judgments. The OMB has fostered a benefit-cost approach througbout its existence, and restructuring the regulatory legislation to strengthen the OMB's role would promote greater balance in regulatory policies.

[93] These provisions are included, for example, in HR 1022 § 105(1) at H2263 (cited in note 76).

[94] A prominent example of an agency including zero within the risk range is the risk reported by the CPSC from urea formaldehyde foam insulation exposures. See Viscusi, *Regulating Consumer Product Safety* at 99-101 (cited in note 78).

obstruct rather than reform regulation. In many respects, this experience is reminiscent of that at the start of the Reagan administration, when regulatory reform became synonymous with cost relief for industry.[95] Whereas the Reagan reforms were often case-specific and generally did not alter the structure of regulatory policy, the more recent reform efforts have had a more structural focus. However, in many cases, these institutional reforms are neither essential nor compelling from an economic standpoint.

Consider, for example, HR 1022, the Risk Assessment and Cost-Benefit Act of 1995.[96] This bill is one of the more ambitious omnibus regulatory reform proposals. It includes a supermandate provision and requires benefit-cost tests and unbiased risk assessments. However, the bill also includes a great deal more.

Some of the provisions simply elaborate on the substantive aspects of the analysis to be undertaken. For example, the bill requires that the agency consider substitution risks in assessing a regulation's total net effect on risk.[97] In other instances, the bill imposes requirements that would appear to be self-evident given the legislation itself, such as provisions pertaining to research and training in risk assessment.[98]

Perhaps most striking are the provisions that are unnecessary given the existence of a benefit-cost test. If benefit-cost guidelines are followed, an approach that focuses on the risk level alone—at best a partial test—is inferior to the more comprehensive approach that considers both risks and costs. Given this fact, two components of the legislation seem both redundant and second-best alternatives to the included benefit-cost test: the first requires that agencies provide risk comparisons to put the risk level in context;[99] the second requires the agency to undertake a comparative risk analysis in its effort to set priorities.[100] Such efforts are misguided because agencies should not necessarily select the regulation that addresses the greatest risks. Rather, they should select those targets of regulation that offer the greatest spread between benefits and costs.

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[95] For a critique and review of the Reagan regulatory reform efforts, see Viscusi, *Fatal Tradeoffs* at 248-92 (cited in note 4).

[96] See generally HR 1022 (cited in note 76).

[97] Id § 105(4) at H2263.

[98] Id § 108 at H2263.

[99] Id § 105(3) at H2263.

[100] Id § 109 at H2263-64.

One of the main reasons why agency critics have targeted policies that address minor risks is that if legislative mandates make risk the main currency of interest, policy debates will follow that dimension. However, once the policy debate is broadened to include a reasoned balancing of benefits and costs, myopic attention to risk levels alone seems overly narrow.

Other possibly burdensome features of the current regulatory reform legislation include process reforms. Regulatory agencies would be required to prepare plans on how they were generating new risk information,[101] to provide reports to Congress on priority setting,[102] and to provide more general reports to Congress on their regulatory efforts.[103] Comprehensive thinking about regulatory performance and policies is potentially instructive, but frequently these efforts involve little more than symbolic exercises that needlessly divert agency resources from the tasks at hand. The key issue is whether Congress would use this information constructively. If the benefits of regulatory policies in fact exceed costs, as documented in the regulatory impact analyses and reviewed by the OMB, then there is greater reason for confidence that new regulations will be much more cost-justified than those adopted to date.

Perhaps the greatest controversy concerus the proposed new stages of regulatory policy review. The first stage is peer review by panels of scientific experts; such review would be required for regulations imposing major costs.[104] Introducing another layer of regulatory review will, however, delay new regulations.[105] By increasing the OMB's scientific capabilities and creating a permanent institutional base with such expertise, a thorough scientific review of regulatory proposals would be possible under the current system. Avoiding formal peer review would also address concerns that society will suffer environmental or risk costs during the delays occasioned by the review.

The final set of provisions, pertaining to judicial review, is particularly controversial and raises the prospect that the courts may delay many regulatory proposals.[106] To the extent that

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[101] Id § 501 at H2265.

[102] Id § 601 at H2265.

[103] Id § 107(B) at H2263.

[104] See, for example, id § 301 at H2264-65.

[105] Based on the author's current experience in serving on two EPA Science Advisory Boards, he does not have a great deal of confidence in the expeditiousness of the peer review process.

[106] The judicial review provisions are the subject of HR 1022 § 401 at H2265 (cited in

nonmonetary benefit-cost components are included in the analysis, judicial review may focus on ambiguous policy criteria. Turning the courts into venues of economic inquiry also presumes a degree of economic expertise that courts currently lack. Instead of dealing with these issues in the courts, the OMB and its staff of regulatory overseers could provide the needed institutional check on misguided regulatory policies once the criteria for regulations were altered.[107] It should also be noted that adding judicial review provisions may encourage legal challenges. However, even without these provisions, which are a red flag to opponents, one can always challenge regulatory actions in court if they violate the agency's legislative mandate. Therefore, highlighting the potential for judicial challenges through special provisions in reform legislation may be unnecessary.

CONCLUSION

In recent years, analysts have devoted considerable attention to devising policy analysis approaches that would enable policymakers to eliminate the most undesirable regulations without violating legislative prohibitions against benefit-cost balancing. Risk-risk analysis and its variants that consider the mortality consequences of regulatory expenditures are perhaps the most visible policy assessment techniques of this type. Such circuitous mechanisms for eliminating undesirable regulations are potentially useful in trimming the least productive efforts. However, until an assessment of the overall beneficial and adverse effects of regulation becomes the guideline for regulatory policy decisions, these choices will necessarily fall short of what is attainable.

A single comprehensive bill could eliminate the inefficiencies stemming from a variety of restrictive legislative mandates. Legislation that includes benefit-cost tests, principles of honest risk assessment, and a supermandate provision would provide the necessary legislative counterpart to augment the OMB's regulatory oversight. Including extraneous features and imposing expanded institutional requirements that could delay vital regulato-

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note 76).

[107] Justice Breyer, for example, advocates establishing an elite civil service corps who would develop expertise in regulatory analysis issues, including both science and economics. Such a professional group committed to regulatory analysis and review is likely to be better positioned than courts te make other policy judgments. See Breyer, *Breaking the Vicious Circle* at 59-81 (cited in note 62).

ry improvements may distract attention from the central task of revamping the fundamental criteria for setting regulatory policy.

Society currently commits hundreds of billions of dollars each year to risk and environmental regulations. It is time that we demand an honest return on our risk reduction investment.